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ET

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DE

LA SOCIÉTÉ ROYALE

DU

CANADA

TROISIÈME SÉRIE—TOME IX.

SÉANCE DE MAI 1915

EN VENTE CHEZ
JAS. HOPE ET FILS, OTTAWA; LA CIE COPP-CLARK (LIMITÉE) TORONTO
BERNARD QUARITCH, LONDRES, ANGLETERRE
1916.

PROCEEDINGS

AND

TRANSACTIONS

OF

THE ROYAL SOCIETY

OF

CANADA

THIRD SERIES—VOLUME IX.

MEETING OF MAY 1915

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1916

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THE ROYAL SOCIETY OF CANADA

FOUNDER: HIS GRACE THE DUKE OF ARGYLL, K.T., &c.
(WHEN GOVERNOR-GENERAL OF CANADA IN 1882)

OFFICERS FOR 1915-1916

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ADDITIONAL MEMBERS OF COUNCIL:

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THE ROYAL SOCIETY OF CANADA

LIST OF MEMBERS, 1915-1916

The date given is the date of election; c, denotes a charter member.

SECTION I.—LITTÉRATURE FRANÇAISE, HISTOIRE, ARCHÉOLOGIE, SOCIOLOGIE, ETC.

c—BÉGIN, S. E. LE CARDINAL L.-N., archevêque de Québec, docteur en théologie, *Québec.*

1905—BRUCHÉSI, S. G. MGR PAUL, archevêque de Montréal, docteur en théologie, *Montréal.*

1902—CHAPAIS, THOMAS, membre du Conseil législatif, docteur ès lettres, chevalier de la Légion d'honneur, *Québec.*

1914—CHOQUETTE, ERNEST, membre du Conseil législatif, *Saint-Hilaire.*

1890—DAVID, L.-O., sénateur, chevalier de la Légion d'honneur, *Montreal.*

1885—DE CELLES, A.-D., C.M.G., LL.D., docteur ès lettres, chevalier de la Légion d'honneur, *Ottawa.*

1915—GARNEAU, HECTOR, LL.B., bachelier en droit, professeur à l'Ecole d'Enseignement Supérieure de Montréal, *Montréal.*

1898—GERIN, LÉON, *Coaticooke.*

1911—GOSSELIN, MONSIGNOR AMÉDÉE-E., recteur de l'Université Laval, maître ès arts, *Québec.*

1892—GOSSELIN, L'ABBÉ AUGUSTE, docteur ès lettres, *Saint-Charles-de-Bellechasse.*

c—LE MAY, PAMPHILE, docteur ès lettres, *Saint-Jean-Deschaillons, près Québec.*

1908—LEMIEUX, RODOLPHE, membre du Conseil privé du Canada, docteur en droit, officier de la Légion d'honneur, *Ottawa.*

1911—LOZEAU, ALBERT, officier d'Académie, *Montréal.*

1908—MIGNAULT, PIERRE-BASILE, C.R., docteur en droit, *Montreal.*

1913—MONTIGNY, LOUVIGNY TESTARD DE, officier de l'Instruction publique, *Ottawa.*

1914—MONTPETIT, EDOUARD, LL.L., diplômé de l'Ecole des Sciences politiques de Paris, officier de l'Instruction publique, *Montreal.*

1909—MYRAND, ERNEST, docteur ès lettres, *Québec.*

1903—PAQUET, MONSIGNOR LOUIS-AD., docteur en théologie, *Québec.*

1899—POIRIER, PASCAL, sénateur, chevalier de la Légion d'honneur, *Shédiac.*

1903—PRUD'HOMME, L.-A., juge, *Saint-Boniface.*

1908—RIVARD, ADJUTOR, maître ès arts, docteur ès lettres, *Québec.*

1915—ROUILLARD, EUGENE, Bachelier en droit de l'Université Laval, officier d'Academie, *Québec.*

c—ROUTHIER, SIR ADOLPHE-B., C.G.C. Saint-Grégoire, docteur en droit et ès lettres, ancien president general, *Québec.*

1904—ROY, L'ABBÉ CAMILLE, docteur ès lettres, licencié ès lettres de l'Université de Paris, *Québec.*

1911—ROY, PIERRE-GEORGES, docteur ès lettres, officier de l'Instruction Publique, *Lévis.*

c—SULTE, BENJAMIN, docteur ès lettres, ancien président général, *Ottawa.*

Section II.—ENGLISH LITERATURE, HISTORY, ARCHÆOLOGY, SOCIOLOGY, ETC.

1901—Bryce, Rev. George, M.A., LL.D., *Winnipeg* (ex-president).
1911—Burpee, Lawrence, J., F.R.G.S., Sec'y, International Joint Commission, *Ottawa.*
1894—Campbell, W. Wilfred, LL.D., Dominion Archives, *Ottawa.*
1906—Coyne, J. H., M.A., LL.D., *St. Thomas.*
1906—Cruikshank, Col. E. A., *Calgary.*
c—Denison, Col. G. T., B.C.L., *Toronto* (ex-president; life member).
1905—Doughty, Arthur, G., C.M.G., Litt. D., Dominion Archivist, *Ottawa.*
1915—Edgar, Pelham, Ph.D., Victoria College, *Toronto.*
1911—Grant, W. Lawson, M.A. (Oxon), Queen's University, *Kingston.*
1913—Hill-Tout, Charles, *Abbotsford, B.C.*
1913—Hutton, Maurice, M.A., LL.D., University of Toronto, *Toronto.*
1905—James, C. C., C.M.G., LL.D., 144 St. George St., *Toronto.* (Life member).
1910—Jones, Rev. Arthur E., S.J., LL.D., St. Mary's College, *Montreal.*
1910—King, Hon. W. L. Mackenzie, C.M.G., Ph.D., *Ottawa.*
1913—Leacock, Stephen, B.A., Ph.D., McGill University, *Montreal.*
1903—LeSueur, W. D., B.A., LL.D., *Ottawa* (ex-president).
1902—Lighthall, William Douw, M.A., B.C.L., F.R.S.L., *Montreal.*
1898—Longley, Hon. Mr. Justice, LL.D., *Halifax.*
1910—Macphail, Andrew, B.A., M.D., *Montreal.*
1914—Mavor, James, Ph.D., University of Toronto, *Toronto.*
1911—McLachlan, R. Wallace, F.R.N.S., *Westmount.*
1914—Peterson, Sir William, K.C.M.G., LL.D., Principal McGill University, *Montreal.*
1913—Phillips-Wolley, Sir Clive, Kt., F.R.G.S., *Somenos, B.C.*
1906—Raymond, Ven. Archdeacon W. O., LL.D., *St. John.*
1914—Robertson, J. Ross, *Toronto.*
1899—Scott, D. Campbell, Deputy Superintendent-General of Indian Affairs, *Ottawa.*
1900—Scott, Rev. Frederick George, *Quebec.*
1906—Shortt, Adam, C.M.G., M.A., LL.D., *Ottawa.*
1910—Thomson, E. W., F.R.S.L., *Ottawa.*
1911—Walker, Sir Edmund, C.V.O., *Toronto.*
1905—Wood, Lt.-Col. William, *Quebec.*
1908—Wrong, George M., M.A., University of Toronto, *Toronto.*

Section III.—MATHEMATICAL, PHYSICAL AND CHEMICAL SCIENCES.

1914—Allan, Francis Barclay, M.A., Ph.D., University of Toronto, *Toronto.*
1909—Allen, Professor Frank, M.A., Ph.D., University of Manitoba, *Winnipeg.*
1915—Bain, James Watson, B.A. Sc., University of Toronto, *Toronto.*
1899—Baker, Alfred, M.A., LL.D., University of Toronto, *Toronto.*
1902—Barnes, H. T., D.Sc., F.R.S., McGill University, *Montreal.* (Life member).
1913—Burton, E. Franklin, B.A., Ph.D., University of Toronto, *Toronto.*
1915—Clark, A. L., B.Sc., Ph. D., Queen's University, *Kingston.*
1897—Dawson, W. Bell, M.A., Ma.E., D.Sc., M. Inst. C.E., *Ottawa.*
c—Deville, E., LL.D., Surveyor-General, *Ottawa.*
c—Dupuis, N.F., M.A., F.R.S.E., Queen's University, *Kingston.*

1891—Ellis, W. H., M.D., University of Toronto, *Toronto.*
1910—Eve, A. S., D.Sc., McGill University, *Montreal.*
1909—Fields, John Charles, Ph.D., F.R.S., University of Toronto, *Toronto.*
—Fleming, Sir Sandford, K.C.M.G., LL.D., C.E., *Ottawa* (ex-president; life member).
—Girdwood, G. P., M.D., McGill University, *Montreal.* (Life member).
1902—Glashan, J. C., LL.D., *Ottawa.*
1891—Goodwin, W. L., D.Sc., Queen's University, *Kingston.*
1908—Harkness, James, M.A., (Cantab. & Lond.). McGill University, *Montreal.*
1911—Herdt, Louis A., D.Sc., E.E., McGill University, *Montreal.*
c—Hoffman, G. C., F.I.C., M.M.S., LL.D., *Ottawa.*
1914—Johnson, F. M. G., M.Sc., Ph.D., F.I.C., McGill University, *Montreal.*
1911—Kenrick, Frank B., M.A., Ph.D., University of Toronto, *Toronto.* (Life member).
1915—King, Louis Vessot, M.A., (Cantab), D.Sc., McGill University, *Montreal.*
1908—King, W. F., C.M.G., LL.D., (ex-president) Dominion Observatory, *Ottawa.*
1910—Klotz, Otto, LL.D., F.R.A.S., Dominion Observatory, *Ottawa.*
1911—Lang, William, R., D.Sc., F.I.C., University of Toronto, *Toronto.*
c—Loudon, James, M.A., LL.D., *Toronto* (ex-president).
1913—Mackenzie, A. Stanley, B.A., Ph.D., D.C.L., Dalhousie University, *Halifax.*
1900—McGill, Anthony, B.Sc., LL.D., Chief Analyst, *Ottawa.*
1909—McIntosh, Douglas, Ph.D., McGill University, *Montreal.*
1903—McLennan, J. C., Ph.D., University of Toronto, *Toronto.*
1893—McLeod, C. H., M.E., McGill University, *Montreal.* (Life member).
1911—McClung, Robert K., M.A., D.Sc., B.A. (Cantab.), University of Manitoba, *Winnipeg.*
1899—Miller, W. Lash, Ph.D., University of Toronto, *Toronto.* (Life member).
1910—Plaskett, J. S., B.A., D.Sc., Dominion Observatory, *Ottawa.*
1896—Ruttan, R. F., M.D., C.M., D.Sc., McGill University, *Montreal.*
1899—Shutt, F. T., M.A., D.Sc., F.I.C., F.C.S., Chemist, Central Experimental Farm, *Ottawa.* (Life member).
1913—Stansfield, Alfred, D.Sc., A.R.S.M., McGill University, *Montreal.*
1901—Stupart, R. F., Superintendent Meteorological Service, *Toronto.*
1909—Tory, H. M., M.A., D.Sc., LL.D., *Edmonton.*

SECTION IV—GEOLOGICAL AND BIOLOGICAL SCIENCES.

1902—Adami, J. G., F.R.S., M.A., M.D. (Cantab. and McGill), LL.D., F.R.S.E., McGill University, *Montreal.*
1896—Adams, Frank D., Ph.D., D.Sc., F.R.S., F.G.S., McGill University, *Montreal,* (ex-president).
1900—Ami, Henry M., M.A., D.Sc., F.G.S., *Ottawa.* (Life member).
c—Bailey, L. W., M.A., Ph.D., University of New Brunswick, *Fredericton.*
c—Bell, Robert, B.Ap.Sc., M.D., LL.D., F.G.S., F.R.S., *Ottawa.*
1910—Bensley, Benj. A., Ph.D., University of Toronto, *Toronto.*
1892—Bethune, Rev. C. J. S., M.A., D.C.L., *Guelph.* (Life member).
1911—Brock, Reginald W., M.A., F.G.S., F.G.S.A., University of British Columbia, *Vancouver, B.C.*
1911—Brodie, T. G., M.D., F.R.S., University of Toronto, *Toronto.*
1909—Buller, A. H. Reginald, D.Sc., Ph.D., University of Manitoba, *Winnipeg.*
1885—Burgess, T. J. W., M.D., *Montreal.* (Life member).

1900—Coleman, A. P., M.A., Ph.D., F.R.S., University of Toronto, *Toronto.*
1912—Dowling, D. B., B.Sc., Geological Survey, *Ottawa.*
1915—Dresser, John A., M.A., *Westmount, Que.*
1913—Faribault, E. Rodolphe, B.Ap.Sc., Geological Survey, *Ottawa.*
1912—Faull, J. H., B.A., Ph.D., University of Toronto, *Toronto.*
c—Grant, Sir J. A., K.C.M.G., M.D., F.G.S., *Ottawa* (ex-president).
1910—Harrison, Francis C., B.S.A., D.Sc., Macdonald College, *Ste. Anne de Bellevue, Que.*
1913—Hewitt, C. Gordon, D.Sc., F.E.S., Dominion Entomologist, *Ottawa.*
1913—Huard, L'Abbe Victor A., D.D., *Quebec.*
1912—Knight, A. P., M.A., M.D., Queen's University, *Kingston.*
1900—Lambe, Lawrence M., F.G.S., Geological Survey, *Ottawa.* (Life member).
1900—Macallum, A. B., Ph.D., F.R.S., University of Toronto, *Toronto.*
1888—Mackay, A. H., LL.D., B.Sc., Superintendent of Education, *Halifax.* (Life member).
1909—Mackenzie, J. J., B.A., M.B., University of Toronto, *Toronto.*
1913—McConnell, Richard G., B.A., Deputy Minister of Mines, *Ottawa.*
1912—McInnes, William, B.A., Geological Survey, *Ottawa.* (Life member).
1909—McMurrich, J. P., M.A., Ph.D., University of Toronto, *Toronto.*
1915—McPhedran, Alexander, M.B., University of Toronto, *Toronto.*
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1911—Miller, Willet G., B.A., LL.D., F.G.S.A., *Toronto.* (Life member).
1913—Moore, Clarence L., M.A., Dalhousie University, *Halifax.*
1908—Nicholls, A. G., M.A., M.D., D.Sc., Dalhousie University, *Halifax, N.S.*
1915—Parks, William Arthur, B.A., Ph.D., University of Toronto, *Toronto.*
1902—Prince, E. E., B.A., LL.D., F.L.S., Dominion Commissioner of Fisheries, *Ottawa.* (Life member).
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1910—Tyrrell, Joseph B., M.A., B.Sc., F.G.S., *Toronto.*
1909—Vincent, Swale, M.D., D.Sc., University of Manitoba, *Winnipeg.*
1915—Walker, Edmund Murton, B.A., M.B., University of Toronto, *Toronto.*
1910—White, James, F.R.G.S., Assistant to Chairman, and Secretary, Commission of Conservation, *Ottawa.*
1912—Willey, Arthur, D.Sc., F.R.S., McGill University, *Montreal.*

CORRESPONDING MEMBERS.

Section I.

Salone, Emile, professeur d'histoire au Lycée Condorcet, 68 rue Jouffray, *Paris.*
Hanotaux, Gabriel, de l'Académie française, 21, rue Cassette, *Paris.*
Lamy, Etienne, secrétaire perpétuel de l'Académie française, 3 place d'Iéna, *Paris.*
Lorin, Henri, professeur d'histoire coloniale à l'Université de Bordeaux, 23, quai des Chartrons, *Bordeaux.*

Section II.

Bryce, Rt. Hon. Viscount, D.C.L., *London, England.*
Ganong, Dr. W. F., *Northampton, Mass.*
Parker, Sir Gilbert, Bart., D.C.L., M.P., *London, England.*

Section III.

Bonney, T. G., D.Sc., LL.D., F.R.S., *London, England.*
Metzler, W. H., Ph.D., F.R.S., Edin., Syracuse University, *Syracuse, N.Y.*
Ostwald, Prof. Dr., Wilhelm, *Leipzig.*
Thomson, Sir Joseph J., O.M., F.R.S., *Cambridge, England.*

Section IV.

Osborn, Dr. Henry Fairfield, Columbia University, *New York, N.Y.*
White, Charles David, B.Sc., United States Geological Survey, *Washington, D.C.*

RETIRED MEMBERS.

c—Bourassa, Napoléon, *Montreal.*
1902—Burwash, Rev. Nathanael, S.T.D., LL.D., Victoria College, *Toronto.*
—Callendar, Hugh L., M.A., (Cantab.), F.R.S., *London, England.*
1899—Charland, Père Paul V., Litt. D., *Quebec.*
1909—Colby, Chas. W., M.A., McGill University, *Montreal.*
1897—Cox, John, M.A. (Cantab.), *London, England.*
1894—Dawson, S. E., C.M.G., Litt. D., *Westmount* (ex-president).
1891—Fowler, James, M.A., Queen's University, *Kingston.*
1902—Gagnon, Ernest, docteur ès lettres, officer de l'Instruction publique, *Quebec.*
1904—Gordon, Rev. Charles W., LL.D., *Winnipeg.*
c—Haanel, E., Ph.D., Director of Mines, *Ottawa.*
1894—Harrington, W. H., *Ottawa.*
1911—Leathes, John B., B.A., F.R.C.S., B.Ch. (Oxon.), *Sheffield, England.*
1909—Macbride, Ernest W., M.A., F.R.S., *London, England.*
Mair, Charles, *Prince Albert, Sask.*
Mills, T. Wesley, 45 Warrington Crescent, Maida Vale, *London, England.*
c—Murray, Rev. J. Clark, LL.D., *Montreal.*
c—Osler, Sir W., Bt., M.D., F.R.C.P., F.R.S., *Oxford, England.*
Owens, R. B., M.Sc., Franklin Institute, *Philadelphia, U.S.*
1898—Parkin, G. R., C.M.G., LL.D., *London, England.*
1900—Poole, H. S., M.A., F.G.S., *Spreyton, Stoke, Guildford, England.*
c—Reade, John, LL.D., F.R.S.L., *Montreal.*
1890—Roberts, C. G. D., M.A., *London, England.*
Rutherford, E., B.A. (Cantab.), A.M., F.R.S., *Manchester, England.*
c—Watson, J., M.A., LL.D., *Kingston.*
1900—Willison, Sir John S., LL.D., *Toronto.*
1910—Wilson, Harold A., F.R.S., *Houston, Texas.*
c—Wright, R. Ramsay, M.A., B.Sc., *Bournemouth, England* (ex-president).

LIST OF PRESIDENTS

1882-1883	Sir J. W. Dawson.
1883–1884	L'honorable P. J. O. Chauveau.
1884–1885	Dr. T. Sterry Hunt.
1885–1886	Sir Daniel Wilson.
1886–1887	Monsignor Hamel.
1887–1888	Dr. G. Lawson.
1888–1889	Sir Sandford Fleming, K.C.M.G.
1889–1890	L'Abbè Casgrain.
1890–1891	Very Rev. Principal Grant.
1891–1892	L'abbè Laflamme.
1892–1893	Sir J. G. Bourinot, K.C.M.G.
1893–1894	Dr. G. M. Dawson, C.M.G.
1894–1895	Sir J. Macpherson LeMoine.
1895–1896	Dr. A. R. C. Selwyn, C.M.G.
1896–1897	Most Rev. Archbishop O'Brien.
1897–1898	L'honorable F. G. Marchand.
1898–1899	T. C. Keefer, C.M.G.
1899-1900	Rev. William Clark, D.C.L.
1900–1901	L. Fréchette, C.M.G., LL.D.
1901–1902	James Loudon, LL.D.
1902–1903	Sir J. A. Grant, M.D., K.C.M.C.
1903–1904	Col. G. T. Denison, B.C.L.
1904–1905	Benjamin Sulte, Litt. D.
1905–1906	Dr. Alex. Johnson.
1906–1907	Dr. Wm. Saunders, C.M.G.
1907–1908	Dr. S. E. Dawson, C.M.G.
1908–1909	Dr. J. Edmond Roy.
1909–1910	Rev. Geo. Bryce, LL.D.
1910–1911	R. Ramsay Wright, M.A., B.Sc.
1911–1912	W. F. King, LL.D., C.M.G.
1912–1913	W. Dawson LeSueur, B.A., LL.D.
1913–1914	Frank D. Adams, Ph.D., F.R.S., F.G.S.
1914–1915	Sir Adolphe B. Routhier, Kt.
1915–1916	Alfred Baker, M.A., LL.D.

LIST OF ASSOCIATED SOCIETIES

Ontario.

Hamilton Association for the Promotion of Science, Literature and Art.
The Wellington Field Naturalists' Society.
The Hamilton Scientific Society.
L'Institut Canadien-Français d'Ottawa.
The Women's Wentworth Historical Society.
The Entomological Society of Ontario.
L'Institut Canadien d'Ottawa.
Women's Canadian Historical Society of Ottawa.
Elgin Historical and Scientific Institute.
Women's Auxiliary of the Elgin Historical and Scientific Institute.
Ontario Historical Society.
The Huron Institute.
Niagara Historical Society.
The Ottawa Field Naturalists' Club.
Royal Astronomical Society of Canada.
Canadian Institute, Toronto.
Historical Society, Kingston.
Toronto Astronomical Society.
Lundy's Lane Historical Society.
Women's Canadian Historical Society of Toronto.
United Empire Loyalists Association of Canada.
Peterborough Historical Society.
Canadian Forestry Association.
Hamilton Ladies' College Alumnae.
Club Littéraire Canadien-Français d'Ottawa.
The Historic Landmarks Association of Canada.
Waterloo Historical Society.

Quebec.

Société du Parler Français au Canada, Québec.
Société de Géographie de Québec.
Société d'Economie Sociale et Politique de Québec.
The Quebec Society for the Protection of Plants from Insects and Fungus Diseases.
The Antiquarian and Numismatic Society of Montreal.

L'Institut Canadien de Québec.
Natural History Society of Montreal.
Microscopical Society, Montreal.
Société Historique, Montréal.
Cercle Littéraire et Musical de Montréal.
Literary and Historical Society, Quebec.

British Columbia.

The Natural History Society of British Columbia.
The British Columbia Academy of Science.

Nova Scotia.

The Nova Scotia Historical Society.
The Nova Scotian Institute of Science.

Manitoba.

Manitoba Historical and Scientific Society.

New Brunswick.

New Brunswick Historical Society.
New Brunswick Loyalists' Society.
Natural History Association.
Natural History Society of New Brunswick.

Prince Edward Island.

Natural History and Antiquarian Society of Prince Edward Island.

THE ROYAL SOCIETY OF CANADA

PROCEEDINGS FOR 1915

THIRTY-FOURTH GENERAL MEETING

SESSION I.—(Tuesday, May 25).

The Royal Society of Canada held its thirty-fourth annual meeting in the Chateau Laurier, Ottawa, on May 25, 26 and 27. The Presidential Address and the Popular Lecture were delivered in the Concert Hall.

The President, Sir Adolphe B. Routhier, took the chair at 10 a.m. and, having called the meeting to order, requested the Honorary Secretary to call the roll.

The following members answered to their names or arrived later during the session:—

Officers of the Society.

President, Sir Adolphe B. Routhier, Kt.
Honorary Secretary, Mr. Duncan C. Scott.
Honorary Treasurer, Dr. C. Gordon Hewitt.
Honorary Librarian, Mr. D. B. Dowling.

Section I.—Bruchési, Mgr. Paul; Choquette, Ernest; David, Hon. L. O.; DeCelles, A. D.; deMontigny, L. T.; Garneau, Hector; Gerin, Leon; Gosselin, Abbé Auguste; Lemieux, Hon. Rodolphe; Rouillard, Eugene; Routhier, Sir Adolphe B.; Roy, Camille; Sulte, Benjamin.

Section II.—Bryce, George; Campbell, Wilfred; Coyne, J. H.; Doughty, A. G.; Edgar, Pelham; Hill-Tout, Charles; LeSueur, W. D.; Lighthall, W. D.; Longley, J. W.; McLachlan, R. W.; Mavor, James; Peterson, William; Raymond, W. O.; Scott, D. C.; Shortt, Adam; Walker, Sir Edmund; Wrong, George M.

Section III.—Allan, F. B.; Baker, Alfred; Barnes, H. T.; Burton, E. F.; Clark, A. L.; Dawson, W. B.; Dupuis, N. F.; Ellis, W. H.; Eve, A. S.; Fields, J. C.; Glashan, J. C.; Goodwin, W. L.; Hoffman, G. C.; Johnson, F. M. G.; Kenrick, Frank; King, L. V.; King, W. F.; Klotz, Otto; McGill, A.; McIntosh, D.; McLennan, J. C.; McLeod, C. H.; Miller, W. Lash; Plaskett, J. S.; Ruttan, R. F.; Stansfield, Alfred; Stupart, R. F.; Tory, H. M.

SECTION IV.—Adams, F. D.; Ami, H. M.; Bailey, L. W.; Bensley B. A.; Brock, R. W.; Buller, A. H. R.; Burgess, T. J. W.; Coleman, A. P.; Dowling, D. B.; Dresser, J. A.; Faull, J. H.; Grant, Sir James; Harrison, F. C.; Hewitt, C. G.; Knight, A. P.; Lambe, L. M.; Mackay, A. H.; Macallum, A. B.; McInnes, W.; McMurrich, J. P.; Miller, W. G.; Prince, E. E.; Tyrrell, J. B.; Walker, E. M.; White, James.

Letters of regret for absence were received from: Paquet, Mgr.; Mignault, P. B.; LeMay, Pamphile; Gagnon, Ernest; Bégin, Cardinal L. N.; Gosselin, A. E.; Cruikshank, E. A.; Leacock, S.; McPhail, A.; Robertson, J. R.; Jones, A. E.; Grant, W. L.; Thomson, E. W.; Burpee, L. J.; Denison, G. T.; Wood, William; King, W. L. M.; Shutt, F. T.; Mackenzie, A. S.; Girdwood, G. P.; Allen Frank; MacKenzie, J. J.; Brodie, T. G.; Bethune, C. J. S.; Roddick, T. G.; Bell, Robert; McPhedran, Alexander; Faribault, E. R.

It was moved by Dr. Adams, seconded by Dr. Tory, that the minutes of the annual meeting of last year, as contained in the printed Proceedings of last year in the hands of the members, be confirmed.—Carried.

The Annual Report of Council, printed copies of which had been delivered to the members, was then presented by the Honorary Secretary. The Report was as follows:—

REPORT OF COUNCIL.

FOR THE YEAR 1914–15.

To the Fellows of The Royal Society of Canada:

The Council have the honour to present the following report on the work of the Society during the past year.

The last Annual Meeting was held in Montreal and a full report of the proceedings on that occasion has been distributed. The varied hospitality extended to the Society will be long remembered; and from the importance of the papers presented and the discussions arising therefrom, the meeting takes its place as one of the most important in our history.

Our meeting this year is held in Ottawa at the Chateau Laurier, and it is hoped that the Fellows will find the arrangements which have been made by the officers adequate.

I.—Proceedings and Transactions of the Society.

The new method of publication by quarterly pamphlets was inaugurated during the year; the issue of the quarterlies is now complete and a bound copy of the volume is laid upon the table for inspection. The issue will soon be ready for distribution. It is hoped that the format and the general design of the publication meet with the approval of the Society. The Council beg to draw attention to the necessity for an active interest on the part of the Fellows in the periodical publication.

The volume consists of 1,157 pages with many illustrations; it is larger than last year, and the number of reprints, 6,300, which have been supplied gratuitously to the authors, is also in excess of last year's supply.

We are pleased to note that the fact that the Agenda shows no decrease in the number of papers, implies increased interest in the work of the Society, as, owing to the extraordinary occurrences of the present year, we had anticipated a falling off in contributions.

II.—Election of New Members.

This year there are vacancies in all the sections and as usual the voting was closed on the 1st April. The Council have much pleasure in reporting that the following candidates received a majority of the votes cast and their election is submitted for confirmation.

Section I.

M. Hector Garneau, LL.B.
M. Eugène Rouillard.

Section II.

Pelham Edgar, Ph.D.

Section III.

A. L. Clark, B.Sc., Ph.D.
Louis Vessot King, M.A., D.Sc.

Section IV.

John A. Dresser, M.A.
Alexander McPhedran, M.B.
William Arthur Parks, B.A., Ph.D.
Edmund Murton Walker, B.A., M.B.

III.—Deceased Members.

It is with deep regret that we record five vacancies in the ranks of the Fellows, which have occurred by death: Sir François Langelier, Most Rev. M. F. Howley, Dr. T. C. Keefer, Dr. A. E. Barlow and Dr. William Saunders.

Biographical notices appear herewith.

Hon. Dr. Ernest Choquette contributed the notice of Sir François Langelier; we are indebted to the Right Rev. Mgr. Roche for the memoir of the late Archbishop Howley; Dr. C. Gordon Hewitt has contributed the notice of Dr. William Saunders; and Dr. H. M. Ami those of Dr. Keefer and Dr. Barlow.

(1) Sir François Langelier.

Par la mort de Sir François Langelier, nous avons à déplorer la perte de l'un de nos plus distingués collègues de la Société Royale. Né en 1838, à Sainte-Rosalie, dans une humble maison de paysan, il décédait l'autre jour sous les somptueux lambris du château de Spence-Wood.

Toute son histoire tient dans cette constante montée, coupée ici et là de rares et reposants relais, mais reprenant toujours tout de suite vers les cîmes.

Et c'est ainsi qu'il traversa les diverses et multiples étapes de sa féconde carrière, sans jamais baisser, sans jamais dévier, comme s'il eut en quelque sorte appliqué à sa propre vie l'exemple touchant du sillon qu'il avait toujours vu la charrue paternelle creuser très droit dans le champ natal.

Les voici, ces étapes successives—ces enjambées, je dirais,—classées dans leur ordre chronologique. On les croirait extraites des pages de quelque calendrier, tant les dates se suivent pressées, se bousculent:

François-Charles-Stanislas Langelier était le fils de Louis-Sébastien Langelier et de Julie-Esther Casault. Jeune encore il entrait au Séminaire de Saint-Hyacinthe; ses études classiques terminées, il embrassa la carrière légale et étudia le droit à l'Université Laval; en 1860 il prenait ses degrés de bachelier en loi; l'année suivante, il obtenait le titre de licencié en droit avec grande distinction; la même année il fut admis à la pratique du droit. Afin d'approfondir ses connaissances légales, il partait la même année pour Paris, où il passait deux ans.

En 1863, il revenait à Québec et les autorités de l'Université Laval lui confièrent le cours de droit romain à la Faculté de Québec. Peu de temps après, il fut appelé à la chaire de droit civil, et c'est là

SIR FRANCOIS LANGELIER

surtout qu'il fit voir toute son érudition et qu'il donna la mesure de ses capacités légales et des qualités de professeur.

Le gouvernement de Québec le nommait, en 1878, conseil de la Reine; en 1880 le Marquis de Lorne lui accordait la même distinction.

Au mois de mai 1887, le barreau de Québec le choisissait pour son bâtonnier.

Quelques jours plus tard, il était nommé bâtonnier général de la province.

En 1897 il était élu vice-président de l'Association du Barreau-Canadien.

M. Langelier a occupé un grand nombre de positions importantes, il fut secrétaire de la première société de colonisation organisée au Canada; il fut aussi président de l'Institut Canadien.

Pendant huit ans, de 1882 à 1890, il fut maire de la cité de Québec En 1887, il devint président du conseil des Arts et des Manufactures, dont il était membre depuis plusieurs années.

C'est en 1871 que M. Langelier entra dans la politique; il se présenta comme candidat libéral dans le comté de Bagot; il fut défait, mais au mois de mai 1873 il était élu dans le comté de Montmagny.

Défait de nouveau en 1875; il l'emporta dans Portneuf aux élections générales de 1878 et détint ce siège jusqu'en 1881. Au mois de juillet 1884, il conquit le mandat du comté de Mégantic à la Chambre des Communes; il l'échangea pour celui de Québec-centre lors de élections de 1887; mandat qu'il retint jusqu'à sa sortie de l'arène politique.

De 1878 à 1889 il fit partie du cabinet Joly et fut tout à tour commissaire des terres en 1878-1879, et trésorier provincial en 1879-1880.

En 1898, il fut nommé juge de la Cour Supérieure à Québec; il devint juge en chef suppléant en 1906. C'est en 1909 qu'il fut appelé à faire partie de la Société Royale. En 1911, il était nommé lieutenant-gouverneur pour succéder à Sir A.-P. Pelletier. Quelque temps après il fut fait chevalier.

Sir François Langelier est l'auteur de plusieurs ouvrages très recherchés. En 1868, il publiait une brochure: "Lettres sur les affaires municipales."

En 1894 parut un travail: "De la Preuve en Matière Civile et Commerciale," très apprécié dans le monde légal. Son ouvrage le plus important: "Commentaire du Code Civil de la Province de Québec" parut quelques années plus tard.

L'étendue de son œuvre fut donc considérable. Nous la retrouvons ainsi, dans notre province de Québec, semée à une égale profondeur, dans presque tous les champs de l'activité intellectuelle.

Avocat, professeur de droit, parlementaire, jurisconsulte, magistrat, il haussa chacun de ces titres à leur point culminant. Et alors il semble que, à l'occasion de sa mort, l'imposant personnage qu'il était à la fin de sa carrière dut se fondre dans l'esprit de tous: chacun s'empressant à ce moment de se le représenter sous la qualité qu'il avait le plus admirée chez lui. Le plaideur dut tout de suite se rappeler l'avocat qui pétrissait si habilement le code sous ses fines argumentations; l'étudaint se souvint du professeur, expert à tirer les plus éblouissants commentaires de la sécheresse même des textes de loi; l'assidu des assemblées délibérantes, à Ottawa ou à Québec, revit sans doute le puissant et souple parlementaire, jamais à court, sapant en phrases hachées, de derrière son siège, le lent échafaudage dressé par l'adversaire; quant aux vieux rouges de Bagot et de Montmagny, j'imagine qu'ils n'ont pensé, eux, qu'au jeune et alerte jouteur dont le verbe tombait en cascades, du haut des tribunes paroissiales, et qui peut-être tinte encore à leurs oreilles ravines.

Jusqu'ici, comme vous ne percevez guère son action littéraire en tout cela, peut-être jugez-vous que je déraille et que je m'écarte de mon sujet? Très peu cependant

Si la Société Royale ne comprenait que des gens de lettres dans son sien, je serais probablement assez mal à l'aise pour émettre l'assertion que je désire formuler, car je veux poser que Sir François Langelier ne fut jamais un lettré au sens absolu du mot.

Il l'eût indéniablement été en France,—où le milieu, la seule culture ambiante, suffit en quelque temps à revêtir les esprits d'un précieux vernis artistique semblable a une patine—mais ici, n'est-ce pas, les frottements présentent encore trop de rudesse.

La carrière de Sir François Langelier est donc à mon sens doublement révélatrice. Car si elle témoigne d'abord de la puissance cérébrale étonnante qu'il possédait et à l'aide de laquelle il put, sa vie durant, éparpiller sans la moindre fatigue ses miltiples talents, elle témoigne davantage combien il est difficile, parmi les frustes éléments qui nous enveloppent, d'affiner sa pensée, "de polir sa matière grise," selon que la disait Théophile Gautire.

Ce fut le cas de notre collègue. Et c'est pourquoi, tout en notant dans ses œuvres écrites, dans ses patientes études de droit:—"*Lettres sur les affaires municipales*," "*De la preuve en matière civile*," "*Commentaire du Code Civil de la province de Québec*"—la marque d'une érudition égale à l'ampleur de son intellect, nous ne trouvons point cette séduction de style ou de pensée qui constitue le raffinement littéraire français, quelle que soit l'aride matière sur laquelle on l'exerce.

MOST REV. M. F. HOWLEY

C'est-à-dire que Sir François Langelier fut l'un des produits les plus parfaits que la race canadienne-française pouvait donner, il y a trois-qurats de siècle. Etonnamment doué sans doute sous le rapport des dons naturels, mais incapable par contre de combler les vides qui, à cette époque particulièrement, faisaient la faiblesse ou atténuaient du moins la valeur de nos progrès intellectuels.

De toute autre toutefois, il fut merveilleux. Au barreau, à la chaire d'enseignement, à la tribune publique, au banc du magistrat, il brilla d'une égale distinction et domina d'une incontestable supériorité. C'est pourquoi tous les partis, à l'exemple des individus, peuvent en ce moment sans rien abdiquer de de qui leur est propre, l'honorer avec une si parfaite sincérité.

(2) Most Rev. M. F. Howley,

Archbishop of St. John's, Newfoundland.

By the death of Archbishop Howley, Newfoundland lost one of her most talented sons and her most prominent and patriotic citizens.

Michael Francis Howley was born at St. John's, Sept. 25, 1843. Having completed his preliminary studies in his native town, he proceeded in 1863 to the Propaganda, Rome, to study for the priesthood. He was ordained in June, 1868, and after acting for some time as Secretary to the then Archbishop of Glasgow, he returned in Sept., 1870 to his own country. For the past forty-four years both as Preist and Bishop Dr. Howley took the leading part in the religious and civil life of Terra Nova. Raised to the episcopate in 1892 he was the first Newfoundlander, to reach that dignity, and the scene of enthusiasm at his Consecration in St. John's, June 24, 1892 can never be forgotten by those who witnessed it. He ruled the See of St. George's, West Newfoundland, for three years and was translated to St. John's, Dec., 1894. In 1904 he was named Archbishop and governed his diocese wisely and well until Oct. 15, 1914, when he passed away in the seventy-second year of his age.

Archbishop Howley was a man of superior literary attainments; he had a knack of grouping words gracefully and forcibly together and the inborn talent was improved by assiduous cultivation. Of him it may be said as was said of a great painter, *nulla dies sine linea.* His numerous essays both on ecclesiastical and historical themes were marked by great erudition, interesting exposition and sober judgment. His wide reading and catholic tastes in literature gave him mastery over a large number of subjects, while his travels and long experience of men and things afforded him abundant matter for apt illustration. His "Ecclesiastical History of Newfoundland" is a household book throughout the country; there the patient gleanings of twenty-five years' research are garnered and the old traditions of pioneer catholicity in Terra Nova, which were on the point of perishing are stored for future generations. The Archbishop was also a good *raconteur*—he both wrote and told a story well. Some of his fugitive pieces set off, under an agreeable veil of fiction, the peculiar characteristics, the rough but generous hearts of Newfoundland fisher folk.

He also had considerable metrical gifts, and wrote verse well. Just a few weeks before his death he translated into stirring English numbers an Italian poem on the destruction of Louvain. His "Flag of Newfoundland" has reached the hearts of all his countrymen, and has already become our National anthem.

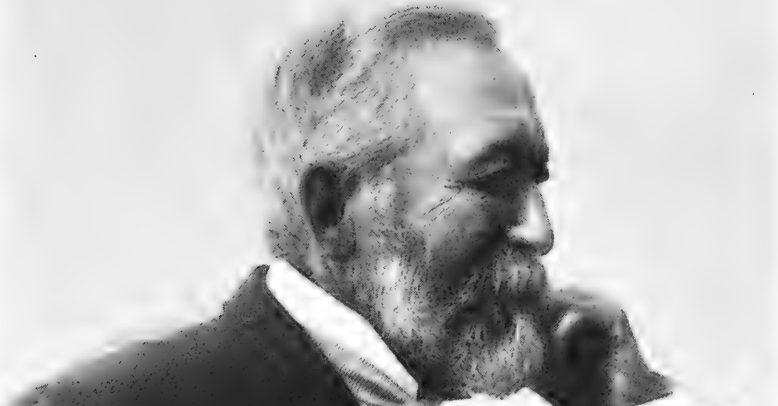
Of late years the constantly increasing demands of his episcopal duties prevented Archbishop Howley from devoting as much time to literary pursuits as he would have wished; still, he utilised every spare moment for reading, writing and research, and left behind him large accumulations of unpublished manuscripts.

Among the deceased prelate's many and rare gifts, the gift of tongues deserves mention. Italian and French he knew very well; and he had some acquaintance with German, Spanish and Celtic Church Latin he could both write and speak with ease and fluency; and in that most difficult department of classical scholarship—lapidary inscriptions—he was a perfect master.

(3) William Saunders.

By the death of Dr. William Saunders, which took place at his residence in London, Ontario, on the 13th September, 1914, the Society lost one of its few remaining charter members. Dr. Saunders was associated with the Society from its foundation; his interest in our welfare was always most keen, and in our councils and activities he was prominent and influential, as he was in all the other varied relations of his life.

Born in Devonshire in 1836 he came to Canada at the age of 12 years with his parents, who settled at London, Ontario. Early in life he studied chemistry and pharmacy and his wide botanical knowledge enabled him to found a most successful business in the manufacture of pharmaceutical preparations, which business he conducted until 1886. In 1882 he became Public Analyst for Western Ontario, having previously held the office of President of the Ontario College of



WILLIAM SAUNDERS

Pharmacy. He was also a professor in the medical faculty of the Western University. His scientific interests were of a very wide character for he soon became one of the leading authorities on entomology. Not only did he assist in the organization of the Entomological Society of Ontario in 1863, but for thirteen years he was Editor of *The Canadian Entomologist.* His work on "*Insects Injurious to Fruits*," published in 1882, was the first and most important treatise of its kind and is now one of the classics on the subject.

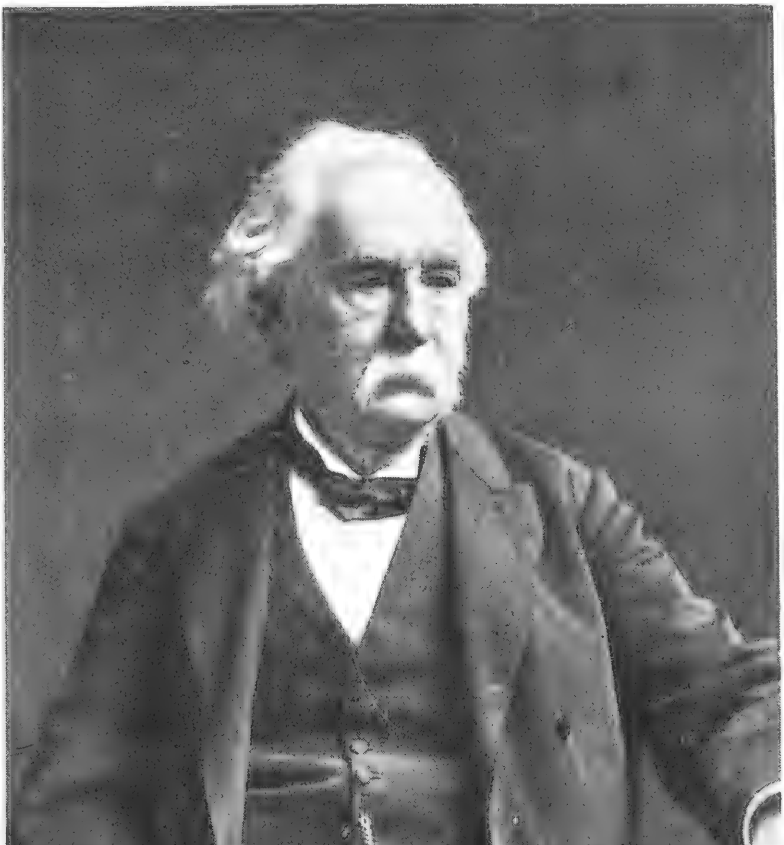
The purchase of a small farm in 1868 enabled him to start his skilful work in the production of new fruits and flowers, etc., which efforts constituted the foundation of his future career. He produced by hybridization valuable varieties of gooseberries, currants and grapes; he added new varieties of roses and barberries to the stock of ornamental plants. This work, interesting and important in itself, served as peliminary training for a larger sphere of usefulenss.

His true life work began in 1886, when at the age of 50 years he was selected to organize the Experimental Farms system of Canada. Two years earlier, when the universal agricultural depression was affecting Canada, which had at that time a population of a little over four millions, a Select Committee of the Dominion Parliament recommended the establishment of central and local experimental farms for the conducting of experiments in all branches of agriculture and horticulture as the best means of developing and encouraging the agricultural interests of the Dominion. Dr. Saunders was commissioned in 1885 to visit and report upon the agricultural experiment stations of the United States and to secure information regarding similar stations in Europe. Following the completion of this work in 1886 the Experimental Farm Stations Act was passed, authorizing the establishment of a central farm at Ottawa for Ontario and Quebec and branch farms in the Maritime Provinces, Manitoba, the North West Territories and British Columbia, and Dr. Saunders was appointed Director of the system.

The results of his work and organization may be seen in the twenty-five voluminous annual reports. From the five original farms the present important Experimental Farms Branch of the Department of Agriculture has developed, which now embraces no less than ten separate divisions of scientific and practical investigation, eighteen branch farms or stations and seven sub-stations. In addition to the work of building up this powerful organization, in which science and practice are conjoined, he found time to carry on original work of the greatest importance and value to the country to which work space forbids more than a brief reference. By crossing the wild Siberian crab apple (*Pyrus baccata*) with hardy Russian and American apples he produced fruits which can be grown in the open prairie and as far north as Fort Vermilion, where the winter temperatures may fall as low as 60°F. His work in cereals, however, has proved to be of the greatest value to Canada. His object was to produce an early ripening wheat of great quality that might be grown in more northerly districts where the standard varieties, such as Red File, were injured in some seasons by early autumnal frosts. As a result of many years of patient crossing involving the production of hundreds of hybrids which were tested for prolificness, earliness and bread-making qualities, a number of wheats have been produced which are now widely cultivated. These experiments led the way to the production of the now famous Marquis wheat, which ripens from five to ten days earlier than Red Fife and which is now replacing the older maturing wheats, including Red Fife, on the western prairies. By this work alone he has extended the northern range of wheat cultivation in Canada enormously, and has thus increased the possible acreage by millions of acres, an achievement which in significance is the greatest in Canadian agriculture, nor will the resulting benefit be confined to the Dominion.

The records of our Society give ample evidence of the high regard in which Dr. Saunders was held and the constancy of his interest in our progress. As before mentioned he was a charter member of the Society and was elected to the Presidency in 1906. The Transactions show a large number of contributions from his pen. The titles of some of the more important may be given. "The Introduction and Dissemination of Noxious Insects," "The Importance of Economizing and Preserving our Forests," "The Influence of Sex in the Hybridizing of Fruits," "Early Ripening Cereals," "Progress of Experiments in Cross-fertilizing at the Experimental Farms," "Results of Tree Planting on he North Western Plains," "Increased Production of Farm Crops by Early Sowing."

All who came in contact with him were impressed by his kindly character and desire to be of the slightest service, which traits secured for him a wide circle of friends in all countries. To those who had the privilege of working with him the most notable characteristics were his tireless energy, his constant thoughtfulness and his love for detail. With a thorough knowledge of the kind of information required by the agriculturist he combined a full appreciation of scientific and practical research as a fundamental necessity and the success of the Experimental Farms system is due largely to that fact. The value of his work not only to Canada but to all parts of the empire drawing food supplies from the Dominion cannot be estimated, but we are able, nevertheless, to appreciate its significance.



THOMAS COLTRIN KEEFER

(4) Thomas Coltrin Keefer.

Thomas Coltrin Keefer, C.M.G., C.E., LL.D., died at his residence, "Rockliffe Manor House," Ottawa, January 7th, 1915, full of years of past work of honour and respect.

The subject of this sketch was born in Thorold, Ontario, November 4th, 1821, being the son of George Keefer, the first President of the Welland Canal Company, a United Empire Loyalist, by his wife Jane, daughter of Edward McBride, who represented the town of Niagara in the Parliament of Upper Canada. His grandfather was an Alsatian Huguenot from Strassburg, who emigrated to North America in the latter part of the eighteenth century and settled in the then British province of New Jersey. He served in the British Army during the Revolutionary war and fell fighting under the command of Sir William Howe.

Mr. Keefer was a member of a large family of ten sons and five daughters. He was educated at Upper Canada College, Toronto, and began his career as an engineer at the early age of seventeen, being first employed on the staff of the Erie Canal. The period from 1837 to 1845 was spent in engineering work on the Erie and Welland Canals. Thence he moved to Ottawa and from 1845 to 1848 was Chief Engineer of the Ottawa River works, his principal task being to facilitate the transportation of the immense timber trade of that river and its numerous tributaries. He was later in charge of surveys for the navigation of the rapids of the St. Lawrence River.

He contributed very materially to the preparatory work connected with the Reciprocity Treaty of 1854. From 1849 to 1853 he was in close collaboration with Mr. I. D. Andrews, the American Consul for New Brunswick and Canada, in the preparation of the statistical and other information as to the trade relations of theBritish North American colonies, particularly as to the trade carried on between these colonies and the United States via the inland waterways. Most of the information as to the Canadian trade contained in Andrews' notable report upon the "Colonial and Lake Trade" was compiled by Mr. Keefer, as is fully acknowledged throughout the report.

In 1851 Mr. Keefer was a Commissioner of Canada to the first International Exhibition held in London, England. About this time also he prepared plans for the preliminary surveys of the Grand Trunk Railway between Montreal and Toronto; also for the construction of a bridge over the St. Lawrence River at Point St. Charles, above Montreal, for the same railway company. In 1862 he was again appointed Canadian Commissioner to the International Exhibition held in London, England; and in 1878 he was Executive Commissioner of Canada at the Paris Exposition, where he formed part of the "international jury of Engineering and Architecture." It was in 1878 that he was created a Companion of the Order of Saint Michael and Saint George by Her late Majesty Queen Victoria, and received from the French Government the decoration of the Legion of Honour for his distinguished services. The late Mr. Keefer designed and built Montreal's first aqueduct, and he was also employed on the construction of the waterworks system of Ottawa and Hamilton.

In 1849 Mr. Keefer produced his "Philosophy of Railways," a work which is reputed to have exercised a powerful influence on the policy of the Government of the day in respect of the construction of railways in Canada. In 1850, for his essay on "The Influence of the Canals of Canada on her agriculture," he won Lord Elgin's prize.

In this essay, Mr. Keefer advocated a moderate system of protection with a view of developing the natural resources of his native country. A list of the writings of our late-lamented Fellow may be found in the Supplement to the volume of Transactions of The Royal Society of Canada for 1891.

The late Mr. Keefer was undoubtedly the greatest hydraulic engineer of his day, having been consulted in practically all the large and important works and enterprises in this country and in the neighbouring Republic. His work and worth no doubt led to his selection as one of the founders of The Royal Society of Canada.

He was a profound lover of books, especially of those dealing with his science and with the history of Canada. These he read from cover to cover, and had the happy faculty of assimilating their contents in a masterful degree.

In 1912 Mr. Keefer had the signal honour of being elected an Honorary member of the "Institution of Civil Engineers of Great Britain," established in London in 1818. He also held honorary membership in the Canadian Society of Civil Engineers and the American Society of Civil Engineers. It has already been noted that Mr. Keefer was a charter member of our Society. The disabilities of advancing age rendered it impossible for him to attend the annual meetings during past years, but his interest in the work of the Society continued unabated, and it may be gratefully acknowledged that his early association with the Society was a source of strength and influence to us.

(5) Alfred Ernest Barlow.

Alfred Ernest Barlow, M.A., D.Sc., F.R.S.C., F.G.S.A., etc., etc., became a Fellow of this Society in 1903. News of his sudden and tragic death, and of that of his wife with him, on that dreadful night when the collier Storstard struck the Empress of Ireland, near Father Point, in the Gulf of St. Lawrence, and sank it, came as a shock to

ALFRED ERNEST BARLOW

all the Fellows of the Society and especially to all geologists. A powerful swimmer, alert, active and resourceful at all times, he was no doubt one of the first to leave the sinking ship accompanied by his wife, but when struck by wreckage from the lurching steamer he was probably rendered unconscious, and both were drowned.

The loss of Dr. Barlow to Science and to this Society cannot be overestimated; for it was his express wish and purpose on his return to Canada, if spared, to devote the balance of his life to research work for the solution of outstanding problems in the geology of Canadian Pre-Cambrian rock-formations.

Dr. Barlow was born in Montreal, Province of Quebec, Canada, June 17th, 1861, being the younger son of the late Robert Barlow who was many years Cartographer to the Geological Survey of Canada in the days of Sir William Logan, having been formerly engaged in the offices of the Ordnance Survey of London, England. Dr. Barlow's father it was who prepared that magnificent geological map of Canada issued in 1866, which is acknowledged to be one of the very best maps ever published in North America.

Trained first at home in Montreal, by his father, Barlow entered the High School, and later in 1879, the Faculty of Arts of McGill University. Here he studied diligently under Sir William Dawson, Professor B. J. Harrington, and others, graduating with first rank honours in the Natural Sciences, including Geology, Palaeontology, Mineralogy, Petrology, etc., and proving himself to be devoted to Geological Science in particular. Having been offered a position on the technical staff of the Geological and Natural History Survey Canada, by Dr. Alfred R. C. Selwyn, Director at Ottawa, Barlow accepted, and in the spring of 1883 began his successful career as a Dominion Geologist. In 1907, he severed this connection to engage in private practice as consulting Geologist, and took up his residence in Montreal.

Dr. Barlow was in his 53rd year when cut off so prematurely; nevertheless he had accomplished much in practical field-geology, in mapping areas of great economic importance, in describing thousands of square miles of territory in the great primitive series of crystalline rocks forming the basal complex in the earth's crust of which Canada has such a vast extent. From research and studies in pure geology his thoughts and activities were directed to economics, for these play a very prominent part in the plans of government administrators who wish to make known the natural, and national resources. Dr. Barlow became the recognized authority on nickel, copper, silver, cobalt, iron, gold and other ore-deposits in the region north of the Great Lakes.

Barlow's writings, published either as official reports or memoirs issued by the Geological Survey of Canada or the Department of Mines at Ottawa, or by various other Governments, institutions, societies, etc., form a progressive series of Geological investigations, involving extensive field-work covering many summer seasons, laboratory and office work, close microscopical examinations linked with petrological researches and chemistry, presented in clear, attractive, accurate and forceful as well as practical manner. His keen powers of observation coupled with his graphic description of the various mineral deposits and areas studied did much to make his numerous writings eagerly sought, not only by the practical miner but also by the ardent student and professor of Geological Science. In all his geological labours Dr. Barlow made laboratory work the handmaid of field work with remarkable success. He ofttimes pointed out to his confrères the value and necessity of close microscopic investigation in the office following detailed field exploration in a given geological area. He also recognized many geological provinces in Canada constituting centres of geological problems of a fascinating nature and, from his experience of some thirty years work in the crystalline rock-formations of Canada, he had begun to correlate and co-ordinate results when he was so suddenly removed by death. A bibliography of his work comprises some sixty volumes, reports, memoirs, papers or pamphlets from 1890 to 1915; his last "memoir"—a posthumous work—was only very recently issued (May, 1915), from the Department of Mines Press. From his numerous writings may be gauged the great volume of his work. Dealing at first with the nickel and copper deposits of Sudbury, in the Province of Ontario, Canada, he pursued further studies of the Archaean complex in the Laurentain and Huronian areas of Lakes Huron, Timagami, Timiscaming and Keepawa. His elaborate monograph of the Lake Timiscaming district forms a classic; whilst his careful researches in the Haliburton region of southeastern Ontario added much to our knowledge of that complicated region. During his geological explorations Dr. Barlow made carefully selected collections of geological specimens with a view of illustrating the precise geological characters and physical appearance of the rocks found in the areas examined. These are preserved in the National Museum at Ottawa and comprise a vast amount of material, much of which has been exhibited or will be in the near future.

In 1912-13, he devoted much time and labour to the preparations and carrying out of the International Geological Congress and accompanied the excursions to the Maritime Provinces, Cobalt, Haliburton, Sudbury, and British Columbia. His lucid and logical expositions of the geological problems of the Archaean convinced many doubting and even antagonistic geologists, and won unstinted praise from all.

Dr. Barlow had fine powers of organization, and his field parties were models of order and excellence. From his assistants he obtained much and willing service while he was ever giving of his store of knowledge to help them in the various tasks assigned to them. His method of work and of taking notes, or preparing for a report, was equally orderly and systematic. His was a logical and well-trained mind, whose powers of co-ordinating results obtained in divers areas led him to decipher many an intricate problem. His note books are models of neatness and accuracy, and they are filled with a vast amount of most valuable information on the mineral and other natural resources of the Dominion. When Dr. Barlow undertook any work or task he wrought until that work or task was accomplished.

Dr. Barlow was held in high esteem by all who knew him, as a sincere, earnest, diligent and successful student and master of Geology in Canada. His devotion to the Science of his predilection was proverbial; whilst his wide knowledge of collateral science gave him that broad view of the relations and results of his own researches as well as those of others which ever mark his writings. Dr. Barlow was of short stature, an active, wiry and energetic man. He could always take his share of the impedimenta over the numerous portages common to the Archaean country traversed by him during his years of active service for his country.

As an officer, or as President of the Canadian Mining Institute Dr. Barlow was untiringly devoted to the interests of that important body guarding the mineral interests of the Dominion. His presidential address, delivered a few days before his death, displays noble sentiments and contains hints of practical value, together with important utterances bearing upon the future of mining in Canada. Therein he has evidently and markedly the soul of a profound geologist, of a sound philosopher, and of an advanced reformer and prophet. Much of the success of the Institute during the past years is ascribed to him.

While a resident of Montreal, the authorities of McGill University availed themselves of the opportunity which his presence afforded to the College, and asked Dr. Barlow to become "Honorary Lecturer in Economic Geology." In that post he did much to stimulate original research on the part of students in Geology and its economic aspect throughout Canada and to increase the usefulness of the Department of Geology in the University.

Dr. Barlow's death removes from The Royal Society of Canada one of its most useful and energetic workers. His loss is a great loss to Canada likewise, for his researches range from the Atlantic to the Pacific, and from the United States boundary to Great Slave Lake and beyond. His lovable personality, and genial manner, as well as his successful career led him to make many and staunch friends, who are now sorely afflicted at his sudden removal from their midst.

IV.—Poisonous Matches.

The Council have pleasure in recording that the Act to prevent the use of poisonous phosphorus in the manufacture of matches has become law. As the Society took an active part in promoting this legislation it is with pleasure that the action of the Dominion Government has been noted.

V.—Permanent Quarters for the Society.

Although no visible progress has been made in providing permanent quarters for the Society the project has been considerably advanced. It is hoped that the new additions to the building for the Department of Public Archives will contain rooms for the use of the Society. The foundation for this building may be laid during the summer. It should be recorded that the Government has been most cordial in its attitude towards the Society, recognizing that we should have permanent headquarters, and that their provision is a matter for Government action.

VI.—The War.

The war in Europe has affected to some extent the usual routine of the Society. The distribution of our publications to the countries engaged in the war, with the exception of Great Britain, has been interrupted, as it was thought better to retain the copies destined for the Continent at least until postal communications would be more regular.

VII.—The Reflecting Telescope.

It is with pleasure that we report that satisfactory progress has been made both on the telescope and its observatory.

The grinding of the principal mirror for the telescope is completed and the rear surface is polished approximately flat and the front spherical. There remains of course the most delicate operation the "figuring" of the front surface to a paraboloid of revolution of a focal length of 30 feet to an accuracy of a quarter wave length of light.

The finished dimensions of the mirror will be diameter 73 inches thickness 12 1-8 inches, weight about 4,500 lbs.

All the heavy steel and iron parts of the mounting have been successfully cast and machined, the large skeleton tube is completed and work on the smaller parts amd the driving mechanism is under way. The shop erection and fitting of the mounting will commence shortly and it is expected to be completed before the end of the year.

The Warner and Swasey Co. who are making the mounting have built a one-tenth size working model of telescope dome and building for exhibition at San Francisco. This is proving extremely useful in settling the complicated questions arising in the construction of the dome and accessories, which are being made by the same firm, and of their proper relation to and working with the telescope.

A good road of easy grade has been built by the Government of British Columbia from the main road to the summit of Saanich Hill, the site of the observatory.

This hill has an elevation of 732 feet and is situated about 8 miles north of Victoria. The water supply system has been completed and the construction of the circular steel building to carry the dome and contain the telescope will soon be begun.

VIII.—Wireless Research Stations.

In the report of last year reference was made to experiments at the Dominion Observatory having in view the use of wireless telegraphy in the determination of longitudes at places remote from telegraph lines. The results of these experiments having been satisfactory, an observer was sent to the upper Ottawa valley, provided with a wireless receiving outfit, and portable astronomical apparatus. The longitudes of four stations were determined, using the time signals sent out from Arlington, D.C. The accuracy of these determinations is believed to compare very favorably with those obtained by the ordinary telegraphic method. The success of these observations will undoubtedly extend the use of this method in determining accurate geographical positions in remote and unmapped parts of the country and will strengthen the arguments for the establishment of Research Stations presented to the Government by the Council in their memorial of October, 1912.

IX.—Copyright.

Guided by the resolutions of the Society on the important subject of Copyright, we have informed ourselves from time to time of the probability of legislation by the Government. We note, with approval, that two important additions were made to the Criminal Code at the last session of Parliament. These clauses protect the rights of the author of any dramatic or operatic work or musical composition in which copyright exists. The main question of Copyright, however, remains untouched and there is urgent need for a progressive act framed according to modern principles. We will not fail at the proper time to urge upon the Government our views as to the necessity of due protection for authors and others who should have the legal rights in their property adequately safeguarded.

X.—Finances of the Society.

The following is the financial statement of the Honorary Treasurer for the year ending April 30th, 1915. The statement includes the Government Grant Account and the General Account and it has been audited by two members of the Society, Dr. Adam Shortt and Dr. J. C. Glashan who were appointed by the Council for that purpose.

STATEMENT OF RECEIPTS AND EXPENDITURE OF THE ROYAL SOCIETY OF CANADA FOR THE YEAR ENDING 30th APRIL, 1915.

GOVERNMENT GRANT ACCOUNT

Receipts

By Balance in Bank of Montreal	$ 2,709.47
" Grant from Dominion Government	8,000.00
" Bank Interest on account	167.05
	$10,876.52

Expenditure.

To Printing and Publication of Society's Transactions and Notices	4,456.80
" Maintenance of Society's Library:	
Clerical assistance and book	609.75
" Clerical assistance	320.00
" Foreign postage, storage and insurance on Transactions and Society's stock	155.00
" Stationery supplies, miscellaneous printing and preparation of Society's seal and die	147.20
" Office furniture	56,15
" Incidental expenditure	76.20
" Balance in Bank of Montreal, 30th April, 1915	5,115.42
	10,936.52
Less outstanding cheques	60.00
	$10,876.52

GENERAL ACCOUNT

Receipts

By Balance on Merchants Bank of Canada	$ 2,988.08
" Annual Subscriptions of Members	550.00
" Life Memberships (Two)	100.00
" Sale of Transactions	64.90
" Balance from Bank of Ottawa	27.50
" Interest on Investments Standard Trusts Co	298.40
" Interest Merchants Bank of Canada	81.65
	$ 4,110.53

Expenditure

To Railroad fares of Members attending Annual Meeting, Montreal, 1914	579.10
" Contribution to Napier Tercentenary Celebration	9.86
" Balance on hand Merchants Bank of Canada, 30th April, 1915	3,521.57
	$ 4,110.53

Audited and found correct.
ADAM SHORTT, } *Auditors.*
J. C. GLASHAN, }
Ottawa, May 10th, 1915.

C. GORDON HEWIT,
Honorary Treasuer

XI.—Report of the Honorary Librarian.

The Honorary Librarian begs to report that during that year the remainder of the books and publications received as exchanges and formerly held in storage has been transferred to the library and placed on the shelves. The receipt of current publications has been very much decreased on account of the war. Several accessions in answer to requests for missing numbers have been received as well as donations from private sources—these latter will no doubt be added to, by the Fellows of the Society.

The Librarian is now engaged in the compilation of a card index, which will be very comprehensive, but for immediate use an alphabetical list has been compiled in condensed form which may be consulted by the Fellows.

In the report for 1914 an estimate of the number of volumes was made. This has been found to be conservative and, as many of these arrive in monthly parts unbound, it is estimated that about 8,000 volumes are in paper covers. As the annual increment is about 500 volumes it would seem expedient to establish a fund for binding and to place each year at least 1,000 volumes in serviceable covers so that they may be consulted by the members with less trouble and risk.

It is quite evident that the library contains many publications not easily found elsewhere and it may prove of great use to the Fellows.

D. B. Dowling,
Honorary Librarian.

When the Honorary Secretary had finished reading the Report, it was moved by Dr. Bryce, seconded by Dr. Burgess, that the Report of Council be received and that the question of adoption be voted on to-morrow.—Carried.

It was moved by Hon. R. Lemieux, seconded by L'Abbe Camille Roy, that the election of M. Hector Garneau and M. Eugene Rouillard as Fellows of Section I be confirmed.—Carried.

It was moved by Dr. LeSueur, seconded by Mr. Wrong, that the election of Dr. Pelham Edgar, as a Fellow of Section II, be confirmed.—Carried.

It was moved by Dr. Plaskett, seconded by Dr. J. C. Fields, that the election of Dr. A. L. Clark and Dr. Louis V. King, as Fellows of Section III, be confirmed.—Carried.

It was moved by Dr. Macallum, seconded by Dr. Adams, that the election of Mr. John A. Dresser, Dr. Alexander McPhedran, Dr. William A. Parks and Dr. Edmund M. Walker, as Fellows of Section IV, be confirmed.—Carried.

Those of the new members who were present, M. Garneau, M. Rouillard, Dr. Edgar, Dr. Clark, Dr. King, Mr. Dresser and Dr. E. M. Walker, were then introduced to the President, as well as Dr. J. H. Faull, who has not been present since elected in 1912, Sir Edmund Walker, elected in 1911, and Dr. William Peterson, C.M.G., elected in 1914.

It was moved by Professor Wrong, seconded by Professor Mavor, that the Society desires to record its sense of indebtedness to the active and retired Fellows who are on service, for their patriotic response to the nation's call. This resolution was most heartily carried.

So far as is at present known the following Fellows have enlisted for active service:—

Dr. Andrew Macphail, Dr. J. J. MacKenzie, Rev. Frederick George Scott, Dr. J. G. Adami, Dr. William R. Lang, Prof. W. Lawson Grant, Dr. T. G. Brodie and Rev. Dr. Charles W. Gordon.

It is hoped there are no omissions; the list is, of course, subject to revision and will be added to in the next issue of the Proceedings if necessary.

The Presidential Address.

The Presidential Address was delivered on Tuesday evening, May 25th, in the presence of the Honorary President of the Society, His Royal Highness the Duke of Connaught. The President, Sir Adolphe B. Routhier, had chosen as his subject, "Le Dualisme

Canadien." The address was listened to attentively by the audience, and at the close of the lecture His Royal Highness graciously addressed the meeting and spoke in complimentary terms of the work of the Society.

SESSION II.—(Wednesday, May 26).

The President took the chair at 12 o'clock.

It was moved by Dr. Adams, seconded by Dr. Tory, that the Report of Council be adopted.—Carried.

Dr. Charles David White, of the United States Geological and the National Museum, Washington, D.C., whose nomination as a corresponding member of Section IV had been submitted to the meeting, was declared elected.

Dr. Otto Klotz's notice of motion for the amendment of the By-laws which read as follows:—"That Section 8, Paragraph 3, of the By-laws be amended by substituting for the words "without presenting a paper" the following:—"and who has not contributed a paper of his own during that time," had been distributed among the Fellows and Dr. Klotz now moved, seconded by Professor Wrong, that it be approved.

After considerable discussion the matter was left over for further consideration.

The Report of the Committee appointed in 1914 to obtain full information as to the dangers to life arising from the presence of carbon monoxide in ordinary illuminating gas was presented for Dr. Girdwood, chairman, by Dr. Ruttan. The report was as follows:—

Mr. President and Fellows of The Royal Society:

GENTLEMEN,

At the last meeting of this Society held in Montreal, in the month of May last, you did us the honour of appointing us a committee for the purpose of collecting information upon the use of water gas in illuminating gas. We thank you for that honour, and now have pleasure in submitting our report as follows.

The conditions of war in Europe have so interfered with postal arrangements that we have been unable to obtain any information from the Continent of Europe, and the information we have been able to obtain has been from the United Kingdom, the United States and Canada.

Throughout Great Britain in the early part of the last century coal gas was introduced as a means for lighting the houses and streets. The gas originally used was made by the distillation of soft coal, of which material an ample supply was obtainable.

Ordinary coal gas thus obtained consists chiefly of lighter hydrocarbons with hydrogen and carries also about 6% of carbon monoxide and gaseous sulphur compounds.

These sulphur compounds must be almost completely removed from the gas before it is distributed.

True coal gas unlike water gas has a very distinct odour and hence its presence even in small quantity in a room can be immediately detected. It is not toxic in the true sense; but in large quantity it suffocates by replacing the oxygen of the air in a room. Unlike the victims of poisoning by water gas or illuminating gas carrying a high percentage of carbon monoxide, persons rendered unconscious by true coal gas can usually be quickly and completely restored to consciousness through artificial respiration when removed to pure air.

Later on water gas was introduced as an illuminant, and was adopted largely in the United States in preference to soft coal gas.

Most gas companies in the United Kingdom have a coal-gas plant and an auxilliary water gas plant for use when the coal supply is stopped by reason of strikes among the miners.

Water gas is manufactured by throwing steam into a retort full of red-hot coal or carbon, by which the steam is decomposed into hydrogen, the oxygen of the water combining with the carbon of the coal to form carbon monoxide. This gas has heating power, but little illuminating quality and therefore it is necessary to carburet it, which is done by the addition of a sufficient quantity of carburetting material of the benzine series.

This water gas is highly poisonous; it contains when carburetted about 40% carbon monoxide and if it escapes unburnt and is taken into the lungs the actively poisonous carbon monoxide combines with the haemoglobin of the blood with which it remains firmly fixed and prevents the absorption of atmospheric oxygen, thus rapidly causing asphyxiation. It is this carbon monoxide which is the poisonous element in the deadly after-damp which occurs in coal mine explosions.

An excellent account of the effects produced by carbon monoxide is given by Dr. Ivor J. Davies in an article in the British Medical Journal of July 11th, 1914, wherein he described the effects of poisoning by carbon monoxide in the terrible explosion in the South Wales colliery, Senghenydd mine, in which 440 men were killed. He treated 36 cases of poisoning, 18 of which recovered, the others died.

Numerous evidences of the poisonous character of this gas are to be found in newspaper reports of firemen being overcome by smoke.

At the present day water gas is also supplied for cooking purposes. When used for illuminating purposes it is burned more generally in burners carrying mantles of earthy material rather than in open burners. These mantles become incandescent by the heat of the burning gas, so that the heat qualities are of more importance than candle power, and we are given to understand that the Government is proposing to abandon the standard of candle power and substitute the calorific power as a standard.

In the houses of the poorer classes, where the gas cooking stove is very often in the sleeping room, the flame may be extinguished by a draught from an open window or by various other causes; this is a constant menace to human life.

The danger of using this water gas is shown by a case which occurred in the city of Montreal, where nine people were discovered in one house unconscious by inhaling the gas which was escaping from two unlighted burners. A man going into the house found the place full of gas fumes, and the people insensible; assistance was sent for, consciousness restored and the people recovered.

The danger of using this gas is also shown in a newspaper clipping sent us by Dr. Mills from London, England, wherein the death of a man, his wife and two children is recorded. Their deaths were due to an escape of gas from the main in the street through the ground into the basement of the house in which they lived.

We have found the records in the Registry Offices both in Great Britain and in Canada almost valueless for giving us the number of deaths due to this gas. In Montreal we have been able to obtain the following:—

Deaths From Poisoning by Gas in Montreal.

Reported from	Health Department	....	by Dr. C. B. Ward
" "	Morgue	....	by Dr. Mactaggart
" "	Royal Victoria Hospital	.....	by Dr. H. B. Cushing
" "	Notre Dame Hospital	....	by Dr. Hingston
" "	Hotel Dieu Hospital	....	by Dr. Hingston
" "	Montreal General Hospital	..	by Dr. Bourne

Year	Accident	Suicide	Total
1907	3		
1908	10		
1909	11		
1910	28		
1911	11	1	
1912	19	3	
1913	8	2	
1914	9		
	99	6	105

Reported from Western Hospital, Montreal—by Dr. R. R. Scott
1914—5 cases C.O. poisoning, all recovered.
1915—(so far) One case,—died from accompanying burns.

Deaths from Poisoning by Gas in the City of New York.

Reported by Dr. Wm. H. Guilfoy, Department of Health.

Year	Accident	Suicide	Total
1909	244	319	
1910	257	274	
1911	282	256	
1912	312	311	
1913	259	328	
	1354	1488	2842

Report of W. T. Sedgwick and F. Schneider Jr. of Institute of Technology, Boston, of Deaths in the State of Massachusetts from Gas, increasing in accordance with the increased use of C.O. (Water-Gas).

Year	Percentage of Water-gas in Total Gas.	Accidental Deaths.	Suicidal Deaths.	Total
1886–7......	1·01	5	2	7
1888........	1·56	7	1	8
1889........	2·43	2	2	4
1890........	6·34	5	2	7
1891........	22·20	18	1	19
1892........	36·60	9	12	21
1893........	40·80	7	9	16
1894........	55·00	14	15	29
1895........	61·00	28	17	45
1896........	62·00	20	13	33
1897........	65·40	47	16	63
1898........	64·60	48	29	77
1899........	63·80	35	35	70
1900........	51·40	35	15	50
1901........	32·30	11	26	37
1902........	37·70	9	39	48
1903........	38·40	47	30	77
1904........	42·30	29	35	64
1905........	41·30	41	23	74
1906........	30·70	35	30	74
1907........	44·70	41	51	92
1908........	44·50	55	93	148
1909........	48·60	66	102	168
				1131

Deaths from Poisoning by Gas in San Francisco.

According to reports lately received from the Department of Public Health and Public Works, no records of death are available. The report of the Departmental Committee on Water-gas and other gases to the Houses of Parliament in London for 1899, page 118, shows that in San Francisco in a period of 25 years.

Year	Accident	Suicide	Homicide	Total
1872–3 to 1896–7........	233	136	6	375

From the principal cities of Canada we have not been able to obtain any records.

There is a general complaint regarding the lack of registration returns in Great Britain and Canada on this subject, no reliable data being obtainable.

In the United States the same deplorable condition exists, with the exception of New York, the States of Massachusetts and Rhode Island. The information we have obtained from Boston is chiefly contained in a lecture delivered by Dr. Sedgwick before the Medical Society of New York. From that lecture we learn that during the last twenty years in the State of Massachusetts, there has been an increase in the number of deaths from suffocation by illuminating gas from 7 deaths per annum (in 1886-7) to 168 in 1909, and during that time water gas has been increasingly used. More than half of these 168 cases were due to suicide. There is no mention of any homicidal cases that we can find, except in San Francisco. As this poisonous gas is generally supplied and readily obtainable, there is danger of its increased use for homicidal purposes.

From these reports we can see how deaths have increased since the use of water gas, and how necessary it is to have some legal regulation as to its use in illuminating gas.

We would suggest that some more careful method of registration should be adopted, so that the actual cause of death and the number of deaths occurring throughout the country from this cause should be readily obtainable at least every year. We would also suggest that a daily record of the carbon monoxide contents of all gas supplies be taken by the gas inspector, and that the companies supplying this gas shall keep a record of the percentage of carbon monoxide gas supplied to the public daily.

We would advise the careful perusal of the report of the chemist of the London County Council on water gas in the London gas supply, and the report of the Departmental Committee in the British Parliament on the manufacture and use of water gas; also of the lecture by Professors Sedgwick and Schneider on the relation of illuminating gas to the public health, from the Sanitary Research Laboratorium, Mass., Institute of Technology, Boston.

We beg to make the following recommendations:

1. Your Committee desire to place on record their dissatisfaction with the vital statistics of the various provinces in regard to deaths from carbon monoxide poisoning. Your Committee would therefore suggest that the Secretary of The Royal Society be instructed to write to the Registrars General of the different provinces, and

request that if possible, more accurate record be kept of deaths from gas poisoning by their Division Registrars.

2. That the Department of Inland Revenue be requested to instruct their gas inspectors to determine the percentage of carbon monoxide in illuminating gas at the same time as they make the examination for sulphuretted compounds.

We have found that on account of the war it has not been possible to obtain the European statistics; your Committee therefore wishes to submit this report merely as a report of progress, and asks permission to continue its work for another year.

In conclusion we wish to return our sincere thanks to all those who have so kindly and promptly responded to our requests for information on this most important subject.

Appended is a list of the cities from which we have received information as to the use of carbon monoxide in their gas supplies. There are very few records to be had of deaths by asphyxiation from this gas, either accidental or suicidal, but there are several Parliamentary papers and pamphlets, obtained from many sources, accompanying this report.

List of cities to the Mayors of which we applied for information and received replies:—

Aberdeen	Leeds	Philadelphia
Birmingham	Liverpool	Quebec
Boston	London	San Francisco
Bristol	Montreal	Swansea
Derby	Newcastle	Toronto
Edinburgh	New York	Vancouver
Glasgow	Ottawa	Washington

List of papers accompanying this Report:—

Parliamentary Report of Water Gas Committee London County Council on Water Gas:—

Gas Undertakings return No. 137.

Gas Undertakings return No. 138.

British Medical Journal No. 2793.

Circular of Bureau of Standards U.S.A.

Inland Revenue Canada Gas Inspection Act.

Report Department of Labour No. 36....1914.

Haematology of Carbon Monoxide poisoning, Toronto.

Lecture by Professor Sedgwick and F. Schneider of Institute of Technology, Boston.

J. P. GIRDWOOD, Chairman.
R. F. RUTTAN
JOHN J. MacKENZIE
T. G. RODDICK

It was moved by Dr. Ruttan, seconded by Dr. Klotz, that the report be adopted and be included in the Proceedings, and that the thanks of the Society be extended specially to Dr. Girdwood for the time and labour expended by him in the preparation of this report. —Carried.

It was moved by Dr. Plaskett, seconded by Dr. Barnes, that Mr. James Watson Bain, B.A. Sc., be elected a Fellow of Section III, there being one vacancy.—Carried.

It was moved by Dr. McLennan, seconded by Professor Eve, that the Government of the Dominion of Canada be asked to secure for Canada the working model of the great Reflecting Telescope recently constructed by Messrs. Warner and Swasey Co. and that if this model be purchased by the Government it be kept on view in Ottawa.

It was moved by Dr. Buller, seconded by Dr. Macallum, that the time allowed for the formal reception of Prof. T. G. Brodie and Professor C. L. Moore as members of the Society be extended for one year.—Carried.

It was moved by Dr. Raymond, seconded by Dr. LeSueur, that in view of the fact that the 1st day of July, 1917, will be the fiftieth anniversary of the formation of the Canadian Dominion, it is desirable that this Society should, in the programme to be arranged for that year, give due recognition of so interesting and important an anniversary, and that the matter be referred to the Council of the Society to consider and report upon at the next annual meeting.

It was moved by Mr. James White, seconded by Mr. Dresser, that the following Fellows constitute the General Printing Committee:

Dr. Sulte, Mr. deMontigny, Dr. LeSueur, Dr. Plaskett, Dr. Shutt, Dr. Prince, Dr. Hewitt, Mr. Dowling and Mr. D. C. Scott. —Carried.

SESSION III.—(Wednesday Afternoon, May 26).

The reports of the following Associated Societies were read or presented:—

(1.) The Entomological Society of Ontario. By Professor W. Lochhead, Delegate.

(2.) The Women's Canadian Historical Society of Ottawa. By Carolyn A. Gullock, Honorary Recording Secretary and Delegate.

(3.) The Elgin Historical and Scientific Institute. By Dr. J. H. Coyne, F.R.S.C. Delegate.

(4.) The Ontario Historical Society. By Dr. J. H. Coyne, F.R.S.C.

(5.) The Waterloo Historical Society. By Dr. J. H. Coyne, F.R.S.C.

(6.) The Niagara Historical Society. By Miss Janet Carnochan, Delegate.

(7.) The Ottawa Field Naturalists' Club. By Arthur Gibson, President and Delegate.

(8.) The Royal Astronomical Society of Canada. By Dr. R. E. deLury, Secretary of the Ottawa Centre and Delegate.

(9.) The Women's Canadian Historical Society of Toronto. By Miss Helen Merrill, Delegate.

(10.) The United Empire Loyalists' Association of Canada. By Lt. Col. F. W. Macqueen, President and Delegate.

(11.) The Huron Institute. By David Williams, Secretary.

(12.) The Historic Landmarks Association. By Mrs. J. B. Simpson, General Secretary.

(13.) Club Litteraire Canadien Français d'Ottawa. By M. Auguste Lemieux, President.

(14.) La Société d'Archeologie et de Numismatique de Montreal. By Victor Morin, LL.D., Delegate.

(15) The Quebec Society for the Protection of Plants. By Professor W. Lochhead, Delegate.

(16.) The Literary and Historical Society of Quebec. By J. M. Harper, M.A., Ph.D., F.E.I.S., Delegate.

(17.) The Natural History Society of Montreal. By Dr. Robert Campbell.

(18.) The New Brunswick Historical Society. By Venerable Archdeacon Raymond, F.R.S.C.

(19.) The Nova Scotian Institute of Science. By A. H. MacKay, LL.D., F.R.S.C., Delegate.

(20.) The Nova Scotia Historical Society. By Hon. Mr. Justice Longley, F.R.S.C., Delegate.

The Popular Lecture.

The popular lecture was delivered on Wednesday evening, May 26th, by Mr. Charles Hill-Tout, F.R.S.C., his subject being "The Antiquity of Man in the Light of Modern Discoveries." The attractive subject chosen by Mr. Hill-Tout brought out a large audience, and the lecture was listened to with manifest interest. The presentation of the subject was greatly aided by appropriate stereopticon views.

SESSION IV.—(Thursday afternoon, May 27).

Reports of the Sections.

SECTION I.

Procès-verbal de la séance du mardi, 25 mai, à 9.30 a.m.

Présents: L'honorable Rodolphe Lemieux, président, Sa Grandeur Monseigneur Bruchési, l'honorable docteur Ernest Choquette, M. le sénateur L.-O. David, M. A-D. DeCelles, M. Hector Garneau, M. Léon Gérin, M. l'abbé Auguste Gosselin, M. Eugène Rouillard, sir Adolphe Routhier, M. l'abbé Camille Roy, M. Benjamin Sulte et M. Louvigny de Montigny, secrétaire.

Se sont excusés: Mgr A.-E. Gosselin, M. Edouard Montpetit, M. Pierre-Georges Roy et Mgr Louis-Ad. Paquet.

Délégués: M. Victor Morin, représentant la Société de Numismatique et d'Archéologie de Montréal; M. Pemberton Smith, représentant la Société des Sites historiques.

—Le secrétaire donne lecture d'une communication du secrétaire général, en date du 28 avril dernier, attirant l'attention de la Section I sur le cas de S. E. le cardinal Bégin et de M. Ernest Gagnon qui, aux termes de l'article 8 des règlements, doivent être considérés comme démissionnaires, et avisant de prendre des mesures en conséquence.

M. l'abbé Roy informe la Section I qu'il apporte un travail de S. E. le cardinal Bégin, intitulé *Pages d'histoire*. Ce travail est reçu et renvoyé au Comité de lecture.

Sur proposition de M. Sulte, appuyé par M. l'abbé Gosselin, il est

Résolu: D'accepter, avec regrets, la démission que M. Ernest Gagnon a adressée à la Société, l'an dernier, et de retenir cependant M. Gagnon parmi les membres retraités de la Société Royale.

—Sur proposition de Mgr. Bruchési, appuyé par M. Garneau, il est

Résolu: Que l'honorable M. Lemieux soit nommé membre du Comité de mise en nomination des dignitaires généraux de la Société Royale, avec M. P.-B. Mignault qui a été choisi, l'an dernier, pour faire partie de ce Comité.

—M. de Montigny, appuyé par M. l'abbé Roy,

Propose: Que soit réaffirmé le vœu suivant, exprimé par la Section I à sa séance du 26 mai 1914:

"Considérant qu'il est de toute nécessité de procurer de l'encouragement aux études et aux travaux littéraires et scientifiques, et que cet encouragement doit d'abord venir de l'Etat;

Qu'une délégation de la Société Royale se présente auprès du gouvernement pour le prier d'affecter annuellement un crédit spécial dont le quart sera attribué à chacune des quatre Sections de la Société Royale pour couronner et récompenser (aux conditions que le gouvernement pourra déterminer) un essai littéraire ou scientifique, selon le cas, relevant de chaque Section, et dont l'auteur sera par elle jugé digne d'encouragement;

Et que, le gouvernement ayant donné l'exemple, les Législatures provinciales, les corps publics et les particuliers soient invités à créer des prix littéraires ou scientifiques devant porter leurs noms et que les diverses Sections de la Société Royale se chargeront volontiers de décerner, aux conditions imposées par les fondateurs de ces prix."

L'Honorable M. Choquette, appuyé par M. Garneau, propose en *Amendement:*—Attendu que rien n'est plus propre chez un peuple à activer le développement intellectuel et à faire reconnaître la valeur des oeuvres littéraires et scientifiques de ses écrivains, que l'existence de prix, couronnes, récompenses publiques quelconques;

Attendu qu'en tous les pays clairvoyants, les gouvernements reconnaissent, en consacrant de larges subventions au maintien des lettres et des arts, combien il importe de favoriser leur progrès à la mesure du progrès économique de ces mêmes pays;

Attendu que ce qui véritablement entrave aujourd'hui l'ambition du Gouvernement de Québec, de même sans doute que celle de plusieurs de nos riches concitoyens, d'aider efficacement les lettres françaises et, dans ce but, d'appliquer d'importantes sommes à la fondation de prix, pensions, etc.,—ainsi que cela se pratique en France et ailleurs—c'est uniquement l'absence, au sein de la Province, d'un corps littéraire officiellement reconnu par l'Etat, et qui, à ce titre, peut être à la fois le dépositaire de ces sommes, le jury d'examen et le dispensateur désigné des prix et des récompenses;

Pour ces divers motifs, la Section française de la Société Royale du Canada, réunie en séance publique, invite le Gouvernement de Québec à considérer s'il ne lui serait pas possible de convertir ladite Section française en un tel corps littéraire provincial et d'en reconnaître ainsi officiellement l'autorité dans toute l'étendue de la Province. Elle se met, en tout cas, à son entière disposition pour tout projet qu'il jugerait bon d'exécuter à l'avantage des lettres françaises.

Après discussion, sur proposition de M. Rouillard, appuyé par M. DeCelles, il est

Résolu: Que la Société Royale poursuive ses démarches auprès du gouvernement fédéral afin d'en obtenir une subvention spéciale destinée à instituer des prix littéraires et scientifiques, conformément au vœu exprimé et adopté au cours de la réunion annuelle de 1914; et que, en outre, une délégation de la Section française de la Société Royale, composée de S. G. Mgr Bruchési, M. le sénateur David et les honorables MM. Lemieux et Choquette, soit chargée de voir sir Lomer Gouin, à la première occasion qui se présentera, afin de s'entendre avec le premier-ministre sur les conditions que le gouvernement de Québec pourrait requérir pour accéder au vœu de la Société Royale et accorder une subvention devant permettre la fondation de prix à être décernés, au nom du gouvernement de Québec, par l'intermédiaire de la Section française de la Société Royale.

—Les manuscrits suivants sont lus et renvoyés au Comité de lecture: *Le Problème des races au Canada*, par S. G. Mgr Bruchési; *La mort de Champlain*, par M. Benjamin Sulte; et *Notes sur les Etudes des trois premiers notaires seigneuriaux de Montréal (1648-1657)*, par M. E.-Z. Massicotte.

Procès-verbal de la séance du mardi, 25 mai, à 3 heures p.m.

M. le sénateur David exprime le souhait que, pour rendre plus intéressantes les séances de la Section française et permettre au public de prendre connaissance de ses travaux, la Section I organise chaque année, au cours de la réunion générale de la Société Royale, une séance française publique.

Sur proposition de M. le sénateur David, appuyé par M. l'abbé Gosselin, il est

Résolu: Que le bureau élu de la Section I soit chargé de s'entendre avec le secrétaire général pour organiser, dès la prochaine réunion annuelle de la Socitété Royale, une séance publique de la Section française.

—Les manuscrits suivants sont lus et renvoyés au Comité de lecture: *La réorganisation de la société canadienne après la conquête*, par M. Léon Gérin; *Les médailles décernées aux Indiens de l'Amérique du Nord*, par M. Victor Morin; et *Poèmes contre les Boches*, par M. Albert Lozeau.

Procès-verbal de la séance du mercredi, 26 mai, à 10 heures a.m.

Sur proposition de M. Sulte, appuyé par M. DeCelles, il est

Résolu: Que, en vertu de l'article 8 des règlements, la Section I réclame le droit d'élire, aux élections de l'an prochain, deux nouveaux membres, en outre des vacances naturelles qu'elle aura à combler.

Le manuscrit suivant est lu et renvoyé au Comité de lecture: *Le folk-lore canadien-français*, par M. Marius Barbeau.

Procès-verbal de la séance du jeudi, 27 mai, à 10 heures a.m.

Sur proposition de l'honorable M. Lemieux, appuyé par sir Adolphe Routhier, il est

Résolu: Que le bureau de la Section I soit constitué comme suit pour le prochain exercice: Président, Mgr A.-E. Gosselin; vice-président, M. A.-D. DeCelles; secrétaire, M. Louvigny de Montigny.

—Sur proposition de M. Gérin, appuyé par M. Garneau, il est

Résolu: Que le Comité de lecture de la Section I soit constitué comme suit pour le prochain exercice: MM. DeCelles, Rivard et Montpetit.

—Sur proposition de l'honorable M. Lemieux, appuyé par M. DeCelles, il est

Résolu: Que M. de Montigny représente la Section I dans le bureau de publication des Mémoires de la Société Royale.

—Sur proposition de M. de Montigny, appuyé par M. Gérin, il est

Résolu: Que le président de la Section française soit chargé de soumettre la délibération suivante à l'approbation de l'assemblée générale des quatre Sections de la Société Royale, qui doit avoir lieu cet après-midi pour clore la réunion annuelle de 1915:

"CONSIDERANT que cette réunion générale de la Société Royale du Canada est la première qui ait lieu depuis la déclaration de la guerre en Europe;

"CONSIDERANT que cette guerre a mis aux prises plusieurs grandes puissances, et particulièrement les mères-parties des deux peuples qui ont fourni les éléments principaux à la formation du Canada;

"CONSIDERANT que le Dominion fait noblement face à la situation en préparant, en équipant et en envoyant des milliers et des milliers de volontaires canadiens combattre le bon combat de la Paix, de la Liberté et de l'Humanité sur le sol ensanglanté de la France et de la Belgique;

"CONSIDERANT que le genre de culture ou de civilisation que l'Allemagne, avec l'aide de l'Autriche et l'appoint de la Turquie, s'efforce, par la violence, d'imposer au reste du monde, répugne absolument à l'idéal plus élevé de justice et d'affranchissement qui a toujours animé la métropole anglaise et l'essaim de ses établissements autonomes sur toute la surface de la terre;

"CONSIDERANT que les tactiques barbares auxquelles nos ennemis ont eu recours pour arriver à leurs fins infâmes ont causé la destruction sacrilège et irréparable de nombreux foyers d'art et de science, comme de plusieurs incomparables monuments d'architecture, particulièrement en Belgique et dans le Nord de la France; et

"CONSIDERANT que la Société Royale du Canada est la principale institution canadienne établie par l'Etat pour promouvoir les arts, les lettres et les sciences; qu'elle ne saurait assister en silence à la destruction de pareils trésors constituant le patrimoine de l'esprit humain tout entier; et qu'elle se glorifie, d'autre part, de compter plusieurs de ses membres parmi les défenseurs qui ont vaillemment répondu à l'appel de l'Angleterre pour repousser l'inique agression de l'Allemange;

"QU'IL SOIT RESOLU

"Que nous, les membres de la Société Royale du Canada, réunis en assemblée annuelle à Ottawa, exprimons énergiquement notre indignation contre les atrocités et les dépradations commises par nos ennemis, et tenons à joindre notre protestation unanime, solennelle et publique, à toutes les protestations exprimées, dans la plupart des pays civilisés, par des institutions semblables à la nôtre, contre la perpétration de pareils crimes."

—Les manuscrits suivants sont lus et renvoyés au Comité de lecture: *Nos amis les Ecossais*, par l'honorable Rodolphe Lemieux; La *langue française hors de France*, par M. A.-D. DeCelles; *Mort au champ d'honneur, le sergent Henry du Roure*, par M. Edouard Montpetit; *La notion du droit*, par Mgr Louis-Ad. Paquet; *La littérature française au Nord-Ouest*, par M. le juge L.-A. Prud'homme; *Les Conseillers au Conseil Souverain de la Nouvelle-France*, par M. Pierre-Georges Roy; et *La sépulture d'Etienne Brulé*, par M. Jules Tremblay.

Ajournement.

L. DE MONTIGNY,
Sécrétaire,
Section I.

On the motion of Hon. Rodolphe Lemieux, seconded by Mr. de Montigny, the report of Section I was adopted.

REPORT OF SECTION II.

Minutes of Section II, Tuesday, May 25th.

In the temporary absence of the President, it was resolved,

On motion of D. C. Scott, seconded by Dr. Campbell, that Dr. Bryce act as President pro tem.

On motion of Prof. Wrong, seconded by Mr. Hill-Tout, it was resolved that Dr. Coyne act as Secretary pro tem.

The President, Mr. R. W. McLachlan, then took the chair.

PRESENT: Ven. Archdeacon Raymond, Sir Edmund Walker, Dr. Adam Shortt, Dr. Doughty, Mr. McLachlan, Dr. Geo. Bryce, Mr. Justice Longley, Dr. W. D. LeSueur, Mr. D. C. Scott, Dr. Mavor, Dr. W. W. Campbell, Mr. Hill-Tout, Professor Wrong, Dr. Edgar, Mr. W. D. Lighthall, Dr. Coyne, Principal Peterson.

Moved by Dr. Bryce, seconded by Prof. Hill-Tout, that this Section approves of the amendment proposed by Dr. Klotz to Section 8, paragraph 3, of the By-laws of the Society.—Carried.

RESOLVED that Dr. Coyne be a member of the Nominating Committee to represent Section II.

The question of copyright as mentioned in the Report of Council was considered.

The Minutes of the meeting of May 26th, 1914, were read and on motion of Mr. Hill-Tout, seconded by Dr. Coyne, were confirmed.

The President, Mr. R. W. McLachlan, read the presidential address, taking as his subject: "The Money of Canada from the Historical Standpoint." The address led to an interesting discussion by the Honourable Mr. Justice Longley, Dr. George Bryce, Mr. Hill-Tout and Dr. Coyne. A vote of thanks proposed by Dr. Bryce, seconded by Mr. Hill-Tout was carried. The Section expressed its desire that the address be printed with illustrations.

Here Mr. Lighthall took up the minutes as Secretary. (Wednesday morning).

The Section proceeded with the election of a member; but the conditions of election were not able to be met.

Mr. W. D. Lighthall read his note on "Some proposed Political Words."

Sir James Grant read his paper on "Progress in Development of Canada for the past Half Century."

Dr. Wrong read his paper on "Elba."

Dr. Edgar read his paper on "Matthew Arnold as Prose Writer."

In the afternoon, Dr. Coyne again acting as Secretary:

Paper No. 3, An Organization of the Scientific Investigation of the Indian Place-nomenclature of the Maritime Provinces of Canada (Fifth Paper), was read by title by Ven. Archdeacon Raymond.

Paper No. 4, Fundamental Processes in Historical Science (Part II, The Correct Processes) was read by title by Dr. LeSueur.

Paper No. 7, More Notes on the Meeting Place of the First Parliament of Upper Canada and the early buildings of Niagara, was read by Miss Janet Carnochan, President of the Niagara Historical Society, and a Vice-President of the Ontario Historical Society.

The session then adjourned.

On Thursday at 10 a.m. the Section re-assembled.

Dr. Bryce read his paper on "Lord Strathcona."

After considerable discussion on this contribution, Miss Helen M. Merrill read her paper on "John White, Attorney-General of Upper Canada, 1792-1796." She exhibited a facsimile of his diary in her possession.

Mr. R. W. McLachlan gave a verbal account o fhis subject "Robert Cruickshank, an Early Montreal Silversmith."

Dr. Ami read by title his paper on "Captain George Vancouver."

By his own request Dr. Sapir's paper was taken as read.

The Section then met in private session.

The following officers were duly elected:

President: Dr. Shortt.

Vice-President: Mr. Wrong.

Secretary: Mr. Burpee.

Printing Committee: Messrs. LeSueur, Burpee and Shortt.

Moved by Dr. Coyne, Seconded by Prof. Hill-Tout that this Section report to the Society that it proposes to elect four members for the next year.—Carried.

Mr. D. C. Scott moved, seconded by Dr. Bryce, the appointment of an Advisory Committee on Nominations, to report to the members of the Section before the ballotting, on the qualifications of candidates for membership, to make recommendations, and to state their reasons; the Committee to consist of Dr. Shortt, Chairman; Dr. Raymond, Mr. W. D.Lighthall, Dr. Bryce, Dr. Coyne, Prof. Wrong, Mr. Hill-Tout.

Dr. LeSueur moved, seconded by Mr. Hill-Tout, to amend by replacing all after "Nominations" down to the list of names, the following:

"To select the names of persons whom they would recommend as suitable for election to the Society, such selection to be communicated to the members when the ballot papers are sent out."—Carried as amended.

Prof. Wrong moved that Dr. Siebert be recommended to the Council as a corresponding Member for this Section.—Carried.

The Section then adjourned.

W. D. LIGHTHALL,
Sec. of Section II.

On the motion of Mr. Lighthall, seconded by Dr. Coyne, the report of Section II was adopted.

REPORT OF SECTION III.

The sessions of Section III have been unusually satisfactory this year both in the attendance of the Fellows and in the number and value of the papers presented.

Five sessions were held, two each on May 25 and 26 and one on May 27 all of which were exceptionally well attended by Fellows and others.

There were present at these sessions 29 Fellows, namely:—Messrs. Allan, Baker, Barnes, Burton, Clark, Dawson, Dupuis, Ellis, Eve, Fields, Glashan, Goodwin, Hoffman, Johnson, Kenrick, Johnson, King, L. V., King, W. F., Klotz, McGill, McIntosh, McLennan, McLeod, Miller, Plaskett, Ruttan, Stansfield, Stupart, Tory. The average attendance at the sessions was 20.

Forty-two papers were presented many of which were of great importance and interest and the majority of them were interestingly discussed. A list of the papers is appended.

The election of Officers for the Section resulted in the choice of the following:—

President—F. T. Shutt, M.A., D.Sc., F.R.S.C.
Vice-President—A. S. Eve, D.Sc., F.R.S.C.
Secretary—J. S. Plaskett, D.Sc., F.R.S.C.

The Officers of the Section were appointed as the Sectional Printing Committee.

Three new Fellows were elected this year, Dr. L. V. King and Prof. Clark in the regular way and Prof. Bain by ballot at the meeting.

It was decided that any vacancies occurring in the Section during the year be filled at the next election.

Action under clause 8 of the By-laws was suspended for a year in the case of Prof. Lang on account of special military duties.

The question of the amendment of clause 8 of the By-laws proposed by Dr. Klotz and referred to the Section was considered and it was decided to recommend to the Society that no change be made in this By-law. It was also decided that no other date for holding the Annual Meeting than the one now used would be suitable for the Fellows of this Section.

The Section recommended to the Society that the Government be asked to provide for the purchase of the working model of the great Canadian telescope made by Warren & Swasey Co. for the San Francisco Exhibition, and that this model be placed on view at Ottawa.

A Committee was appointed by the Section to devise some plan of mathematically investigating the enormous mass of material accumulated in meteorological, magnetic, and other observations, in such a way as to, if possible, make this material of definite practical value.

It was decided by the Section that wherever practicable papers should be printed and distributed to the Fellows of the Section in advance of the meeting to facilitate and render more valuable the discussion of the work. It was further unanimously decided that in no case will a paper be accepted for inclusion in the printed programme unless it be accompanied by a full and suitable abstract of its character.

List of Papers Presented in Section III.

1.—On the Calculation of the Self and Mutual Induction of Coaxial Cylindrical Coils, By Louis Vessot King, M.A. (Cantab).

2.—The Viscosity of Ethyl Ether in the Neighbourhood of the Critical Point. By A. L. Clark, B.Sc., Ph.D.

3.—Derivation of the Complementary Theorem by Dr. J. C. Fields.

4.—A Physical Test on a Natural (Methane) Gas Well by Prof. R. W. Boyle and Prof. H. M. Tory.

5.—An Application of the Calculus of Finite Differences to Correct an Experimental Curve and thus obtain, by a Graphical Method, an Accurate Representation of this Curve. By S. Douglas Killain. Presented by Prof. H. M. Tory.

6.—A Comparison of Radium Standard Solutions. By J. Morran. Presented by Prof. A. S. Eve F.R.S.C.

7.—Liquid Chlorine as a Solvent: Cryoscopic Measurements at Low Temperatures. By P. Waentig and D. McIntosh F.R.S.C.

8.—The preparation of Metallic Vanadium. By R. Edson and D. McIntosh, F.R.S.C.

9.—Bromocamphor Sulphonic Acid and Oxonium Compounds. By D. McIntosh, F.R.S.C.

10.—Glycol Esters of the Fat Acids. By Prof. R. F. Ruttan, F.R.S.C.

11.—The Chemistry of Adipocere. By Prof. R. F. Ruttan, F.R.S.C.

12.—Notes on the Penetrating Radiation from the Earth. By Prof. A. S. Eve, F.R.S.C.

13.—On the Residual Ionisation in Gases over the Sea and on the Surface of Lake Ontario. By Prof. J. C. McLennan, F.R.S.C. and Mr. C. L. Treleaven, B.A.

14.—On the Electrical Conductivity of air Confined in an Ice Vessel. By Prof. J. C. McLennan, F.R.S.C. and Mr. Harold G. Murray.

15.—The Determination of the Distance of the Nearer Stars from their Proper Motions and Radial Velocities. By Reynold K. Young, Ph.D.; Presented by Dr. J. S. Plaskett, F.R.S.C.

16.—Some Experiments on the Thermionic Current. By Prof. A. S. Eve, F.R.S.C.

17.—Progress on the 72 inch Reflecting Telescope. By Dr. J. S. Plaskett, F.R.S.C.

18.—The Solar Rotation. By Dr. J. S. Plaskett, F.R.S.C.

19.—Note on the Ultra Violet Spark Spectrum of Silicon. By Prof. J. C. McLennan, F.R.S.C. and Mr. Evan Edwards, B.Sc.

20.—On the Absorption Spectra of Zinc and other Metallic Vapours. By Prof. J. C. McLennan, F.R.S.C. and Mr. Evan Edwards, B.Sc.

21.—On the Ionisation Potentials of Mercury Zinc and Cadmium Vapours and their Single Line Spectra. By Prof. J. C. McLennan, F.R.S.C. and Mr. J. P. Henderson, B.A.

22.—Application of Wilson's Method to a Study of the Ionisation Paths of Alpha Rays in Hydrogen. By Prof. J. C. McLennan, F.R.S.C. and Mr. H. N. Mercer, B.Sc.

23.—On the Delta Radiation from Zinc freed from Gases under Bombardment by Alpha Rays. By Prof. J. C. McLennan, F.R.S.C. and Mr. C. G. Found, B.A.

24.—On the Measurement of Local Earth Tremors. By Dr. J. B. Porter. Presented by Prof. H. T. Barnes.

25.—Geometrical Configurations that lead to the Solution of a System of Partial Differential Equations of the Second Order. By Chas. T. Sullivan. Presented by Dr. J. Harkness F.R.S.C.

26.—Certain Sets of Orders of Coincidences Associated with an Algebraic Equation. By Prof. J. C. Fields.

27.—On the Infra-Red Spectrum of the Mercury Arc. By Prof. J. C. McLennan, F.R.S.C. and Mr. R. C. Dearle, B.A.

28.—Secondary Cathode Rays from Gases. By A. Norman Shaw, D.Sc., Macdonald College. Presented by Prof. H. T. Barnes, F.R.S.C.

29.—Waves in a Jet of Water. By Mr. Otto Maas. Presented by D. McIntosh, Ph.D., F.R.S.C.

30.—The Diffusion of Oxygen Through Silver. By F. M. G. Johnson, Ph.D., F.R.S.C.

31.—On Osmosis in Soils. By C. J. Lynde, Professor of Physics, and V. V. Dupré, Research Assistant under the Dominion Grant for Agriculture, Macdonald College. Presented by Prof. H. T. Barnes, F.R.S.C.

32.—On the Diurnal Changes in Magnetic Horizontal Force at Agincourt, 1902-1912. By W. E. W. Jackson, M.A. Presented by R. F. Stupart, F.R.S.C.

33.—Comparison of the Callendar Sunshine Receiver and the Ansgtrom Pryheliometer. By John Patterson, M.A. (Cantab). Presented by R. F. Stupart, F.R.S.C.

34.—A Self-Recording Instrument for Measuring Earth Temperatures. By John Patterson, M.A. (Cantab). Presented by R. F. Stupart, F.R.S.C.

35.—The Crushing Strength of Ice. By Prof. H. T. Barnes, F.R.S.C. and Mr. H. M. Mackay.

36.—On the Flow of Air in Two-Dimensional Channels with special reference to the Stability of Stream Line Motion. By Louis Vessot King, M.A. (Cantab).

37.—The Effect of Strain on the Thermal Expansion of Quartz. By Prof. H. T. Barnes, F.R.S.C.

38.—The Separation and Determination of Nickel and Cobalt. By Prof. T. L. Walker. Presented by Prof. W. H. Ellis.

39.—On the Distribution of Air Velocity in the Neighbourhood of a Rotating Cylinder. By A. Gray, B.Sc., and Louis Vessot King, M.A. (Cantab).

40.—On the Resolution of Spectral Lines by an Electric Field. By Prof. J. C. McLennan, F.R.S.C. and Mr. K. H. Kingdon, B.A.

41.—Oh the Study of Rontgen Ray Spectra. By Prof. J. C. McLennan, F.R.S.C., Mr. A. R. McLeod, M.A., and Mr. R. L. Lewis, B.Sc.

42.—The "Ninhydrin" Reaction. By Dr. V. J. Harding. Presented by Prof. R. F. Ruttan, F.R.S.C.

On the motion of Dr. Plaskett, seconded by Dr. Barnes, the report of Section III was adopted.

REPORT OF SECTION IV.

Section IV begs to report that four sessions were held, presided over by Professor A. H. R. Buller. Twenty-five members and several visitors were in attendance. The following new members were added to the Section: Professor J. A. Dresser, Dr. Alexander McPhedran, Professor W. A. Parks, and Dr. E. M. Walker.

Mr. Charles David White, B. Sc., of the United States Geological Survey, was recommended for election as a corresponding member of Section IV.

An extension of one year, under the terms of paragraph 3, section 8 of the By-laws, was granted to Professor T. G. Brodie now on active service and to Professor C. L. Moore.

It was decided to elect not more than four biologists next year to fill the vacancies now existing.

The following motions were approved by the section:—

1. That members shall attend at least once in three years or shall contribute a paper of their own or in collaboration with others, failing which they shall be placed on the retired list.

2. Every member-elect shall attend the first general meeting of the Society after his election and be formally received, unless consent is obtained to postpone his reception for a period not exceeding one year. The Society may upon the recommendation of the council further extend the time for the formal reception.

3. Section IV expresses itself in favor of adhering to the present date of meeting of The Royal Society.

The following officers were chosen for the ensuing year:—

President: J. B. Tyrrell.

Vice-President: J. P. McMurrich.

Secretary: J. J. Mackenzie.

Acting Secretary pro tem: J. H. Faull.

Twenty-six papers, a list of which is appended, were contributed, including an especially interesting presidential address on "Micheli and the Discovery of Reproduction in Fungi."

All of which is respectfully submitted.

J. H. FAULL,
Acting-Secretary.

LIST OF PAPERS PRESENTED IN SECTION IV.

1.—Presidential Address. Micheli and the Discovery of Reproduction in Fungi. By A. H. Reginald Buller, D.Sc., F.R.S.C.

2.—A Contribution to a Knowledge of Canadian Ticks. By Dr. C. Gordon Hewitt, F.R.S.C.

3.—I. A Comparison of Spore-discharge in the Uredineae and the Hymenomycetes. By A. H. Reginald Buller, D.Sc., F.R.S.C.

4.—II. The Movements of Spirogyra Filaments. By A. H. Reginald Buller, D.Sc., F.R.S.C.

5.—Comorocystitis punctatus Billings. By Sir James Grant, K.C.M.G., F.R.S.C.

6.—The Cretaceous Sea in Alberta. By D. B. Dowling, F.R.S.C.

7.—Notes on some hitherto Unrecorded Occurrences in British Columbia of Uncommon Minerals, collected by the late W. J. Sutton, of Victoria. By R. W. Brock, F.R.S.C.

8.—A British Columbia Example of the Contact Metamorphism of a Granitic Rock to a Garnet. By R. W. Brock, F.R.S.C.

9.—The Upper Limit of Temperature Compatible with Life in the Frog. By A. T. Cameron and T. I. Brownlee. Presented by Dr. Swale Vincent, F.R.S.C.

10.—On an Accumulation of Gas in the Tissues of the Frog as a Result of Prolonged Submersion in Water. By A. T. Cameron and T. I. Brownlee. Presented by Dr. Swale Vincent, F.R.S.C.

11.—On the Relative Importance to Life of the Cortex and the Medulla of the Adrenal Bodies. By T. D. Wheeler and Swale Vincent, F.R.S.C.

12.—A Study of some Organisms which Produce Black Fields on Aesculin-Bilesalt Media. By F. C. Harrison, D.Sc., F.R.S.C.

13.—The Harrison-Barlow Nitro-cultures and their Commercial Application. By F. C. Harrison, D.Sc., F.R.S.C.

14.—The Diatoms of the Coast of Vancouver Island, B.C. By Dr. L. W. Bailey, F.R.S.C., and Dr. A. H. MacKay, F.R.S.C.

15.—Metallogenetic Epochs in the pre-Cambrian of Ontario. By Willet G. Miller, F.R.S.C., and Cyril W. Knight.

16.—Modes of Occurrence of some Gold-Bearing Veins in the pre-Cambrian Rocks of Canada. By J. B. Tyrrell, F.R.S.C.

17.—A New Myxobacterium. By J. H. Faull, Ph.D., F.R.S.C.

18.—Some Anatomical Features of Willow Galls and their Significance. By A Cosens, M.A., Ph.D., and T. Sinclair, M.A. Presented by J. H. Faull, Ph.D., F.R.S.C.

19.—On a pre-Cambrian Outlier in Central Manitoba. By Professor R. C. Wallace. Presented by A. H. Reginald Buller, D.Sc., F.R.S.C.

20.—The Swarming of Odontosyllis. By C. McLean Fraser, Ph.D. Presented by A. B. Macallum, Ph.D., F.R.S.C.

21.—Trematodes from Marine and Frest Water Fishes, including a new Species of Microcotyle. By A. R. Cooper.

22.—On the Resistance of Bacillus anthracis Spores to High Temperature. By R. H. Malone and E. Shanley. Presented by Dr. J. G. Adami, F.R.S.C.

23.—Bibliography of Canadian Botany for the Year 1914. By Dr. A. H. MacKay, F.R.S.C.

24.—Bibliography of Canadian Geology for 1914. By Wyatt Malcolm. Presented by R. G. McConnell, B.A., F.R.S.C.

25.—Bibliography of Canadian Entomology for the Year 1914. By Rev. C. J. S. Bethune, D.C.L., F.R.S.C.

26.—Bibliography of Canadian Zoology for the Year 1914, (exclusive of Entomology). By E. M. Walker, B.A., M.B.

On motion of Dr. Faull, seconded by Dr. Buller, the report of Section IV was adopted.

The Honourable Rodolphe Lemieux introduced the following resolution:—

Whereas this is the first general meeting of The Royal Society of Canada since the breaking out of the war in Europe;

Whereas the said war is one involving several of the great powers, and especially the mother countries of the two main stocks of people making up this Dominion;

Whereas Canada is nobly performing her duty in this emergency in training, equipping and sending forth thousands upon thousands of her hardy sons to fight the battles of peace, freedom and humanity on the blood-soaked battlefields of France and Belgium;

Whereas the type of kultur or civilization which Germany and her ally Austria, with the help of Turkey, have undertaken to impose by force on the rest of the universe is supremely repugnant to those higher ideals of justice and liberty which it has been the especial burden of the British mother country and its galaxy of self-governing commonwealths to establish;

Whereas the barbarous means resorted to by our foes to attain their sinister ends have entailed the ruthless destruction of many of the finest monuments of architecture, treasures of art and institutions of learning, particularly in Belgium and the north of France;

And whereas The Royal Society of Canada, as the premier Canadian institution representative of the interests of Art, Science and Literature, is bound to manifest its deepest concern in the preservation of such monuments, treasures and institutions; and whereas The Royal Society of Canada glories in having some of its members who answered the call of England against the German wild agression;

Be it Resolved:

That we members of The Royal Society of Canada, duly assembled for our Annual meeting in Ottawa, do strongly voice our loathing of the atrocities and depredations thus committed by our foes, and that we do solemnly enter and make public our desire to join our unanimous protest with those which have emanated from similar institutions the world over against the perpetration of such crimes.

Moved by Hon. Rodolphe Lemieux (President of Section I), seconded by Hon. Mr. Justice Longley (Past-President of Section II), that the resolution be adopted and the motion was unanimously and enthusiastically carried.

It was moved by Dr. W. Lash Miller, seconded by Dr. Barnes, that whereas during the last few years the work of reducing the meteorological and magnetic observations carried out by the Government of Canada since 1840 has been undertaken, and has already yielded results of scientific and practical importance and, whereas this work is proceeding very slowly, therefore The Royal Society strongly urges the Government that additions be made to the computing staff, so that accumulations may be overtaken, and the reduction of current observations may be kept up to date.

It was moved by Mr. Stupart, seconded by Dr. Klotz, that a grant of three hundred dollars be made to Dr. L. V. King to enable him to continue his work on Meteorological Physics.—Carried.

Further consideration was then given to the amendment of the by-laws as proposed by Dr. Klotz. After full discussion, in which a number of the Fellows took part, it was moved by Dr. Bryce, seconded by Dr. Tory, that this amendemnt be left over for future consideration.—Carried.

Dr. Macallum gave notice of motion to amend the by-laws in respect of the method of electing the Fellows and explained to the meeting the procedure he intended to propose.

The report of the nominating committee was then presented by Dr. Klotz.

The following nominations were made:—

For President,—Dr. Alfred Baker.
Vice-President.—Dr. A. B. Macallum.
Honorary Secretary,—Mr. Duncan C. Scott.
Honorary Treasurer,—Dr. C. Gordon Hewitt.
Honorary Librarian,—Mr. D. B. Dowling.

It was moved by Dr. Klotz, seconded by Dr. LeSueur, that the report of the nominating committee be received and adopted.—Carried.

It was moved by Dr. LeSueur, seconded by Dr. Macallum, that the thanks of this meeting be presented to the officers of the Society and the other members of the Council for their very efficient services during the past year.—Carried.

The meeting was then declared adjourned by the newly elected President.

APPENDIX A

PRESIDENTIAL ADDRESS

LE DUALISME CANADIEN

BY

Sir ADOLPHE B. ROUTHIER, Kt., M.S.R.C

LE DUALISME CANADIEN.

QU'IL PLAISE À VOS ALTESSES ROYALES,[1] MESDAMES, MESSIEURS.

Il n'est peut-être pas inutile de vous expliquer tout d'abord le sens exact du titre de ma conférence.

Par ces deux mots "Dualisme Canadien," je veux dire que la nation canadienne se compse de deux éléments principaux, au point de vue ethnographique, et que ces deux éléments ont chacun une mentalité bien caractérisée, et sont essentiellement différents par le sang, par la langue, par la religion.

L'un est français et parle la langue française, l'autre est anglais et parle la langue anglaise. Le premier est catholique, le second est protestant. Mais les deux sont unis, et forment la nation canadienne. Une même constitution les régit, ils ont le même souverain, le même drapeau, le même territoire national, ou la même patrie, qui est le Canada.

Voilà ce que j'appelle le "Dualisme Canadien."

Comment les deux races qui le composent se trouvent-elles unies dans une vie commune sur le même territoire?—Vous le savez:

Le Français en a été le découvreur, le fondateur, le premier occupant; l'anglais l'a acquis par un traité de cession signé par la France. Le premier l'habite depuis trois siècles; le second, depuis un siècle et demi. La langue française y est parlée depuis trois cents ans, et l'anglais depuis cent cinquante ans.

Qui a créé cet état de chose? Est-ce le hasard? Non, certes, il n'y a rien de fortuit dans les événements de la vie des peuples.

Est-il l'oeuvre de quelques hommes illustres que l'on appelle les fondateurs, les Pères, *the Makers of Canada*? Oui, sans doute, mais ces hommes n'ont été que les instruments de ce pouvoir supérieur que l'on appelle la Providence. N'en doutons pas, Messieurs, la mission que ces hommes ont remplie, ils l'avaient reçue d'en haut. Ne mettons jamais en doute l'existence de cette Force surhumaine qui domine les peuples, et que Bossuet dans son langage incomparable a désignée par ces mots: "Celui qui règne dans les Cieux et de qui relèvent tous les empires!" Car à tous ceux qui méconnaissent cette puissance souveraine, "Dieu sait donner, quand il lui plaît, de grandes et de terribles leçons." C'est encore une parole de Bossuet, le plus grand orateur qui ait parlé la langue française.

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[1]Leurs Altesses Royales, le Duc & la Duchesse de Connaught.

Il me serait facile, si j'en avais le temps, de feuilleter avec vous notre histoire et de vous démontrer cette vérité historique: que le Dualisme Canadien est l'oeuvre de la Providence des Nations. Et j'ajoute qu'il est un groupement humain choisi, une élite, issue de deux nations très illustres et très puissantes.

Le Canada Français est né à l'âge classique de la France, qui fut l'âge de sa grandeur, de sa puissance et de sa gloire.

Il est devenu colonie anglaise, quand la France allait être entraînée dans les perturbations sociales, politiques et religieuses de la Révolution française, qui durent encore. Et, dans l'opinion des esprits les plus versés dans la philosophie de l'histoire, ce fut un bienfait de la Providence, qui a préservé le Canada français des divisions profondes et séculaires qui affligent la France, depuis plus d'un siècle.

Le Dualisme Canadien n'a pas encore une longue histoire, mais il a déjà assez vécu et assez grandi pour prouver sa vitalité et pour compter sur un grand avenir.

Et quelles sont les raisons de ces belles espérances ? Je les trouve 1° Dans la double autorité politique et religieuse régulièrement constituée dans notre pays. 2° Dans les libertés nécessaires appuyées sur l'ordre, et régulièrement balancées et pondérées par le respect des lois et des traditions. 3° Dans la société domestique, ou la famille, fondée sur la religion et sur la morale. 4° Dans la paix, entre la religion et l'Etat assurant la stabilité de l'édifice social.

Ces quatre éléments vitaux de notre existence nationale sont également essentiels; mais il en est un cinquième qui est tout aussi nécessaire que les autres—c'est la Concorde, l'union fraternelle entre les deux races.

Dans le Dualisme Canadien la Providence a voulu, et elle veut, que Français et Anglais soient des frères puisqu'elle leur a donné la même patrie. Or il n'y a rien de plus désastreux dans une famille que des frères ennemis. Mais pourquoi donc ne serions-nous pas de vrais frères ? Ne sommes-nous pas tous des Chrétiens ? Protestants et Catholiques, ne croyons-nous pas tous au même Jésus-Christ et à sa divinité ? Et c'est le plus grand bienfait que le Canada ait reçu de la Providence: Français et Anglais, nous sommes tous nés dans la religion chrétienne, et nous n'avons pas d'autre Dieu que le Christ.

Ah! Messieurs, ne nous laissons jamais enlever par la fausse science cette croyance salutaire qui seule peut alimenter la vie d'un peuple et fonder à jamais sa stabilité.

D'où qu'elle vienne, d'Allemagne, de France, d'Angleterre, ou des Etats-Unis, et quels que soient les génies et les savants qui la propagent, rejetons-la comme un poison cette fausse science qui enseigne aux nations à se passer de Dieu, et qui inculque à l'humanité l'orgueil satanique de se croire Dieu elle-même.

Vous ne l'ignorez pas, Messieurs, la grande erreur de notre temps, l'erreur fondamentale de la science moderne—qui lui vient de la philosophie allemande—c'est de croire et d'enseigner que l'humanité, par les efforts de son génie et par ses progrès indéfinis, est en voie de devenir Dieu. Kant, Fichte, Hégel, Schopenhauer et leurs disciples ont tour à tour enseigné cette religion nouvelle qui s'appelle *humanisme*. Et si la guerre effroyable dont nous sommes les témoins épouvantés n'arrête pas sa marche, l'Allemagne prétendra enfanter le Dieu nouveau pour la plus grande gloire des Allemands, et pour l'heureuse servitude que la *Kultur* germanique donnera aux autres nations. Mais cela ne se fera pas, Messieurs. C'est en vain que l'Allemand démolit les cathédrales gothiques. L'incendie dans les temples a rallumé le feu sacré dans les âmes et l'étincelle divine a jailli jusque dans la fange où les Teutons ont promené leurs atrocités et leurs débauches. L'appel aux armes a été un appel aux âmes; la France de Clovis, de Charlemagne, de saint Louis et de Jeanne d'Arc, qu'on croyait à jamais endormie dans le cimetière des siècles, s'est soudainement réveillée quand la cathédrale de Rheims est tombée sur elle. Partout le besoin des églises s'est fait sentir quand l'Allemagne s'est mise à les détruire.

Car les peuples comme les individus ont besoin d'un idéal. Et soyez-en convaincus, Mesdames et Messieurs, il n'y a qu'un seul Idéal et il est divin.

Les peuples modernes ont voulu s'en faire un autre, comme les anciens se faisaient eux-mêmes leurs dieux.

Et la joie était grande dans tous les grands centres humains de voir le génie multiplier ses conquêtes, sur terre et sur mer, sous la mer et dans les airs. L'homme devenait tout-puissant, et la science allemande s'exaltait dans son orgueil.

Elle était toujours un peu nuageuse et lourde, trop épaisse pour le brillant esprit de Paris. Mais le Parisien la vulgarisait, la faisait lumineuse et légère, et les femmes elles-mêmes s'en nourissaient, et devenaient de plus en plus des oeuvres d'art et des instruments de plaisir.

Le monde chantait les beautés de la civilisation nouvelle et le nouvel idéal. Il s'épanouissait dans l'orgueil de sa puissance, dans l'abondance de ses plaisirs et dans les promesses d'une paix perpétuelle.

Quand un pessimiste parlait de guerre future, on s'esclaffait de rire. La guerre était une calamité possible jadis, dans les siècles de ténèbres, mais non plus au soleil de la civilisation moderne. La science diplomatique, les inventions nouvelles, et l'art militaire lui-même perfectionné rendaient la guerre impossible et garantissaient un millénaire de paix.

Qui oserait troubler une ère si heureuse et si admirable? C'était le Dieu des armées qui jadis jetait les nations les unes contre les autres. Mais il n'existait plus le Dieu des armées. Le lumière du vingtième siècle l'avait éclipsé. Et cette lumière venait du Nord, de la savante Allemagne. Ce n'était donc pas de là que pouvaient venir les Barbares.

Et cependant c'est bien de là qu'ils sont venus!

"Le jour vient, disait Henri Heine, où les vieilles divinités guerrières de la Germanie se lèveront de leurs tombeaux fabuleux, où Thor se dressera avec son marteau gigantesque et démolira les cathédrales gothiques...où vous entendrez un craquement comme jamais craquement ne s'est encore fait entendre dans l'histoire du monde...où les aigles tomberont morts du haut des airs (ne dirait-on pas que Heine a vu la lutte des aéroplanes et des Zeppelins?) Le jour vient où l'on exécutera en Allemagne un drame auprès duquel la Révolution française ne sera qu'une innocente idylle."

Ainsi prophétisait Henri Heine, et vous savez avec quelle douloureuse exactitude ses visions prophétiques se sont réalisées.

Or, il est incontestable, Messieurs, que ces grandes calamités sont envoyées aux peuples quand ils cessent de croire à la divinité de Jésus-Christ, et quand ils prétendent substituer une civilisation sans Dieu à la civilisation chrétienne.

L'apôtre des nations, dont les protestants reconnaissent la grande autorité, a écrit que c'est la foi chrétienne qui a renversé le mur de séparation entre les peuples; et qui de deux peuples n'en fait qu'un.

Les nations européennes ont souvent méconnu cette vérité, et c'est en les affligeant que Dieu les rappelle au grand devoir de la fraternité.

Il y a quelques semaines, le "Times" de Londres disait:

"Parmi toutes les douleurs de cette guerre, il y a cependant une joie pour nous: celle d'être devenus frères des Français, comme jamais deux peuples ne l'ont été. Il nous est venu, après des siècles de conflits, une sorte de millénaire d'amitié. En cela nous sentons qu'il y a pour le monde une espérance qui surpasse toutes les craintes, même en ce point de calamité où en est le monde."

"Malgré nos stupides querelles et nos malentendus, et en dépit de nos différences de caractère il y eut toujours au fond une entente entre nous; et quand Sir Philip Sidney parlait de la France comme de la *douce ennemie*, il traduisait le sentiment anglais des siècles passés et des siècles futurs.

"Voilà pourquoi nous admirons la France, comme nous n'avons jamais encore admiré aucune nation."

Ces nobles sentiments d'amitié, si éloquemment exprimés par le "Times," sont sincères et profonds, et je suis convaincu qu'ils seront durables, parce qu'ils sont cimentés par le sang versé pour la même cause, sur les mêmes champs de bataille.

Est-ce que la même cause ne produira pas les mêmes effets dans le Dualisme Canadien ? Il n'est pas possible qu'il en soit autrement. Canadiens Anglais et Canadiens Français ont franchi les mers et ils se battent ensemble à côté de leurs frères d'Europe. Ils sont déjà frères puisqu'ils ont la même mère-patrie; mais ils devront s'aimer davantage quand ils auront mêlé leur sang pour la civilisation chétienne et pour le triomphe des deux grandes races auxquelles ils appartienneent.

Avez-vous jamais remarqué, Messieurs, de quelle manière s'est accomplie l'union des deux races dans notre pays ? Je ne crois pas que l'histoire nous en fournisse un autre exemple. Français et Anglais se sont rencontrés deux fois sur le même champ de bataille. La première bataille des Plaines d'Abraham a été une victoire pour les Anglais, et la seconde, une victoire pour les Français. Mais ce sont les vainqueurs de la dernière bataille qui se sont soumis, et les vaincus qui sont devenus les maîtres. Les deux éléments ont été tour à tour vainqueurs et vaincus, et le même sol arrosé du sang des deux est devenu leur commune patrie. Wolfe et Montcalm l'ont acheté et payé de leur sang le même jour à la même bataille; et Montcalm en mourant a écrit au général anglais: "Ayez pour les Canadiens-Français les sentiments qu'ils m'avaient inspirés. Qu'ils ne s'aperçoivent pas d'avoir changé de maître. Je fus leur père, soyez leur protecteur."

L'Angleterre a accepté ce legs universel d'une valeur infinie, et elle est tenue d'en remplir les charges. Y avez-vous jamais réfléchi, Messieurs ? Et ne pensez-vous pas qu'il y a là un traité d'alliance dont les obligations sont sacrées ? Et que les héritiers qui ont recueilli ce legs magnifique sont obligés de respecter les volontés du testateur ?

Oui, certes, et ce fut aussi un décret de la Providence que Français et Anglais nous soyons devenus les co-héritiers du riche héritage établi par la France. Elle a été bien généreuse pour vous, cette Providence, quand elle vous a donné en héritage la moitié de l'Amérique du Nord—que nous Français avions conquise par cent cinquante ans de travaux et de peines. Au moins faut-il que chacun des co-héritiers laisse à l'autre sa part d'héritage dans son intégrité.

Or parmi les biens qui composent le patrimoine national il n'en est pas de plus précieux que les libertés nécessaires, la liberté de la religion, la liberté de la langue, et la liberté d'enseigner l'une et l'autre dans les écoles.

Le peuple auquel on enlève ces libertés est un peuple déshérité; et les majorités parlementaires qui en dépouillent les minorités commettent à la fois une injustice et une grande erreur politique.

Il y a aujourd'hui en Europe une puissance formidable qui a rêvé de détruire la France, et de rendre à jamais muette la langue française, si pleine d'harmonie et de clarté, héritière des beautés et des gloires de l'antiquité grecque et latine.

Mais deux grandes puissances se sont dressées devant l'Allemagne, et l'empêcheront de réaliser ce rêve barbare. Ce sont l'Angleterre et la Russie. Gloire à elles, Messieurs, d'avoir si bien compris que détruire la France et son verbe glorieux, ce serait porter un coup mortel à la Civilisation.

Est-ce qu'il y aurait par hasard dans notre pays un groupe de nos concitoyens qui voudraient imiter l'Allemagne et supprimer la France d'Amérique?

Je me refuse à le croire, par ce que je vois sur les champs de bataille de l'Europe notre brillante jeunesse, anglaise et française, verser son sang pour le salut de la France et du beau parler français.

Elle sait qu'en luttant pour ce noble pays, elle lutte pour l'idéal, pour l'art, pour la civilisation, pour l'une des plus grandes gloires de l'humanité.

Il y a des siècles que la France est le phare intellectuel le plus brillant qui éclaire l'Europe; mais il éclairera davantage quand il ne sera plus alimenté par l'huile fumeuse et asphyxiante d'Outre-Rhin.

La France reprend aujourd'hui le cours interrompu de ses épopées chevaleresques, et sa langue sublime les chantera demain, alors que les Teutons agiteront encore les framées rouillées de leur dieu Thor, et poursuivront leur rêves barbares dans les sombres forêts de la Germanie.

Le moment serait bien mal choisi pour tenter de détruire en Canada ce que la civilisation chrétienne travaille si glorieusement à sauver en Europe, au prix de son sang.

Quand notre peuple possède deux grands luminaires qui éclairent son horizon, il serait insensé de vouloir éteindre l'un des deux.

Quand Rome eut conquis la Grèce, elle ne supprima pas sa belle langue. Au contraire elle lui emprunta ses beautés et ses gloires; et les hommes les plus illustres de la République Romaine, ses écrivains, ses orateurs, ses artistes allaient compléter leurs études dans les écoles d'Athènes.

Il y a eu dans le passé, successivement, trois langues universelles,—la grecque, la latine et la française. Aujourd'hui l'Anglais, le Russe et l'Allemand peuvent également prétendre être des langues universelles; mais la langue française n'en reste pas moins, comme disait M. Lamy, de l'Académie Française, "l'une des plus magnifiques parures qu'ait jamais revêtue la pensée humaine."

Et puisque le Dualisme Canadien possède cette parure pourquoi voudrait-on l'en dépouiller ?

Le Dualisme Canadien est un état de choses qu'on ne peut pas supprimer. Et il a un double verbe. Si les deux éléments ethniques qui le composent ont tous les deux droit à l'existence, ils ont tous les deux droit de parler chacun sa langue. Un homme muet n'est pas un homme complet. C'est un infirme.

Mais qui vous empêche de parler français, dira-t-on ? Personne ? Non, sans doute; mais comment le parlerai-je si je ne le sais pas ? Et comment le saurai-je si les écoles de l'Etat que je soutiens de mon argent ne me l'enseignent pas ?

C'est une question de justice—une question d'intérêt national—une question de progrès intellectuel—une question de gratitude pour les loyaux services que la race française a rendus dans le passé, et rend en ce moment à l'Angleterre.

De quelque côté qu'on examine ces questions, à quelque point de vue que l'on se place, la logique des faits et l'équité naturelle donnent raison à la minorité.

Quand une suite d'événements historiques, et des circonstances de temps, de lieu, et de formation ethnique ont réuni sous la même autorité deux races différentes, elles apportent naturellement dans l'union pour le plus grand avantage de tous, leurs talents, leurs facultés, leur énergie, leur travail, leurs vertus, leurs richesses intellectuelles, et les produits de leur littérature et de leur langue.

Or ce n'est pas un obstacle à leur développement de parler deux langues. Au contraire, c'est un perfectionnement plus complet de leur esprit.

Et non seulement je crois que c'est une grande faute politique de vouloir contraindre l'une ou l'autre des deux races à renoncer à sa langue. Mais je suis convaincu qu'il n'est pas possible d'imposer par la force à une race une langue étrangère à la sienne.

Aucune puissance, vous le savez, ne fut plus forte que l'empire romain qui avait tous les moyens de répandre et propager l'usage du latin jusqu'aux confins du monde civilisé.

Et cependant le latin n'a pas subsisté, même en Italie, et les nombreuses races que Rome avait subjuguées et gouvernées ont toutes gardé et parlé leurs langues primitives. Remarquez bien d'ailleurs que le Dualisme Canadien n'est pas la seule nation qui soit composée de deux éléments ethniques différents. Il est même très peu de nations qui se soient formées d'une seule race homogène.

Dans le Royaume-Uni on parle plusieurs langues. Dans la glorieuse Belgique on parle trois langues. La Suisse également a trois langues officielles. En France les Bretons et les Provençaux parlent encore leur dialecte originaire, et la France possède une littérature bretonne et une littérature provençale.

Nous avons déjà nous-mêmes deux littératures qui nous font honneur, et quand le public qui lit ouvre les gros volumes que notre société publie chaque année, il ne doit pas s'affliger d'y voir que le Dualisme Canadien parle bien son double verbe, et qu'il produit des oeuvres qui vivront dans les deux langues.

Remarquons encore que dans l'union de deux races il y a cet avantage qu'elles se corrigent parfois mutuellement de leurs défauts, et qu'elles échangent souvent insensiblement leurs qualités.

L'Anglais flegmatique et froid calme le Français qui se passionne et s'agite pour une idée ou un sentiment; et le Français élève l'Anglais audessus des intérêts purement matériels, et lui ouvre des horizons plus généreux et plus larges.

L'Anglais plus pratique et plus habile en affaires, crée chez son compatriote français une émulation qui ne lui est pas inutile quand il veut chercher fortune.

Si donc le Dualisme Canadien entend bien ses intérêts nationaux, et veut s'assurer un grand avenir, il doit éviter les luttes intestines, et tous les malentendus qui peuvent naître de la différence des mentalités et des caractères.

Pour cela il faut que chaque élément rende à l'autre justice égale. Il faut plus. Il faut que leur union engendre l'amitié et la fraternité puisqu'ils ont la même mère-patrie, et qu'ils sont prêts tous les deux à verser leur sang pour elle.

Comme Canadien-Français, je suis heureux de voir avec quelle générosité et quelle largeur de sentiment la province de Québec accorde à la minorité anglaise toutes les libertés nécessaires dans l'exercice de sa religion et dans l'enseignement de ses écoles et je me demande pourquoi la majorité anglaise des autres provinces ne rendrait pas la même justice intégrale à la minorité française.

Dans les temps douloureux que nous traversons, et quand nous lisons chaque jour dans le "*Roll of Honor*" les noms de nos compatriotes tués ou blessés sur les champs de bataille de France et de Belgique, comment pourrions-nous éterniser ici de mesquines querelles?

Non cela ne sera pas. Les larmes et le sang versé par tant de familles canadiennes feront naître la fleur de charité sur le sol canadien, et quand viendra l'automne il nous donnera des fruits de justice et de paix.

APPENDIX B

THE DOMINION ASTRONOMICAL OBSERVATORY

BY

W. F. KING, C.M.G., LL.D.

THE DOMINION ASTRONOMICAL OBSERVATORY AND THE BOUNDARY AND GEODETIC SURVEYS.

Astrophysics.

The past year has been very favourable for observing and 906 stellar spectrograms have been secured as compared with 531 of the previous year. Six new binary orbits have been completed and published, namely; 23 Cassiopeiae, ω Cassiopeiae, 136 Tauri, ζ Andromedae, 1149 Groombridge and 50 Draconis. Additional observations of θ^2 Tauri have been secured which strengthen the determination of its orbit. Two other orbits, μ Persei and B. A. C. 5890, are practically complete but have not been published. Some nine others are more or less complete. Some stars, upon which considerable labour has been expended, have been abandoned as the small range in velocity coupled with the poor quality of their spectra renders the determination of the periods difficult.

As the number of known spectroscopic binaries among the brighter stars is rapidly becoming worked up, some attention has been given to stars for which no observations are as yet available. These are principally of the B and A types between 5·0 and 5·5 photographic magnitude and it is expected that some new binaries will be discovered among them.

A statistical study has been made of the motions of 167 stars whose radial velocities, proper motions and parallaxes are available.

A set of star maps to facilitate the observation of meteors has been prepared and published and they have since been adopted by the American Meteor Society.

The glass disc for the 72-inch reflector left Antwerp a few days before war broke out and in due time reached the J. A. Brashear Co., contractors for the optical parts.

The edges were trued up and a hole in the centre 9 inches in diameter was successfully cut out. After roughly polishing both surfaces the best one was chosen and it is now being ground to the desired form. Satisfactory progress is being made in the construction of the mounting for the telescope and it is expected that it will be erected by the beginning of next year.

A carriage road has been built by the Provincial Government of British Columbia to the observatory site at the summit of Little Saanich Hill. Contracts have been let by the Dominion Department of Public Works for the construction of the building, with dome 66 feet in diameter, for the telescope. A well has been bored on the property, and a pump installed to raise the water to a tank on the summit.

Solar Observations.

The solar rotation plates of 1911-12-13, have been measured and reduced by Dr. Plaskett and will be published shortly. A summary of the results was presented at the current meeting of the Society.

Direct photographs of the sun (113 in number) were taken on all suitable days when spots were present. With the 23-foot spectrograph 303 plates were made. About 150 of these (1000 exposures) recorded simultaneously two sets of spectra of the limbs, one of the centre of the Sun's disc and two of iodine comparison spectra at λ 5600. The majority of these were taken at the Sun's equator, while 29 plates were made at position-angles 15° apart from 0° to 90°. Plates of spot-spectra (124 in number having over 500 exposures) record, for various spots in various positions, the penumbral convection for the gases producing the spectral lines in regions from λ 3800 to λ 6200. Some of the above plates have been measured, though most of the time available for measurement has been spent in completing the measures of the 1911-1913 solar rotation spectra.

Photometric Observations.

The time previously given to micrometer work with the 15-inch telescope has been devoted during the past year to the mounting and adjusting of the new photographic telescope. This equipment consists of two doublets of 8-inch and 6-inch aperture and 40-inch and 30-inch focus respectively, a Zeiss lens of 3·3-inch aperture and 11·8-inch focus, a guiding telescope of 4·5-inch aperture and 52·5-inch focus, and two objective prisms of 15° and 25° to attach to the 8-inch doublet separately or together. The whole is mounted equatorially, the driving clock having both hand and electric slow-motions.

Direct photographs and spectra of Delavan's comet were obtained during the late summer, and in the winter the lenses of the doublets were thoroughly tested for curvature of field and aberration. The 6-inch proved to be suitable for extra-focal work as applied to star magnitudes and, as an excellent dark-room has been provided, work is now being carried on in the investigation of variable stars. It is intended to extend the photometric work with this instrument as well as to devote some time to direct photography of comets and star fields in the Milky Way.

Meridian Observations.

Observations with the meridian circle were made on 126 nights. On 101 nights the work was devoted to the list of latitude stars which has been under observation for several years; the number of observations obtained was approximately 2,000 for right ascension and 1,800 for declination. Two observers were engaged throughout the year, and two others for shorter periods.

The regular programme of astronomical field-work comprised the determination of the latitudes and longitudes of fifteen stations, seven of these being in British Columbia, and eight in Quebec. Kamloops, one of the stations in British Columbia, was used as a longitude base for the remaining six, it being first determined from Field, B.C., the previous base station.

The longitudes of the stations in Quebec were determined from Ottawa. Three-inch Cooke transits, with registering micrometers and latitude levels, were used for the field observations; personal equations were determined as usual.

Besides these stations the longitudes of four others in the Province of Quebec, where no telegraph line was available, were determined by wireless telegraphy. For this purpose the time signals sent out by the U.S. wireless station at Arlington, Va., were utilized as a means of comparison between the observer's chronometer and the Observatory sidereal clock, thus replacing the usual "arbitrary signals" transmitted over the telegraph line for the same purpose. To effect the comparison, a break-circuit chronometer, rated to gain about ten minutes per day, was caused by a suitable arrangement to beat in the telephones of the wireless receiving set, at the same time that the wireless time-signals were being received; by noting the times at which coincidences occurred it was found possible to make comparisons to within about ·01 second. This being done at both the field station and the Observatory, a direct comparison of clocks was effected, independent altogether of the accuracy of the Arlington signals. The transportation in the field was effected by canoe; the receiving aerials were erected on trees, ground connections being made in running water wherever possible. The results indicate that the accuracy of such longitude determinations may be expected to be practically the same as those determined by wire. The latitudes of these stations were also observed. The telescope used was a portable broken-type transit by Heyde, fitted with registering micrometer and latitude level.

The time-service has been maintained as in previous years. About 325 electrically driven clocks are operated in the various

Government buildings by means of several secondary master-clocks continuously synchronized from the Observatory by the method mentioned in a previous report. In addition, relays beating seconds are maintained in several offices in the city, time-signals are sent out by telegraph and telephone; the time is recorded on the various seismographs, and a time-ball is dropped on Parliament Hill.

Geophysics.

The two Bosch horizontal photographic pendulums the Spindler and Hoyer vertical, with mechanical registration, have been in constant operation during the past year. The efficiency of the former has been increased by replacing the hardened steel cup supports or bearings by jewels (diamonds). During the calendar year 1914, 76 distant earthquakes were recorded besides the local one of Feb. 10, 1914, of which a monograph is now in press.

The delegate for Canada to the International Seismological meeting at Petrograd which was to convene in August, had his journey thither terminated at London by the war.

The undagraph installed at Chebucto Head, outside of Halifax harbour, after considerable delay in permanently securing the sea end of the pipe, is now in constant operation, and the resulting undagrams are undergoing examination with the corresponding seismograms showing microseisms, for correlation of ocean waves with microseisms.

The study of the deformation of the earth under the influence of the moon and to a less degree by the sun, is now about being begun by the installation of the particular apparatus in the vault especially constructed therefor at the Observatory. The principle of the apparatus is that of a horizontal pendulum with Zöllner suspension.

The magnetic survey of Canada undertaken by the Observatory has progressed satisfactorily and 37 stations were occupied, besides Ottawa and the base-station Agincourt. The greater number of the stations are in a virgin field, being along the new Transcontinental railway. As heretofore the three magnetic elements,—declination, inclination and intensity have been observed.

Similarly the systematic gravity survey of Canada completed its first season's work, occupying 18 stations between Tadoussac and Windsor. The observations with the half-seconds pendulum are relative, but as repeated observations with the apparatus were made at Washington, absolute values for gravity are obtained, so that thereby our observations will be linked up with those of the United States, and also with the international series.

There is a growing public demand, coming from all parts of

Canada, for information in the various departments of geophysics, particularly in regard to the "variation of the compass" as popularly the magnetic declination is called.

Surveys.

The field work of the international boundary surveys has been practically completed, with the exception of part of the Ontario-Minnesota boundary, following the rivers and lakes east of Rainy lake, and that part of the Quebec-Maine boundary which lies along the so-called Highlands. Some additional triangulation also has been found necessary along the St. Francis and St. John rivers.

In 1914, triangulation was carried on by the Geodetic Survey along the British Columbia coast south of Dixon Entrance and also along the straits separating Vancouver island from the main land. A base line was measured near the mouth of Fraser river.

Triangulation was also carried on in Ontario, west of Lake Superior, and in the southwestern peninsula; in Quebec, along the lower St. Lawrence river; and in New Brunswick and Nova Scotia along the Bay of Fundy.

Precise levelling was carried on by six parties, operating in all the provinces except Prince Edward Island and Manitoba. Connection has been made with certain of the tide gauge stations of the Department of the Naval Service in the Maritime Provinces. Attention is now being given to the strengthening of the net work of levels extending westerly, with a view to the establishment of a good sea level datum for central Canada.

APPENDIX C

THE METEOROLOGICAL SERVICE OF CANADA

BY

R. F. STUPART, F.R.S.C.
Director, Dominion Meteorological Service.

THE METEOROLOGICAL SERVICE OF CANADA.

Reports have been received at the Central Office from 650 stations, including telegraph reporting stations, climatological and storm signal stations.

Forecasts and Storm Warnings:—Bi-daily synchronous weather charts have been compiled on every day throughout the year, Sundays and holidays included, based on telegraphic reports from 38 stations in Canada, 100 in the United States, 4 in Newfoundland and 1 in Bermuda. Three of our most useful stations, Sable Island and Belle Isle in the Atlantic and Triangle Island in the Pacific, ceased reporting by wireless at the outbreak of the War. These charts have formed the basis of the forecasts and storm warnings which have been issued from Toronto for all the provinces, exclusive of British Columbia, where at Victoria a somewhat less comprehensive chart is prepared for forecasting in that Province. The daily weather chart shewing the Meteorological conditions over the Northern Hemisphere was discontinued on the outbreak of the War, and its loss is to be greatly deplored, as it was undoubtedly a very great assistance in forecasting the paths of storms.

Storm warnings have been issued to 112 display stations in Canada and of 2037 warnings issued 88% were verified by subsequent high winds; 323 warnings were received late; 204 owing to issue and 119 owing to telegraphic delays. Forecasts have been telegraphed twice daily to Newfoundland and warnings of expected storms were issued on 34 occasions.

Forecasts have been telephoned twice daily to the Radio-telegraph station on Toronto Island whence they are transmitted to the various wireless stations on the Great Lakes. Forecasts and storm warnings have also been telegraphed to the Radio-telegraph stations at Montreal, Fame Point and Halifax and to the Superintendent of the Signal Service, Quebec, and from these points have been disseminated broadcast to all vessels equipped with wireless apparatus. Arrangements have also been made within the year whereby copies of the daily bulletins supplied to most of the larger towns and villages in Ontario are handed to the Central telephone exchange office, the Bell Telephone having agreed to furnish the same to any of their subscribers who may ask for them.

Physics Branch.

The exploration of the upper atmosphere has not been carried on with the same regularity as during the previous three years, as from the outbreak of the War it was found impossible to obtain the necessary balloons from Europe. Since February however, the Sterling Rubber Company of Guelph has been manufacturing balloons which are proving most satisfactory and we are now in a position to carry on the investigation at regular intervals.

In all 18 balloons were sent up in 1914 and 13 were recovered. In 1915 to date 6 have been sent up and 4 have been recovered. The following table gives a summary of records not published in the last Report.

Date 1914	A	B	C	D	E	F	G
Feb. 1	† 5·3	–60·7	9·4	–68·8	E	143	S. 84 E.
" 4	5·1	–65·9	6·6	–55·3	E	184	N·70 E.
March 4	6·3	–75·1	9·1	–71·5	E	152	S·82 E.
" 5	6·2	–78·7	8·5	–63·4	W	87	N·35 E.
May 7	6·2	–72·4	8·3	–68·8	W	47	N·67 E.
June 4	8·7	–86·8	9·6	–79·6	S.W	239	S·66 E.
July 1	* —	—	7·2	–66·1	N	134	N·87 E.
Aug. 5	9·7	–74·2	10·8	–65·2	W	20	S·75 E.
1915							
January 27th	5·6	–68·0	6·7	–57·1	E	104	N·48 E.
" 28th	* —	—	4·5	–47·2	S	78	N·88 E.
March 11th	5·3	–60·3	8·3	–59·8	S.W	105	S·38 E.
April 10th	6·9	–73·3	11·3	–69·7	S.E	140	N·53 E

*Did not reach the stratosphere.

†Above 5·3 miles the temperature increased or remained stationary up to 6·8 miles when it again decreased slowly up to the highest point reached.

A. Height in miles to beginning of stratosphere.
B. Temperature Fahrenheit at beginning of stratosphere.
C. Greatest height, in miles, reached by balloon.
D. Temperature Fahrenheit at greatest height.
E. Direction balloon travelled at starting point.
F. Distance, in miles, of point where balloon fell from starting point.
G. Bearing of point where balloon fell from starting point.

At a meeting of the International Meteorological Commission held in 1913, it was decided to carry on a systematic survey of the Atmosphere over the Polar regions during the years that Capt. Amundsen was attempting to reach the North Pole and the Stefansson expedition was likewise in the Arctic regions. During last summer Mr. J. Patterson of the Central office was assigned the duty of instructing certain observers in the far north in taking the observations which this survey would entail and which was to consist of sending off small balloons and following and measuring their flight by means of theodolites. Mr. Patterson during his journey to the mouth of the

Mackenzie and return instructed the various observers chosen for this special work and also inspected the many Meteorological stations lying between Edmonton and the Arctic Sea. It is to be regretted that the War will probably lead to a lack of that international co-operation which alone could make this investigation effective.

Seismology.

The Milne Seismographs at Toronto and Victoria have continued in operation throughout the year.

On April 30th, 1914, the Victoria instrument was removed to the basement of the new Observatory, the boom being now approximately 222 feet above sea level. The number of earth tremors recorded at both stations during the year was one-third greater than is usually recorded, Toronto shewing 108 and Victoria 110.

Five of the movements were comparatively large and occurred on April 11th, August 4th, October 1st, November 24th, and January 13th the last named being caused by the disastrous Italian earthquake of that date. The preliminary tremors of this quake were recorded in Toronto at 7h. 12m. 12s. G.M.T. and continued for one hour and twenty-two minutes. The first waves reached Victoria at 7h. 15m. 48s.; the duration of the disturbance was one hour and forty-two minutes. The largest range of motion was 2·8 millimetres at Toronto and 2·0 millimetres at Victoria. The Director of the Rome Observatory, Italy, gives the beginning of this earthquake, recorded at Rome as 6h. 52m. 55s.

We continue to send duplicates of all our seismological tabulations to a number of Central Seismological Institutions throughout the world, this data being used conjointly with that from other countries for the purpose of seismic investigation.

Early in the year the seismological equipment of the new Observatory at Victoria was augmented by a vertical Seismograph recording on smoked paper. Other instruments ordered from Germany have not been received.

More recently a small observatory for Meteorological work and a time service was completed and occupied in St. John, N.B., and here again the work will in future be carried on under most favourable conditions.

Magnetic observations.—The photographic magnetic instruments have been kept in continuous operation throughout the year. In August 1914 a photographic Vertical Force Instrument was added to the equipment so that now we have a complete record of all the magnetic elements. The zeros of these recording instruments are determined by absolute observations, taken bi-weekly for Declination and Vertical Force, and bi-monthly for Horizontal Force.

The westerly declination has changed from 6 22·4′ in March 1914 to 6 27·2′ in March 1915, an increase of 4·8′. The Horizontal Force has decreased from 0·161007 dynes to 0·160387, and the inclination has increased from 74 41·7′ to 74 43·3.′ In March 1915 the Vertical Force was 0·586729 dynes.

Magnetic disturbances were of infrequent occurrence during the early part of the year; but commencing in June there were very few days in which some disturbing forces were not in operation. The greatest variation in declination occurred during the magnetic storm of the 20th and 21st of March, 1915. amounting to 53·4′. In Horizontal Force however, the greatest range occurred during the storm of the 27th and 28th of September, 1914, the variation amounting to 0·00340 dynes.

The mean diurnal range from the hourly ordinates of declination varied from a maximum of 13·2′ in August, 1914, to a minimum of 5·3′ in November, 1914, whilst that of Horizontal Force varied from a maximum of 0·00042 dynes in August 1914 to a minimum of 0·00020 dynes in February 1915. The ranges in Vertical Force for January, February and March 1915 have been 0·00007 dynes, 0·00008 dynes and 0·00014 dynes.

During the year the compass attachments to 191 surveyors' transits were adjusted and compared with the Agincourt Standard Declinometer and the index corrections were determined and supplied to the Surveyor General. Assistance was given to Mr. Purser and Mr. Wright of the Department of the Interior in standardizing their magnetic instruments both before and after their field work.

Assistance was also given to Mr. French of the Dominion Observatory in comparing his instruments with the Agincourt standards, both before and after his field work.

The computing and compiling of magnetic data from the Observatory records since 1872 are being carried on by Mr. W. E. W. Jackson.

Respectfully submitted.

R. F. Stupart,

Director.

Phenological Observations, Canada, 1914.

The phenological statistics collected by the Meteorological Service are in charge of Mr. F. F. Payne of the Central Office, Toronto, who makes the following report for 1914.

"Apart from the phenological reports from Nova Scotia, fifty-six were received, of which 8 were from British Columbia, 3 from Mackenzie Territory, 5 from Alberta, 9 from Saskatchewan, 11 from Manitoba, 10 from Ontario, 4 from Quebec, 5 from New Brunswick, and 1 from Prince Edward Island. The number from each province while insufficient for deducing average dates, agree fairly well and shew that in British Columbia vegetation generally was more forward than usual in the early part of the summer. Similar conditions prevailed in western Alberta, whilst in other portions of this province the spring conditions were normal. In Saskatchewan the dates of flowering of plants differed little from those of 1913 when the conditions were also normal. In Manitoba and eastward to the Atlantic coast vegetation was somewhat backward until early in June when rapid growth took place, and by the end of that month its condition was about average.

"As will be seen by the tables of dates included in this report, observations were received from several new stations; but former observers at a few other places have failed to report.

"The Meteorological Service is much indebted to Dr. A. H. Mackay, Superintendent of Education for Nova Scotia and his assistants for the average dates for this province given in a separate table. These averages are deduced from a very large number of observations recorded by the teachers throughout the province, assisted in most cases by the school children who bring the first blooms for identification as part of their study of nature. Owing to the great number of observers and others taking part in the production of the tables for Nova Scotia, their names are omitted in the following list."

"The Province is divided into its main climate slopes or regions not always coterminous with the boundaries of counties. Slopes, especially those to the coast, are sub-divided into belts such as (a) the coast belt, (b) the low inland belt, and (c) the high inland belt, as below":—

No.	Region of Slopes.	Belts.
I.	Yarmouth and Digby Counties,	(a) Coast, (b) Low Inlands, (c) High Inlands.
II.	Shelburne Queens & Lunen'g Cos.	" " "
III.	Annapolis and Kings Counties,	(a) Coast, (b) North Mt., (c) Annapolis Valley (d) Cornwallis Valley, (e) South Mt.
IV.	Hants and Colchester Counties	(a) Coast, (b) Low Inlands, (c) High Inlands.
V.	Halifax and Guysboro Counties,	" " "
VI.A,	Cobequid Slope (to the south),	" " "
VI.B,	Chignecto Slope (to the n'hwest)	" " "
VII.	North'rland Sts Slope (to the N'h),	" " "
VIII.	Richmond & Cape Breton Co's.,	" " "
IX.	Bras d'Or Slope (to the southe't),	" " "
X.	Inverness Slope (to Gulf, N. W.),	" " "

Where the letters a, b, and c appear in the tables they refer to these slopes or regions.

List of Stations and Observers.

S. R. S. Bayne,	Alberni, B.C.
W. H. Quant,	Keremeos, B.C.
Mrs. Hugh Hunter,	Princeton, B.C.
John Strand	Quesnel, B.C.
Gordon R. Brown,	Robson, B.C.
P. E. French.	Salmon Arm, B.C.
C. F. Walker,	Tzouhalem, B.C.
Lt. Col. F. J. Gavin,	Waldo, B.C.
Rev. G. Houssais,	Fort Good Hope, M.T.
Rev. X. G. Ducot,	Fort Norman, M.T.
Rev. C. H. Girous,	Fort Providence, M.T.
N. B. Sanson,	Banff, Alta.
Robt. Jones,	Fort Vermillion, Alta.
Mrs. W. L. Fulton,	Halkirk, Alta.
R. J. Paris,	Lethbridge, Alta.
Thomas B. Waite,	Ranfurly, Alta.
Miss M. E. Brown,	Rabbit Lake, Sask.
L. B. Potter,	Eastend, Sask.
R. H. Carter,	Fort Qu'Appelle, Sask.
Miss R. A. Clarke,	Fleming, Sask.
Geo. Lang,	Indian Head, Sask.
C. W. Bryden,	Mistawasis, Sask.
H. F. Perkins,	Prince Albert, Sask.
Victo. Willing,	Saskatoon, Sask.

W. R. Orton and pupils	Winton, Sask.
G. H. Blackwell and pupils,	Dickens, Man.
C. J. Baragar,	Elm Creek, Man.
Miss Mary R. Dutton,	Gilbert Plains, Man.
Miss J. C. Iverach,	Isabella, Man.
Neepawa Collegiate Institute,	Neepawa, Man.
William Irvine,	Almasippi, Man.
A. Goodridge,	Oak Bank, Man.
Miss E. Smith,	Oak Bluff, Man.
Dr. H. M. Speechly,	Pilot Mound, Man.
Jas. D. Plaice,	Rapid City, Man.
Norman Criddle,	Treesbank, Man.
Ayr Public School,	Ayr, Ont.
John Hollingsworth,	Beatrice, Ont.
Miss Mary Moffitt,	Cape Croker, Ont.
Thos. Smith,	Cottam, Ont.
W. E. McDonald,	Lucknow, Ont.
Rev. C. J. Young,	Madoc, Ont.
Miss M. A. Smyth,	Millbank, Ont.
L. G. Morgan,	Port Dover, Ont.
Miss A. M. Thompson,	Queensboro, Ont.
F. F. Payne,	Toronto, Ont.
David McKenzie,	Abitibi, Que.
Sister M. de St. Marcel,	Fraserville, Que.
Knowlton Academy,	Knowlton, Que.
A. H. MacLennan,	Macdonald College, Que.
T. E. Colpitts,	Alma, N.B.
Miss M. McKinney,	Benton, N.B.
Miss B. Gilks and pupils,	Northampton, N.B.
Pemple School,	Pemple, N.B.
Miss R. Waye,	Charlottetown, P.E.I.

I. Phenological Observations Canada, 1914.

Year 1914.

Day of year corresponding to the last day of each month.

January	31	July	212
February	59	August	243
March	90	September	273
April	120	October	304
May	151	November	334
June	181	December	365

When first seen.

	Alberni, B. C.	Keremeos, B. C.	Princeton, B. C.	Quesnel, B. C.	Robson, B. C.	Salmon Arm, B. C.	Tzouhalem, B. C.	Waldo, B. C.	Fort Good Hope, M. T.	Fort Norman, J. T.	Fort Providence, M. T.	Banff, Alta.	Fort Vermillion, Alta.	Halkirk, Alta.	Lethbridge, Alta.
1. Alder (Alnus incana)....Shedding pollen	73				70		71		141	146					
2. Canada Thistle (Cirsium arvense Flower'g	179	153		191	172			169							161
3. Trailing Arbutus (Epigaea repens) "								108							
4 Dandelion (Taraxacum officinale) "	64	107	106	126	97	108	69	112		171		152	149	167	125
5. Violet, Blue (Viola palmata cucullata) "	98	101	110	135	110		109	111			150		149	136	
6. Violet, White (Viola blanda) "			121	138	110								139		
7. Columbine (Aquilegia) "	131		142				137	143							146
8. Trees appear green	94	94	116	110	93	104	110	106	154			139	124	137	130
9. Red Clover (Trifolium pratense) Flowering	135	139	157	128	144			142					206		155
10. White Clover Trifolium repens) "	121		146	128	116		132	132							140
11. Wild Raspberry (Rubus strigosus) "	122			187	152		132	158	174		152				
12. Cultivated Currant (Ribes rubrum) "	110	110	124	150	117		100	116		168			138		128
13. Wild Rose (Rosa) "	137	126	142	149	135	131	132	139	168		169			170	161
14. Trillium (Trillium) "	97						74			157					
15. Anemone (Anemone) "							113	91					135	105	
16. Maple (acer) "	96						97			163		146	139		122
17. Strawberry Wild (Fragaria Virginiana) "	110	110	115		92	103	91	115	171				140	136	
18. Strawberry Wild (Fragaria Virginiana) Fruit ripe	145	155	153	153	146		137	150	197		180		201	175	
19. Crocus, Cultivated (Crocus)Flowering	67				79		'47	105					123		102

When becoming common.

	Alberni, B. C.	Keremeos, B. C.	Princeton, B. C.	Quesnel, B. C.	Robson, B. C.	Salmon Arm, B. C.	Tzouhalem, B. C.	Wuldo, B. C.	Fort Good Hope, M. T.	Fort Norman, M. T.	Fort Providence, M. T.	Banff, Alta.	Fort Vermillion, Alta.	Halkirk, Alta.	Lethbridge, Alta.
1. Alder (Alnus incana)....Shedding pollen					74				141	150					
2. Canada Thistle (Cirsium arvense Flower'g		163			182	182		173							178
3. Trailing Arbutus (Epigaea repens) "							104	110							
4 Dandelion (Taraxacum officinale) "	106	116	116	152	100	115	169	120				155			132
5. Violet, Blue (Viola palmata cucullata) "			117	145	114		114	120							
6. Violet, White (Viola blanda) "			131	117	114			132							
7. Columbine (Aquilegia) "	152		150					146							
8. Trees appear green		104	129		100	119			159						141
9. Red Clover (Trifolium pratense) Flowering	156	146	171		152			148							163
10. White Clover Trifolium repens) "		146	154	141	140			137							147
11. Wild Raspberry (Rubus strigosus) "				201	161				178						
12. Cultivated Currant (Ribes rubrum) "		115			120			120							130
13. Wild Rose (Rosa) "	144	134	152	161	152	137		142	172						
14. Trillium (Trillium) "															
15. Anemone (Anemone) "								97		165				114	
16. Maple (acer) "	112														132
17. Strawberry Wild (Fragaria Virginiana) "		115	123		110	110		120	174	166				139	
18. Strawberry Wild (Fragaria Virginiana) Fruit ripe		161		171	152	154		156	201					189	
19. Crocus, Cultivated (Crocus)Flowering					83			108							110

127	112	145	133	165	124	115	142					159		140	20. Lilac (Syringa vulgaris)) "
119	110	132		124	122	106	132							138	21. Apple (Pyrus malus) "
115	99			120	112	61									22. Plum, Cultivated (Prunus domestica) "
117	124			118		100						140	149		23. Cherry, Wild (Prunus) "
107	101			113	108	97	134								24. Cherry, Cultivated (Prunus cerasus) "
124	57	81	122	79	63	79		159					121		25. Buttercup (Ranunculus acris) "
						132						149			26. Yellow Pond Lilly (Nuphar advena) "
138							142								27. Blue-eyed Grass (Sisyrinchium) "
117	100	122		124			124		166			138	137		28. Saskatoon (Amalanchier Canadensis) "
		212	187				184		197		168		192		29. Golden Rod (Solidago) "
109		74	87			87		127	121	109	90	106	96	94	30. Wild Geese
		64	89					127	121		83	104	95	91	31. Wild Ducks
55	68	72	73	64	61	91	69		129		74	113		78	32. Robins (Merula) "
50	68	66	153	71	65		101		125				102	114	33. Meadow Larks (Sturnella)
71	70	76	81	76	70	82	67			93	75			101	34. Blue Birds (Sialia sialis)
			122				76	132				135			35. Flickers or Golden Woodpeckers (Colaptes auratus)
		87					93		125		119	146			36. Song Sparrows (Melospiza fasciata)
82	103		62	98	96	75	116	154			137	142	146		37. Swallows (Clivicola riparia)
									87						38. Juncoes (Junco hyemalis)
							158								39. Orioles (Icterus galbula)
	138											131			40. King Birds (Tyrannus tyrannus)
94	134	130	161	126		80	127								41. Humming Birds (Trochilus colubris)
54	97	94		79		57		140	133		113	131	116	104	42. Frogs Piping
	58		91	74	68		73	140	148			120			43. Earth Worm Casts (frost out of ground)
					82		79	130	145		136	126	117	59	44. Lakes Open
	52	71					68	136	134		100	115			45. Rivers Open
59	59	96	102	77	68		78		144			120	117	75	46. Ploughing
92	74	96	102	99	93		96		146			120	103	66	47. Sowing
166	126	187	201	163	168		201					196	197	169	48. Hay Cutting
	198	222	158	222	191							224	204	197	49. Grain Cutting
125	73	03	130	114	75		93	148	153			120	138	110	50. Potato Planting

20. Lilac (Syringa vulgaris)	135	122		146	171	131		147							148
21. Apple (Pyrus malus)		123	139		130	130		137							144
22. Plum, Cultivated (Prunus domestica)		104			155	121									
23. Cherry, Wild (Prunus)		130			155	128								164	
24. Cherry, Cultivated (Prunus cerasus)		105			152	115		137							
25. Buttercup (Ranunculus acris)	132	66		136	91	72		182	163					130	
26. Yellow Pond Lilly (Nuphar advena)															
27. Blue-eyed Grass (Sisyrinchium)														163	
28. Saskatoon (Amalanchier Canadensis)		103			130			127		168					
29. Golden Rod (Solidago)								190							
30. Wild Geese									130	126	126			103	98
31. Wild Ducks									130	126		100		103	97
32. Robins (Merula)		75	86		69	71		76				84			91
33. Meadow Larks (Sturnella)		75	86		74	73				126				109	119
34. Blue Birds (Sialia sialis)		84	93		83	77		71				81			110
35. Flickers or Golden Woodpeckers (Colaptes auratus)								79	134						
36. Song Sparrows (Melospiza fasciata)			92					95							
37. Swallows (Clivicola riparia)		115		151	115			120	158			142			
38. Juncoes (Junco hyemalis)										106		108			
39. Orioles (Icterus galbula)															
40. King Birds (Tyrannus tyrannus)															
41. Humming Birds (Trochilus colubris)			133		140	188									
42. Frogs Piping					83				149	133		115		121	108
43. Earth Worm Casts (frost out of ground)		69				79			161						162
44. Lakes Open						90			152						66
45. Rivers Open									149						
46. Ploughing		75	104		91	89		95					124	113	86
47. Sowing		91	104		102	98							121	111	91
48. Hay Cutting	212	134			168	171		209						206	182
49. Grain Cutting	239	222			224	206								233	213
50. Potato Planting	135	120	132		121	96		108					126	146	136

II. PHENOLOGICAL OBSERVATIONS, CANADA, 1914.

Year 1914.

Day of year corresponding to the last day of each month.

January	31	July	212
February	59	August	243
March	90	September	273
April	120	October	304
May	151	November	334
June	181	December	365

When first seen.

	Ranfurly, Alta.	Armadale, Sask.	Eastend, Sask.	Fort Qu'Appelle, Sask.	Fleming, Sask.	Indian Head Sask.,	Mistawasis, Sask.	Prince Albert, Sask.	Saskatoon, Sask.	Winton, Sask.	Dickens, Man.	Elm Creek, Man.	Gilbert Plains, Man.	Isabella, Man.	Neepawa, Man.
1. Alder (Alnus incana). . Shedding pollen						119			121				95		
2. Canada Thistle (Cirsium arvense) Flower'g	183			214	183					187		191	201	196	
3. Trailing Arbutus (Epigaea repen)s. . "															
4. Dandelion (Taraxacum officinale) . . . "	154	157			137	118	157	114	129	108		145	138	138	135
5. Violet, Blue (Viola palmata cucullata) "	136	136		131	135	139	140		129	122			141	140	128
6. Violet, White (Viola blanda) . . . . "	143	143		140		142			140	131			138	137	132
7. Columbine (Aquilegia) "	155									161			202	153	159
8. Trees appear green	134	135		129	128	137	140		118	133		145	139	138	136
9. Red Clover (Trifolium pratense) Flowering	226	154		161	164				153	179		169	179	196	157
10. White Clover Trifolium repens) . . . . . . "	162	169			163	148			153	166			147	172	157
11. Wild Raspberry (Rubus strigosus) . . . "	160	164		179	171				162	152		161	155	161	153
12. Cultivated Currant (Ribses rubrum) "	138		135		162	140			140	155		152	154	153	
13. Wild Rose (Rosa) "	159	157	154	156	156			156	152	150		152	174	159	159
14. Trillium (Trillium) "													145		144
15. Anemone (Anemone) "	109		116	106	106	102	107		103	153	114		136	107	99
16. Maple (Acer) "	128		123			140		112	121						111
17. Strawberry Wild (Fragaria Virginiana) . . .	140	137	136	132	139	125	141		123	100		182	138	139	139
18. Strawberry Wild (Fragaria Virginiana) Fruit Ripe	186	171	173	164	160				164	162		161	171	172	
19. Crocus, Cultivated (Crocus) Flowering	157					152				114		116	142	171	
20. Lilac (Syringa vulgaris) . . . . "	156				165	151			146				155	153	153
21. Apple (Pyrus malus) . . . . "	143					149			146				152		155
22. Plum, Cultivated (Prunus domestica) "	141		141			145							146		144

When becoming common.

	Ranfurly, Alta.	Armadale, Sask.	Eastend, Sask.	Fort Qu'Appelle, Sask.	Fleming, Sask.	Indian Head, Sask.	Mistawasis, Sask.	Prince Albert, Sask.	Saskatoon, Sask.	Winton, Sask.	Dickens, Man.	Elm Creek, Man.	Gilbert Plains, Man.	Isabella, Man.	Neepawa, Man.
1. Alder (Alnus incana). . Shedding pollen									123				105		
2. Canada Thistle (Cirsium arvense) Flower'g	191			222	193					187			204	196	
3. Trailing Arbutus (Epigaea repen)s. . "															
4. Dandelion (Taraxacum officinale) . . . "	159	161			140			130	136	144		152	146	140	140
5. Violet, Blue (Viola palmata cucullata) "	140	144		137	141				134	140			144	140	132
6. Violet, White (Viola blanda) . . . . "	145	146		152					142	146			141	142	136
7. Columbine (Aquilegia) "	169									166			204	164	
8. Trees appear green	136	138		135	143				121	138			144	140	144
9. Red Clover (Trifolium pratense) Flowering		158		166	167				155	186			186		
10. White Clover Trifolium repens) . . . . . . "	169	172			166				155				150		
11. Wild Raspberry (Rubus strigosus) . . . "	164	169		181	178				169	152			164	167	159
12. Cultivated Currant (Ribses rubrum) "	143				167				144	155			163		144
13. Wild Rose (Rosa) "	163	166		158	164				156	156			171	155	
14. Trillium (Trillium) "													150		
15. Anemone (Anemone) "	115		118	121	114				106	158	114		144	114	107
16. Maple (Acer) "	132								123						114
17. Strawberry Wild (Fragaria Virginiana) . . .	144	150		135	141				126	132			144	145	146
18. Strawberry Wild (Fragaria Virginiana) Fruit Ripe	191			166	167				169	167			181		
19. Crocus, Cultivated (Crocus) Flowering	161									114			146		
20. Lilac (Syringa vulgaris) . . . . "	161				169				152				161	156	158
21. Apple (Pyrus malus) . . . . "	150								150				155		
22. Plum, Cultivated (Prunus domestica) "	147												150		146

139	157	140	138	141			137	140	135			144	146	144	23. Cherry, Wild (Prunus) "	144				148			142	144	146			148	146	146
143												146			24. Cherry, Cultivated (Prunus cerasus). "	150	161											150		
			121	112		122			115			138	123	113	25. Buttercup (Ranunculus acris)....... "				127	120					115			144		120
16	7			188					123			140			26. Yellow Pond Lilly (Nuphar advena) "	171												144		
151	157		151	152	135	157		147	129			186	151	144	27. Blue-eyed Grass (Sisyrinchium) "	160	158			163				151	132			197	160	
143	149	136	139	152	151	147	135	134	135			145	143	144	28. Saskatoon (Amlaanchier Canadensis) "	140	153		141	159			145	137	143			150		
191	171	210	169					189	187			200	197		29. Golden Rod (Solidago) "	195	190	211						192	195			204	201	
92	102	75	90	89	94	99		94	102	89	100	103	96	84	30. Wild Geese...................... "	97	110	89	100	98				121	94	89	108	118	112	106
102	100	89	75	76	91	104	96	98	96	107	97	103	102	95	31. Wild Ducks............................	110	112		105	109			96	121	104	107		118	110	105
113	104	95	108	91	108	104	96	109	103	85	103	105	106		32. Robins (Merula)...........	115	114	109	121	110				113	108	85		120	100	106
135	107	90	105	102	88	100		102	111	90	105	115	72	100	33. Meadow Larks (Sturnella)....		102	104	119	108				104		90		123	95	106
					134			153	112	111		127		157	34. Blue Birds (Sialia sialis)................			93	120							111		132		
114		105	115	140	136		113	108	122	107	105	112	102	105	35. Flickers or Golden Woodpeckers (Colaptes auratus)............................	117		114		150				119		107		123	121	110
114		111	94		100		111	89	121			124	133	102	36. Song Sparrows (Melospiza fasciata).......	117		113	109					122	125			132		
126		141	156	97	114		128		105			124		151	37. Swallows (Clivicola riparia).............	133		142		104					125			132		159
103		108	82	132	98		96	100	107		100	105		120	38. Juncoes (Junco hyemalis)................	105				140				110			110	122	110	
			141	141	139			147	127			137	139	115	39. Orioles (Icterus galbula)................				152									146	121	144
139		140	141	130	142			145	117		105	141			40. King Birds (Tyrannus tyrannus).........	143		144	157	138				150				145		
153					157		152	161	135		135	150	159	144	41. Humming Birds (Trochilus colubris).....															
106	102		68	104		104	104	106	104	95	135	109	103	105	42. Frogs Piping..........................	110	106		100	112				108		95	116	121		105
	103	95		92	105				128		152	135	114	128	43. Earth Worm Casts (frost out of ground)..		105													
125				92		119			106		175	123		110	44. Lakes Open............................	130												130		
		100		97			110	103	105		105	113		110	45. Rivers Open...........................													123		
105	103	100	104	105	103			99	105	100	112	110	110		46. Ploughing.............................	110	105		108	108				104	107	100		117	114	
106	106	121	101	108				104	114		106	110	101	104	47. Sowing................................	112	110		103	110				108	117		112	121	119	110
203	198		152	198	165				198	199	182	198	203		48. Hay Cutting...........................	208	202			201					206	199	196	204	213	
229	216		218	218	232			210	218	217	213	217	227		49. Grain Cutting.........................	236	222		221	232				219	229	217	217	224		
115	131	131	125	132	140	137		130	128	121	153	134	140	107	50. Potato Planting.......................	127	136			139		144		140	144	121		144		130

III. Phenological Observations, Canada, 1914.

Year 1914.

Day of year corresponding to the last day of each month.

January	31	July	212
February	59	August	243
March	90	September	273
April	120	October	304
May	151	November	334
June	181	December	365

When first seen.

	Almasippi, Man.	Oak Bank, Man.	Oak Bluff, Man.	Pilot Mound, Man.	Rapid City, Man.	Treesbank, Man.	Ayr, Ont.	Beatrice, Ont.	Cape Croker, Ont.	Cottam, Ont.	Lucknow, Ont.	Madoc, Ont.	Millbank, Ont.	Port Dover, Ont.	Queensboro, Ont.
1. Alder (Alnus incana)..Shredding pollen		122	121			116								110	
2. Canada Thistle (Cirsium arvense) Flower'g				189	198						182		161	166	201
3. Trailing Arbutus (Epigaea repens) "							109					123		115	
4. Dandelion (Taraxacum officinale).... "	139	146		138	144	148	114	130	125	107	118	126	138	105	119
5. Violet, Blue (Viola palmata cucullata) "	142	143	136	135	138		117	128				136	130	102	125
6. Violet, White (Viola blanda)........ "				143	139		124	128				138	118	105	128
7. Columbine (Aquilegia) "				161		154	140					143	130	161	150
8. Trees appear green....................	124		121	136	138	129	123	130			125	130	135	145	126
9. Red Clover (Trifolium pratense) Flowering				171			152		152		156	150		146	155
10. White Clover Trifolium repens)..... "				177		163	131		154		152	151	168	150	159
11. Wild Raspberry (Rubus strigosus).. "	148			154	158	157	153				158	158	147	152	157
12. Cultivated Currant (Ribes rubrum). "				145	147	138	127				137	153		156	128
13. Wild Rose (Rosa) "	157	153	163	161	159	158	154					163	152	160	
14. Trillium (Trillium) "				145		144	121				122	129	132	122	150
15. Anemone (Anemone) "	138			100	110	102	123					123	140	108	158
16. Maple (Acer)..... "			130	135		126	117			104	128	126		104	
17. Strawberry Wild (Fragarai Virginiana)...	141			141	144	137	131			130	123	130	140	125	130
18. Strawberry Wild (Fragaria Virginiana Fruit ripe..........................	165			167	179	161	157				158	175	153	159	156
19. Crocus, Cultivated (Crocus) Flowering							103				104	123		74	108
20. Lilac (Syringa vulgaris).......... "			152	149	152	148	140				141	143	139	146	145
21. Apple (Pyrus malus).............. "				145	148	148	131				139	142	136	137	136
22. Plum, Cultivated (Prunus domestica) "		143		144			131	137			135	140	140	132	
23. Cherry, Wild (Prunus) "	140		144	144	144	140	126				138	142	134	120	143

When becoming common.

	Almasippi, Man.	Oak Bank, Man.	Oak Bluff, Man.	Pilot Mound, Man.	Rapid City, Man.	Treesbank, Man.	Ayr, Ont.	Beatrice, Ont.	Cape Croker, Ont.	Cottam, Ont.	Lucknow, Ont.	Madoc, Ont.	Millbank, Ont.	Port Dover, Ont.	Queensboro, Ont.
1. Alder (Alnus incana)..Shredding pollen						117									105
2. Canada Thistle (Cirsium arvense) Flower'g				196	206						194				213
3. Trailing Arbutus (Epigaea repens) "							117					127			
4. Dandelion (Taraxacum officinale).... "	141			143	148	152	124		135		125	130			128
5. Violet, Blue (Viola palmata cucullata) "	144	151	146	140	142	136	131		130		127	137	140	108	130
6. Violet, White (Viola blanda)........ "				145	142	145	131				127	140	130	111	130
7. Columbine (Aquilegia) "						159	147		159		151			171	136
8. Trees appear green....................	135		131		143	137	128		129			132	152		132
9. Red Clover (Trifolium pratense) Flowering				176					161		160	152		154	162
10. White Clover Trifolium repens)..... "				181		168	152		161		159			156	162
11. Wild Raspberry (Rubus strigosus).. "	150			161	161	162					160			158	
12. Cultivated Currant (Ribes rubrum). "				152	150	143	128		142		139	155		160	136
13. Wild Rose (Rosa) "	161	171	181	166	166	166	160					165		163	
14. Trillium (Trillium) "				150		149	129		127		125	133		128	133
15. Anemone (Anemone) "	140			110	113	106	131					127		120	
16. Maple (Acer)..... "			136	137		132	128								136
17. Strawberry Wild (Fragarai Virginiana)...	143			143	148	139	139		142		128				136
18. Strawberry Wild (Fragaria Virginiana Fruit ripe..........................	169			171			164		164		161				166
19. Crocus, Cultivated (Crocus) Flowering							110								109
20. Lilac (Syringa vulgaris).......... "			161	151	156	153	146		149		147	147	143		152
21. Apple (Pyrus malus).............. "				147	150	152	140		145		141	145	150		144
22. Plum, Cultivated (Prunus domestica) "				148			140		142		138				
23. Cherry, Wild (Prunus) "	142		150	148	145	144	131		138		141				145

						130				131	144	136	127		24. Cherry, Cultivated (Prunus cerasus) "
128		131	125	112		130					134	136	137	157	25. Buttercup (Ranunculus acris)...... "
											180	151	193	159	26. Yellow Pond Lilly (Nuphar advena) "
	152	151	147	156	147	151							150	152	27. Blue-eyed Grass (Sisyrinchium) "
139	143		142	145	140									150	28. Saskatoon (Amalanchier Canadensis) "
			191	206	194					205	195	213	196	205	29. Golden Rod (Solidago) "
103	113	73	78	100	77				115		89		70		30. Wild Geese...........................
104	105	100	100	101	102						86	74		109	31. Wild Ducks...........................
105	122	104	104	103	104	71		85	74	75	88	69	75	71	32. Robins (Merula)........
105		93	95	104	97	85	86	90		85	102	87	75	102	33. Meadow Larks (Sturnella)....
			117		138	73		85	73	75	88	90	76	71	34. Blue Birds (Sialia sialis)................
116		119	106		106	103			74		95		98	108	35. Flickers or Golden Woodpeckers (Coalptes auratus)...........................
92			109		106	72				85	91		107	87	36. Song Sparrows (Melospiza fasciata)......
		131	135	137	120	110		126			109	111	131	108	37. Swallows (Clivicola riparia).............
137		66	95		91						91	93		91	38. Juncoes (Junco hyemalis)..............
105			145	141	136	109		142			131	94	158	126	39. Orioles (Icterus galbula)................
137		131	136	139	138	121				125	131	90	156	125	40. King Birds (Tyrannus tyrannus).........
137			146		145	122			129		143	130	144	129	41. Humming Birds (Trochilus colubris).....
105	105	100	110	105	108	88	110	120		89	104		85	103	42. Frogs Piping..........................
131			130	117		96	127					96	97	112	43. Earth Worm Casts (frost out of ground)..
			115			103		110			112	121	86	99	44. Lakes Open...........................
102		110	106	107	106	74					102	86	90	89	45. Rivers Open..........................
110		110	104	110	106	90	121	92		104	110	107	103		46. Ploughing............................
104	122	114	105	107	106	107	130	115		109	117	107	107		47. Sowing..............................
196	196		188	204			201		195	168	183	180	162	176	48. Hay Cutting..........................
208	219	232	218	219	213		232		200	198	196		196	201	49. Grain Cutting.........................
134		131	140	139		108	144	138		122	128	140	110	124	50. Potato Planting.......................

24. Cherry, Cultivated (Prunus cerasus) "							140		141		134				
25. Buttercup (Ranunculus acris)...... "	132			135	146		140		50				144		162
26. Yellow Pond Lilly (Nuphar advena) "												187			165
27. Blue-eyed Grass (Sisyrinchium) "					158	151	156		154						159
28. Saskatoon (Amalanchier Canadensis) "	141			144	146	144									134
29. Golden Rod (Solidago) "					214	205		225			214		244		216
30. Wild Geese...........................	110					108	88						123		
31. Wild Ducks...........................	104		110	105		105	86		98			104	121		137
32. Robins (Merula)........	107		108	110		106	84		98		85	91			84
33. Meadow Larks (Sturnella)....	110		110	105		101	104		98			106			103
34. Blue Birds (Sialia sialis)................							85				85	90			85
35. Flickers or Golden Woodpeckers (Coalptes auratus)...........................	121			110		112	107					106			108
36. Song Sparrows (Melospiza fasciata)......	105		121	115		113	84		103			93			90
37. Swallows (Clivicola riparia).............				140		135	112		126						109
38. Juncoes (Junco hyemalis)..............	139		73	105		104						93			91
39. Orioles (Icterus galbula)................	110			150		141	130					135			127
40. King Birds (Tyrannus tyrannus).........	140					145	131		137			135			127
41. Humming Birds (Trochilus colubris).....	140			150			128		140						
42. Frogs Piping..........................	110		107	130		108	104				104				107
43. Earth Worm Casts (frost out of ground)..	133			135			104		123				120		121
44. Lakes Open...........................							113								102
45. Rivers Open..........................	102						87								95
46. Ploughing............................	110		121				113		114		106		117		121
47. Sowing..............................	110		121		122		118		128		117				135
48. Hay Cutting..........................	201			191	208						187				189
49. Grain Cutting.........................	217		244	222	223										213
50. Potato Planting.......................	139		121	145	139		140				138				136

IV. Phenological Observations, Canada, 1914.

Year 1914.

Day of year corresponding to the last day of each month.

January	31	July	212
February	59	August	243
March	90	September	273
April	120	October	304
May	151	November	334
June	181	December	365

When first seen.

	Toronto, Ont.	Abitibi, Que.	Fraserville, Que.	Knowlton, Que.	Macdonald College, Que.	Alma, N. B.	Benton, N. B.	De Bec, N. B.	Northampton, N. B.	Pemple, N. B.	Charlottetown, P. E. I.
1. Alder (Alnus incana)..........Shedding pollen	98	143				152		121	110		90
2. Canada Thistle (Cirsium arvense).......Flowering	192		196			213				166	209
3. Trailing Arbutus (Epigaea repens)....... "	110		128			105	122		136		124
4. Dandelion (Taraxacum officinale)....... "	129	157	135	133	109	135	140	152	141	146	129
5. Violet, Blue (Viola palmata cucullata)... "	131		140	131	135	130	135	148	135	135	127
6. Violet, White (Viola blanda)........... "	135		146	131		121	132	141	135	135	125
7. Columbine (Aquilegia).... "	152		151						153		164
8. Trees appear green....................	125	140		138	136	152		121	126	138	121
9. Red Clover (Trifolium pratense).......Flowering	160			160		182	146		159	160	166
10. White Clover Trifolium repens)........ "	156			152		182	148		160	159	166
11. Wild Raspberry (Rubus strigosus)....... "	155			149		166	162		129	161	179
12. Cultivated Currant (Ribes rubrum)...... "	134	153		139	134	166	139			148	146
13. Wild Rose (Rosa)... "	153			164			167		164	166	179
14. Trillium (Trillium)... "	130			132	121	121	135	140	136	135	148
15. Anemone (Anemone)........"	136				97	152	136		157	142	
16. Maple (Acer)... "	103					152	146	121	121	130	142
17. Strawberry Wild (Fragaria Virginiana)..........	134	156		131	139	152	139	141	139	140	142
18. Strawberry Wild (Fragaria Virginiana)Fruit ripe.	171	201		159			174	171	144	173	173
19. Crocus, Cultivated (Crocus).Flowering	91				109						107
20. Lilac (Syringa vulgaris)............... "	145		161	145	144		155	152	146	152	164
21. Apple (Pyrus malus)................... "	138		161	138	130	152	144	152	145	147	150
22. Plum, Cultivated (Prunus domestica).... "	136		176	138		152	145	140	141	143	157
23. Cherry, Wild (Prunus)... "	129		171	135		152	146	153	141	146	150
24. Cherry, Cultivated (Prunus cerasus)..... "	126		171		132	152	147	154		146	150
25. Buttercup (Ranunculus acris)........... "	155			143		166	148	147	161	160	166
26. Yellow Pond Lilly (Nuphar advena)..... "	177						149				183

When becoming common.

	Toronto, Ont.	Abitibi, Que.	Fraserville, Que.	Knowlton, Que.	Macdonald College, Que.	Alma, N. B.	Benton, N. B.	De Bec, N. B.	Northampton, N. B.	Pemple, N. B.	Charlottetown, P. E. I.
1. Alder	105					161					103
2. Canada Thistle	196					227					212
3. Trailing Arbutus	113					121	129				137
4. Dandelion	135			140		166	145			152	146
5. Violet, Blue	136			140			144			141	145
6. Violet, White	137			140			140			141	145
7. Columbine	156										171
8. Trees appear green		155		145		166				142	136
9. Red Clover	172			166		196	149			166	174
10. White Clover	159			162		196	150			169	174
11. Wild Raspberry	159						165			169	184
12. Cultivated Currant	136						146			166	152
13. Wild Rose	157			171			177			181	154
14. Trillium	135					135	140			138	157
15. Anemone	138						144			145	
16. Maple	110						150			136	150
17. Strawberry Wild	137			168			150			146	156
18. Strawberry Wild (Fruit ripe)							180			176	189
19. Crocus, Cultivated	98										130
20. Lilac	150			152			157			157	171
21. Apple	140					166	149			149	154
22. Plum, Cultivated	140					166	149				168
23. Cherry, Wild	136					166	148			147	155
24. Cherry, Cultivated	142					166	149			148	155
25. Buttercup	161			150			151			169	171
26. Yellow Pond Lilly	177						157				188

								158	160	168	27. Blue-eyed Grass (Sisyrinchium) “										166	204
											28. Saskatoon (Amalanchier Canadensis).... “											
218		237				156				215	29. Golden Rod (Solidago)... “	222						174				222
	107	113	101	108		103	149	101		68	30. Wild Geese..................................		123									103
60	108	110		107			168		119	67	31. Wild Ducks..................................	110	123								149	103
78	110	122	79	91		119	100	90	98	102	32. Robins (Merula)............	91			87			136			130	124
102	134		141							155	33. Meadow Larks (Sturnella)..........	106										
73		123	87	104		149		139	161	155	34. Blue Birds (Sialia sialis)........................	103						153			174	169
106	117		74				159	118		140	35. Flickers or Golden Woodpeckers (Colaptes auratus	114										
66	121	121	84	93		144	153	90	117	143	36. Song Sparrows (Melospiza fasciata)..............	93						150			130	159
115	126		113	112		140	158	125	132	135	37. Swallows (Chivicola riparia)....................	115						146			140	150
66				96		110		98	120	88	38. Juncoes (Junco hyemalis)......................	103						126			121	124
128				142		136	191		147		39. Orioles (Icterus galbula).......................	135						156			155	
137	124		123			154	171	140	139	158	40. King Birds (Tyrannus tyrannus)................	140						175			141	171
128			131	129		150		140	146	147	41. Humming Birds (Trochilus colubris).............	137						157				168
106	132	125	85	109		122	127	126	130	129	42. Frogs Piping..................................	110						144			138	138
98	135	130	110	118		119		142		130	43. Earth Worm Casts (frost out of ground)..........	104										138
91	133		122	121		118	100			100	44. Lakes Open..................................											121
79	125	105	147	110		116	91	109	110	87	45. Rivers Open..................................										112	95
100		125	112	112		140		125	133	135	46. Ploughing..................................				121			146			135	142
121		135		121		149		129	137	134	47. Sowing..................................							156			139	141
179						212		196	201	141	48. Hay Cutting..................................	218							219		204	204
213						240			243	245	49. Grain Cutting..................................								250'		246	250
129		130	131	128		155		134	143	136	50. Potato Planting..................................				140			162	151'		146	142

PHENOLOGICAL OBSERVATIONS, 1914.

Year 1914.

Day of the year corresponding to the last day the month.

January	31	July	212
February	59	August	243
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May	151	November	334
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When first seen.

Species	I. Yarmouth and Digby Counties, N.S.	II. Shelburne, Queens and Lunenburg Counties, N.S.	III. Anapolis and Kings Counties, N.S.	IV. Hants and Colchester Counties, N.S.	V. Halifax and Guysboro Counties, N.S.	VI. Cobequoid and Chignecto Slopes, N.S.	VII. Northumberland Slope, N.S.	VII. Richmond and Cape Breton, N.S.	IX. Bras d'Or Slope, N.S.	X. Inverness Slope, N.S.	Average Dates, N.S.
1. Alder (Alnus incana, Wild)............Flowering	113	104	120	119	117	112	118	121	126	126	118
2. Aspen (Populus tremuloides)........... "	117	118	131	118	126	127	126	128	125	125	124
3. May Flower (Epigea repens, L)......... "	101	100	105	118	114	124	124	127	124	124	116
4. Field Horsetail (Equisetum arvense)..... "	132	132	130	134	143	134	137	137	137	137	135
5. Blood Root (Sanguinaria Canadensis..... "	134	127	131	137	139	140	136	145	138	138	137
6. White Violet (Viola Blanda)............ "	127	125	131	125	132	129	137	139	142	142	134
7. Blue Violet (Viola palmata, *cucullata*).... "	128	128	132	136	135	134	140	142	145	145	137
8. Hepatica (Hepatica triloba, etc)......... "	123		141	130			138	176			142
9. Red Maple (Acer rubrum............. "	131	137	131	134	131	129	135	137	135	135	133
10. Strawberry, Wild (Fragaria Virginiana... "	125	126	129	134	133	134	136	139	139	139	133
11. Strawberry, Wild (Fragaria Virginiana) Fruit ripe	166	161	161	163	167	167	169	175	176	176	168
12. Dandelion (Taraxacum officinale........Flowering	132	127	135	137	139	138	140	145	141	141	137
13. Adders Tongue Lily (Erythronium Americanum Flowering	125	151	145	140	150	143	145	156	148	148	145
14. Gold Thread (Coptis trifolia............ "	137	135	142	141	140	139	142	146	144	144	141
15. Spring Beauty (Claytonia Caroliniana... "	134	145	140	136	141	133	134	147	137	137	139
16. Ground Ivy (Nepeta Glechoma......... "	144	135	166	141	145	143	147	143	149	149	146
17. Indian Pear (Amelanchier Canadensis.... "	146	139	141	143	149	142	143	154	148	148	145
18. Indian Pear (Amelanchier Canadensis) Fruit ripe							202	167			185
19. Wild Red Cherry (Prunus Pennsylvanica Flowering	147	145	144	145	153	145	144	162	156	156	150
20. Wild Red Cherry, (Prunus Pennsylvanica) Fruit ripe					254		219				236
21. Blueberry (Vaccinium Can. and Penn..)Flowering	143	137	146	146	144	142	147	159	156	156	148
22. Blueberry (Vaccinium Can)........Fruit ripe							219	275	249	249	248
23. Tall Buttercup (Ranunculus acris)....Flowering	152	150	151	155	163	156	154	169	165	165	158
24. Creeping Buttercup (R. Repens)........ "	162	151	158	160	165	167	166	176	171	171	165

When becoming common.

Species	Average Dates, N.S.	I. Yarmouth and Digby Counties, N.S.	II. Shelburne, Queens and Lunenburg Counties, N.S.	III. Anapolis and Kings Counties, N.S.	IV. Hants and Colchester Counties, N.S.	V. Halfiax and Guysboro Counties, N.S.	VI. Cobequoid and Chignecto Slopes, N.S.	VII. Northumberland Slope, N.S.	VIII. Richmond and Cape Breton, N.S.	IX. Bras d'Or Slope, N.S.	X. Inverness Slope, N.S.
1. Alder (Alnus incana, Wild)............Flowering	125	120	112	129	125	121	120	124	130	133	133
2. Aspen (Populus tremuloides)........... "	131	126	123	136	125	131	128	131	139	140	140
3. May Flower (Epigea repens, L)......... "	124	113	110	116	126	123	124	131	134	133	133
4. Field Horsetail (Equisetum arvense)..... "	141	138	137	136	139	148	139	142	144	146	146
5. Blood Root (Sanguinaria Canadensis..... "	140	139	130	136	141	143	144	141		144	144
6. White Violet (Viola Blanda)............ "	140	134	127	136	142	139	138	142	146	150	150
7. Blue Violet (Viola palmata, *cucullata*).... "	143	135	133	138	147	141	142	144	149	151	151
8. Hepatica (Hepatica triloba, etc)......... "	146	129		141	137			144	179		
9. Red Maple (Acer rubrum............. "	139	136	134	136	139	136	135	139	143	147	147
10. Strawberry, Wild (Fragaria Virginiana... "	141	132	133	136	141	139	146	143	145	146	146
11. Strawberry, Wild (Fragaria Virginiana) Fruit ripe	174	178	168	170	172	176	175	175	180		
12. Dandelion (Taraxacum officinale........Flowering	143	139	134	139	142	143	145	145	152	148	148
13. Adders Tongue Lily (Erythronium Americanum Flowering	151	150	152	149	144	154	152	150	160	150	150
14. Gold Thread (Coptis trifolia............ "	146	142	140	146	145	146	144	145	151	148	148
15. Spring Beauty (Claytonia Caroliniana... "	144	140	151	142	141	145	140	138	153	145	145
16. Ground Ivy (Nepeta Glechoma......... "	151	150	141	171	146	147	153	151	154	151	151
17. Indian Pear (Amelanchier Canadensis.... "	150	149	142	144	147	154	147	146	158	155	155
18. Indian Pear (Amelanchier Canadensis) Fruit ripe	190							205	176		
19. Wild Red Cherry (Prunus Pennsylvanica Flowering	154	152	149	147	150	160	150	147	167	159	159
20. Wild Red Cherry, (Prunus Pennsylvanica) Fruit ripe	244					263		226			
21. Blueberry (Vaccinium Can. and Penn..)Flowering	155	153	143	162	151	151	150	151	162	164	164
22. Blueberry (Vaccinium Can)........Fruit ripe	254							225	289	252	252
23. Tall Buttercup (Ranunculus acris)....Flowering	165	159	155	158	163	169	164	163	175	172	172
24. Creeping Buttercup (R. Repens)........ "	168	167	155	163	163	168	171	172	177	173	173

143	152	145	149	159	152	150	160	157	157	153	25. Painted Trillium (Trill, erythrocarpum . . “	158	149	155	152	153	161	157	155	172	165	165
147	146	148	152	156	151	152	163	162	162	154	26. Rhodora (Rhododendron Rhodora)...... “	159	153	149	158	157	160	157	157	169	167	167
159	153	150	154	151	154	150	164	160	160	155	27. Pigeon Berry.....(Cornus Canadensis... “	161	166	158	155	158	159	160	156	170	166	166
154	213		156	159		156	270	138	138	173	28. Pigeon Berry (Cornus Canadensis) Fruit ripe.....	174		213		160	161		158	280		
147	157	150	150	157	150	150	159	147	147	152	29. Star Flower (Trentalis Americana.......Flowering	158	153	155	154	155	165	159	156	163	161	161
152	156	149	160	158	162	154	166	176	176	161	30. Clintonia, Clintonia borealis............ “	164	157	161	155	165	166	167	160	175		
154	167	151	158	163		161	166	166	166	161	31. Marsh Calla (Callapalustris)........... “	163	160	170	151	167	166		163	171	160	160
158	155	153	160	163	163	160	172	164	164	161	32. Lady's Slipper (Cypripedium acaule..... “	166	164	160	159	167	164	168	166	169	170	170
156	153	150	157	164	162	160	173	169	169	161	33. Blue-eyed Grass (Sisyrinchium angustifolia “	166	160	157	155	162	168	168	165	177	173	173
161	163	165	163	164	168	163	177	161	161	165	34. Twinflower (Linnæa borealis)........... “	167	165	167	170	166	162	167	166	168	170	170
147	157	153	152	164	157	153	169	168	168	159	35. Pale Laurel (Kalmia glauca)............ “	164	163	163	157	155	168	163	159	173	169	169
158	162	161	157	169	155	158	169	164	164	162	36. Lambkill (Kalmia augustifolia).......... “	165	159	165	169	163	162	161	159	172	168	168
156	164	150	162	173	156	163	181			163	37. English Hawthorn (Cratægus oxyacantha) “	164	162	168	147	167	174	161	167			
161	157	160	161	166	161	159	172			162	38. Scarlet fruited Thorn (Cratægus coccinea, etc. ....Flowering	167	169	161	166	167	168	171	164	174		
160	166	166	171	171	172	170	174	173	173	170	39. Blue Flag (Iris versicolor).............. “	172	166	167	171	174	176	176	175	179	170	170
160	161	164	168	172	170	169	175	166	166	167	40. Ox-eye Daisy (Chrysanthemum Leucanth “	169	166	166	169	174	173	176	174		160	160
162	166	164	173	174	175	163	171	163	163	167	41. Yellow Pond Lily (Nuphar advena)...... “	171	169	170	168	172	179		164	174	169	169
164	159	164	161	161	156	155	164	156	156	158	42. Raspberry (Rubus strigosus)............ “	165	167	164	171	163	164	166	160	168	162	162
213	206	161				194	256	233	233	214	43. Raspberry (Rubus strigosus).......Fruit ripe...	217	213	206	175				195	266	237	237
173	170	172	176	171		154	190	172	172	172	44. Yellow Rattle (Rhinanthus Crista-galli..Flowering	172	177	175	175		172		157		175	175
160	165	157	169	156	168	165	171	170	170	165	45. High Blackberry (Rubus villosus)....... “	172	172	171	172	173	164	175	169	176	175	175
	214	228		245		237	263	288	288	245	46. High Blackberry (Rubus villosus . ..Fruit ripe.	256		214	240		252		245	263	288	288
168	168	175	178	171		164	179	163	163	170	47. Pitcher Plant (Sarracenia purpurea).....Flowering	172	171	173	175		176		170		170	170
169	164	150	145	173	173	143	179	170	170	163	48. Heal-All (Brunella vulgaris)........... “	164	169	168	155	148		178	145		175	175
170	166	166	176	177	174	176	168	132	132	163	49. Common Wild Rose (Rosa lucida)....... “	167	175	170	172		178		177	167	150	150
165	167	169	171	167	172	173	172	170	170	169	50. Fall Dandelion (Leontodon autumnale) . . “	174	173	172	174	175	171	175	177	178	175	175
169	161		144	170		159	170	172	172	165	51. Batter-and-Eggs (Linaria vulgaris)...... “	169	174	163		152	175		161	178	175	175
145	136	138	142	145	142	137	144	142	142	143	52. Expanding Leaves (Trees appear green).. “	150	154	147	144	148	158	155	144	156	150	150
144	144	144	145	151	145	144	160	150	150	148	53. Red Currant (Ribes rubrum) (cultivated) “	153	160	149	149	149	160	149	149	164	152	152
						205		250	250	235	54. Red Currant (Ribes rubrum (fruit ripe)..........	236							207		250	250

PHENOLOGICAL OBSERVATIONS, 1914.

Day of the year corresponding to the last day of the month.

January	31	July	212
February	31	July	212
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When first seen.												When becoming common.										
I. Yarmouth and Digby Counties.	II. Shelburne, Queens and Lunenburg Counties.	III. Anapolis and Kings Counties.	IV. Hants and Colchester Counties.	V. Halifax and Guysboro Counties.	VI. Cobequid and Chignecto Slope.	VII. Northumberland Slope.	VIII. Richmond and Cape Breton.	IX. Bras d'Or Slope.	X. Inverness Slope.	AVERAGE DATES N.S.		AVERAGE DATES N.S.	1. Yarmouth and Digby Counties.	II. Shelburne, Queens and Lunenburg Counties.	III. Anapolis and Kings Counties.	IV. Hants and Colchester Counties.	V. Halifax and Guysboro Counties.	VI. Cobequid and Chignecto Slopes.	VII. Northumberland Slope.	VIII. Richmond and Cape Breton.	IX. Bras d'Or Slope.	X. Inverness Slope.
154	147	148	147	158	148	146	162	143	143	150	55. Black Currant (R. nigrum) (cultivated).. Flowering	155	158	154	152	153	160	151	150	168	151	151
						186				185	56. Black Currant (R. nigrum)........... Fruit ripe	188							188			
146	147	144	148	158	148	145	162	152	152	150	57. Cherry (Prunus Cerasus)............. Flowering	155	152	150	149	152	164	154	149	167	157	157
						208	229			219	58. Cherry (Prunus Cerasus).......... Fruit ripe	220							210	229		
148	146	146	148	158	152	146	162	155	155	149	59. Plum (Prunus domestica)........... Flowering	157	156	151	150	153	163	155	151	170	161	161
149	147	147	150	157	154	149	165	157	157	153	60. Apple (Pyrus Malus).................. "	160	153	153	155	155	165	160	154	172	165	165
158	154	153	161	169	150	159	173	166	166	161	61. Lilac (Syringa vulgaris)................ "	166	161	158	167	165	173	167	163	177	165	165
163	161	167	164	170	167	169	173	168	168	167	62. White Clover (Trifolium repens)........ "	171	170	168	169	168	174	176	174	176	165	165
157	159	163	166	169	169	169	173	172	172	167	63. Red Clover (Trifolium pratense)........ "	170	166	166	168	169	173	178	174	178	163	163
166	164	163	172	163	169	174	176	162	162	167	64. Timothy (Phleum pratense)............ "	168	168	166	172	176	172	176	174		160	160
181	171	176				185	220			186	65. Potato (Solanum tuberosum)........... "	198	194	171					204	226		
119	119	122	133	125	133	138	128	133	133	128	66. Ploughing first of season....................	134	124	124	132	140	131	139	141	137	138	138
129	121	134	140	133	143	142	140	140	140	136	67. Sowing....................................	143	143	133	143	146	137	146	146	147	146	146
127	121	135	141	132	137	141	134	137	137	134	68. Potato-planting............................	140	129	128	145	149	137	147	147	141	141	141
135	127	133	139	141	138	133	130	122	122	132	69. Sheep-shearing............................	141	138	138	140	147	148	152	148	142	131	131
233	194			222		208	244	222	222	220	70. Hay-cutting................................	228	244	203			224		214	253	227	227
288	235	232	243	290		249	256	267	267	258	71. Grain-cutting..............................	270	290	241	257	253	294		252	265	287	287
298	270	255	281	276		278	286	288	288	280	72. Potato-digging.............................	288	301	276	271	284	282		282	304	298	298
82	75	76	84	97	105	98	114	112	112	92	73a. Opening of rivers.........................											
106	104	110	114	110		119	125	129	129	116	73b. Opening of lakes..........................											
120	122	123	123	121	120	122	124	124	124	122	74a. Last snow to whiten ground...............											
139	132	124	130	125	139	140	133	142	142	135	74b. Last snow to fly in air....................											
147	116	129	146	143		145	145	137	137	138	75a. Last spring frost—hard....................											
159	145	156	152	150		157	166	144	144	153	75b. Last spring frost—hoar....................											
95	123	71		106		105	121	128	128	109	76a. Water in streams—high.....................											
337				304		222				287	76b. Water in streams—low......................											

278	283		287	291		260	265	293	293	281	77a. First autumn frost—hoar											
304	298		290	308		293	294	321	321	303	77b. First autumn frost,—hard											
300	298		272	308		286	300	305	305	297	78a. First snow to fly in air											
335	336		293	315		303	315	323	323	318	78b. First snow to whiten ground											
343	345					341	351			345	79a. Closing of lakes											
						348	366			357	79b. Closing of rivers											
97	83	93	90	93	81	94	96	113	113	96	81a. Wild ducks migrating, N.											
354										354	81b. Wild ducks migrating, S.											
97	79	82	88	92	82	87	94	97	97	90	82a. Wild geese migrating, N.											
354	253							304	304	304	82b. Wild geese migrating, S.											
85	90	86	100	100	93	103	103	106	106	97	83. Melospiza fasciata,	North										
88	81	84	86	90	90	91	97	104	104	91	84. Turdus migratorius	"										
94	97	95	98	92	101	84	106	104	104	97	85. Junco hiemalis	"										
118	115	134	133	117	116	139	125	140	140	127	86. Actitis macularia	"										
120	110	115	124	116		144		121	121	121	87. Sturnella magna	"										
114	118	131	133	110	115	135	128	124	124	123	88. Ceryle Alcyon	"										
125	134	130	147	122	153	136	127	135	135	134	89. Dendrœca coronata	"										
134	129	146	142	131	141	138	157	155	155	143	90. D. æstiva	"										
129	118	122	138	94	128	113	136	126	126	123	91. Zonotrichia alba											
143	143	142	144	141	143	141	167	149	149	146	92. Trochilus colubris	"										
131	123	142	139	139	140	132	162			138	93. Tyrannus Carolinensis	"										
133	115	137	142		138	141	159	132	132	136	94. Dolychonyx oryzivorus	"										
145	142	138	143	145	133	145	170	166	166	149	95. Spinis tristis	"										
145	130	135	146	151		121	157	152	152	143	96. Setophaga ructicilla	"										
145	164		150		149	131	158			149	97. Ampelis cedrorum	"										
133	130	136	126	141	139	135	150	125	125	134	98. Chordeiles Virginianus											
107	105	110	115	118	119	117	130	125	125	117	99. First piping of frogs											
116	108	122	124	121	128	132	132	133	133	125	100. First appearance, of snakes											

THUNDERSTORMS. Nova Scotia, 1914.

Year 1914.	I. Yarmouth and Digby Counties, N.S.	II. Shelburne, Queens and Lunenburg Counties, N.S.	III. Anapolis and Kings Counties, N.S.	IV. Hants and Colchester Counties, N.S.	V. Halifax and Guysboro Counties, N.S.	VI. Cobequid and Chignecto Slopes, N.S.	VII. Northumberland Slope, N.S.	VIII. Richmond and Cape Breton, N.S.	IX. Bras d'Or Slope, N.S.	X. Inverness Slope, N.S.	I. Yarmouth and Digby Counties, N.S.	II. Shelburne, Queens and Lunenburg Counties, N.S.	III. Anapolis and Kings Counties, N.S.	IV. Hants and Colchester Counties, N.S.	V. Halifax and Guysboro Counties, N.S.	VI. Cobequid and Chignecto Slopes, N.S.	VII. Northumberland Slope, N.S.	VIII. Richmond and Cape Breton, N.S.	IX. Bras d'Or Slope, N.S.	X. Inverness Slope, N.S.	Year 1914.
10		10																			
56								56	59			199									199
								63	62												
59								65^{2}													
								66^{13}	66^{2}												
62 63				68												201					201
																207					207
65^{2} 66^{15}			74				71^{4}		70^{2}							208					
68 70^{2}		75		76																	208
71^{4} 74	77^{3}	77^{11}	77^{4}	77^{7}	77^{3}				77												
75 76				78^{9}	78^{2}		78^{12}					215									215
77^{29} 78^{23}				105	83		102	95													
					102			97													
83 95							105														
97 102^{2}			109^{2}	109^{4}		109	109^{2}														
105^{2}						110															
109^{9}	113																				
110 113												227				227^{2}					227^{3}
118 119		118	119													233					
128												233									233^{2}
129^{22}													235								235
130^{2}																					
131^{5}				128																	
					129^{5}			129^{13}	129^{3}												
132				129	130			130													
133^{2}					131			131^{3}	131						240						240
								132								242^{2}		244			
134			133	135^{6}	133																242
					134		135^{10}	136^{2}	135												

135^{17}	136		136		136								245								244 245
													246		246	246					
136^{5}		138						138				247	247		247	247^{2}		247	247		246^{3}
138^{2} 141					141										249						
144													250								247^{7}
																250		250^{2}	250		249
145^{2}	144	145						145										251			
146			147	147	148^{8}	147	147^{2}	146								254		253			250^{5}
								147^{3}	147												
147^{9}	148^{2}	148^{14}	148^{3}	148^{10}		148^{2}	148^{16}	148^{13}	148^{3}												
148^{72}		150		150^{2}			150	150								267					251 253
150^{6} 151^{30}	151^{3}	151^{2}	151^{2}	151^{5}	151^{4}	151	151^{12}	151			276					273		274			254 267
152^{30}	152^{3}	152^{8}	152	152^{2}	152^{3}	152	152^{4}	152^{7}	152		278										273
153^{7}	153	153		153	153		153	153	153												274 276
																		294			278
154^{2} 155^{2}	154^{2}	155		156				155													
156															302						294
157^{2}																		309			
															308						302
158 159	157	158		157								308			309						
								159													304
160^{3}																					308^{2} 309
									160			315									
161^{10}					160		160									315					
								161^{4}	161			317^{2}		317		316		316			315^{2}
163^{22}			161	161^{2}	161^{2}											317					
								163^{4}													316^{2}
164^{8}	163^{5}	163^{4}	163^{4}	163^{2}	163		163	164^{5}	163							318					
165 166^{2}	164	164	164		165											319					317^{4}
167^{8}		167^{2}	167	167	166				166												
					167																318
168^{4} 171		168		171	168			167													
173^{4}					173^{2}		173	168	168												319
175^{7}					175^{2}		175^{3}		173		345										
176^{37}	176^{4}	176^{9}	176^{7}	176^{8}	176^{3}		176		175^{2}		346										345
177 179		177		179					176		348										346
																					348

NOTE.—The indices indicate the number of stations from which Thunderstorms were reported on the day of the year specified

APPENDIX D

DEPARTMENT OF INLAND REVENUE
LABORATORY BRANCH

BY

A. McGILL, B.A., B.Sc., LL.D., F.R.S.C.
Chief Analyst.

FEDERAL INSPECTION OF FOODS AND DRUGS IN CANADA.

As already explained, the systematic inspection carried out by the Department of Inland Revenue, as administrator of the Adulteration Act, has been reported in bulletin form since 1887 . The Bulletins in question appear at irregular intervals; and the whole number of them to this date is 314. My last report to The Royal Society brought the record down to Bulletin No. 276 published in February of 1914. Since that date the following have appeared:—

			Samples
Bulletin No.	277	Tincture of Iodine	72
	278	Infants' & Invalids' Foods	86
	279	Flour	139
	280	Soft Drinks	150
	281	Butter	340
	282	Cattle Medicines	120
	283	Ale (Beer)	75
	284	Arsenate of Lead	82
	285	Canned Corn	205
	286	Ground Ginger	259
	287	Tea	149
	288	Confectionery	174
	289	Strained Honey	194
	290	Coffee & Substitutes	339
	291	Fertilisers	480
	292	Marshmallows	93
	293	Evaporated Apples	184
	294	Salad Oil	114
	295	Lime Juice	100
	296	Registered Stock Feeds	151
	297	Effervescent Citrate of Magnesia	52
	298	Milk in small towns	59
	299	Macaroni, etc.	142
	300	White Lead ground in Oil	104
	301	White Paint	116
	302	Bran	187
	303	Paris Green	24
	304	Condensed Milk	200
	305	Evaporated Milk	178
	306	Hydrogen Peroxide	37
	307	Unfermented Grape Juice	111

			Samples
Bulletin No.	308	Baking Powder	251
	309	Jams & Compound Jams	234
	310	Milk in small towns	208
	311	Middlings (Shorts)	189
	312	Molasses	140
	313	Vinegar	245
	314	White Pepper	318

These bulletins not only furnish information regarding the particular inspection with which they immediately deal, but in most cases, are introduced by an explanatory letter giving, as briefly as possible the salient features of the subject matter, and an account of any standards which have been established by law, with the reasons for the same. Manufacturers of and dealers in these articles, as well as the consuming public generally, should find much to interest them in these publications; and the Deputy Minister of Inland Revenue is pleased to supply them, on request, and without cost, to all who apply for them, so far as the editions printed permit.

During the past year Standards have been legalized as follows:—

Colouring matter in Food. (G. 1112 and 1167).

Sugar. (G. 1135).

Maple Products. (G. 1152).

Limejuice. (G. 1172).

Explanatory circulars concerning Warranty of Purity (G. 1120) and warnings to dealers in certain foods. (G. 1169).

An amendment to the Adulteration Act received the assent of Parliament on June 12th, 1914, and is published as Chap. 19 of the Statutes of Canada.

Sub laboratories have been established in Halifax, Winnipeg and Vancouver. That stationed at Halifax is in charge of Mr. C. C. Forward, and was put in commission in December, that at Vancouver in charge of Mr. J. A. Dawson in February of this year. The sub-laboratory at Winnipeg, in charge of Mr. E. L. C. Forster is nearly ready for work. It is hoped that during the next twelve months these extensions of the main laboratories at Ottawa will give a good account of themselves.

APPENDIX E

DEPARTMENT OF THE INTERIOR,
FORESTRY BRANCH.

FOREST PRODUCTS LABORATORIES

BY

JOHN S. BATES, Chem. E., Ph. D.

Superintendent.

THE WORK OF THE FOREST PRODUCTS LABORATORIES OF CANADA.

The Forest Products Laboratories, Canada, were established in 1913 under the Forestry Branch of the Department of the Interior. The plan of co-operation with McGill University has proved to be a very satisfactory one and this union of government and university in scientific research may be considered as marking an era in Canada's development. The relation of the laboratories to the University is flexible and the co-operation is primarily one of goodwill, the university having provided quarters for our laboratory work and the Federal Government, through the Forestry Branch, paying all salaries and furnishing all equipment.

The period to date has been mainly one of organization and preparation for systematic, scientific work. The progress has been slow in some respects owing to the newness of this type of work in Canada and the small supply of specially trained technical men. However, I think it will be apparent from the discussion which is to follow that a real start has been made in this work, which is of such vital importance to Canada.

PERSONNEL.

At the beginning of the fiscal year, April 1st, 1914, the writer took over the duties of Superintendent in succession to Mr. A. G. McIntyre. At this time the staff numbered ten, made up of seven technical men and three office assistants. Twelve months later the permanent staff totalled twenty-three, while at the present time the permanent staff numbers twenty-nine, with two others appointed to commence duties later in the summer. Five of our technical men are now absent on active military service, these being Messrs. F. W. Fraser, D. M. Trapnell, L. N. Seaman, W. B. Campbell and L. L. Brown.

ACCOMMODATION.

Up to the fall of 1914 the staff found temporary accommodation in the Old Medical Building, granted for our use by McGill University. We are now quartered for a period of four years in the buildings at 700 University Street, which were recently purchased by McGill University. The office building is a large stone structure containing about twenty-five rooms in all. The adjoining building has been reconstructed to serve as an experimental paper mill. For the work in timber testing the university placed at our disposal the testing laboratory in the Engineering Building, which provides most excellent facilities for this branch of our work. A wood-working shop, small sawmill, storage yard and special seasoning shed are also available.

The progress of work in the laboratories will no doubt be made clearer by separate discussion of each division. The present organization includes the Division of Administration and the technical divisions of Timber Tests, Timber Physics, Pulp and Paper and Wood Preservation.

ADMINISTRATION.

The Division of Administration is concerned with the general operation of the laboratories, correspondence, library and so forth. A favorable start has been made in collecting a library containing information on the special work which concerns the laboratories. Preliminary plans have been made for the collecting and exhibiting of wood specimens, samples of treated wood, pulp and paper, wood distillates and the other numerous products which can be obtained from the raw material furnished by our Canadian forests.

TIMBER TESTS.

Project No. 1, "Mechanical and Physical Properties of Canadian Woods as Determined by Tests on Small Clear Specimens," was undertaken for the purpose of establishing the strength characteristics of the important Canadian wood species. The testing procedure includes eight strength tests—Static bending, compression parallel to grain, compression perpendicular to grain, shear, tension, impact bending, cleavage and hardness. The first species under test is Douglas Fir, obtained from Alberta and British Columbia. The results have shown that the fast growing Douglas Fir of the Pacific Coast has unusual strength and that the slower growing and smaller mountain types, although more affected by knots and other defects are of very good quality. The tests confirm the fact that our Canadian Douglas Fir is a first-class structural material.

Project No. 2, "Strength Functions and Physical Properties of Nova Scotia Mine Timbers," has been carried on during the last half of the year in connection with a general investigation of Nova Scotia mine timbers instituted by McGill University in co-operation with the Forestry Branch. Over seven hundred representative pit props and booms were obtained from Nova Scotia, including five species—Black Spruce, Red Spruce, Balsam Fir, White Birch and Yellow Birch. Most of these timbers have been tested in commercial sizes in the large machines. Much valuable information has been obtained from these tests and results will be ready for publication in the near future.

TIMBER PHYSICS.

Considerable equipment, including microtome, microscopes, photomicrographic apparatus, projection lantern, cameras, electric ovens, autoclave, balances and so forth, has been obtained for this division. The work has to do largely with the determination of physical and structural properties of wood by the testing of moisture content, specific gravity, percent springwood, percent summerwood, percent sapwood, percent heartwood, fibre dimensions, cell structure, microscopic characteristics and fungus infection. There has been considerable study to learn the relation of microscopic structure of wood to penetration by preservatives and other liquids. General botanical studies are also made. All the photographic work is done by this division, including the making of microscopic slides, photomicrographs and lantern slides of wood sections and pulp fibres, as well as miscellaneous photographs, copies, enlargements, etc. Studies have been made to improve the methods of wood identification. Investigations are in progress on the relation of vapor pressure and shrinkage to the moisture content of wood.

PULP AND PAPER.

Special attention has been given to the equipping of a thoroughly modern semi-commercial experimental paper mill and it is safe to say that when all the equipment is in place, this mill will be without an equal in any of the centres throughout the world, where experimental work of this kind is in progress A special Fourdrinier paper machine has been installed , the machine being about 75ft. in length and turning out a sheet 30 inches in width. The machine is flexible in its adjustments and attachments and is designed to make practically all grades of paper. A single beater of 40 lbs. capacity and a double beater of 60 lbs. capacity have been installed, with interchangeable basalt lava and steel rolls with individual motor drive to each roll. The remaining equipment, which is now in place, includes three stuff chests, riffler, screen, four pumps, five motors, two paper testing instruments, Erfurt sizing system and a variety of small apparatus. Sulphite and soda digesters and other equipment will be installed in the near future, for the manufacture of wood pulp by chemical processes, on a satisfactory scale. Preliminary work has been done on several pulp and paper investigations. Queen's University has co-operated in research on the chemical composition of waste sulphite liquor, which is produced in such large quantities by our paper mills.

WOOD PRESERVATION.

A new Division of Wood Preservation was organized in October, 1914. The scope of this division includes the study of wood preservatives and methods of treating wood to prolong the life of railroad ties, paving blocks, telegraph poles, posts, piling, trestle timber, mine props and structural timber in general. A study of wood destroying fungi has also been undertaken as well as methods of fireproofing wood. A certain amount of equipment in the form of retorts, pumps, motors, air compressor, and so forth, have been obtained for the carrying on of experimental work. Particular attention is being paid to the subject of railway ties in Canada.

PROPOSED DIVISIONS.

Although it is not feasible to establish more than the four above-mentioned technical divisions at the present time there are a number of other branches of work in the field of forest products which demand attention and which should be taken care of in separate divisions some time in the future. These include Divisions of Lumber, Chemistry, Wood Distillation and Hydrolysis.

GENERAL.

The investigations made by the laboratories are regulated by an Advisory Committee of seven members who represent a wide range of experience and interest.

The members of the staff are called upon from time to time to give lectures before scientific societies, university students or the general public and a good deal of interest has been stimulated in this way.

The publications contributed to date by the laboratories are Forestry Branch Circular No. 8; "Forest Products Laboratories", Circular No. 9; "Chemical Methods for Utilizing Wood Wastes", and Bulletin No. 49, "Treated Wood Block Paving."

An important function of the laboratories has been that of answering inquiries on forest products. In this way the laboratories have undertaken to act as a bureau of information for the benefit of the public.

The laboratories are co-operating as far as possible with various industries, railways, universities, societies and individuals. In fact, the use of wood is a subject which is so extended and varied that the problems can only be solved by the united efforts of all who are concerned with the handling of wood and its products.

July 16, 1915.

APPENDIX F

REPORTS OF ASSOCIATED SOCIETIES

I. Report of the Entomological Society of Ontario.

Presented by Prof. W. LOCHHEAD, Delegate.

I have the honor of presenting the following report of the work of the Ontario Entomological Society for the year 1914-15.

The past year was a very successful one. The active membership continues to increase, and the Society has now a relatively large number of trained workers engaged in the investigation of the many insect problems that arise yearly in every province. The presence of these new members has a stimulating influence on the general work of the Society. They are young men, mostly graduates of the agricultural colleges, and filled with the enthusiasm of youth and eager to advance the interests of their profession. As a matter of fact the entomological interests of the Dominion are now to a large extent in their keeping.

Another feature of recent entomological work is the appearance of an increasing amount of investigation that might fairly be classed as high grade. This result may be attributed to the fact that our younger entomologists have the advantages of a scientific training and are thus able to undertake problems beyond the power of their predecessors.

Much of the credit for the vigorous condition of the Society must be assigned to its active President, Dr. C. G. Hewitt, Dominion Entomologist, who presided most worthily at the 51st annual meeting held in Toronto on the 5th and 6th of November last. This meeting was well attended, and many valuable papers were presented. Considerable discussion took place on various subjects of importance, particularly on the outbreak of the Army-worm in Canada in 1914.

Following is a list of the chief papers and addresses:—

"Applied Entomology in Canada: its rise and Progress," the address of the President, Dr. C. G. Hewitt:

"The Habits of Spiders" ((illustrated), by Prof. J. H. Comstock, Cornel University.

"Jean Henri Fabre, the French Entomologist", by Prof. W. Lochhead, Macdonald College, P.Q.

"Insects of the Season" by Prof. L. Caesar, A. Gibson, W. Lochhead, A. Cosens, J. A. Morris, W. A. Ross, C. E. Grant, and C. E. Petch.

"The 1914 Outbreak of the Army Worm in Canada," by A. Gibson.

"The Army Worm in Ontario in 1914," by A. W. Baker, O.A.C.

"Mountains and Hills," by Dr. T. W. Fyles, Ottawa.

"Experiments with Poisoned Bran Baits for Locust Control," by A. Gibson, Ottawa.

"An Imported Red Spider attacking Fruit Trees," by Prof. L. Caesar.

"Cherry Fruit Flies," by Prof. L. Caesar.

"Control of Forest and Shade Tree Insects of the Farm," by J. M. Swaine, Ottawa.

"Variation in the Hedgehog Caterpillar," by A. Gibson.

The *Canadian Entomologist*, the monthly journal of the Society, continues to maintain its high reputation and its wide circulation in spite of the increased subscription price. The 46th volume, completed in December last, is the largest and most fully illustrated that has yet been published.

During the year 1914 and since the last meeting of the Royal Society, the Ontario Entomological Society lost two of its best known members. Mr. H. H. Lyman perished in the disaster to the "Empress of Ireland" on the 29th of May—a few days after he had presented his report as delegate of this Society. Dr. William Saunders, ex-Director of the Dominion Experimental Farms and one of the charter members of this Society, died at his home in London on September 13th. In his Presidential Address at the Annual Meeting in T ronto, Dr. Hewitt spoke very feelingly of the loss of these two highly esteemed members and ex-presidents of our Society, and paid a high tribute to their memories. Besides, our worthy and revered member, Rev. Dr. Bethune, who knew both very intimately for many years, has written notes of high appreciation in the 45th Annual Report.

II.—16th Annual Report of Women's Canadian Historical Society of Ottawa, 1914-1915.

By Carolyn A. Gullock, Hon. Rec. Secy. and Delegate.

The years 1914-1915 will be handed down in Canadian History as years involved in the greatest world war. Instead of celebrating peace, Canada is sending her sons to aid the mother country in upholding the principles of truth and justice.

And though we cannot yet foretell the ultimate issue of the gigantic struggle, we are nevertheless absolutely convinced that right must eventually triumph over vaunted might, and humanitarian ideals over organized oppression.

The one outstanding fact which overshadows all others in the Society's annals during the past year is the passing away of our President, Mrs. Thos. Ahearn. Mrs. Ahearn was elected President in 1903, remaining in office until November 1914. During those years she gave generously of her time and talents for the welfare of the Society, and will long be held in loving remembrance.

In looking over the records we find that two public, one special, four general and eleven executive meetings were held during the year.

In June 1914, the Ontario Historical Society held its Annual Meeting in Ottawa, with headquarters at Chateau Laurier. This Society was represented by Mrs. Walter Armstrong, Mme. Rheaume and Mrs. Redmond Quain.

The opening meeting of the Society was held on October 9th, when Mr. Clarence Warner delivered an address on "Canada if Germany should win." In November at the general meeting, Mrs. Walter Armstrong gave an account of the annual meeting of the Ontario Historical Society, and Mrs. Simpson, one on the Peace Celebration and the celebration of 100th Anniversary of the battle of Lundy's Lane held at Niagara Falls, Ontario, July 25th.

The Transactions of the year consisted of a series of papers on French treaties in their relation to Canada:

St. Germain-en-laye............Miss M. Casey.
Treaty of Rhyswick............Mme. Gerin.
Treaty of Utrecht..............Mme. Rheaume.
Treaty of Aix-la-Chapelle.......Mme. Leliévre.

The Society was instrumental in having erected on Nepean Point, through the kindness of the Honourable Robert Rogers, and with the co-operation of Mr. Thos. Ahearn, an historical relic—one of the International Boundary Posts in use between the River St. Croix and the St. Lawrence to mark the boundary between Canada and the United States. The post was a gift to the City of Ottawa from Dr. W. F. King, Director of the Dominion Observatory, and given by the City into the care of the Women's Canadian Historical Society.

On the 3rd of June, 1914, the late Mrs. Thos. Ahearn turned the first sod for the foundation stone of the monument erected on Nepean Point in memory of Champlain.

A testimonial was presented to Mrs. J. B. Simpson in acknowledgment of her valuable service as Rec. Secy. for a period of six years. Mrs. Simpson having been appointed English Secretary to the Landmarks Association was unable to give her time to the Historical Society.

Mrs. Braddish Billings was appointed to represent this Society on the Council of the Landmarks Association, and at the annual meeting of the Ontario Historical Society to be held in June 1915.

Mrs. J. B. Simpson was appointed delegate to the celebration of the 100th Anniversary of the Battle of Lundy's Lane, and to the annual meeting of the Royal Society of Canada.

The following have been elected Honorary Members during the year:—Dr. W. F. King, Hon W. J. Roche, M.D., James Bonar, Mr. Thos. Ahearn, Dr. Jas. Robertson, Mr. Clarence Warner and Mrs. Rubidge.

The officers of the Society for the ensuing year are:—

Patroness—H.R.H. The Duchess of Connaught.

Hon. Presidents—Lady Borden, Lady Laurier.

President—Lady Sifton.

Hon. Vice President—Lady Foster.

Vice Presidents—Mrs. J. L. McDougall, Mme. L. N. Rheaume, Mrs. R. H. McLean, Mrs. Otto Klotz, Mme. Lelièvre, Mrs. R. H. Ells, Mrs. Walter Armstrong, Mrs. I. J. Christie, Mrs. G. N. Newcomb, Mrs. A. Shortt, Mrs. J. B. Simpson, Miss Eva Read.

Rec. Secretary—Mrs. Gullock.

Cor. Secretary—Mrs. Braddish Billings.

Treasurer—Miss Lina Rothwell.

Librarian—Miss Eva Read.

Auditor—Mr. J. D. Fraser.

Executiue Committee:—Mrs. H. H. Bligh, Mrs. A. E. Attwood, Mrs. T. P. Foran, Mrs. R. Quain, Mrs. Fauvel, Mrs. C. H. Thorburn, Mrs. Robert Brown, Mrs. A. F. Bishop, Miss Mutchmore, Miss Drysdale.

The correspondence included about one hundred and twenty letters received, besides pamphlets, advertisements, lists of publications, etc.

The foreign correspondence is confined to a strong protest from some fifteen or sixteen of the French Universities against the accusation of Germany, as to France being the sole cause of the present war.

Our connection with various American Institutions is broadening, and now extends from the Atlantic to the Pacific with a corresponding interchange of publications,

In October a request was received from New Orleans to have the Society represented at the celebration of the 100th Anniversary of the Battle of New Orleans.

At the request of the Ontario Historical Society an invitation was sent to the American Historical Society inviting that Society to hold its next Annual Meeting in Ottawa.

Congratulations were sent to Lady Borden and Lady Foster for honors conferred by His Gracious Majesty King George V, upon Sir R. L. Borden and Sir Geo. E. Foster.

Letters of sympathy with the Society in the death of the President, Mrs. Thos. Ahearn, were received from Mr. Clarence Warner, President of the Ontario Historical Society and from the Women's Historical Society of Toronto.

The Treasurer's annual statement showed receipts to be $663.74 disbursements $604.14, leaving a balance on hand at the close of the year of $59.60.

A large number of books, papers and pamphlets have been received from Canada, United States and Sweden, and have been catalogued, the Society sending its publications in exchange.

III.—Annual Report of the Elgin Historical and Scientific Institute.

Presented by Dr. J. H. Coyne, F.R.S.C., Delegate.

Seven regular meetings have been held, the attendance has been well maintained, and valuable papers have been presented.

Four new members have been elected. Two members, His Honour Judge David John Hughes, and Mr. James E. Orr have died.

Judge Hughes had almost completed the ninety-fifth year of his age, having been born on 7th May, 1820. For more than fifty years he had filled the position of Judge of the County Court of the County of Elgin. A man of great energy and varied activities, he filled a large space in the public life of the community. Although for a number of years he has been absent from our meetings, he took considerable interest in the earlier work of the Institute, and was for a period a member of its Council.

Mr. James E. Orr of Westminster had taken an active interest in the work of recording reminiscences of pioneers, and publishing them through the medium of newspapers and magazines, both in Canada and the United States. Many incidents of early settlement and pioneer life which would otherwise have been lost to posterity have been preserved, through his unassuming efforts, continued through many years and indeed to the very time of his death.

The Institute was represented by its President at the Annual Meetings of The Royal Society of Canada and of the Ontario Historical Society.

The following programme of papers and addresses was carried out:

Oct. 5. "The Queen Charlotte Islands", by John F. Langan, F.R.G.S.

The speaker gave a detailed account, largely from personal knowledge of the islands, their geography, natural resources, industries and general development, showing their remarkable progress during the last decade.

Nov. 2. "Why is Canada in the War?", by the President.

Canada's position as an important integral part of the British Empire was emphasized. Canadian devotion to the empire was proven in the American Revolution, the War of 1812, the rebellion of 1837, and the wars in the Crimea, the Soudan and South Africa.

British and Prussian ideals were compared and contrasted. As the maintainer of treaties and defender of smaller and oppressed nationalities, Britain had only one course open to her, when Belgian territory was invaded by those who had solemnly guarranteed her permanent neutrality. Canada proudly ranged herself beside the motherland, to venture all for the great cause. The sufferings of the heroic Belgian people, the unprecedented brutality of the invaders, imperatively required that the war be carried on at all costs to its logical and righteous conclusion.

Dec. 7. "A page of Ontario's History", by George R. Pattullo, President of the Oxford Historical Society.

Mr. Pattullo acted as a commissioner for Ontario in the almost forgotten struggle with Manitoba for possession of the disputed territory west of Lake Superior. This extensive region had been awarded to Ontario by the arbitrators chosen by the parties. The award having been disputed by the Manitoba government was finally confirmed by formal decision of the Imperial Privy Council. Enterprising newspapers of the time magnified the difficulty into the appearance of a civil war between the provinces. Mr. Pattullo gave a valuable historical summary of the dispute, dwelling effectively upon its humorous as well as its more serious aspects.

Feb. 1. "The Treaty of Ghent", by Rev. R. I. Warner, M.A., D.D., President of Alma College.

The causes and issues of the war were examined. The main results were advantageous to both contending states through the re-establishment of friendly relations, the resulting subsequent conventions and treaties, and the hundred years of peace.

March 8. "One aspect of the Peace Celebration", by Clarence M. Warner of Napanee, President of the Ontario Historical Society.

Mr. Warner explained the critical diplomatic relations between

Great Britain and the United States 25, 50 and 75 years respectively after the War of 1812-1815, effectually barring any possibility of Peace celebrations at the periods mentioned. Popular sentiment was unduly excited on one or both sides of the international boundary at each period.

April 12. "The Faith of our Fathers", by Rev. Joseph E. Ryerson, a sympathetic treatment of the differences in religious belief and practice among the pioneers of Upper Canada .

May 3. "Readings from an Author's MS.", by Rev. R. W. Norwood, M.A. of London.

Mr. Norwood dwelt with the future of humanity from the standpoint of the philosopher and poet.

The Women's Auxiliary, whose members are also members of the Institute, has had a successful year. Its activities have been almost entirely limited to the exigencies of the war, the preparation of papers having been largely dispensed with in order that the Society's energies might be devoted in co-operation with other Societies to effective work for the soldiers at the front.

The Institute has gladly contributed a substantial sum, considering the resources available, to the Patriotic Fund, to which its members generally have also individually contributed. The Council believes that the Institute will be willing to make further payments to the limit of the fund, if required. All other objects of our Society may well remain in abeyance, as long as the existence of the empire, our civilization, and the fundamental principles and aims of Christianity are in peril.

The Treasurer's report shows a cash balance of $377.64.

The names of officers for 1914-1915 are as follow:—

President:—James H. Coyne, LL.D., F.R.S.C.

Vice-President—Mrs. J. H. Wilson.

Secretary—W. W. Olmsted.

Treasurer—W. H. Murch.

Editor—Judge C. O. Ermatinger.

Curator—Dr. Archibald Leitch.

Councillors—K. W. McKay, Mrs. J. S. Robertson, Dr. C. W. Marlatt, Rev. N. H. McGillivray, A. W. Graham,

Advisory Council:—John F. Langan, F.R.G.S., Rev. R. I. Warner, M.A., D.D., John W. Stewart, F. B. Holtby. Mrs. W. St. Thomas Smith, Mrs. C. St. Clair Leitch, Mrs. Archibald Leitch, Mrs. Symington, Miss Ella N. Bowes, M.A., George A. Anderson, E. S. Anderson, Herbert S. Wegg.

IV.—Report of the Ontario Historical Society.

By Dr. J. H. Coyne, F.R.S.C.

The membership consists of 410 annual, 49 ex-officio, 31 delegate, 6 honorary, 7 corresponding and 2 life—making a total of 505.

The receipts for 1914-15 were $1410.12, the expenditures $1406.82, mainly for publications and expenses therewith.

In 1914-15, the Society issued an Annual Report of 138 pages, and Vol. XIII of the "Papers and Records" series, with 115 pages, containing ten papers, as follows:—

Annals of an Old Post Office on Yonge Street (Richmond Hill). By the late Matthew Teefy.

Some Unpublished letters from General Brock.

Some Mistakes in History. By Miss Janet Carnochan.

The Valley of the Ottawa in 1613. By Benjamin Sulte, LL.D., F.R.S.C.

Gleanings from Ottawa Scrap Books. By Miss Amy Horsey.

The Highway of the Ottawa. By T. W. Edwin Sowter.

The County History as a Factor in Social Progress. By Miss Edith L. Marsh.

The Rush-Bagot Agreement of 1817. By E. H. Scammell.

Early Militia Matters in Upper Canada, 1808-42. By Rev. A. B. Sherk.

The British North American League, 1849. By Prof. Cephas D. Allin.

Twenty-two affiliated societies reported the progress of their work.

During the year the Library received 359 books, 368 pamphlets, and 321 minor prints (newspapers, photographs, etc.).

The officers of the Society for 1915-16 are as follow:—

President—Clarence M. Warner, Napanee.

Vice-Presidents—Sir Edmund Walker, C.V.O., LL.D., D.C.L., F.R.S.C.; Miss Janet Carnochan, and the Presidents of affiliated societies.

Treasurer—C. C. James, C.M.G., LL.D., F.R.S.C., Toronto.

Secretary—A. F. Hunter, M.A., Normal School Building, Toronto.

Executive Council—The above officers with Mrs. Braddish Billings, J. Stuart Carstairs, B.A., Alex. Fraser, LL.D., Litt.D., F.S.A., Joseph L. Gilmour, B.A., D.D., W. L. Grant, M.A., F.R.S.C., Jas. H. Coyne, LL.D., F.R.S.C., C. C. James, C.M.G., LL.D., F.R.S.C., George R. Pattullo, David Williams, and John Dearness, M.A.

V.—The Waterloo Historical Society.

By Dr. J. H. Coyne, F.R.S.C.

Berlin, November 13th, 1914.

The second annual meeting of the Waterloo Historical Society was held in the Free Library Hall, Berlin, on November 13, 1914, the President, W. H. Breithaupt, in the chair.

SECRETARY-TREASURER'S REPORT.

Berlin, November 13th, 1914.

I have the honor of presenting the second annual report of the Waterloo Historical Society for the year ending October 31st, 1914.

The work of the Society has made progress during the past year, and a number of notable additions have been made to the Society's collection.

Your President and Secretary have visited various parts of the County and have placed the needs of the Society before representative citizens. We have been assured of support everywhere, and hope to receive valuable contributions from time to time.

It is apparent that material of much historical value has been scattered or lost, but there is much still to be had which should be secured without delay to be added to our collection.

A list of donations received during the year appears elsewhere.

The hope is expressed that the members of the Society will continue to take a deep interest in collecting material for our museum. Let this be anything pertaining to the early settlement of this County, for example, old documents, deeds, family histories, photographs, Indian objects, etc.

Lecture.

This year we were fortunate in having an address by Dr. Otto Klotz, Dominion Astronomer, of Ottawa. The address, which was an excellent presentation of the subject dealt with "The Boundaries of Canada."

Financial Statement.

Receipts for 1914:		
Balance from 1913	$150.61	
Berlin Free Library for repairs	13.00	
Members' Fees	51.50	
Waterloo County Grant	100.00	
Legislative Grant	100.00	
1913 Reports	1.00	
		$416.11
Disbursements for 1914:		
Postage, Printing and Stationery	$ 44.08	
Cases and Repairs	103.90	
Lecture	10.00	
Rent and Caretaker	19.00	
Bookbinding	31.75	
First Annual Report	40.00	
Frames and mounting maps	16.00	
Second Annual Report (estimated)	80.00	
Services of Secretaries	30.00	
		$374.73
Balance on hand		$ 41.38

All of which is respectfully submitted.

P. FISCHER,
Secretary-Treasurer Waterloo Historical Society.

The report was duly received and adopted.

Election of Officers.

On motion of J. E. Klotz seconded by D,. Forsyth, the officers of 1914 were re-elected to office for the year 1915.

VI.—Report of the Niagara Historical Society 1915.

Presented By Miss Janet Carnochan, President and Delegate.

In our report this year we are able to record considerable progress as regards membership, contributions to the collection, publications and general interest in our own work. We have held regular meetings every month during the winter at which, interesting papers were read, and one open meeting at which an address was given by A. W. Wright, on "Lessons of the War." We have printed No. 27 "Names only but much more" and the story of No. 1 Company Niagara. Our picnic was held in Niagara Park in August and was well attended a short address was given by Mrs. Forsyth Grant, the President of the Women's Historical Society of Toronto. The papers read during the year were Reminiscences of Mrs. Pilkington the daughter of Col. Nelles of Grimsby one of the earliest settlers. Letters of Hon. Wm. Dickson of Albany when a prisoner in 1813 and correspondence with General Dearborn, Reminiscences of Michael Gonder of Black Creek, Extracts from the diary of the Hon. James Crooks of Niagara during the war of 1812-14 printed by the Woman's Historical Society of Toronto. Letter giving an account of voyage of two companies of the Royal Canadian Rifles in 1857 to Fort Garry by way of Hudson Bay, contributed by the late Nichol Kingsmill K.C. A paper was read by Mrs. J. J. Wright on the work of the Women's Institute and the women of Niagara in contributing to the Hospital Fund, the Red Cross, the relief of the Belgians and the Secours National as well as to the Niagara boys who have since the beginning of the war volunteered, are in training or are at the front.

We are now printing pamphlet No. 28 which will consist almost wholly of family history, being reminiscences of early settlers in the Niagara peninsula. During the year we have distributed 600 pamphlets and nearly 800 reports, 1,500 visitors have inscribed their names in the visitors' book, several tablets have been placed in the building, one to the King's 8th or Liverpool Regiment which served here in early years, one to Silas Smith of Winona, one to John Kennedy of St. Anns and one to John Harris of Niagara, all early residents of the town or neighborhood.

The President of the Society was one of those appointed by the Ontario Historical Society to attend the anniversary of the battle of Beaver Dams, the interesting points of which were the unveiling of a memorial window to George Keefer, the founder of Thorold, the attendance of Indian chiefs and the making of Dr. Ryerson a chieftain, the presence of 4,000 from the military camp at Niagara. The centenary of the battle of Lundy's Lane was also attended. In the exhibition of relics the only article of military clothing worn at the battle was the coat of Col. MacDougal of Niagara then in the Glengarry Light Infantry.

There have been many groups of visitors as Literary Clubs, Sunday schools, Military, all interested in the collection. The building is open regularly twice a week and during camp a portion of every day and at many other times; the interest shewn is very great and many accounts have been given of the value of the collection particularly of the rare books and pamphlets and many inquiries have been received as 270 letters have been written by the President during the year in the interest of the Society. The Society has been honored by its President being made a Vice-President of the Ontario Historical Society.

As regards finance at the last annual meeting the Treasurer's statement shewed that Members fees amounted to $78, sale of pamphlets $27, Contribution box $47, Government and County Grant $225, while in expenditure for printing $124, postage $23, book case tablets and improvements $79 while the Society had expended $19 for care of an old cemetery of the colored people and $12.50 had been given to the Hospital fund still leaving a balance on hand.

We have received several new members, there are now 250 members on the roll many of these being in distant places but we have to deplore the loss of several valued members, one who had lately joined, R. W. Crooks, was a victim of the Lusitania disaster caused by the lawless, unprecedented and murderous acts of the German government.

Among the articles contributed is a valuable oil painting of Dr. Dunlop who waited on over 200 wounded at Butler's Barracks the day after the battle of Lundy's Lane 25th July 1814. Portrait of David Thorburn M.P.P., Warden of the County of Lincoln, copy of the oil painting of Adam Vrooman and Mrs. Vrooman, many original letters given by Mrs. Dunn relating to the Second family among them a letter of Hon. Robert Hamilton 1790, Buckle given by General Brock at Queenston to John Crysler of Crysler's farm given by Miss Crysler, Morrisburg, three spits or roasting jacks all different. Among pamphlets sent were very interesting ones by Prof. Siebert of Columbus University, relating to the migration of the United Empire Loyalists to England, West Indies, Nova Scotia and Ontario.

We rejoice that so much interest is being taken in the past history of Canada which is at the present time adding so gloriously to its history.

Officers.

Honorary President—Col Cruikshank, D.O.C.
President—Miss Carnochan.
Vice. Pres.—Rev. Canon Garrett.
2nd Vice Pres.—Mrs. T. F. Best.

Secretary—John Eckersley.
Treasurer—Mrs. S. D. Manning.
Curator and Editor—Miss Carnochan.
Assistant Curators—Mrs. E. J. Thompson, Miss Creed.
Committee—Alfred Ball, Mrs. Goff, Miss Clements, Wm. Ryan, C, E, Sproule.

VII.—Report of the Ottawa Field-Naturalists' Club.

By Mr. Arthur Gibson, President and Delegate.

The council of the Ottawa Field-Naturalists' Club presents to The Royal Society of Canada the following report for the year ending March, 1915.

Membership.—The membership of the Club at present is 329; 323 ordinary members and 6 corresponding members.

Branches of the Club.—Botanical Branch. This branch held seven meetings during the 1914-1915 season. At these meetings there was an average attendance of about 14 members. Reports of these meetings are printed in the *Ottawa Naturalist.* The subjects presented were as follow:—

"The Possibilities in Canada for Home Grown Seed," by Messrs G. H. Clark, M. O. Malte and W. T. Macoun.

"Some Canadian Wild Fruits," by J. M. Macoun;

"Climatic and Soil Conditions as They Influence Plant Life," with special reference to Canadian Grasses, by M. O. Malte.

"The New Greenhouses at the Experimental Farm" and lantern slides illustrating some "Native Shrubs and Trees," by W. T. Macoun.

"An Account of a Trip to Egypt and Palestine," by R. B. Whyte and lanters slides of "Plant Adaptations," by D. A. Campbell.

"Forestry Problems in Canada;" by J. R. Dickson and "Facts regarding the Organization of the Forestry Branch," with lantern slides," by C. J. Tulley.

"Wood Fibre—its uses in Pulp and Paper Making," by J. S. Bates, of the Forest Products Laboratories, McGill University, Montreal.

Entomological Branch. No meetings of this branch were held during the past winter, but during the collecting season, large numbers of insects were gathered for systematic study, and many new records for the Ottawa district obtained. Some of these captures were recorded in *The Entomological Record* for 1914, which appeared in the annual report of the Entomological Society of Ontario.

Winter Series of Lectures.—The series of lectures presented during the winter was very successful. The following is the programme as carried out:

December 8th, 1914, (Tuesday). "Sea Fisheries of Norway." Illustrated with lantern views. By Dr. J. Hjort, of Norway. In the Normal School Assembly Hall.

January 12th, 1915, (Tuesday). "The Royal Botanic Gardens, Kew." Illustrated with lantern views. By Professor R. B. Thomson, Botanical Laboratory, University of Toronto. In the Normal School Assembly Hall.

January 26th, 1915, (Tuesday). "The Indians of the West Coast." Illustrated with lantern views. By Dr. Edward Sapir, Department of Anthropology, Geological Survey, Ottawa. In the Normal School Assembly Hall.

February 9th, 1915, (Tuesday). "Fossils." Illustrated with lantern views. By Mr. L. D. Burling, Geological Survey, Ottawa. In the Carnegie Library Assembly Hall.

February 23rd, 1915, (Tuesday). "Milk." Illustrated with lantern views. By Mr. J. H. Grisdale, Director Experimental Farms, Ottawa. In the Normal School Assembly Hall.

March 9th, 1915, (Tuesday). "Some Interesting Canadian Birds." Illustrated with lantern views. By Dr. M. Y. Williams, Geological Survey, Ottawa. In the Carnegie Library Assembly Hall.

March 23, 1915, (Tuesday), Annual Meeting and Presidential Address, "The Habits of Insects in Relation to their Control." By Mr. Arthur Gibson, Entomological Branch, Department of Agriculture, Ottawa. In the Carnegie Library Assembly Hall.

Spring and Autumn Excursions:—Eight excursions were held during the Club year. The districts visited in spring were: Rockcliffe; Above the Chaudière Falls—North Shore of the Ottawa River; Britannia; Fairy Lake; Leamy's Lake; Ironside.

In the autumn excursions were held to McKay's Lake and the Experimental Farm.

Bird Sanctuaries.—Last year the Club reported on a scheme for the establishment of two bird sanctuaries for the Ottawa district, one at Rockcliffe and the other at the Central Experimental Farm. We are glad to state now that 250 nesting boxes were placed in Rockcliffe Park and 160 in the grounds of the Experimental Farm in the spring of 1914, and that during the past nesting season many of the boxes were occupied by birds, particularly tree swallows and wrens.

The Ottawa Naturalist.—The official organ of the Club. *The Ottawa Naturalist* has appeared regularly during the year. Volume

XXVIII comprising 180 pages has been completed. Mr. Arthur Gibson has continued to edit it. The following are the most important papers published in the volume:—

"On a new genus and species of carnivorous Dinosaur from the Belly River Formation of Alberta, with a description of the skull of *Stephanosaurus marginatus* from the same horizon." By L. M. Lambe.

"The Waterways of the Mackenzie River Basin." By Charles Camsell.

"Lichens from Vancouver Island." By G. K. Merrill.

"Abscission." By F. E. Lloyd.

"Gall Midges as Forest Insects." By E. P. Felt.

"The Problem of Bird Encouragement." By W. E. Saunders.

"Myosaurus in Canada." By E. L. Greene.

"The genus Antennaria in Greenland." By M. P. Porsild.

"Geological Survey Museum Work on Point Pelee." By P. A. Taverner.

"Pleistocene Raised Beaches at Victoria, B.C." By C. F. Newcombe.

"The Snow-flea." By Charles Macnamara.

"List of Tachinidæ from the Province of Quebec." By J. D. Tothill.

"The Value of some Mammals and Birds as destroyers of Noxious Insects." By Norman Criddle.

"Ceramograptus ruedemanni." By G. H. Hudson.

"The Banded Pocket Mouse, *Perognathus fasciatus* Wied.' By Stuart Criddle.

"The New Zealand Peripitus." By E. E. Prince.

"Notes on the Preparatory Stages of *Proserpinus flavofasciata ulalume*." By Arthur Gibson.

"Hybridization in the genus Viola." By M. O. Malte and J. M. Macoun.

Fauna Ottawaensis: Order Lepidoptera; Family Noctuidae subfamily Phytometrinae." By Arthur Gibson.

"Botanical notes from Portneuf Co., Que." By Bro. M. Victorin.

Council, 1915-1916.—The present council of the Club is as follows: President, Mr. Arthur Gibson; Vice-Presidents, Mr. H. I. Smith. Dr. C. Gordon Hewitt; Secretary, Mr. G. O. McMillan; Treasurer' Mr. G. LeLacheur; Editor, Mr. Arthur Gibson; Librarian, Mr. J. R. Fryer; Members of Council, Drs. M. Y. Williams, M. O. Malte, Messrs. Andrew Halkett, P. A. Taverner, L. H. Newman, J. R. Dymond, L. D. Burling, E. D. Eddy, Misses F. Fyles and D. Stewart.

VIII.—Report of the Royal Astronomical Society of Canada.

BY RALPH E. DE LURY, Secretary of the Ottawa Centre and Delegate.

During 1914 the Society had a very successful year. Its eight Centres held in all about 75 meetings. Its membership increased from 422 to 498. A new Centre was established at Victoria, B.C.

The following extracts from the Report for 1914 by Mr. J. R. Collins, General Secretary of the Society, give the number of meetings held at each Centre, the number of active members at each Centre and the list of General Officers of the Society elected for 1915; also, the essential parts of the Reports of the Secretaries of the various Centres which include lists of papers presented, and lists of Officers elected for 1915;

Toronto,	Meetings	held	16	Membership	135
Ottawa,	"	"	13	"	99
Hamilton	"	"	7	"	27
Guelph	"	"	9	"	36
Peterborough				"	44
Winnipeg	"	"	11	"	18
Regina	"	"	3	"	15
Victoria	"	"	6	"	101
					475
Honorary Members					23
Total Membership					498

GENERAL EXECUTIVE FOR 1915:

Honorary President—Dr. W. F. King, Chief Astronomer, Ottawa.
President—Dr. J. S. Plaskett, Ottawa.
First Vice-President—Dr. A. D. Watson, Toronto.
Second Vice-President—A. F. Miller, Toronto.
Secretary—J. R. Collins, Toronto.
Treasurer—Chas. P. Sparling, Toronto.
Recorder—W. E. Jackson, Toronto.
Librarian—H. B. Collier, Toronto.
Curator—Robert S. Duncan, Toronto.

Council—Rev. Dr. I. J. Kavanagh, Montreal; Rev. Dr. Marsh, Holstein; Stuart Strathy, Toronto; Sir Joseph Pope, Ottawa; Dr. Otto Klotz, Ottawa; Dr. W. M. Wunder, Toronto; and Past-Presidents, Andrew Elvins, John A. Paterson, R. F. Stupart, Professor C. A. Chant, W. Balfour Musson, Professor A. T. De Lury, Professor Louis B. Stewart; and the presiding officer of each Centre as follows: F. A. McDiarmid, W. A. Logan, Wm. Bruce, James Duff, Professor W. H. Day and A. W. McCurdy.

EXTRACTS FROM THE REPORT OF DR. R. E. DE LURY, SECRETARY OF THE OTTAWA CENTRE:

Evening Meetings, Spring Term:

"The Work of the Dominion Observatory," (Two Lectures), Dr. W. F. King.
"How Knowledge Grows," (Second Lecture) Dr. J. C. Glashan.
"Radio-Telegraphy," C. P. Edwards.

Evening Meetings, Fall Term:

"The New Six-Foot Reflecting Telescope," Dr. J. S. Plaskett.
"The Constitution of the Atom," Dr. J. C. McLennan.

Afternoon Meetings, Spring Term:

"The Atlanta Meeting of the A.A.A.S.," Dr. Otto Klotz.
"Review of Current Progress in Astronomy" (consisting of "Terrestrial Magnetism," C. A. French; "Some Stellar Problems," Dr. R. K. Young; "Photometric Work and Comets," R. M. Motherwell; "Stellar Spectroscopy," T. H. Parker; "Solar Magnetism and Convection," Dr. R. E. De Lury.)
"Electricity and its Application to Telegraphy," W. A. Dier.
"Atmospheric Conditions Suitable for the Large Reflector," W. E. Harper.

Afternoon Meetings, Fall Term:

"The Evanston Meeting of the American Astronomical Society," Dr. J. S. Plaskett.
"The Geodetic Problem," W. M. Tobey.
"The New Photographic Telescope," R. M. Motherwell.

Besides these regular meetings, an At-Home was held on January 29th; a special meeting on March 20th, to take advantage of the presence in the city of Dr. J. A. Brashear, who gave a talk on "Reminiscences of S. P. Langley;" and the Annual Meeting was held on December 17th.

The following Officers were elected for 1915:
President—F. A. McDiarmid.
Vice-President—J. J. McArthur.

Secretary—Dr. R. E. DeLury.

Treasurer—D. B. Nugent.

Councillors—R. M. Motherwell, W. M. Tobey, Dr. R. K. Young; and Past-Presidents, Dr. W. F. King, Dr. Otto Klotz, Dr. J. S. Plaskett and R. M. Stewart.

Mr. T. H. Wingham, Secretary of the Hamilton Centre, reported as follows:—

During the session seven lectures were held as follows:

December 12, 1913—"Wonders of the Heavens," Wm. Bruce.

January 23, 1914—"Astronomical Phenomena, 1914," Dr. C. A. Chant.

February 13—"Cosmogony," A. A. Hibner.

March 13—"Problems of the Sun," Dr. Marsh.

April 10—"How I Sculptured the Moon," H. B. Collier.

May 22—"Horrocks," Dr. A. D. Watson.

November 19—"Wonders of the Heavens" (Second Lecture), W. Bruce

The three-inch telescope is in the hands of one of the members who reports a considerable interest aroused in his neighbourhood.

The Annual Meeting of the Centre was held December 17, 1914. The Officers were all re-elected to serve for 1915:

President—Wm. Bruce.

First Vice-President—W. A. Robinson.

Second Vice-President—Rev. J. J. Morton.

Third Vice-President—Edgar Scholes.

Secretary—T. H. Wingham.

Treasurer—Seneca Jones.

Council—Miss I. M. Walker, J. F. Harper, Mrs. J. F. Harper, J. J. Evel, J. M. Williams.

Mr. J. T. Luton, Secretary of the Guelph Centre, reported the following Officers for 1915:

Honorary-President—Mr. H. Westoby.

Honorary Vice-President—Mr. James Davison.

President—Professor W. H. Day.

First Vice-President—Dr. H. G. Roberts.

Second Vice-President—Mr. H. G. B. Leadlay.

Secretary-Treasurer—Mr. R. R. Graham.

Recorder—Mr J. T. Luton.

Council—Mrs. J. J. Drew, Miss M. Mills, Messrs. McNiece, Luton, Graesser, Asbury, Col. D. McCrae, and Ald. H. Mahoney.

Mr. T. C. Elliott, Secretary of the Peterborough Centre, reported as Officers for 1915:

President—W. A. Logan.

Vice-President—C. Fessenden.

Secretary-Treasurer—S. J. Keyes.

Council—W. I. Chisholm, H. O. Fisk, T. C. Elliott, D. Walker, D. Easson, H. Carveth.

Extracts from the Report of C. E. Bastin, Secretary of the Winnipeg Centre:

During the year eleven meetings were held as follow:

January 14, 1914—"Observations with a Reflecting Telescope, 1913," H. W. Malpass.
January 28—"The Spectroscope and the Spectro-heliograph," Professor N. B. McLean.
February 11—"The Sun," Professor L. A. H. Warren.
February 25—Meeting not held.
March 11—Observation Meeting.
March 25—"Celestial Distances," F. Powell.
April 8—"Jupiter," J. H. Kolb.
October 21—"Some Physical Features of the Moon," C. E. Bastin.
November 11—"The Measuring of Time," Dr. H. R. Kingston.
November 25—Annual Meeting, Conclusion of Dr. Kingston's address.
December 9—"Double Stars," Professor L. A. H. Warren.

Officers for 1915:

President—C. E. Bastin.

Vice-President—J. H. Kolb.

Secretary-Treasurer—Dr. H. R. Kingston.

Council—Rev. Father Blain, Professor N. B. McLean, Professor L. A. H. Warren, F. Powell.

Mr. A. J. Pyke, Secretary of the Regina Centre reported the Officers for 1915 as follow:

Honorary President—Dr. R. A. Wilson.

Honorary Vice-President—N. MacMurchy.

President—James Duff.

Vice-President—W. G. Scrimgeour.

Secretary Treasurer—A. J. Pyke.

Auditor—J. E. Campbell.

Council—W. Trant, H. S. McClung, E. Murray, Miss E. D. Cathro.

During the year three meetings of the Society were held, at one of which Dr. J. L. Hogg, of the University of Saskatchewan, addressed the members.

Extracts from the Report of E. H. Cotterell, Secretary of the Victoria Centre.

During the nine months that this Centre has operated six meetings have been held:

"Some of the Advantages to be derived from the Study of Astronomy," F. Napier Denison.
"The Evolution of the Idea of Astronomy," (Illustrated), E. H. Cotterell.
"Astronomy as applied to Cartography," (Illustrated), G. G. Aitken.
"A Study of the Moon," outdoor meeting at the Meteorological Observatory.
"Original Researches on Pendulum Movements," Napier Denison.
"The New 72-inch Reflector Telescope," A. W. McCurdy.
The Annual Meeting.

In July the Centre held a picnic at the New Observatory site Dr. W. F. King and Dr. J. S. Plaskett being present.

Officers for 1915.

Honorary President—Dr. Young, Minister of Education.

President—A. W. McCurdy.

Vice-President—E. H. Cotterell.

Honorary Secretary-Treasurer—Dr. L. T. Houghton.

Council—G. G. Aitken, W. S. Drewry, J. W. Lethaby, F. C. Swannell, J. E. Unbach, G, Gray Donald, Augustine Symonds.

IX.—Report of The Women's Canadian Historical Society of Toronto.

By Miss Helen Merrill, Delegate.

Since last reported this Society has had 8 regular and 9 executive meetings and has added 23 new members to its number. We published this year Transaction No. 13, which includes 3 most interesting papers:—

Recollections of the War of 1812, by the Hon. Jas. Crooks.

Biography of Extracts from late Capt Wright, by C. J. Nisbit and C. M. Gardiner.

Memoirs of Capt. Richard Emeric Vidal, R.N., Vice Admiral Alex. Thos. Emeric Vidal, R. N., Pioneers of Upper Canada.

The attendance at the meetings has been good though we began our year's wotk with the resignation of our able President, Mrs. Forsyth Grant, who was presented with a silver stamp box filled with gold as a mark of our love and appreciation. Miss Fitz-Gibbon was unanimously elected President whose interest in this Society since its organization in 1895 has been unflagging.

The papers have been as follows:—

Oct. England at outbreak of the War. By Miss Fitz-Gibbon.
Nov. Annual meeting and election of officers.
Jan. Causes leading up to present War. By Prof. Mavor of Toronto University.
Feb. Diary of Dr. Gibson who travelled through Toronto, 1858. By Mrs. J. B. Tyrrell.
Mar. Domestic Problems in Olden Days. By Miss Emily Weaver.
Apr. Letters read by Mr. Robt. Stark from his daughter now in Austria.

The most active Committee has been the Red Cross Committee, which organized a few weeks after the declaration of the War. Members of the Society have sent contributions to the amount of 800 articles, chiefly sheets, and $260 in money.

Through the death on May 17th of our founder and President and most active and enthusiastic worker in all things patriotic, past and present, we have suffered a loss, the greatness of which we cannot now realize. Without her enthusiastic presence one cannot imagine what our Historical Society will be like. However, we must only hope that the members will put more zeal in their work and so carry out the wishes of Miss Fitz-Gibbon.

All of which is respectfully submitted,

Luella Corley,
Hon. Corres. Secty.

X.—Annual Report of the United Empire Loyalists' Association of Canada.

Presented by Lt.-Col. Fred W. Macqueen, President and Delegate.

The past year has been an exceptional one for this Association, particularly in activity along various lines. Five regular meetings were held, and on June 24, 1914, Frank H. Keefer, Esq., K.C., Thorold, Ont., assisted by Miss Helen Merrill, arranged a Centennial Celebration at Beaverdams, in which the United Empire Loyalists took part, and which was attended by the Militia consisting of 5,000 troops then in Camp at Niagara, and by many persons from Thorold and neighbouring towns. The picturesque homestead of the Keefer family, built by their U. E. Loyalist ancestor, was visited, and a Memorial Window to Mr. Keefer's father, George Keefer, was unveiled in the Anglican church, by Colonel Ryerson, President of the U. E. Loyalists' Association, Toronto, who gave the following impressive address:—

"I esteem it a great privilege and an honour to be permitted to unveil this window as a memorial to George Keefer, United Empire Loyalist, first churchwarden of this church and one of the first citizens of this town. George Keefer was a true patriot, a gentleman, a man of honour and a worthy representative of his race. This memorial will assist in preserving the memory of this good man, his sacrifices for the unity of the Empire and his services to the community in which he lived. Joseph Howe well said: 'He must be a sluggish soul who can look without emotion on the quiet graves of the early settlers of this country, who can tread among their mouldering graves without a thought of their privations and their toils, who looking out upon the rural loveliness, the fruitfulness and peace by which he is surrounded, does not drop a tear to the memories of the dead who won, by the stoutness of their hearts and the sweat of their brows, the blessings their children have only to enjoy and to cherish. They plunged into the forest, not as we do now for a summer day's ramble, but to win a home from the ruggedness of uncultivated nature.'

"It is also befitting that on this historic ground we should recognise the blessings of Divine Providence in securing to us the blessing of civil and religious liberty. This whole frontier has been consecrated to British liberty by the sacrifices of our forefathers, by the blood which they shed and the hardships which they endured for the maintenance of British supremacy in this country.

"May we, while contrasting the present with the past, never forget the debt of gratitude we owe to the pioneers, may we ever feel our spirits awakened by the recollections of their lives, our thoughts ennobled by the remembrance of their trials and our holiest and best resolves strengthened with a portion of their strength. Reverently let us mention their names. Let us seek to be worthy sons of such heroic sires. May their mantles fall on us and may we live up to the privilege and obligation which they have entailed upon us by their strenuous toil, their brave endurance and their steadfast loyalty."

During the military manœuvres at the monument at Beaverdams, photographs were taken of descendants of several prominent Loyalists who fought there in 1812-1814, including Colonel Ryerson, Miss Laura Ryerson, Mr. Allen W. Johnson, Miss Marjorie Fitz-Gibbon and Rev. Canon Arthur Jarvis. The Mayor of Thorold, Mr. Keefer, Colonel Ryerson and others made appropriate speeches, and a remarkable address was read by Mr. Hilton Hill, Warrior of the Six Nations Indians, who were well represented in the grand Centennial gathering and who, at the close of the programme, adopted Colonel Ryerson as a Chief into one of their tribes.

At the Centennial Celebration at Lundy's Lane on the 25th July, the U. E. Loyalists placed a wreath on the grave of John Burch, U. E., the first person buried there. The most impressive number on the programme, and that which won closest attention from the vast audience gathered in the historic burying-ground, was Lt.-Col. Macqueen's fine reading of Duncan Campbell Scott's "Lundy's Lane."

When, a few days later, war was declared between Great Britain and Germany, the U. E. L. Association empowered its Ladies' Committee to add to its numbers to collect money and materials to be applied to the sick and wounded in the war in the Canadian contingent through the Canadian Red Cross Society. As a result, 250 fully equipped hospital kit-bags valued at $6 each have been provided the Canadian Expeditionary Forces, including 25 contributed by Mrs. Harshaw, Regent of the U. E. L. Chapter of the Daughters of the Empire, Napanee. Five hundred pairs of woollen wristlets also were collected and distributed at Valcartier. In connection with this work a most successful bridge was arranged by Mrs. George A. Shaw, and a concert by Mrs. Rena Chadwick. Following the disastrous march of the German army into Belgium, Miss Evelyn Johnson, New York, sister of Pauline Johnson, the Indian Poet, wrote to Miss Merrill suggesting that the U. E. Loyalists should be the first to render assistance to the Belgians, and earnestly advising that Madame Lalla Vandervelde, wife of the Belgian Minister of State, then on her way to America, to lecture on behalf of Belgian repatriation, be invited to speak in Toronto. Under the auspices of the United Empire Loyalists the Belgian Relief Committee was formed, which included representatives from leading organisations in Toronto, and which arranged for a lecture in Massey Hall, by Madame Vandervelde, October 17, the proceeds amounting to more than $5,000 to be applied to Belgian repatriation at the close of the war. This Committee has continued operative and more than $9,000 has been collected for Belgian immediate relief.

At the annual meeting in January last, on the retirement of Colonel Ryerson from the presidency on account of being obliged as National President of the Canadian Red Cross Society to inspect the branches in Europe, an Address and a gold badge of the U. E. Loyalists' Association were presented him in recognition of distinguished service rendered the Association.

In Massey Hall in February, Lt.-Colonel F. W. Macqueen, who had succeeded Colonel Ryerson as President, by acclamation, delivered one of his brilliant, patriotic and historical lectures on Canada.

On account of the war it was decided not to hold the annual luncheon this year on May 18, in celebration of the landing of the loyalists at St. John, N.B., in 1783.

During the year the membership roll was increased by several new members and the following Addresses and historical Papers given:—

November 12, 1914.—An Address on the European War, by Colonel Ryerson.

December 10.—"The Origin of the Highland Regiments in the British Army," by Mr. C. E. Macdonald.

December 17.—An illustrated lecture on Belgium, by W. S. Herrington, K.C., Napanee.

March 11.—An Address on the European War, by Lt.-Colonel Macqueen.

April 8.—An Address on India and the Hindus, by Dr. Sundar Singh.

OFFICERS, CENTRAL COUNCIL AND COMMITTEES FOR 1915.

Past President—Colonel G. Sterling Ryerson.

President—Lt.-Colonel Fred W. Macqueen.

Vice-Presidents—C. E. Macdonald, F. O. Loft, E. B. L. Hill, Col. Hugh H. McLean, M.P., Mrs. Dignam.

Honorary General Secretary—Miss Helen M. Merrill.

Honorary Treasurer—E. A. MacLaurin.

Honorary Legal Adviser—W. B. Raymond, K.C.

Honorary Genealogist—E. M. Chadwick, K.C.

Honorary Chaplain—Rev. Canon A. W. Macnab.

Standard Bearer—Miss Laura Ryerson.

Central Council—Rev. Canon Alfred Brown, Halifax; George H. Ham, Montreal; Col. A. H. Macdonald, Guelph; Sir John Beverley Robinson, Edgewood, N.Y.; Lt.-Col. J. J. Gregory, Lacombe, Alberta; Mrs. J. J. Gemmel, Ottawa; Albert J. Hill, New Westminster; Lt.-Col. R. W. Gregory, St. Catharines; H. S. Seaman, Winnipeg; W. S. Herrington, K.C., Napanee; Mrs. J. Bryce Saunders, Edmonton; Lt.-Col. W. Hamilton Merritt; L. V. Chipman, Annapolis Royal, N.S.; Hugh Munro, M.P.P., Alexandria.

The following ten members of Council with the Officers form the Executive Committee—Major W. N. Keefer, Allan W. Johnson, A. T. Bowlby, Rev. Canon Jarvis, A. R. Davis, Lt.-Col. A. E. Belcher, Lt.-Col. G. A. Shaw, Mrs. Norman Allen, Mrs. R. Stearns Hicks, Mrs. Edmund Phillips.

Investigating Committee—Lt.-Colonel Macqueen, Miss Helen Merrill, Mr. E. A. MacLaurin.

Publishing Committee—The President, the Secretary, the Treasurer.

Ladies' Committee—Mrs. R. A. Pyne, Mrs. G. A. Shaw, Mrs. A. S. Foster, Mrs. Forsyth Grant, Miss Laura Clarke, Miss Dickson, Mrs. Hamilton Burns, Mrs. Brereton, Miss Kate Beemer, Mrs. Hirschfelder, Mrs. R. W. Hicks, Mrs. Allen Johnson.

XI.—Report of the Huron Institute.

Presented by David Williams, Secretary.

To review the past twelve months in the work of the Huron Institute without a reference to the continental war across the sea, would leave this report incomplete. Obviously the Institute has been, in common with almost everything else, seriously affected, attention having been diverted from the work it has been customary for it to do, to the greater things of the Empire. Collingwood people have, since the outbreak of hostilities, been earnestly and actively engaged in providing for the brave and noble sons who are on the firing line. During the fall and winter a series of lectures on the war was conducted, while other patriotic gatherings were held from time to time, the subject of these being of such paramount importance as to overshadow aught else, thus leaving no place wherein our Institute might appear by the way of public meetings. Instead of writing and reading history, the people were making history.

Because of the crowding out, as it were, this Institute has no word of disapproval; but instead adds its pean of praise to those who have with such unanimity united to render a national service. With the Institute, however, the past year has not been lost. Since the last annual meeting considerable work has been done that is of value. Probably the outstanding accomplishment is the publication of Volume II, Papers and Records. This is a book of one hundred and seventy pages, and is in a large sense an "Old Boys' " volume. containing as it does over 300 pictures of Collingwood's sons, scattered the world over. Each picture is accompanied by a brief sketch, thus recording through these autobiographies much of the early history of Collingwood. The volume also contains several papers dealing directly with the origin and progress of Collingwood, and incidentally sone reference to the settlement of the Township of Nottawasaga, of which the present site of this town was originally a part. It is not a publication of the subscription variety, no charge whatsoever being made upon those whose pictures appear in its pages, and it is gratifying to be in a position to report that already despite the depression that prevails, about one half of the edition has already been disposed of.

Our museum has not been neglected, and during the year many additions have been recorded. The "Old Boys'" gallery has been added to, and has now upwards of seventy-five framed pictures, while our collection of models of lake steamers, some of the originals of which have long since passed from the marine register, has also been increased in number. Maps, photographs of the town, some quite rare pictures of value, including the Fathers of Confederation, and Ontario's first parliament, and many documents have been contributed, all adding to the interest and historical worth of the Institute's collection.

During the year the Institute was frequently visited by residents of the town and by many visitors from outside points. The customary annual grant was received from the Provincial Government, and in this connection we record our appreciation of the interest in our work by the Hon. R. A. Pyne, Minister of Education and the Hon. J. S. Duff, Minister of Agriculture.

The Institute was represented last year at the Annual Meeting of the Ontario Historical Society, and also at the celebration of the 100th Anniversary of the Battle of Lundy's Lane. Reports were submitted to the Ontario Education Department, the Ontario Historical Society, The Royal Society and the American Historical Society in accordance with the requirement and wishes of the different organizations.

In conclusion, it is highly satisfactory to be in a position to submit a report showing the Institute, after the large expenditure of the past year, to have all indebtedness cleared off, and a balance, though small, to its credit.

Collingwood, May 18, 1915.

XII.—Historic Landmarks Association.

By Mrs. J. B. Simpson, General Secretary.

The Historic Landmarks Association seems to have been launched in the reflected glory of the Battlefields of the Plains of Abraham and the Tercentenary of Quebec. Our aim is to spread it across the Continent, asking from the whole Dominion all that is worthy of record and permanent preservation as national heirlooms—that will tell the story to generations yet to come—"lest we forget."

Though working under the shadow of this awful war, a genuine response has come from Halifax to Victoria—let us mark and preserve the places in Canada where deeds worthy of record were performed, from the country's earliest days.

This Association desires to gather from all parts of the Dominion of Canada, all the knowledge available regarding each site or case it is proposed to mark—obtain verification of the same from documents in the Dominion Archives and other reliable sources, submit reports from each province to the Council, which will then consider the merits of each application and, when desired, recommend to the Government for approval.

Dividing our correspondence according to Provinces, we can only lightly touch on places, reporting progress as we further go.

Nova Scotia.

From Halifax, N.S., Mr. W. C. Milner (who succeeded Prof. Ganong) writes:—"For two years I have been giving special attention to placing monuments over historic sites in the ancient Province of Acadia," and asks for information as to the aims and scope of the Historic Landmarks Association.

We might note here that the "Memorial Tower" of Halifax, erected to commemorate the First Parliament of Nova Scotia, or of what was then Canada, initiated by the Canadian Club of that city, was carried to a successful national completion through the efforts of our distinguished veteran citizen, Sir Sandford Fleming, who has contributed valuable data for our Directory of Historic Sites. Beckles Willson, the well known writer and landmarker too, for he has established himself in the Homestead of Judge Haliburton ("Sam Slick, the Clockmaker"), at Windsor—where he says:—"I am in full sympathy with the objects of your Association. Our Canadian landmarks have too frequently been treated by our progressive people almost as effectually as the Belgian landmarks were treated by the Germans."

Cape Breton Island.

On Cape Breton Island, the historic ground of Louisbourg with its two sieges in 1745 and 58, once known from its splendid fortress as the "Dunkirk of America"—should be preserved—and is now we understand on the list of the Dominion Parks Commissioner, Mr. J. B. Harkin.

Prince Edward Island.

Premier J. A. Mathieson, of Prince Edward Island writes:—"While appreciating very fully the value of the work which your Association has undertaken I regret I cannot recommend any action until the war is over."

It was at Charlottetown, last fall, that the fiftieth anniversary of the inception of Confederation was appropriately marked by a Memorial Bronze Tablet inscribed:—

"In the hearts and in the minds of the Delegates who assembled in this room, on Sept. 1st, 1864, was born 'The Dominion of Canada.'

"Providence being their guide they builded better than they knew.

"This tablet is erected on the occasion of the fiftieth anniversary of the event."

New Brunswick.

Among correspondence from New Brunswick, E. C. Durnford, Esq., Sackville, enters a plea for the preservation of the old U. E. Loyalist Burying Ground of that place. And the Ven. Archdeacon Raymond, of St. John, contributes a valuable list of memorial landmarks for our Directory of Historic Sites, also mentioning, among others in contemplation, one "to perpetuate the fame of the Loyalists who founded the City of St. John on the 18th May, 1786."

Quebec.

In Quebec city so full of historical sites, the Wolfe Memorial Church, the latest projected landmark, is in abeyance, the prime mover, Rev. Canon Scott with his son, having answered the call to the front.

In Montreal, rich in historic memories, all important sites have been marked with tablets by the well known "Antiquarian Society."

On the 23rd April this year, (St. George's Day) the Officers of the "Historic Landmarks Association," conjointly with the officers of the "Antiquarian Society," received Field Marshal H.R.H. the Duke of Connaught, Governor General of Canada, who accompanied by his staff, and a guard of honour from the 42nd Highlanders, formally unveiled the new Memorial tablet just inserted on the monument of Lieut. General Sir Benjamin D'Urban, once Commander of the Forces in Canada; and after whom the city of Durban, S.A., is named. General D'Urban was the man who brought about the erection at Quebec of the present monument to General Wolfe. The address to His Royal Highness was presented by Mr. W. D. Lighthall, F.R.S.C., our Vice-President at Montreal.

This monument in the "old Military burying ground" on Papineau Avenue was completely defaced by vandals about two years ago; and was replaced by the personal efforts and generosity of Mr. W. H. Leach, of Montreal, also one of our members.

Ontario.

The Ontario Historical Society, with its 41 affiliated local ones, wishes us "every success." Their Historic Sites and Monuments Committee so ably convened by the President, Mr. Clarence Warner, has done splendid work. A special plea is made for a memorial Park on the Battlefield site of Beaverdams, on which Mr. Frank Keefer, K.C., of Thorold, has written an interesting brochure. He has received the endorsation of the Ontario Historical Society, the United Empire Loyalists, our Historic Landmarks Association and from the Dominion Parks Commissioner who we have every reason to believe will, in the near future, include it in his growing list of National Historic Parks.

Among the 1000 Islands, our attention has been called to the "Chimney Island" above Brockville, by Sir Clifford Sifton who writes: "It is extremely necessary to do something to mark this Island" and suggesting—it would be an excellent idea if this Island were included in the Dominion Parks group and a small landing place and pavilion erected upon it"—adding "if the above suggestion is adopted it would be desirable to have some kind of a stone tablet firmly planted with a short inscription upon it."

In our Capital city, a monument has been erected to Champlain on Nepean Point, on the spot where he stood, astrolabe in hand, taking his last observation.

A. J. Russell's brochure on "Champlain's Astrolabe," from which the sculptor, Hamilton McCarthy took his model, has a map of part of the County of North Renfrew, shewing the exact spot where lost in June of 1613, and found in August of 1867. The inauguration of this site took place last June when the President of the Women's Canadian Historical Society, the late Mrs. Thomas Ahearn, turned the first sod for the foundation stone.

On Major Hill Park our Association has succeeded in marking the site of the house occupied by Lieut. Col. John By, R.E., builder of the Rideau Canal, 1826-32, and founder of Bytown, Ottawa, our Federal Capital. The two historic stones, one bearing the coat of arms of the Royal British Engineers, the other "Lieut. Colonel J. By, Comm. Royal Eng.," that were removed from the arch of the Old Sappers and Miners Bridge, when it was demolished on construction of the present "Connaught Place," have been placed on the site, and a bronze tablet inserted.

An interesting monument, up the Ottawa river at Portage du Fort, has been preserved, which bears the following inscription:—"To commemorate the visit of Lady Head, who made the tour of the Upper Ottawa in a bark canoe, in 1856." (first white woman).

Following the Ottawa and French rivers to Champlain's "Mer Douce," and crossing Lake Superior we come to the Twin Cities of Port Arthur and Fort William in the latter, the gateway to the North-West, the Thunder Bay Historical Society is erecting a national monument of polished red granite:—"To Commemorate the Locality made famous by the Pioneer Fur Traders of the Great North-West," and giving a concise history of the Companies (some 2,000 letters) from 1612 to 1889. Mr. Peter McKellar, President of the Thunder Bay Historical society writes:—"We claim that the Kaministigwia was the gateway through which the vast North-West was discovered. Therefore Fort William, (Fort Caministigoyan built 1648) on the Kaministigwia is the most suitable place for the monument to the great fur traders."

Manitoba.

Among correspondents from Winnipeg (old Fort Garry) we number a grandson of the first Governor and builder of the Upper and Lower Forts. The brass memorial tablet on Fort Garry gate, presented by the Canadian Club of Winnipeg, bears an interesting historical record, from erection in 1806 of first fort, Gibraltar—second in 1822, re-named Fort Garry; re-built 1835—demolished in 1882, except the gateway which in 1897, with the park, was presented by the Hudson's Bay Company to the city of Winnipeg. To the heroic Hudson, from whom the Company derived its name—Isaac Cowie writes:—"the united West should erect her first monument in bronze or sculptured stone." Might this not be fitly commemorated when our Hudson's Bay railway—"opens the Bay," that, "where *he* went a thousand ships can go."

Alberta.

From the University of Alberta, Edmonton, and Mrs. Arthur Murphy ("Janey Canuck"), we received appreciative letters,—the latter is anxious to "secure the preservation of the Hudson's Bay Fort at Edmonton, which is rapidly falling into ruins"; also drawing attention "to a blockhouse built by the 65th Regiment of Montreal at Millet, Alta., time of the Riel rebellion."

British Columbia.

Charles Mair, western pioneer and poet, writing from Fort Steele, B.C.:—"With so many calls for Canadian and Imperial patriotic purposes...decides,—this is a patriotic association which calls for every Canadian's support. I may be able to indicate hereafter one or two points of interest in this valley, sites knit to primitive history."

Miss Agnes C. Laut, author of "The Pathfinders" and "Conquest of the Great North West," is a valuable ally, for she says—"You have my interest indeed in the good cause you are forwarding...tell me exactly what I can do for you...the West is woefully destitute in pride of age and place, and the places worthy of memory are legion."

From Vancouver, Miss Isabel A. R. McLean, evinces great interest in the "valuable work" of our Association which, "when the stress of war is over, will find heartier response." Drawing attention ..."While on a trip through Columbia Valley last summer, the site was pointed out of David Thompson's fur-trading post overlooking Windermere Lake, the stones where he built his fireplace still there and corners of his stoutly built log house—one of Canada's greatest map makers, and first to journey to the mouth of the Columbia river—thought then some Society should mark the spot." (It is now on our list.)

Mr. E. O. S. Scholefield, the Provincial Librarian at Victoria, in his application for membership asks if he is eligible, not being a member of The Royal Society—adding—"As far as British Columbia is concerned, there is a great deal to do with regard to the preservation of the sites of historic scenes and spots."

Sufficient has been quoted to shew awakened interest, intelligent grasp and something definite done; but this is only, as it were, the first leaf turned, in volumes yet to come.

We have taken you across the continent from Halifax to Vancouver, where in Stanley Park from that three-cornered piece of land (now fenced off) on Siwash Rock, the ashes of our Indian Princess poet were, (in fulfilment of her request) thrown to the waters.

And where—the first to emerge triumphant over every danger and distress on the shore of the vast Pacific, at the entrance to Vancouver's Cascade Canal,—his tablet the rock, materials at hand vermilion and grease, explorer, discoverer and artist in one (no requisitions required) took his observation and inscribed:—"Alexander Mackenzie, from Canada by Land, the twenty second of July, one thousand seven hundred and ninety-three." Our first Landmarker recorded!

Let us work with the same energy and enthusiasm, believing that our beloved Canada does need the exalting touch of every landmark that bears a living message, and that she can keep, either in substance or in souvenir.

XIII.—Rapport du Club Littéraire Canadien Français d'Ottawa.

Par M. Auguste Lemieux. Président.

Le Club Littéraire Canadien Français d'Ottawa, a l'honneur de vous présenter le compte-rendu de ses études au cours de l'année académique 1914-1915.

Notre programme comprenait deux parties:

I. 10 conférences littéraires.

II. 10 conférences philosophiques.

Première partie. (Littérature).

Les séances littéraires ont eu lieu comme toujours, le dimanche de quatre à cinq heures, P.M. Voici les sujets traités:

		1914
1.	Homère	22 novembre.
2.	Virgile	29 "
3.	Démosthène	6 décembre
4.	Cicéron	13 "
5.	Sophocle	20 "
		1915
6.	Shakespeare	17 janvier.
7.	Hugo	24 "
8.	Rousseau	31 "
9.	Racine	7 février
10.	Bossuet	14 "

Seconde partie. (Philosophie).

		1914
1.	a. L'unité de la morale dans l'antiquité....	1 décembre.
	b. Brisée par la philosophie..............	
	c. Refaite par le Christ..................	
2.	Nouvelle rupture de cette unité par les systèmes modernes..................	8 "
3.	Identité de ces systèmes avec les systèmes anciens...........................	15 "
4.	Il faut revenir à la morale traditionnelle. Dieu.............................	22 "
		1915
5.	La conscience..........................	10 janvier.
6.	La liberté.............................	26 "
7.	L'obligation, le devoir................	2 février.
8.	La responsabilité, la sanction.........	9 "
9.	a. Les sanctions terrestres...............	
	b. Les sanctions d'outre-tombe...........	16 "
10.	La morale évangélique.................	23 "

Le public studieux de la Capitale se montre très empressé à nos réunions.

Nous atteignons aussi, dans la mesure permise, le but que nous nous sommes toujours proposé: exciter, parmi les Canadiens, le goût des choses de l'esprit, l'amour du beau, du vrai, du bien.

XIV.—Rapport de la Société d'Archéologie et de Numismatique de Montréal.

A LA SOCIÉTÉ ROYALE DU CANADA, POUR L'ANNEE 1914-1915.

Présenté par VICTOR MORIN, LL.D., Délégué.

Depuis le rapport que j'avais l'honneur de présenter à cette Société l'an dernier, au nom de la Société d'Archéologie et de Numismatique de Montréal, les perturbations causées dans le monde entier par la guerre la plus terrible dont l'histoire fasse mention, ont eu leur répercussion dans toutes les sphères où s'exerce l'activité humaine.

Notre Société n'a pas été exemptes de ces préoccupations, bien que le caractère pacifique de ses études semblerait devoir la mettre à l'abri des soucis diplomatiques.

Elle s'est émue surtout des actes de vandalisme qui n'ont pas respecté des monuments qui faisaient l'orgueil de tout un peuple, et justement indignée, au lendemain de la destruction de la bibliothèque de Louvain et du bombardement de la cathédrale de Reims, elle protestait, le 18 décembre dernier, par la délibération suivante à laquelle elle invitait toutes les sociétés-soeurs à se joindre:

"La Société d'Archéologie et de Numismatique de Montréal réprouve, avec toute l'énergie dont elle est capable, les procédés indignes dont l'armée allemande s'est servi dans la présente guerre; les rigueurs injustifiables exercées sur des êtres inoffensifs, les ravages non motivés de la propriété publique et privée, la destruction systématique des monuments, des oeuvres d'art et des bibliothèques sont indignes d'une nation civilisée. Notre société déplore la perte irréparable des trésors de l'Université de Louvain, des merveilles de la cathédrale de Reims, et des autres oeuvres admirables produites en France et en Belgique par le génie humain dans le cours des siècles et anéanties par la barbarie allemande en un instant. Elle stigmatise l'hypocrisie et l'outrecuidance d'une nation qui ose se décerner des certificats de "kultur" en face de semblables atrocités, et elle invite les sociétés-soeurs, qui conservent pieusement le culte de ces manifestations du génie de l'homme à travers les âges, à s'unir dans une énergique protestation."

Nos relations avec les sociétés scientifiques se sont ralenties par suite de ces événements, et notre liste d'échange avec les sociétés-soeurs est tombée de 523 qu'elle était en 1913 à 337 en 1914, les diminutions s'accusant principalement chez les sociétés dont le siège se trouve en pays ennemi.

Notre Revue.

Forts cependant de l'énergique axiome "business as usual" que l'Angleterre a lancé d'un bout à l'autre de son empire comme une note de clairon, nous avons continué la publication de notre Revue trimestrielle "Canadian Antiquarian & Numismatic Journal" en dépit de circonstances adverses.

Les membres et les amis de notre Société, qui ont alimenté les colonnes de cette Revue par le passé, ont contribué au cours de l'année les articles suivants:

E.-Z. Massicotte: "Le Combat de la Rivière des Prairies en 1690" —"La Population de Montréal en 1673"—Fondation d'une Communauté de Frères Instituteurs à Montréal en 1686"—"La Bourse de Montréal sous le Régime Français"—"Les Registres de l'Etat Civil des Eglises Protestantes de Montréal."

W. D. Lighthall: "The Manor House of Lacolle."

R. W. McLachlan: "The Original Settlement of the Township of Brompton"—"A New Study of the Coins vexator canadiensis"—"Protestant Church Registers of Civil Status of Montreal."

P.-O. Tremblay: "Décorations Pontificales."

O.-M.-H. Lapalice: "Registre du Fort de la Presque-Isle"—"L'Esclavage Nègre au Canada."

Montarville de la Bruère: "Correspondance de LaFontaine en 1837 et 38."

Benjamin Sulte: "Samuel Champlain."

Victor Morin: "Notes d'archéologie et de numismatique, et revue des événements courants publiées dans chaque numéro sous le titre de "Memoranda."

Séances de la Société.

La Société a tenu les neuf séances mensuelles de son année académique, au cours desquelles des travaux littéraires, archéologiques et historiques ont été présentés, et des exhibitions d'objets intéressants ont été faites par les membres de la Société.

En outre des études publiées par notre Revue et énumérées ci-dessus, nous avons reçu, au cours de ces séances, des travaux de la part de Monsieur P. J. L'Heureux sur "Les Origines de l'administration municipale de Montréal," et de la part du Rev. O. M. Smith sur "La Tragédie de Henri VIII," et "La Fondation de Québec."

Acquisitions.

En dépit des circonstances adverses, nous avons reçu des dons précieux au cours de la présente année: 295 volumes, brochures et documents ont été ajoutés à notre bibliothèque, en outre des revues des sociétés-soeurs.

Notre galerie nationale de personnages illustres s'est augmentée de 14 portraits, au nombre desquels on en compte cinq de la famille de J.-F. Perrault, le père de l'éducation au Canada.

Nous avons en outre reçu sept objets d'archéologie canadienne, dix relatifs à d'autres pays, et quatre médailles canadiennes.

Au nombre des objets historiques, nous devons mentionner les fauteuils du premier Conseil de Ville de la Cité de Montréal qui siégeait au marché Bonsecours pour sa séance d'inauguration le 24 Janvier 1852.

Les exécuteurs testamentaires de la succession de feu H. H. Lyman, un de nos membres dévoués, nous ont présenté une riche collection de croquis et dessins d'édifices historiques, de maisons anciennes et autres pièces intéressantes du vieux Montréal et du vieux Québec, faits par feu Rosewell C. Lyman, qui ont une valeur historique et artistique inappréciable.

Nous devons également à la munificence du Dr John Finley, président de l'Université de l'Etat de New-York, la présentation d'une porte en maçonnerie du manoir de Samuel de Champlain à Brouage en France, dont les ruines ont été achetées par lui. Cette pièce historique a été reconstituée par les soins de la Société à l'intérieur du Château de Ramezay.

Organisation d'un Bureau de Syndics.

En vue de donner au public toutes garanties de stabilité pour les objets précieux confiés à nos soins, nous avons constitué, en vertu d'un Acte de la Législature de Québec, un Bureau Permanent de Syndics qui possèdent le titre légal de tous les biens de la Société, et qui sont chargés de voir à leur conservation et entretien.

Ce Bureau se compose des officiers et membres suivants: Président: W. D. Lighthall, C.R., M.S.R.C.; Vice-président: Gaspard DeSerres; Sécretaire-trésorier et Conservateur du musée et des archives; Victor Morin, LL.D.

Syndics: George Sumner, E.-P. Lachapelle, M.D., F. Cleveland Morgan, G.-N. Moncel et Charles T. Hart.

Le premier soin de ce Bureau, organisé au moins d'octobre dernier, fut d'ordonner la préparation d'un inventaire historique et raisonné de toutes les pièces et objets appartenant à la Société et qui forment le musée du Château de Ramezay; cet inventaire est actuellement en cours d'exécution, et il formera une encyclopédie d'archéologie canadienne des plus intéressantes à consulter.

Mouvement des Membres et Officiers de la Société.

La Société a admis 45 nouveaux membres par voie d'élection au cours de l'année qui vient de s'écouler.

D'un autre côté, deux de ses anciens membres se sont retirés, et quatre sont décédés.

Les officiers élus pour l'année 1915 sont les suivants:

Président—W. D. Lighthall, C.R., M.S.R.C.

Vice-présidents—Ludger Gravel, James Reid, Abbé N. Dubois, S. M. Baylis, Victor Morin, LL.D., et C.-A. de Lotbinière-Harwood, C.R.

Secrétaire-archiviste—R. W. McLachlan, M.S.R.C.
Secrétaire-correspondant—Pemberton Smith.
Trésorier—George Durnford.
Conservateur du musée—P.-O. Tremblay.
Conservateur de la bibliothèque—Montarville de la Bruère.
Membres du Conseil—E.-Z. Massicotte, J.-C.-A. Heriot, G.-N. Moncel, S. W. Ewing, A. Chaussé, R. W. Redford, O.-M. Lapalice, J.-T.-L. Ployart et Frédéric Villeneuve; nous avons le regret d'annoncer le décès de ce dernier au cours du mois d'avril.

En me nommant délégué pour la représenter auprès de la Société Royale du Canada, la Société d'Archéologie et de Numismatique de Montréal m'a fait un honneur que j'apprécie à bon droit; et au souvenir de la visite agréable dont vous nous avez honorés au Château de Ramezay à l'occasion de votre réunion annuelle de 1914, elle m'a chargé de joindre l'expression de ses voeux pour le succès de vos travaux.

OTTAWA, 26 mai, 1915.

XV.—Report of the Quebec Society for the Protection of Plants.

Presented by PROF. W. LOCHHEAD, Delegate.

This Society, although neither so old nor so large as its sister Society, the Entomological Society of Ontario, has a wider field of work, inasmuch as it includes both injurious insects and fungi—in fact anything that interferes with the growth of economic plants.

During the year that has just passed the Society published its 6th Annual Report and held its 7th Annual Meeting at Macdonald College. The 7th Annual Report is now in the hands of the printer. The membership continues to grow and is composed of both French and English speaking residents of the Province of Quebec. The Society receives a yearly grant of $250 from the provincial Department of Agriculture, which also bears the expense of printing the Annual Report in both French and English. The Society is also grateful for the helpful assistance of the Dominion Entomological Branch and the Division of Botany of the Dominion Experimental Farms at its annual meetings.

Following is a list of the papers and addresses given at the 7th Annual Meeting held in March last:

"The Web of Life" (President's address) by Prof. W. Lochhead of Macdonald College;

"Aphrophora spumaria, the Spittle Insect" by J. C. Chapais;

"Some Silent Invaders of our Fields" by Bro. Victorin, Longueuil.

"The Woolly Aphis in Quebec" by Rev. Father Leopold, La Trappe;

"The Brown Tail Moth in the Maritime Provinces" by Mr. Strickland, Ottawa;

"The Medicinal Plants of Quebec" by John Adams, Ottawa;

"Potato Diseases" by H. T. Güssow, Ottawa;

"Parasites of the Bud Moth" by E. M. DuPorte, Macdonald College;

"Cereal Rusts" by W. P. Fraser, Macdonald College;

"Some Successes and Failures in Controlling Insects" (illustrated) by Prof. C. R. Crosby, Cornell University.

Following are the Officers for the current year:

President—Prof. W. Lochhead, Macdonald College;

Vice-president—Mr. A. Dupuis, Village des Aulnaies, P.Q.

Secretary-Treas.—J. M. Swaine, Ottawa.

Curator and Librarian—Mr. P. I. Bryce, Macdonald College.

Directors—Rev. Dr. Fyles, Ottawa, Rev. Father Leopold, LaTrappe, Brother Victorin, Longueuil, A. F. Winn, Westmount, Prof. Fontanel, St. Mary's College, Montreal, G. Chagnon, Montreal, Dr. Hamilton, Macdonald College, Rev. Abbe Huard, Quebec.

XVI.—The Report of the Literary and Historical Society of Quebec.

By Dr. J. M. Harper, M.A., Ph.D., F.E.I.S., Delegate.

In the Council's last Annual Report of the Society which I represent—namely the Literary and Historical Society of Quebec, the oldest of its kind in Canada—there occurs the following sentence: "The future of the Empire and of Canada depends upon the success or failure of Great Britain and her Allies on the field of battle"; and the sentence a mere truism in itself, stands as a greeting from Quebec to The Royal Society this year, embodying, as it may, a blending of the national patriotic airs of our fair Dominion and the Motherland. Our brave lads have been taking their place on the battlefield whereon the struggle is on hand to re-establish the balance of power as a means of securing peace; and well have they played their part, well have they provided for all our Canadian literary and historical societies of Canada, and The Royal Society above all, the material from which the literary art draws its nourishment, as it plays its part in the upbuilding of nationhoods, old and new.

Our Society continues to hold its own, a wholesome interest being taken on the part of its increasing members in the various branches of its work, as is evidenced in the increasing circulation of the volumes on its library shelves, in the number of the members who frequent its reading rooms, and in the attendances at the lectures and council meetings. The new books selected as additions to the library include, under careful supervision of the Committee, the latest works on science and art—comprising volumes on history, geography, biography, and fiction. Nor is there any neglect of the output of our Canadian authorship, as is elsewhere too often the case, our large collection of *Canadiana* being steadily added to year by year. It is needless to say that on the tables of our reading rooms are to be found only the magazines and periodicals which tend to cultivate a taste for the literature that is literature.

I have represented our Society more than once; and this year as its President, I have to announce that the historical documents which I referred to in my last year's report have been published—namely "The Memoires de Chevalier Johnstone" and "The Journal of Lady Durham." The Society has in view the issue of two other historical documents this year, namely "The Diary of Lieut. Charles Grey" and "The Letters of Mrs. Alicia Cockburn."

Arrangements are in the way of being made to prepetuate the courses of public lectures in connection with the institution, the course for 1915 having been inaugurated by Professor Welsh of Montreal, who gave his highly interesting illustrated lecture on "Punch and its Cartoonists" in April last.

The Society has put on record its approval of having the American Historical Society hold its annual meeting in Canada in 1916, with our various literary and historical societies in Canada sending delegates. The Society likewise concurred in and supported the protest of the Antiquarian and Numismatic Society of Montreal against the iconoclastic conduct of the German soldiery in connection with the gross and unseemly destruction of so many precious collections of antiquarian art during their invasion of the towns and cities of Belgium. On the other hand the Council heartily approved of sending a large number of volumes as a gift to the men of the First Contingent of our own Canadian soldiery during their stay at Valcartier and when they set sail in their transports from Quebec to the Motherland and thence to the front.

The Royal Society of Canada held its last annual meeting in the city of Montreal; and should it ever again decide to hold a Convention outside of the Dominion Capital City, it might be well worth considering whether Quebec would not be a suitable place for holding it. It is at least very gratifying to all Quebecers in general and to our Society in particular, that it is a native of the city of Quebec who occupies the chair of the Royal Society of Canada this present year.

XVII.—Report of Natural History Society of Montreal

By Dr. Robert Campbell.

The following report of the proceedings of the Natural History Society of Montreal, for the past twelve months, is respectfully submitted.

Papers were presented and read at the monthly meetings of the Society as follows:

Oct. 26th, 1914: "Denver Colorado Plants." Mrs. G. P. Girdwood.

"Righthandedness". Dr. G. P. Girdwood.

Nov. 30th, 1914: "The Bedrock and the Raised Benches of Montreal." Prof. John Stansfield.

Jan. 25th, 1915: "The Geology of Mt. Royal Tunnel." Dr. J Austen Bancroft.

Feb. 22nd, 1915: "Exhibit of Canadian Grasses." Dr. R. Campbell.

March 29th, 1915: "Inside the Atom." Dr. A. S. Eve.

April 26th, 1915: "Illumination." Dr. Howard T. Barnes.

The Somerville Course of Lectures was as follows:

Thursday, February 18th, at 8 p.m.: "Science and Agriculture". J. S. Buchan, K.C., B.C.L.

Thursday, February 25th, at 8 p.m.: "The Mount Royal Tunnel." S. P. Brown, B.Sc., Chief Engineer C. N. Montreal Tunnel.

Thursday, March 4th, at 8 p.m.: "The Canadian Oyster." J. Stafford, M.A., Ph.D., Biological Staff, McGill College.

Thursday, March 11th, at 8 p.m.: "Sketch of some former Eminent Members of the Natural History Society." Rev. Robert Campbell, M.A., D.D.

Thursday, March 18th, at 8 p.m.: "The Supply of Nickel and its Uses." Alfred Stansfield, D.Sc., A.R.S.M., Professor of Metallurgy McGill College.

The Saturday Half-hour Talks to Children were on the following Topics:

Saturday, February 20th, at 3 p.m.: "The Youthful Life of the Belgians." Madame Bieler.

Saturday, February 27th, at 3 p.m.: "The Youthful Life of the French." Madame Hodgson.

Saturday, March 6th, at 3 p.m.: "The Youthful Life of the Russians." Madame Sammett.

Saturday, March 13th, at 3 p.m.: "The Youthful Life of the Germans." Dr. Maud Abbott.

Saturday, March 20th, at 3 p.m.: "The Youthful Life of the Austro-Hungarians." Rev. Robert Campbell, M.A., D.D.

Notwithstanding that the entire community was occupied, throughout the session, with the all-absorbing question of the war, there was a fair attendance at all the meetings of the Society. The Half-Hour Talks to Children, being taken up with matters cognate to the war, commanded very large audiences.

As usual, the Society has been under special obligation to members of the Scientific Staff of McGill University, both for monthly papers and lectures in the Somerville Course.

Mortality among members has been very heavy during the year. Two days after the meetings of the Royal Society, held in Montreal, in May of last year, two distinguished members of our Society found a watery grave by the sinking of the Empress steamer, Dr. A. E. Barlow, and Mr. H. H. Lyman. We lost also Dr. Wesley Mills, a former President, Prof. Bemrose, John Harper, a former Chairman of the Council, Guy Drummond a member of the Council, who so gallantly fell in the battle of Neuve Chapelle, while leading his men against the Germans, and Col. J. H. Burland, who also may be said to have given his life for his country, through his exhausting work in promoting the civil department of the war.

The Society resumed the publication of the Record of Science, two numbers being issued within the year and a third number is now in hand, which will complete Volume IX.

Besides the usual exchanges 250 volumes and 1000 pamphlets and scientific papers were donated to the Library by Mr. Leslie Craig, being part of the library of the late Thomas Craig, F.R.M.S.; and many other donations to the Library and Museum are promised, as soon as we have a suitable building in which to display them.

The question of amalgamation with the "Mechanics' Institute" has made good progress during the year and the confident expectation is cherished that it will be effected before the next report is issued.

The following are the office-bearers at present.:

Patron—His Royal Highness Duke of Connaught, K.G., The Governor-General of Canada.

President—Milton L. Mersey, M.Sc., LL.D.
Vice-Presidents—Frank D. Adams, Ph.D., F.R.S.C.
Dr. Howard T. Barnes, F.R.S.C.
J. S. Buchan, K.C., B.C.L.
Rev. Robert Campbell, M.A., D.D.
Miss Carrie M. Derick, M.A.
J. C. Holden, F.R.G.S.
J.as W. Pyke.
Major G. W. Stephens.
Miss Van Horne.
Secretary—Alfred Griffin.
Hon. Corresponding Secretary—F. W. Richards.
Hon. Treasurer—W. A. Stephenson.
Hon. Librarian—Harry Bragg, M.J.I.
Hon. Curator—Prof. Nevil Norton Evans.
Members of Council—J. A. U. Beaudry, C.E., *Chairman.*
W. Drysdale.
S. W. Ewing.
Joseph Fortier.
W. D'Oyley Hutchins.
H. Lampard.
G. S. J. Phillips.

XVIII.—Report of the New Brunswick Historical Society.

Presented by Ven. Archdeacon Raymond, F.R.S.C., delegate.

This Society has now completed thirty years of active work. From time to time it has assisted in the fitting commemoration of notable anniversaries in the history of the maritime provinces. In nearly every instance the movement has originated with our Society.

Among the anniversaries so observed have been the following:—The commemoration of the hundredth anniversary of the landing of the Loyalists at St. John in 1883. The centennial of the erection of the first church in St. John in 1790. The tercentenary of the founding of the first known European settlement in New Brunswick on Caton's Island and the holding during the autumn of the same year of the first recorded religious service for Europeans by Father Biard held on this island in October, 1611. The placing of tablets to commemorate anniversaries or to point out historic sites of local importance has continued to occupy the attention of the Society. In all its history probably no event has been so enthusiastically commemorated as the tercentenary of the discovery of the port and river of

St. John by the Sieurs de Monts and Champlain on the 24th of June, 1904. The most elaborate and impressive individual memorial that the province of New Brunswick can boast of is that of the splendid statue of Samuel de Champlain placed in Queen Square in connection with the anniversary.

St. John, New Brunswick, therefore finds in the unveiling of the Champlain Statue at Nepean Point tomorrow , an exemplification of the saying"Imitation is the most sincere form of flattery."

During the past year the society has published another Volume of its collections, the largest and in some respects the most valuable that has yet been issued. A copy is herewith presented to the library of the Royal Society.

Officers.

Geo. A. Henderson—President.
C. Ward—Vice President.
Dr. W. O. Raymond—Corresp. Sec'y.
John Willet—Recording Sec'y.
T. O'Brien—Librarian.

XIX.—Report of the Nova Scotian Institute of Science, Halifax, N.S.

(Established, 31st December, 1862.)

Presented by A. H. Mackay, LL.D., F.R.S.C., Delegate.

The Nova Scotian Institute of Science begs to present the following report on its proceedings during its fifty-second annual session (1914-15).

The following officers were elected for the year 1914-15:—

President—Donald MacEachearn Fergusson F.C.S., *ex officio* F.R.M.S.

First Vice-President—Prof. David Fraser Harris, M.D., C.M., D.Sc., F.R.S.E.

Second Vice-President—President Arthur Stanley MacKenzie, Ph.D., F R.S C.

Treasurer—Maynard Bowman, B.A.

Corresponding Secretary—Prof. Ebenezer MacKay, Ph.D.,

Recording Secretary and Librarian—Harry Piers.

Councillors without office—Alexander Howard MacKay, LL.D., F.R.S.C.; Prof. Clarence L. Moore, M.A., F.R.S.C.; Alexander McKay, M.A.; Prof. Donald Sutherland McIntosh, M.Sc.; Carleton Bell Nickerson, M.A.; Prof. Howard Logan Bronson, Ph.D.; and William Harrop Hattie, M.D.

Auditors—Watson Lendby Bishop and William McKerron.

Meetings were held from 21st October, 1914, to 10th May, 1915, at which the following papers were presented:—

1. Presidential Address: (a) deceased members, (b) review of the year's work, (c) remarks on valency. By Donald M. Fergusson, F.C.S.

2. The Distribution of the Active Deposit of Thorium in an electric field. By George H. Henderson, B.Sc.

3. Neuro-muscular Rhythms and the Tremor of Tonus. By Prof. D. Fraser Harris, M.D., C.M., D.Sc., F.R.S.E.

4. An Investigation of the "Chromate Method" of Separating the Alkaline Earths. By Herbert B. Vickery.

5. A Physical Measurement of X-Rays. By Prof. Howard L. Bronson, Ph.D.

6. Notes on an Abnormal Wave Occurrence on the Northern Cape Breton Coast. By Prof. Donald S. McIntosh, M.Sc.

7. Additions to the catalogue of Butterflies and Moths collected in the neighborhood of Halifax, N.S. etc. By Jospeh Perrin.

8. Accidental Electrical Stimulation of the Human Retina *in situ*. By Prof. D. Fraser Harris, M.D., D.Sc., F.R.S.E.

9. Phenological Observations in Nova Scotia, 1914. By A. H. MacKay, LL.D., F.R.S.C.

During the year 1914, the library of the Institute received 1,803 books and pamphlets. The total number received in the same year by the Provincial Science Library, with which that of the society is incorporated, was 2,848. The total number of books and pamphlets in the Science Library on 31st December, 1914, was 54,658, of which 39,417 (or 72 per cent) belong to the Institute.

The Proceedings and Transactions, Vol. XIII, Part 3, is now ready for distribution and subsequent parts are in the press.

HALIFAX, N.S.,

21st May, 1915.

XX.—Report of the Nova Scotia Historical Society.

By MR. JUSTICE LONGLEY, F.R.S.C., Delegate.

The Society has had a most successful year, met regularly and there were thirty members elected during the year.

The officers for the current year are as follow:

President—Venerable Archdeacon Armitage.

Vice President—Dr. Allison.

Vice President—Joseph A. Chisholm.

Vice President—Judge Savary.

Corresponding Secretary—Harry Piers.

Recording Secretary—William L. Payzant.

Treasurer—George E. Nichols.

Auditors—W. L. Brown and Col. Oxley

Other Members of Council—Dr. A. H. McKay, .G W. T. Irving, George Mullane, and Rev. Dr. Forrest.

Library Commissioners—Major J. P. Edwards, Rev. Dr. Forrest, J. J. Hunt and Dr. A. H. MacKay.

Librarian—Miss Annie Donahoe.

There was a new volume of collections brought out which includes the following papers:—

1. Wolfe's Men in Nova Scotia, by Mr. Beckles Wilson.
2. Jonathan Belcher, First Chief Justice of Nova Soctia, by Sir Charles Townsend.
3. Dockyard Reminiscences, by Charles Roche.
4. Early Scottish Settlers in Cape Breton, by Mrs. Charles Archibald.
5. Artists in Nova Scotia, by Harry Piers.
6. History of Nova Scotia Postage Stamps, by Donald A. King.

Most of these articles are furnished with a considerable number of illustrations.

During the year there were also a number of tablets erected marking historic sites.

W. L. Payzant,
Recording Secretary.

Mémoires de la Société Royale du Canada
SECTION I

Serie III | JUIN 1915 | Vol. IX

Poèmes contre les Boches

Par M. Albert Lozeau, M.S.R.C.

(Lus à la réunion de mai, 1915.)

I

A LA BELGIQUE SANGLANTE

Salut, honneur, amour à toi, brave Belgique
Immensément grandie en une heure tragique!
Terre familiale, active, au doux accueil,
Te voilà déchirée, et ton peuple est en deuil!
Tu souffres aujourd'hui tant de maux ineffables:
La faim, le feu, la mort injustement t'accablent! . . .
Pour n'avoir pas dit: Oui; pour avoir résisté
Au voleur qui voulait prendre ta liberté,
Tu vois tomber tes fils en héros! Mais ta gloire
Débordera demain les pages de l'Histoire!

La France et toi, de quelle ardeur nous vous aimons!
Comme avec piété souvent nous vous nommons!
Vous êtes les deux Sœurs nobles et magnifiques
Dont battent réunis les deux cœurs héroïques!
Nous les entendons bien malgré les océans,
Et ce n'est pas le bruit de "leurs" canons géants
Qui les étoufferaient au fond de nos pensées,
Sur leur rythme pareil sans cesse cadencées! . . .

Oui, petite Belgique infinie en grandeur,
Nous te couronnerons d'amour et de splendeur!
Nous lèverons les yeux et fixerons ton âme
Pour apprendre à mourir plutôt que d'être infâme!
Pour savoir que la Force échoue au pied du Droit,
Et qu'un tout petit peuple ayant un vaillant roi
Peut mater l'Ogre! et, dans l'horreur de la tuerie,
Faire d'un sol sanglant une illustre Patrie!

II

VERS L'ALSACE

Soldats qui reprenez l'Alsace et la Lorraine,
Beaux Chevaliers du Droit, héros libérateurs,
Que Jeanne d'Arc et saint Michel, vos protecteurs,
Vous donnent la victoire absolue et prochaine!

Certes, vous dédaignez la colère germaine;
Vous êtes au combat d'intrépides lutteurs,
Car vous voilà campés sur les blanches hauteurs
Où votre fier regard désormais se promène . . .

La France, avec ceux-là qui sont la France ici,
Ont tout-à-coup le cœur d'émotion saisi
Quand vous faites un pas en avant, vers l'Alsace!

C'est que nous connaissons d'autres persécutés,
Nos frères par le sang, qui demandent leur place
Au soleil radieux des justes libertés!

III

POUR LES FRANÇAIS BLESSÉS

Que de héros meurtris sur la terre de France!
Dans le fer et le feu, comme ils se sont battus!
Le courage et l'honneur sont leurs mâles vertus:
Ils tombent sans qu'un mot révèle leur souffrance . . .

Leur cœur viril est plein de force et d'espérance;
Et tous les grands amours qu'ici-bas ils ont eus
Devant l'amour sacré du Pays se sont tus!
Ils tombent, Canadiens, pour notre délivrance!

Puisqu'ils luttent depuis tant de jours, ces soldats,
Vengeant l'humanité de honteux attentats,
A nous le saint devoir de panser leurs blessures!

Frères, c'est notre sang le sang qui coule d'eux!
Pour le prouver, il a des origines sûres!
Donnons pour nos blessés pâles et glorieux!

IV

POUR DEMANDER A DIEU QU'IL DÉLIVRE LE SOL DE FRANCE

Nous vous en supplions ardemment, ô Jésus,
Chassez l'envahisseur qui piétine dessus!

Chassez les assassins et les incendiaires,
Expulsez de leurs trous les hordes sanguinaires!

Chassez tous les sabreurs d'enfants et de vieillards,
Les fourbes, les bourreaux sadiques, les pillards:

Tous ces mutilateurs avinés, tous ces reîtres,
Ces cyniques bandits, et ces tueurs de prêtres!

Chassez du sol français qu'ils souillent de leur sang,
Ces hommes de carnage et d'orgueil menaçant!

Chassez-les par les prés et par les forêts chauves,
Comme on traque un troupeau hurlant de bêtes fauves!

Chassez les criminels invoquant votre Nom,
Qui font cracher sur Vous la gueule du canon;

Les soudards promenant sur l'autel et le porche
L'insulte de l'ivresse et le feu de la torche!

Chassez cet Empereur au visage fardé,
Qui joint l'hypocrisie au vice faisandé,

Chassez-le,—son séjour trop longtemps se prolonge,—
Ce Roi de trahison, ce Prince de mensonge!

Délivrez ce beau sol, où la grâce fleurit,
De cette laideur fière et de tout ce prurit!

Balayez d'un grand vent de justice les plaines,
Et faites-y régner vos douceurs souveraines . . .

Nous vous en supplions ardemment, ô Jésus,
Chassez l'envahisseur qui piétine dessus!

Montréal.
1914-1915.

Le Problème des Races au Canada.

Par S. G. MONSEIGNEUR PAUL BRUCHÉSI, M.S.R.C.

(Lu à la réunion de mai, 1915).

Monsieur John Boyd vient de consacrer à la mémoire de Sir Georges Etienne Cartier un ouvrage aussi large d'esprit qu'il est abondamment documenté. Un des chapitres les plus intéressants, sans contredit, est celui où il expose l'idéal du grand homme d'Etat.[1]

L'une des doctrines qui composent cet idéal nous intéresse surtout, à cause du relief que lui donnent les difficultés de l'heure présente. A l'époque de Cartier, comme aujourd'hui, la diversité des races inspirait à plusieurs des craintes sérieuses sur le maintien de l'unité politique au Canada. Cartier, sans nier le péril créé par cet état de choses, le combattait par ces paroles:

"Quelques-uns ont exprimé l'espoir que ces différences ethniques disparaissent avec le temps. La fusion des races est un rêve, une utopie, une impossibilité. Des distinctions comme celle-là, il en existera toujours; la diversité est la loi du monde physique, moral et politique. Soutenir que nous ne pouvons constituer une nation solide parce qu'en pratique le Bas-Canada est composé de Français et de Catholiques, le Haut-Canada d'Anglo-protestants, c'est une prétention on ne peut plus futile.

"La Grande-Bretagne est partagée entre trois grandes races. Est-ce que cette diversité a nui à ses progrès, à son bien-être ? Est-ce que les trois races n'ont pas mis en commun leurs qualités, leur énergie, leur courage, et contribué ainsi à la gloire de l'Angleterre, à sa législation si sage, à ses succès sur terre comme sur mer, à son expansion commerciale ?

"Notre Confédération, de même, comprendra des catholiques et des protestants, des Anglais, des Français, des Irlandais et des Ecossais. Chacun de ces groupes, par ses efforts et ses succès, ajoutera quelque chose à la prospérité du Dominion, à la gloire de la nouvelle union. Nous appartenons à des races différentes; ce n'est pas pour nous quereller, mais pour travailler de concert au bien commun. Nous ne pouvons, à coups de lois, supprimer les différences ethniques; mais, j'en suis convaincu, Anglo-Canadiens et Canadiens-Français estimeront à leur juste valeur les avantages de leur situation. Se coudoyant comme les membres d'une grande famille, ils retire-

[1] *Sir G. E. Cartier—His life and times*, ch. XVII.

ront de leur contact un heureux esprit d'émulation. En fait, la diversité des races contribuera, croyez-m'en, à la prospérité de l'ensemble."[1]

En parlant ainsi, le principal artisan de la Confédération touchait à tous les aspects du vaste problème qui, dans notre pays, a de tout temps sollicité l'attention des hommes d'action et de pensée.

Il en est des différences ethniques comme de tant d'autres phénomènes: elles proviennent de la nature elle-même. A cause de cela, aucun pouvoir politique ne peut les faire disparaître, comme aucun ne peut les créer. Elles ne dépendent pas davantage de la volonté de ceux qu'elles séparent; il a même fallu une loi positive pour permettre à l'homme né en dehors du pays de sa race d'être considéré comme citoyen du pays de sa naissance. On choisit son allégeance politique, on ne choisit pas sa race. On change de patrie, on ne change pas son caractère ethnique. On peut désirer ne pas être Français ou Anglais; on ne saurait, quand on est l'un ou l'autre, s'empêcher de l'être. Ceux-là qui protestent le plus vigoureusement contre leur origine sont les premiers à en prendre la défense quand il arrive à un imprudent de s'y attaquer.

Qui donc a fait cela ? Qui donc a fait que l'Espagnol fut espagnol, l'Allemand allemand, l'Anglais anglais, le Français français ? Celui-là même qui a imprimé aux différents groupes de l'humanité des caractères si divers, même opposés. Dieu l'a voulu: l'être humain apporte en naissant une tournure d'esprit, une langue, des goûts intellectuels, des tendances morales qui se retrouvent chez tous les enfants de même sang que lui. La communauté civile et politique dont il fera partie lui procurera plus tard d'autres tendances et d'autres goûts. Les uns et les autres demeureraient improductifs, s'ils parvenaient à effacer les caractères ethniques, au lieu de s'y adapter pour les compléter. Ces oppositions sont encore plus irréductibles lorsque s'y surajoutent deux cultures aussi différentes que la culture latine et la culture celtique.

Une cloison étanche, établie par Dieu même, sépare donc les groupes ethniques. Suit-il de ce fait que leurs membres aient le droit de supprimer les frontières politiques du pays qu'ils habitent ? qu'ils puissent se rattacher, par-dessus elles et malgré elles, au berceau de la race ? Ce serait mettre en péril le rouage politique, l'un de ceux qui contribuent davantage au bon fonctionnement de la machine humaine. La fausseté du principe des nationalités, lorsqu'on l'entend ainsi, saute aux yeux de quiconque réfléchit. Ce principe toutefois n'est plus erroné, s'il proclame seulement que les membres

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[1] Ibid., p. 355.

d'un même groupe ethnique, rassemblés sur un territoire déterminé et puisant dans leur agglomération la force politique avec la paix nationale, peuvent aspirer à servir d'Etats-tampons entre des puissances toujours prêtes à en venir aux mains. Il n'est pas faux non plus quand il affirme qu'une nationalité, à laquelle la constitution du pays dont elle fait partie assure sa liberté, a le droit, tout en respectant et les lois communes et les autres races de ce pays, de se développer conformément à son caractère propre et à ses traditions particulières.

Le problème des races se pose chez nous de cette dernière façon.

Déjà la série de nos chartes constitutionnelles, de 1760 à 1867, avait fait des Canadiens non des sujets anglais, mais des sujets britanniques parlant les uns l'anglais, les autres le français.

La Confédération de 1867 a uni des corps différents. Elle a laissé à chacun d'eux un terrain politique où il peut évoluer à sa guise, l'arène provinciale. Elle leur a, de même, proposé et fait accepter une certaine allégeance à l'égard d'une autorité commune, le pouvoir fédéral. Mais, en même temps, le pacte fédératif reconnaissait à chacune des deux races fondamentales la liberté de garder ses aspirations et de tendre à les satisfaire selon sa volonté. Il comportait même une garantie pour le cas où leur infériorité numérique exposerait ces deux races, et les autres comme elles, dans le domaine religieux, scolaire et linguistique, aux empiètements d'une majorité quelconque. Les Pères du projet l'avaient compris: l'union des quatre provinces initiales ne pouvait avoir ni pour point de départ ni pour terme l'absorption des unes par les autres. "Les petits peuples qui y donnaient leur adhésion", a dit justement un de nos écrivains, "trop faibles pour conquérir leur indépendance, étaient aussi trop fiers de leur sang pour consentir à une pareille fusion."[1]

Pour se convaincre que telle était bien la conviction des signataires, il suffirait de se reporter à leurs délibérations et à l'article 133, qui reconnaît à la langue française les mêmes droits qu'à la langue anglaise. Les déclarations subséquentes de ses rédacteurs ne permettent pas même de mettre en doute leur intention. Sir John Macdonald, le plus autorisé de leurs porte-parole, s'en rendait garant quand il répondait, le 17 février 1890, à son adversaire Dalton McCarthy: "Nous avons une constitution en vertu de laquelle tous les sujets britanniques ont des droits égaux en matière de langue, de religion, de propriété et de personne. Il n'y a pas ici de race supérieure, il n'y a pas de race conquise; nous sommes tous sujets britanniques." Par leur conduite en maintes circonstances autant que par leurs dis-

[1] L'abbé Groulx: La Constitution fédérative de 1867. (Revue canadienne, nov. 1914, p. 396.

cours, nos principaux hommes d'Etat, les honorables Edward Blake et Richard Scott, les Sirs Charles Tupper et McKenzie Bowell, contresignaient et adoptaient comme leur, cette affirmation si catégorique.[1]

Pour ce qui est des Canadiens-Français, même avant cette époque, on avait compris qu'ils méritaient cette égalité officielle. Leur dévouement en 1763, en 1775 et en 1812, avait prouvé hautement leur loyauté. La longue durée de leur séjour dans le pays, la différence de leurs mœurs, de leurs traditions, de leur foi, de leur langue, faisaient d'eux, en face de la république voisine, le rempart le plus solide contre les infiltrations dangereuses, une barrière infranchissable à toute tentative extérieure. Les Anglais, nouveaux venus des Iles Britanniques, fortement apparentés aux Américains, eussent résisté moins facilement sans doute à ces tentatives comme à ces infiltrations. Cette double vérité a été proclamée, dans les termes les plus nets, à différentes périodes de notre histoire, par Sir Guy Carleton, le général Haldimand, sir Andrew Stuart, lord Elgin, l'honorable Henry Pope,

La protection que méritaient les Canadiens-Français minorité dans la Confédération, les minorités provinciales, de quelque race qu'elles fussent, pouvaient la réclamer également. Si elles avaient cru trouver dans l'union une moindre garantie de leurs droits naturels ou acquis, eussent-elles consenti à s'y associer ? Elles y entrèrent attirées par cette pensée qu'elles obtiendraient, de leurs nationaux constituant une majorité dans les autres provinces, l'appui nécessaire contre l'oppression possible de la majorité locale. Pour attester l'influence de cette intention sur leur signature, il suffit de se rappeler le soin avec lequel les honorables A. T. Galt et Henry Pope veillèrent à faire insérer dans le pacte une clause favorable à la minorité anglo-protestante du Québec.[2] Qu'on songe encore aux insistances de sir Richard Scott pour protéger la minorité catholique de l'Ontario par la reconnaissance constitutionnelle des écoles séparées.[3] Tous ces efforts seraient inexplicables, si nos législateurs n'avaient pas eu en tête que l'égalité de droits entre Anglais et Français, entre majorités et minorités, constituait la base même du pacte interprovincial.

Pour tout homme sérieux les conséquences de ce principe sont évidentes.

En voici le premier corollaire: aucun élément de la Confédération ne doit être molesté pour sa façon de rendre à Dieu le culte qui lui

[1] Débats de la confédération (Québec, Fréchette 1865). Affaire du Nouveau Brunswick 1872. Affaire du Manitoba 1890. Affaire de l'Alberta et de la Saskatchewan, 1905. *Recollections of Sixty Years* de Sir Chs Tupper.

[2] *Débats de la Confédération*, 1865.

[3] *Loi des Ecoles séparées* d'Ontario, 1863; discussion à l'Assemblée législative.

est dû. Sans doute, il serait à souhaiter que tous les composants, confondus dans l'unité politique, le fussent également dans l'unité religieuse. Plût au ciel que tous servissent Dieu de la seule manière dont il veut être honoré! C'est même le devoir de tout véritable apôtre d'amener à l'unique bercail divin les brebis des divers troupeaux humains. Mais cette unification ne saurait être l'œuvre de la violence. Jusqu'à ce que la persuasion ait accompli son œuvre de conquête pacifique, en vertu de la constitution les différents groupes ne doivent pas être lésés, dans les croyances où ils vivent de bonne foi, par les groupes d'autre croyance.

Cette tolérance pratique dans l'ordre religieux a elle-même pour conséquence la reconnaissance de l'école séparée, de l'école confessionnelle. Quiconque croit vraie la foi qu'il pratique a le droit naturel et le devoir corrélatif d'en instruire ceux "qui sont quelque chose de lui",[1] ses enfants. L'école est le prolongement de la famille. Incapable, quand l'enfant a dépassé un certain âge, de lui assurer davantage l'éducation convenable, le père ne fait que substituer aux siennes l'autorité et les aptitudes du maître ou de l'institutrice. Parce que les circonstances le contraignent de faire exercer par d'autres son droit, s'en suit-il qu'il le perde et soit dégagé de son devoir ? L'absurdité d'une pareille prétention est évidente. Elle le devient plus encore si l'on songe qu'avant de faire de l'enfant un honnête citoyen, l'école doit former en lui un croyant sincère. Comment cette fin primordiale serait-elle atteinte, si le père ne peut choisir pour son fils des maîtres, et employer pour lui des livres qui enseignent à son enfant ce que lui-même croit être la vérité religieuse ? Comment le père satisferait-il à son devoir s'il est obligé de confier son fils à des esprits qui peuvent être nourris d'erreur ou de fausseté, à des volontés incapables souvent de se conformer elles-mêmes à la loi morale ?

Ce danger, on le sait par l'exemple d'autres pays, n'est pas chimérique. Il est double quand le législateur oublie la troisième conséquence du principe proclamé par les Pères de la Confédération, quand il empêche qu'on instruise les enfants au moyen de leur langue maternelle. La pédagogie, appuyée sur l'expérience des siècles, l'a affirmé de tout temps: il y a entre le langage propre à une race et la tournure de son esprit, une alliance étroite, entre les mots qui lui communiquent la science et la solidité comme l'étendue de cette science une association nécessaire. Se servir, pour la faire acquérir à l'enfant, de termes, d'expressions, de tours, d'images qui ne concordent pas avec la façon des siens de penser, de sentir et de s'exprimer, c'est vouloir imprimer une photographie sur une plaque insensible, écrire des caractères avec une plume dépourvue d'encre, faire lire sans lu-

[1] Léon XIII: Encycl. *Rerum Novarum.*

mière un livre dans les ténèbres. Une fois l'enfant pourvu des notions essentielles, qu'on emploie un autre idiôme, à la bonne heure! Encore ne faut-il pas le priver totalement, même alors, de l'usage de sa langue propre. Une foule de connaissances, qu'il eut acquises d'instinct à l'aide de celle-ci, lui échapperont à cause des heures qu'i aura dépensées sans profit à apprendre le maniement de l'autre.

Liberté de la langue maternelle, liberté de l'école nationale, liberté de l'école confessionnelle: telles sont les conclusions implicitement contenues dans le principe fondamental de notre constitution. En affirmant ce principe, les promoteurs de la Confédération les affirmaient; en le revendiquant aux heures de lutte, ils les revendiquaient elles aussi.

Ces conclusions et ce principe, si on se les rappelait toujours pour les appliquer, préviendraient tous les conflits possibles entre les races qui habitent notre pays cosmopolite. C'est parce qu'on les oublie parfois qu'il en surgit çà et là, à moins que leur éclosion ne soit le résultat d'une crainte injustifiée.

Déjà en 1792, l'on soutint que la reconnaissance de la liberté religieuse, scolaire et linguistique, battait en brèche l'unité politique et nationale. Les motifs, invoqués alors contre cette prétention par M. de Lotbinière[1] et repris depuis par tous les esprits cultivés, n'ont pas perdu leur valeur. Au contraire, l'expérience d'un siècle de plus l'a démontré: l'Angleterre, loin d'être affaiblie par la diversité des langues de ses multiples sujets, puise dans cette diversité même une force et un éclat qui excitent l'envie de ses rivaux. Pareillement, les distinctions religieuses n'ont nui en rien à l'homogénéité de ses peuples divers, à la loyauté de ceux auxquels elle accordait une quasi autonomie. La croyance catholique, par exemple, fait remonter à Dieu la source de l'autorité; par là même, elle en impose le respect plus impérieusement que les autres doctrines, celles qui font de la volonté souveraine une émanation des volontés individuelles renonçant à leur prétendu pouvoir. Et enfin, la diversité d'éducation, la même expérience d'un siècle l'atteste encore, n'a pas créé entre les esprits des sujets, des oppositions irréductibles; elle a été pour la Grande-Bretagne le germe fécond du développement intellectuel le plus varié qui soit.

Cette vérité, ceux-là la méconnaissent qui tentent d'écarter le principe et les conséquences posés par l'Acte de 1867. Ils se rendent ainsi responsables des conflits malheureux dont le Canada est périodiquement secoué.

Comme il serait facile pourtant de les supprimer, même de les prévenir!

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[1] Bédard: *Histoire de cinquante ans* (1791-1840, ch. I, pp. 4-5.

Cartier indiquait le moyen à prendre quand, dans le même discours que je citais au début, il résumait par cette maxime sa doctrine et sa pratique: "Ma politique consiste à respecter les droits de tous." Il suffirait de s'en tenir, comme Cartier, au respect des droits de tous. Explicitement garantis par la lettre de la constitution, ou implicitement contenus dans son esprit, ils sont intangibles. Quiconque y porte une main sacrilège s'expose non à des représailles sanglantes et immédiates, mais aux coups d'une justice immanente et supérieure, tardive parfois, mais inévitable. Pour elle, ni les majorités temporaires ne comptent ni la légalité ne prime le droit.

Cette conviction a toujours inspiré les relations mutuelles des deux races qui se coudoient dans la province de Québec. Leur conduite, partout imitée, sauvegarderait partout la tranquillité et la paix. En une circonstance récente, les représentants parlementaires de la minorité y ont proclamé la largeur de vues avec laquelle ses membres sont traités. Qu'on agisse de même partout, et l'on aura moins besoin de rappeler sans cesse l'esprit de notre constitution et la pensée de ses promoteurs non plus que la maxime du grand Cartier, gage de la stabilité du lien interprovincial: "Ma politique consiste à respecter les droits de tous." Je viens d'énoncer des idées qui ne peuvent, ce me semble, être contredites nulle part; et je suis heureux de les avoir énoncées au sein de cette *Société Royale* qui par son but clairement défini, ses règlements, ses traditions, je pourrais dire par son essence même, leur donne, en face du Canada tout entier, le plus éloquent des témoignages. Ce n'est pas ici qu'il a été dit et qu'il sera dit jamais: "Que pouvons-nous gagner à maintenir deux langues ?"

La Mort de Champlain.

Par M. BENJAMIN SULTE, M.S.R.C.

(Lu à la réunion de mai 1915).

Il n'a jamais rien été mis sous nos yeux de ce que le fondateur de Québec pensait, dans les derniers mois de sa vie, touchant la situation de la Nouvelle-France, sauf sa lettre[1] du 15 août 1635 adressée au cardinal de Richelieu, qui ne touche guère à la question telle qui présentée ici, car c'est plutôt sa demande ordinaire de secours en faveur de la colonie que l'énoncé d'un état quelconque. Il s'y exprime sur un ton assez peu rassuré, et nous savons qu'il était justifiable de se plaindre. Charlevoix a dit fort justement: il a manqué à Champlain d'être plus écouté et d'être secouru à propos.

Malgré son courage et la largeur de ses vues, Champlain avait toujours été empêché d'agir en dehors du commerce des fourrures. Ses plans de colonisation étaient repoussés en principe . Les années 1633-1635 avaient bien vu arriver, enfin, quelques jeunes familles de cultivateurs, sous leur seule impulsion individuelle, mais cela constituait-il un commencement sérieux, puisque la compagnie des Cent-Associés périclitait et bornait ses soins à tirer encore quelque bénéfice de la traite des pelleteries ?

I.

Au mois d'octobre 1635, la paralysie se manifesta chez cet homme de soixante-huit ans que de longs et pénibles voyages sur mer, ou dans les solitudes inconnues, par les lacs et les rivières du Canada devaient prédisposer à une carrière encore plus courte qu'elle ne l'était finalement et, comme il arrive toujours à celui qui va quitter ce monde, un retour vers le passé a dû lui remettre en mémoire ce mois de juillet de l'année 1608 où, débarquant à Québec, conducteur de quelques vulgaires engagés, il se voyait au milieu de forêts immenses dont la limite, à droite et à gauche, partout, lui semblait impénétrable et qui n'offraient, en réalité, pour toute voie accessible, que des cours d'eau venant on ne sait d'où.

Sa pensée, bien différente et, à cause de cela plus ample que celle des explorateurs de son temps, s'était complue à imaginer ce que de-

[1] Dionne: *Samuel Champlain*, II. 537.

viendrait ce pays nouveau en exploitant ses ressources naturelles et par là même le colonisant. La conception d'une France nouvelle lui apparaissait possible; il devisait le moyen d'y parvenir. Tout ce qui s'est fait, longtemps après lui, était en germe dans ses calculs, il n'en faut pas douter puisque ses œuvres écrites en sont des témoignages irréfutables. Que d'efforts il avait tentés, mais inutilement, pour atteindre son but! Sans cesse arrêté dans sa marche par ordre supérieur, il n'en avait pas moins persévéré, afin de tirer profit adroitement des occasions fugitives qui pouvaient favoriser ses projets.

N'était-ce pas un coup de Providence que l'action indépendante et inattendue du docteur Robert Giffard fondant, à Beauport, l'été de 1634 une petite colonie purement agricole, alors que tant de desseins semblables conçus par Champlain lui-même n'avaient pu recevoir l'approbation de ses maîtres? Ne pourrait-on pas supposer que Giffard, comprenant ces misères, se serait en quelque sorte substitué à sa place, par une entente mutuelle, afin de contourner l'obstacle barrant la route depuis des années? Aux termes de leur monopole, les compagnies ne pouvaient refuser à un simple bourgeois ce qu'elles repoussaient venant de la part de leur propre employé. Une fois des habitants fixés aux portes de Québec, la colonisation générale s'en suivrait. Champlain n'en demandait pas davantage, tant il était convaincu que le premier essai entraînerait toute une suite d'événements, car il comptait sur les pionniers pour en attirer d'autres—et voilà comment son idée nous frappe en lisant ses écrits. Il voulait une population de cultivateurs qui se recruterait d'elle-même, qui choisirait son monde et dont le caractère serait à la fois la stabilité et l'accord dans les habitudes de la vie, la nature du travail, la saine moralité.

Où rencontre-t-on, à cette époque, des hommes tels que Champlain, Giffard, Juchereau, en matière de colonisation? Nulle part. Aussi leur devons-nous tout ce que nous ne pouvons reconnaître chez les autres—ces marchands, comtes, ducs, princes, ministres, roi, et que sais-je! tout un groupe de puissants du jour qui se donnaient les airs de protecteurs du Canada, mais n'allaient pas plus loin que la forme.

Tardivement, mais enfin, pas trop tard, le début d'une œuvre solide venait d'avoir lieu et promettait de se soutenir, comme en effet elle se développa avec le temps.

Ceux qui disaient s'intéresser au Canada n'y voyaient que la facile récolte des fourrures, laquelle ne pouvait pas durer toujours et ne fondait rien. Champlain demandait la conquête du sol par la charrue, mais il était tellement seul de son avis que personne ne l'écoutait. On allait même jusqu'à s'effrayer de ses vues qui menaçaient de "dépeupler la France" au profit du Canada! La France renfermait bien dix millions d'âmes. Le Canada se serait contenté de cinq mille. Faire surgir par delà l'Atlantique un royaume en pleine forêt, au dépens de l'ancien! Renverser l'univers, quelle aberration pensait le grand Sully et tant d'autres!

Reportant ses souvenirs sur un ordre de choses différent, Champlain voyait l'admirable travail qu'il avait accompli pour se concilier les Algonquins et les Hurons. Sa tactique a été la base de l'amitié des Sauvages pour les Français, au grand étonnement des historiens. Vous apprendrez tout d'abord leur langue, disait-il aux quelques jeunes gens instruits qu'il avait su choisir en Normandie et à Paris pour en faire des interprètes; vous irez à eux les premiers; vous vous adapterez à leurs us et coutumes; vous serez des frères pour ces pauvres peuples—et l'on sait ce qui en résulta. Je me demande, par exemple, si le tempérament français n'est pas pour beaucoup dans la réussite de ce plan, tout bon qu'il soit à première vue.

Allons plus loin de ce côté. Les interprètes accomplirent des prodiges dans le domaine de la géographie—et les coureurs de bois suivirent la leçon. Inspirés par Champlain qui avait parcouru le Haut-Canada et compris le système des grands lacs, ils pénétrèrent de là jusqu'à l'Atlantique en découvrant la Pennsylvanie; au lac Michigan; au Wisconsin, au lac Supérieur jusqu'à son extrémité ouest et obtinrent une vague connaissance du Mississipi, qu'ils prenaient pour l'océan Pacifique d'après le mot algonquin *Michisipi*, les grandes eaux.

Tant par ses propres explorations que par le moyen de ses interprètes, le fondateur de la colonie avait amassé une foule de renseignements qu'il a versés dans ses cartes et répandus dans ses rapports—deux œuvres de haute valeur dont chacune suffirait à la gloire de son nom, car ce qu'il n'a pas eu la permission d'exécuter il nous le donne la plume et le compas à la main.

II.

Dans sa lettre du 15 août 1635, mentionnée ci-dessus, Champlain ne dit pas qu'il est malade ni qu'il a connaissance des arrangements qui se faisaient à Paris, par conséquent, il devait voir la situation dans l'état où je viens de la décrire et rien ne devait le consoler, après tant d'épreuves et de revers. Allait-il continuer de vivre entouré de l'horizon assombri au milieu duquel il se débattait depuis près de trente ans? On juge de ses angoisses par l'ensemble des faits. C'est un moment pénible pour un homme de cœur.

Au mois de décembre tout espoir était perdu quant à la santé. Faut-il écarter de sa couche funèbre le rayon consolateur qui transfigure et souvent trompe les mourants ? bien qu'il ait pu se dire qu'il viendrait un jour où ses projets seront réalisés, dans un avenir peut-être lointain mais enfin que le Canada ne saurait rester éternellement sauvage et que le soleil de la civilisation l'éclairera, au gré de Dieu, quand les princes et les humbles seront d'accord.

Le 25 décembre il s'éteignit. Les lignes suivantes, du Père Paul Le Jeune, renferment à peu près tout ce que l'on sait de cette fin: "Nous pouvons dire que sa mort a été remplie de bénédictions. Je crois que Dieu lui a fait cette faveur en considération des biens qu'il a procurés à la Nouvelle-France, où nous espérons qu'un jour Dieu sera aimé et servi de nos Français et connu et adoré de nos Sauvages." Si le mot "bénédictions" embrasse les choses de la terre il indique un esprit satisfait sous le rapport temporel. Prenant l'expression dans le sens religieux, nous n'avons plus rien pour savoir quelle était la pensée de Champlain en ce qui regarde le Canada.

Mais non! il faut chercher encore. Il me paraît maintenant que la Providence avait transformé la déception en joie lorsque survint pour le premier Canadien l'heure de rendre ses comptes. Suivez, je vous prie, mon raisonnement:

Les sieurs de Châteaufort et Delisle, chevaliers de l'ordre de Malte, étaient arrivés à Québec cette année. Il n'est pas possible qu'ils aient fait à Champlain un mystère de ce qui se préparait en France à l'égard du Canada. Alors, ce que l'on ne nous a point dit se devine: tout semblait aller pour le mieux, car un changement favorable était annoncé à brève échéance: on projetait une colonie en Canada.

Le père des Cent-Associés était Isaac de Razilly, commandeur de l'ordre de Malte. La preuve en est dans ses notes et mémoires adressés à Richelieu et à Lauzon dès 1626 et très bien reçus par eux. Voyant, plus tard, que la compagnie, fondée en 1627, s'en allait à vau-l'eau, il conçut le projet (1632) de s'associer les chevaliers de Malte pour occuper l'Acadie, soit au nom de l'Ordre, soit sous le contrôle des Cent-Associés, et il partit sans retard pour mettre son idée à exécution. Champlain avait dû connaître cela puisqu'il était en France.

Les affaires des Cent-Associés allant de mal en pis, on proposa, vers 1635, d'abandonner le Canada à l'ordre de Malte, ce que désiraient et acceptaient MM. de Razilly, de Sillery et de Montmagny, tous trois chevalier de cet ordre. Champlain dut être mis au courant de l'entente et il ne pouvait que s'en réjouir, parce que des établissements stables devenaient possibles et même certains sous la direction des chevaliers.

Observons aussi que durant l'été de 1635 où vers l'automne, on lui avait envoyé Marc-Antoine Brasdefer de Châteaufort avec plein pouvoir du roi pour le suppléer en cas de besoin. Cette dernière démarche signifie que l'on préparait les voies au changement prévu— et peut-être savait-on à Paris que la santé de Champlain inspirait des craintes.

Par les navires de France arrivés avant les glaces de l'automne en 1635, on apprit probablement à Québec que le transfert du Canada à l'ordre de Malte était résolu en principe et que le bureau de France attendait la réponse du grand-maître à la demande d'autorisation que lui avait adressée Razilly le 8 septembre. Certes! il y avait de quoi ranimer les espérances d'un homme aussi courageux que le fondateur de Québec, aussi pouvons-nous croire qu'il mourut consolé par la vision du développement immédiat de sa colonie. Reportant ses regards en arrière, il voyait la longue série de ses travaux aboutissant à des résultats longtemps désirés et survenant par des moyens jusqu'alors imprévus.

Le Père Le Jeune avait reçu, cette année 1635, des promesses séduisantes dont il se montre heureux et fier pour le Canada dans ses lettres de 1636. Lui et Châteaufort n'ont pas dû cacher à Champlain la marche favorable des affaires. D'ailleurs Champlain devait être renseigné de bonne source.

Le projet de Malte ne fut qu'une lueur passagère, mais, précisément, elle apparut dans son éclat, à Québec, en novembre et décembre, tout le monde s'y trompa, crut à l'aurore d'une période de prospérité, et les fêtes de Noël, du Jour de l'An, des Rois se seraient passées en réjouissances plus grandes que jamais, si la perte du fondateur n'était pas survenue en ce moment. Ici est le point fondamental de mon article: Champlain mourut consolé par une riante illusion. Il s'est endormi heureux de savoir qu'on la comprenait. Ce dut être, aux yeux de tous les témoins de cette scène, le digne couronnement d'une admirable carrière de travail et de persévérance.

III.

Châteaufort n'avait empiété sur aucune des fonctions de Champlain et paraît avoir agi comme son lieutenant, mais après les obsèques "lorsque le peuple était encore assemblé à l'église, on lut publiquement des lettres que les Cent-Associés avaient mises en dépôt entre les mains du Père Le Jeune, pour être ouvertes après la mort de Champlain et par lesquelles ils donnaient, par *interim*, la charge de gouverneur à M. de Châteaufort, en attendant qu'avec l'agrément du roi ils y eussent pourvu d'une manière définitive." Ce texte de M.

Faillon est un résumé exact de ce que l'on connaît de la circonstance en question.

Le 15 janvier 1636, vingt jour après la mort de Champlain qui ne pouvait être connue à Paris, à la réunion des Cent-Associés, il y eut quatre concessions de terres en seigneuries approuvées et signées: 1° la côte de Lauzon à Simon Le Maître, 2° l'île d'Orléans à Jacques Castillon, 3° la côte de Beaupré à Antoine Cheffault, 4° Portneuf à Jacques Le Neuf de la Poterie. Dans chacun de ces actes on lit: "Mandons au sieur de Montmagny, chevalier de l'ordre de Saint-Jean de Jérusalem (Malte était le terme usuel) gouverneur pour notre Compagnie sous l'autorité du roi et de monseigneur le cardinal duc de Richelieu, de Québec et autres lieux et places sur le fleuve Saint-Laurent, que de la présente concession il fasse jouir le dit sieur Le Maître . . ."

M. de Montmagny était donc déjà nommé gouverneur. Nous savons pourquoi et comment. Ce n'était point une disgrâce pour Champlain, comme j'ai cru le voir[1] et c'est par la brochure de notre confrère Joseph-Edmond Roy[2] que j'ai été amené à écrire le présent article qui fait mourir Champlain dans une satisfaction d'esprit que personne ne soupçonnait.

La débilité physique suffisait pour que Champlain renonçât à ses fonctions. La perspective de remettre les affaires de la colonie entre les mains des chevaliers rendait encore plus honorable la retraite de l'ancien fonctionnaire.

Les chevaliers avaient des établissements dans les Antilles où les parents de M. de Montmagny jouaient un grand rôle. Le projet du Canada s'explique comme celui-là—et d'autres que l'on pourrait nommer. A Paris, on n'attendait plus qu'un signal du chef de l'Ordre pour compléter les préparatifs en vue de Québec. Razilly était déjà rendu en pays acadien. La fatalité s'en mêla bientôt.

Le 5 février 1636 le Grand-Maître écrivait de Malte que la guerre étant déclarée contre la Turquie, Razilly et les chevaliers du projet canadien devaient porter leurs forces du côté de Malte et ne pas songer à l'Amérique en ce moment. C'était une suspension, mais elle n'eut pas de terme. Le rêve s'évanouit. Du commencement à la fin des pourparlers, il s'était écoulé à peine douze mois. Champlain était mort à l'heure où tout paraissait devoir réussir.

Razilly décéda cette année 1636. Quant à Montmagny on le voit arriver à Québec, le 11 juin, sans colons, sans soldats, prenant la succession de Champlain telle quelle, ne pouvant l'améliorer et se résignant avec regret à vivoter d'un peu de commerce de fourrures,

[1] En 1882: Histoire des *Canadiens-Français*, II, 59).

[2] En 1888: *L'Ordre de Malte en Canada.*

car la guerre des Iroquois "coupait les chemins partout." Il envoya Châteaufort commander aux Trois-Rivières, puis Delisle. Ces deux hommes paraissent être restés, en tout, une vingtaine de mois dans le pays.

IV.

Le lecteur aimerait peut-être à examiner le tableau de la population blanche de Québec, Beauport et Trois-Rivières, les seuls postes établis jusqu'à la fin de 1635, et comme ce désir nous a été manifesté par des amateurs aussi clairvoyants que zélés pour la vulgarisation de notre histoire, voici ce qu'il nous est possible de donner, en attendant mieux. La grande difficulté à cet égard vient de ce que nous n'avons rien d'officiel pour base et c'est pourquoi, jusqu'à ces dernières années, les Canadiens étaient dans une entière ignorance sur cette matière. La moindre notice révélant l'existence d'un colon se compose de bribes de renseignements recueillies à droite et à gauche, de toute part, avec patience et longueur de temps, comme si l'on sculptait une statue de pierre avec une épingle. Voyez ceci, par exemple:

Dans les œuvres de Champlain il y a une mention de Nicolas Marsolet qui nous fixe sur la date de son arrivée. Le même homme est cité à titre d'interprète pour Tadoussac dans les *Relations* et le *Journal* des Jésuites. Les papiers des seigneuries montrent qu'on lui avait accordé en fief Gentilly et les Prairies Marsolet. Les actes des notaires nous disent où était sa résidence aux portes de Québec. Les recensements donnent son âge et d'autres détails. Les délibérations du conseil de la colonie nous le font voir dans son emploi et son commerce. Le registre de l'église indique le lieu de sa naissance, son marriage, le baptême de ses enfants, la date de sa mort—et son histoire est ainsi reconstruite, ou à peu près. Même procédé pour tous les autres colons. Le lecteur ne s'imagine pas ce qu'a coûté de labeur la plus simple note—il croit plutôt que nous avons trouvé la chose toute faite et qu'il a suffi de la copier.

C'est M. l'abbé Ferland qui, vers 1850, s'est avisé de ce genre de recherches, mais sans le pousser bien loin. Le dictionnaire Tanguay aussi est d'un très grand secours, sous ce rapport.

On pensait, il y a soixante ans, que jamais nous ne pourrions connaître l'origine, la date de l'arrivée et bien d'autres petits faits concernant les premiers Canadiens, cependant, à force de travail cette page blanche, si déplorablement muette, commence à se remplir, le mystère nous livre son secret comme malgré lui—en réalité, on le lui arrache.

On le peut, je l'essaie; un plus savant le fasse.

Voici ce que l'on connait maintenant de la création du Canada, côté des plus anciens habitants sérieux et sans rien dire des autres Français qui n'ont séjournés ici qu'un certain temps au service des compagnies de traite:—

1608.—NICOLAS MARSOLET, né en Normandie, 1587 et non pas 1601, arriva avec Champlain l'été de 1608 et non pas 1613 comme on l'a dit. Il fut interprète, cultivateur, commis de la traite, seigneur de Gentilly et des Prairies Marsolet près du Cap-de-la-Madeleine; résidait près de Québec sur une terre à lui appartenant. Marié en 1636 avec Marie Le Barbier, il décéda en 1677 et sa femme lui survécut. De leur fille Louise mariée à Jean Lemire sont descendus les familles Marsolais d'aujourd'hui.

1608.—ETIENNE BRULÉ, jeune garçon, natif de Champigny au sud-est de Paris, intreprète algonquin et huron, a découvert la Pennsylvanie (1618) et le lac Supérieur (1622) et périt de la main des Sauvages, chez les Hurons, en 1632. D'autres employés des compagnies de traite sont connus de nom, depuis 1608 à 1634, mais n'entrent point dans la liste des "habitants" puis qu'ils n'ont séjourné dans la colonie que temporairement.

1613.—NICOLAS PIVERT, cultivateur, arriva avec sa femme Marguerite Langlois et la nièce de cette dernière—nom inconnu. Il vivait encore en 1637. Sa femme mourut en 1643. Pas de descendance.

1613.—GUILLAUME COUILLARD, de Saint-Malo, en Bretagne, matelot, charpentier calfat, cultivateur, seigneur, deuxième anobli en Canada. Se maria en 1621 avec Guillemette, fille de Louis Hébert. Décédé en 1663. Descendance très nombreuse.

1613.—ABRAHAM MARTIN arriva avec sa femme Marguerite Langlois et leurs enfants: Anne et Marguerite. Il était pilote, cultivateur, s'occupa de la pêche du loup-marin. Son fils Charles-Amador, fut le second prêtre canadien. Maître Abraham, comme on l'appelait, mourut en 1664 et sa femme l'année suivante. Ils laissaient sept filles mariées. En 1645 Martin reçut du docteur Adrien Duchesne la terre qui porta depuis le nom de plaine d'Abraham.

1613.—PIERRE DESPORTES arriva avec sa femme Françoise Langlois et leur fille Hélène qui devait être au berceau ou très jeune. Il prit une terre adjoignant Québec. C'est tout ce que nous savons de lui sauf qu'il est mentionné en diverses occasions jusque vers 1640. Hélène épousa, en 1634, Guillaume fils de Louis Hébert, puis, en 1640, elle se remaria avec Noël Morin. Parmi ses nombreux enfants on compte Germain Morin, le premier prêtre canadien. Ainsi, Marguerite Langlois et Hélène Desportes, arrivées ensemble au Canada, furent les mères des deux premiers prêtres nés en ce pays.

1615.—Jacques Hertel, de Normandie, interprète, cultivateur, seigneur, épousa, en 1641, Marie, sœur de François Marguerie. Mourut en 1651. Famille anoblie. Belle et nombreuse descendance.

1617.—LOUIS HÉBERT, apothécaire, de Paris; sa femme Marie Rollet; leurs enfants: Anne, Guillaume, Guillemette. Anne épousa en 1618 Joseph-Marie-Etienne Jonquet, de Normandie, arrivé probablement aussi en 1617;

tous deux moururent en 1619. Guillemette se maria, en 1621, avec Guillaume Couillard. Louis Hébert mourut en 1627 des suites d'une chute, et sa veuve épousa peu après Guillaume Hubou. Guillaume Hébert se maria, en 1634, avec Hélène Desportes; sa descendance s'éteignit vers 1665. Louis Hébert et sa famille avaient demeurés à Port-Royal, en Acadie. Il était procureur du roi à Québec en 1621, reçut un fief, cultiva la terre le premier en Canada. Fut un homme utile.

1618.—JEAN NICOLET, de Normandie, interprète, propriétaire de terrain (*Spencer Wood*) grand explorateur, marié en 1637 à Marguerite Couillard. Noyé en 1642. Sa fille Marguerite épousa Jean-Baptiste Le Gardeur de Repentigny dont la descendance s'est distinguée.

1618.—ADRIEN DUCHESNE, de Normandie, chirurgien, cultivateur, marié à Françoise Langlois, possédait les terrains avoisinant Québec, dont il passa une partie à Abraham Martin en 1645. Il fut très utile à la colonie. Décédé après 1652. En 1640 il avait fait venir de Normandie son neveu Charles Lemoine, célèbre dans notre histoire, ainsi que sa descendance.

1621.—OLIVIER LE TARDIF, de Normandie, d'abord sous-commis de la traite puis en-chef, interprète, cultivateur, se maria, en 1637 avec Louise, fille de Guillaume Couillard. Décédé en 1665. Nombreuse descendance.

1622.—THIERRY DESDAMES, navigateur, sous-commis de la traite à Québec, commandant à Miscou de 1639 à 1643 au moins, encore cité en 1646. Toujours mentionné favorablement. Pas de descendance connue.

1623.—JEAN-PAUL GODEFROY, de Paris, interprète, commis de la traite, commerçant, conseiller au conseil de la colonie, commandant des navires de la compagnie des Habitants, délégué à Boston pour négocier un traité de commerce, marié en 1646 avec Madeleine Le Gardeur de Repentigny, décédé vers 1669, laissa une fille qui se fit religieuse.

1626.—JEAN GODEFROY, de Normandie, interprète, cultivateur, seigneur, anobli par Louis XIV en 1668. Marié en 1636 avec Marie Le Neuf du Hérisson, de Normandie, qui venait d'arriver en Canada, il a laissé une nombreuse et belle-famille qui existe encore. Son frère Thomas, interprète, resta célibataire et fut tué par les Iroquois en 1652.

1627.—FRANÇOIS MARGUERIE, né 1614 en Normandie, interprète, ne se maria point. Il fit venir sa sœur qui épousa Jacques Hertel. Noyé en 1648.

1627.—GUILLAUME HUBOU, de Normandie, cultivateur, épouse en 1629 Marie Rollet, veuve de Louis Hébert, et décède en 1653; elle en 1649. Pas d'enfants.

1634.—JEAN SAUVAGET, de la Rochelle, arriva avec sa femme Anne Dupuis, leur fille Jeanne, née en 1614, laquelle paraît être devenue veuve d'un nommé Guillaume Benassis vers ce temps, car Madeleine Benassis, fille de Jeanne Sauvaget se déclare née en 1634. Ces quatre personnes arrivées ensemble, se fixèrent aux Trois-Rivières. Sauvaget fut cultivateur, procureur fiscal, seigneur de la Pointe-du-Lac et mourut en 1661; sa femme en 1686 âgée de 86 ou 87 ans et non pas 100 ans. Jeanne remariée en 1656 à Elie Bourbeau, mourut en 1704, et Madeleine en 1716. Cette dernière avait épousé, en 1647, Etienne Seigneuret; elle hérita du fief de son grand-père Sauvaget, le passa à sa fille Marguerite, qui le passa à son mari Louis Godefroy de Tonnancour.

1634.—GUILLAUME PEPIN, de la Saintonge, cultivateur, marié, 1645, avec Jeanne Mechin. Syndic des Trois-Rivières, siège comme juge. Une partie des terrains des Ursulines des Trois-Rivières viennent de sa générosité. Décède en 1697 dernier survivant des temps de Champlain. Nombreuse descendance. L'un de ses fils Pierre, a été seigneur du fief Laforce près Nicolet. Un autre, Jean, a donné son nom au lac Pepin du Mississipi.

1634.—ROBERT GIFFARD, du Perche, chirurgien, avait une cabane à Beauport en 1627. Il était né en 1587. En 1633 il épousa Marie Renouard, en France et vint à Québec avec elle. Leur fille Françoise naquit aussitôt débarquée à Québec. Giffard amenait des familles formant quarante-deux personnes. Il commença de suite l'établissement de Beauport—c'est un second Champlain. Cultivateur, médecin, seigneur, il a été un homme actif et de sens pratique. Décédé en 1668. Son fils Joseph, né en 1645, mourut en 1706 sans laisser d'enfant, de sorte que la seigneurie de Beauport passa à sa sœur Françoise mariée à Jean Juchereau. Robert Giffard avait été anobli, le premier en Canada. Ensuite vinrent Couillard et Boucher.

1634.—JEAN JUCHEREAU, de la Beauce, marié à Marie Langlois, vint avec elle et leurs enfants: Jean, Nicolas, Noël, Geneviève qui tous (sauf Noël) ont fondé des familles. Il a travaillé activement à la colonisation ,fut seigneur, conseiller au Conseil Souverain de Québec et mourut en 1672. Descendance anoblie. Giffard fut un second Champlain et Juchereau est troisième.

1634.—JEAN GUYON, du Perche, cultivateur, maçon, marié à Mathurine Robin. Ils amenaient leurs enfants: Jean, Simon, Marie, Claude, Barbe, Denis, Michel. Giffard lui céda un fief qui prit le nom du Buisson, lequel se transmit à la famille. Guyon exerça la pêche du loup-marin. Il avait de l'instruction. Décédé en 1663, il laissait de nombreux enfants dont la descendance existe encore.

1634.—Un autre JEAN GUYON, aussi du Perche, marié à Madeleine Boulé, s'établit à Beauport ou à Québec. On leur connait deux enfants nés en Canada.

1634.—MARTIN GROUVEL, maître de barque, épousa en 1635 Marguerite Aubert, dont le père et la mère: François Aubert et Anne Fauconnier ne paraissent pas être venue dans la colonie. Grouvel demeurait à la côte de Beaupré. De 1650 à 1657 ou le voit conduire un bâtiment à la traite de Tadoussac. Il se noya dans le golfe Saint-Laurent, en 1660, revenant d'un voyage en Normandie. Pas de descendance.

1634.—ROBERT DROUIN, du Perche, cultivateur, épousa Anne Cloutier en 1636 et décèda en 1685. Nombreuse descendance.

1634.—FRANÇOIS DROUET, du Perche, épouse Périnne Godin, en 1638. Elle était née à la Flèche en Anjou. Nous ne savons rien de plus sur leur compte.

1634.—NOËL LANGLOIS, de Normandie, pilote, possédant un navire océanique, cultivateur, épouse, à Québec, cette année, Françoise Grenier. Décédé en 1684. Nombreuse descendance.

1634.—SÉBASTIEN DODIER, du Perche, charpentier, cultivateur, parent de Gaspard Boucher. Vers 1644 il épousa Marie Bonhomme. Décédé après 1660. Nombreuse descendance.

1634.—GUILLAUME ISABEL, cultivateur, marié à Catherine Dodier en 1648, tué par les Iroquois en 1652. Nombreuse descendance.

1634.—JEAN CÔTÉ épousa, à Québec, en 1635, Anne, fille d'Abraham Martin. Il était cultivateur. Décédé en 1661, il laissa une descendance qui s'est multiplié à l'infini.

1634.—THOMAS GIROUX, du Perche. Il vivait encore en 1638. On ne lui connaît pas de descendance. Les Giroux du Canada viennent de trois familles de ce nom datant de 1654, 1668, 1699.

1634.—ZACHARIE CLOUTIER, du Perche, charpentier, cultivateur, marié en 1615 avec Xaintes Dupont. Ils amenaient leurs enfants: Anne, Zacharie, Jean, Charles, Louise. Il décède en 1676 âgée de 86 ans. Nombreuses descendance.

1634.—JEAN BOURDON, de Normandie, arpenteur, ingénieur, cultivateur, seigneur, procureur du roi, épousa, à Québec, en 1635, Jacqueline Potel et en eut quatre filles toutes religieuses, et Jean-François qui mourut célibataire après 1688, et Jacques sieur d'Autray, compagnon de LaSalle, aussi célibataire. Jean Bourdon mourut en 1668. Il a fait une carte géographique de la région de Québec, avec le nom de chaque habitant sur sa terre.

1634.—MARIN BOUCHER, du Perche, cultivateur, maçon, marié en 1625 à Périnne Malet. Tous deux arrivent avec leurs enfants: Françoise et Jean-Galeran. Boucher décède en 1671. Nombreuse descendance.

1634.—Gaspard Boucher, cousin du précédent, marié en 1619 avec Nicole Lemaire. Ils amenaient leurs enfants: Madeleine, Pierre, Nicolas, Marie et Marguerite. Boucher, cultivateur, vécut à Beauport et aux Trois-Rivières où son fils, le célèbre Pierre Boucher, devint gouverneur. Sa mort eut lieu après 1658. Sa descendance, nombreuse et remarquable, a été anoblie dans la personne de Pierre.

1634.—PIERRE BLONDEL, brasseur, arriva avec sa femme Marie-Alice Gourdin. Un nommé Nicolas Blondel, âgé de 22 ans, avait été pris à Québec en 1629 et conduit en Angleterre. Pierre et sa femme eurent deux enfants aux Trois-Rivières; l'un d'eux, Pierre, épousa Marie Mezerai.

1634.—PHILIPPE AMYOT, de la Beauce, cultivateur, marié en 1627 avec Anne Convent. Ils amenaient leurs enfants: Mathieu, Charles, Jean-Gencien. Amyot mourut vers 1638. Nombreuse descendance. Anoblie.

1635.—PIERRE DELAUNAY, du Maine, commis de la traite, épouse Françoise Pinguet, en 1645. Il fut tué par les Iroquois en 1654. Nombreuse descendance.

1635.—CHARLES SEVESTRES était marié en 1627 avec Marie Pichon, veuve de Philippe Gautier sieur de Comporté. Tous deux vinrent dans la colonie amenant leurs enfants: Catherine, Charles, Guillaume Gautier, et Denise et Marguerite Sevestre. Le defunt Philippe Gautier était de Paris et l'on peut supposer que Sevestre demeurait aussi dans cette ville. Ce dernier fut juge de la senéchaussée de Québec et seigneur d'Autray et Lavaltrie. Il mourut en 1657; sa femme en 1661, laissant trois filles: Denise, Marguerite et Madeleine-Catherine, toutes mariées.

1635.—Jacques, frère de Charles et d'Etienne Sevestre, resta célibataire et mourut en 1685. Il possédait une terre de quarante arpents aux plaines d'Abraham.

1635.—Etienne, frère de Charles Sevestre, arriva avec leur mère Marguerite Petitpas, mais le père Etienne Sevestre n'a vu la colonie. Cet Etienne, frère de Charles, se noya, à Québec, le 2 mai 1640. La mère Marguerite Petitpas fut inhumée à Québec le 14 septembre suivant.

1635.—Charles Gautier, venu avec son beau-père Charles Sevestre, épousa en 1656 Catherine Le Camus. Il portait le nom de sieur de Boisverdun. Il n'a laissé que des filles. Catherine, sœur de Charles et Guillaume Gautier, se maria, en 1638, avec Denis Duquet, dont la descendance est nombreuse.

1635.—Guillaume Gautier, venu avec son beau-père Charles Sevestre, épousa en 1648 Esther de Lambourg et ne laissa pas de postérité. On le nommait le sieur de la Chesnaye.

V.

Les vingt-sept années qui vont de 1608 à 1635 donnaient, comme résultat, au dernier mois de la dernière année, cent treize âmes de population fixe, distribuées de la manière suivante:

Hommes mariés 22. Femmes mariées 22	44
Petits garçons 24. Petites filles 24	48
Hommes mariés après 1635	13
Hommes qui sont restés célibataires	6
Veuves	2
	113

La population flottante de 1635 se composait des 49 personnes suivantes qui n'ont pas fait souche dans la colonie—et cette liste est nécessairement incomplète, mais nous n'en savons pas davantage:—

Châteaufort, Delisle, déjà mentionnés; monsieur de Saint-Jean, gentilhomme qui, par la suite, accompagna M. de Montmagny; Duplessis-Bochart, chef de traite et conduisant les navires de France; Laviolette commandant aux Trois-Rivières; François de Ré commis chef de la traite, Maupertuis qui fut commandant aux Trois-Rivières; André de Malapart, militaire, poète, homme d'action; Nicolas Courson, chirurgien, Monsieur de Latreille, commis; Jean Alaume, boulanger; Jean Dorival maître valet du fort des Trois-Rivières; Lefebvre, valet de Duplessis-Bochart; Antoine, trompette de Duplessis-Bochart; Antoine, manœuvre; Lamarche, Delormel, Jean Rousseau, de Paris; Claude Sylvestre, de Paris. Total 19.

Il y avait deux prêtres séculiers: Gilles Nicolet et Jean LeSueur.

Les Pères Jésuites étaient au nombre de 16, avec les frères Jean Liégeois, Gilbert Buret, Pierre Feauté, Claude Frémont, Pierre Letellier, et . . . Serrurier, et les domestiques Simon Baron, Robert Hache, Dominique Scot, François Petitpré, Robert Le Cocq et Daniel Castillon.

VI.

L'année 1636 se ressentit de l'élan pris en 1634-35, car il arriva au moins vingt colons, mais la situation devenant douteuse bientôt après, il n'en arriva guère plus de vingt autres en 1637-1640 et une quarantaine de là à 1646.

Il est possible que, parmi les colons qui se présentent à nos recherches comme arrivant de 1636 à 1640 il s'en trouva qui datent de 1633-1635; comme aussi dans le nombre de ceux que nous plaçons de 1640 à 1645 il peut y en avoir qui sont de 1636 à 1639.

En tout cas, nous estimons que, en 1640 (avant le début de Montréal) la population stable était de 274 âmes au moins.[1]

Le recrutement s'opérait en France par voie de parenté, de voisinage ou encore par l'influence qu'exerçaient certains colons sur leurs amis et connaissances du village natal, en un mot sans l'intervention ni la gérance de l'Etat ou des compagnies. Dans cet ordre de choses, point d'archives, aucune écriture publique ou privé qui reste pour notre renseignement, pas non plus de liste de noms—rien pour l'usage de l'histoire.

Pas de vieillards dans cette immigration—tous jeunes ménages; rarement une famille formée depuis dix ans. Ceci explique la rapide croissance d'un noyau de population qui paraît si faible par son chiffre.

Braves gens qui sont venus de si loin dans l'espoir d'adoucir leur sort et d'assurer à leurs enfants un avenir moins précaire que cette existence des provinces françaises constamment tourmentées par la guerre et les aventures de tous genres. Le royaume, en ce temps-là, ne ressemblait ni à l'âge d'or, ni au paradis terrestre, il s'en fallait de beaucoup . Leurs espérances n'ont pas été trompées. D'autre part, aucun d'eux ne se figurait qu'il accomplissait une belle et grande œuvre. Ils y allaient de toute leur énergie, de bon cœur, avec le regret de s'expatrier, ce qui est toujours pénible et l'était encore plus il y a trois cents ans que de nos jours, à cause de la longue, dangereuse et incommode navigation qu'il fallait subir sans espoir de

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[1] *Histoire des Canadiens-Français*, II. 92, 145.

retourner jamais faire une visite au pays natal; à cause aussi de l'éloignement presque fabuleux où ils allaient vivre, du manque de tant de choses nécessaires au milieu des forêts et des Sauvages; puis il y avait l'incertitude d'une entreprise toute nouvelle, réputée extravagante ou pour le moins risquée. N'importe! ils se jetaient à corps perdu dans l'avenir, sans deviner qu'ils plaçaient leurs noms sous l'égide de l'histoire d'une autre patrie, à titre de fondateurs, et toujours avec la détermination de bien faire.

L'oubli s'est emparé d'eux à la mort de chacun. Plus de deux cents ans ont passé sur leurs cendres. Personne ne pouvait dire, en 1870, quels hommes c'étaient que les premiers Canadiens. Il a fallu Laverdière et Tanguay pour commencer à les faire connaître. Leurs noms, leur berceau, l'époque de leur arrivée, leur nombre, les lieux où ils se sont établis chez nous, tout cela entre dans la lumière à présent. Notre Canada français se fait gloire de les avoir eu pour ancêtres, car leur origine est pure, leurs descendants ont toujours été dignes d'eux; en fouillant ce passé nous n'avons rien à craindre. Ces colons primitifs ont embrassé la terre du Canada avec amour, ils ne l'ont plus quittée, elle a nourri leurs familles dont les branches et les rameaux prospèrent au mileu de nous, ce qui offre un contraste marquant et honorable si on compare sous ce rapport la majorité des colonies dispersées sur le globe. Le petit nombre et les petits moyens ont produit sur les bords du Saint-Laurent des résultats aussi notables que le grand nombre et de vastes ressources ont eu tant de peine à réaliser partout ailleurs.

VII.

Avec nos ancêtres si longtemps oubliés de l'histoire, le fondateur du Canada fut presqu'enseveli. Son éloge, il est vrai, se rencontre au cours de divers narrations publiées par les Jésuites, les Récollets, Charlevoix, et répétées par Bibaud, Garneau, Ferland, Faillon. Il ne se pouvait pas qu'un tel homme ne fût pas mentionné un peu partout, mais avant 1870, où parut à Québec la belle et savante édition des Œuvres, par Laverdière, personne n'avait pris la mesure exacte de sa valeur. Il nous manquait un grand nom, une large idée pour servir de base à nos annales. Laverdière le découvrit avec la parfaite connaissance de ses mérites. Il voulut remettre en lumière les rapports rédigés par cet esprit si juste et si clair, depuis le voyage au Mexique (1598) jusqu'à son dernier retour au Canada en 1633. Ce n'était pas une tâche facile, attendu que les imprimés du temps de Louis XIII étaient devenus rarissimes, n'avaient jamais été réunis en un corps de volumes, et qu'il fallait les rechercher par toute l'Europe, dans les bibliothèques publiques ou privées, au hasard d'en omettre quelques uns. Néanmoins, bon chasseur de sa nature et doué de l'instinct qui double l'érudition, il ne perdit aucune piste et parvint à se procurer copie de ces textes si précieux pour nous.

Lorsque parurent[1] les 1478 pages du recueil,[2] avec la complète biographie de l'auteur et les abondantes notes explicatives qui accompagnent le texte ancien, il y eut un tressaillement dans notre petit monde littéraire et bientôt la surprise se communiqua aux lettrés des Etats-Unis. Un Champlain de taille héroïque s'offrait à notre admiration. Les secrets du Canada naissant devenaient intelligibles. La vraie couleur des choses se montrait enfin et, du milieu de tant de personnages aux noms bruyants, aux titres pompeux qui figurent dans nos plus vieux récits, se dressa le plus humble d'entre eux, les dominant tous et se dessinant en vigueur sur le fond embrouillée de notre histoire, qu'il éclairait pour toujours. Nous avions Champlain vivant puisque c'était lui qui parlait. Chacun pouvait à son aise dégager les hommes, les actions, les faits de cette chronique minutieuse et touffue d'une époque lointaine, mais de haute importance à nos yeux attendu qu'elle renferme les origines de notre patrie.

Les marques de respect envers cette mémoire nationale ne tardèrent pas à se manifester chez les écrivains qui, tous, s'empressèrent d'exhumer une masse de renseignements de ce trésor de vérités.

Puis, on entra dans l'ère des monuments et des statues. En 1878 la ville de Brouage, ou plutôt dans le lieu où naquit Champlain, une belle colonne de pierre fut élevée qui rappelle le souvenir du grand Saintongeois et du Canada. Dix ans plus tard, la ville de Québec inaugurait un monument artistique surmonté d'une statue de son fondateur. En Normandie où Champlain engagea ses fameux interprètes et qui donna ses premiers colons au pays nouveau; à Honfleur port d'embarquement pour le Canada, on a posé, en 1899, une plaque commémorative en présence d'une délégation canadienne et d'un immense concours de population. La ville de Saint-Jean, Nouveau Brunswick, a érigé, en 1904, sur la belle place publique de son port une statue de l'explorateur qui regarde la mer du haut d'un superbe piédestal. Au lac Champlain, les Américains ont prodigué l'argent pour ériger un luxieux monument qui fait connaître le découvreur de la région environnante. A Ottawa, à Orillia, des

[1] A l'université Laval. L'ouvrage fut conduit par George E. Desbarats, avec les ouvriers suivants: Paul Dumas, Isaac Fortier, L-Robert Dupont, Jacques Darveau, Edouard Aubé. Leggo et Cie étaient les lithographes et les phototypistes.

[2] Ces livres portent: "Seconde édition" parce que un incendie consuma la première, en 1869, avant qu'elle ne fut brochée. De tout ce travail, il ne restait qu'un exemplaires en feuilles qui servit à l'édition finale ou "seconde"

statues de Champlain, de nobles proportions, sont inaugurée en ce moment. Bref, tous les endroits qu'il occupe historiquement il y est aussi représenté en pierre ou en bronze.

Il s'est formé à Toronto une association appelée Champlain, qui imprime, en langue anglaise, les livres les plus anciens de notre histoire, le tout exécuté avec science, un goût parfait et un luxe approprié. En ce moment paraît dans cette collection remarquable tout ce qui compose les œuvres de Champlain. Le père de nos provinces maritimes, de Québec, d'Ontario et d'une partie de l'Etat de New-York aura des lecteurs partout dans ces territoires ou, pour mieux dire, dans toute l'Amérique du Nord.

Ainsi, les Français—c'est assez naturel; les Canadiens-Français—ce qui ne surprend pas; les Anglais d'Ontario et des provinces maritimes—un fait remarquable; les citoyens de la Nouvelle-Angleterre—autre sujet d'admiration—tous et de tous côtés ont rendu hommage à Champlain de la même manière qu'en tout pays civilisé on traite les héros et les grands hommes de la nation.

Mort au Champ d'Honneur—Le Sergent Henry Desroys du Roure.

Par M. EDOUARD MONTPETIT, M.S.R.C.

(Lu à la réunion de mai 1915).

La guerre n'a pas épargné les lettres françaises. Des noms, qui se lisaient hier sur la couverture d'un livre pour en imposer le succès, sont inscrits maintenant sur une croix de bois, comme une suprême parole d'heroïsme. La leçon de ces morts est celle que l'histoire enseigne aux hommes qui veulent connaître le secret de la durée. Magnifique et lointaine destinée: tous ont été grands; tous ont obéi à l'appel de la France, sans être effleurés par un murmure, acceptant de combattre pour les idées qu'ils avaient semées, pour les oeuvres qu'ils avaient aimées et conçues, pour la renommée qui les avait sacrés; tous, depuis le comte Albert de Mun, qui, chaque matin, sonnait la charge des âmes et dont le coeur s'est brisé sous la poussée d'un impérieux espoir, jusqu'aux plus humbles parmi les écrivains, artisans quotidiens de la pensée, rompus depuis longtemps à la silencieuse discipline du courage.

Leur mort a la fécondité des premiers holocaustes. Pendant que d'autres, les ainés, transmettaient à la nation le mot d'ordre de la victoire et, loin des combats, armaient les volontés d'une espérance patiente et invincible; eux, ils manifestaient sur les champs de bataille la véritable grandeur de la France, sa simplicité allègre et tenace, que les peuples trompés avaient trop vite méconnue. Est-il un argument qui rayonne et triomphe davantage, une preuve qui revête un plus sûr éclat que cette liste, douloureusement longue, où la gloire fidèle trace de jour en jour les noms des hommes que déjà elle avait élus: Max Doumic, Charles Péguy, Pierre Ginisty, Ernest Psichari, François Laurentie, Henry Desroys du Roure, et tant d'autres que la posterité attentive recueille pieusement comme un patrimoine de vie? Hâtons-nous de dire leurs exploits, s'écrie Maurice Barrès. Certes, rien de ce qui a été tel ne doit être ignoré. Recherchons dans leur passé la source généreuse où leur coeur a puisé. Ils ont mérité l'Histoire.

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Henry du Roure était de ceux que nous avons coutume d'appeler "les amis du Canada." Il aimait notre pays, notre population, sans les connaître autrement que par le bien qu'on lui en avait exprimé. Sans doute, la persistance du sentiment français, qui fait la trame unique de notre histoire, l'avait retenu et enchanté. Chérissant sa patrie par-dessus tout, il savait gré à notre peuple de son attachement à ses origines lointaines. Ces idées, je le sentis, nous rapprochèrent aussitôt lorsque je le rencontrai, un soir de juin 1913, dans l'intimité parfaite de sa famille. Nous causâmes peu; mais les mots échangés nous liaient déjà, comme si les réflexions qu'ils portaient en eux nous eussent depuis longtemps préparés l'un à l'autre. De ces heures trop brèves, je garde un souvenir vivant qui se prolonge maintenant dans un adieu; seul mérite de ces quelques pages, consacrées à la mémoire de l'ami d'un jour, disparu à jamais.

De sa vie, nous savons peu de chose. Il avait soin d'ailleurs de n'en rien dire, n'attachant d'importance qu'aux vérités de l'action. Il travaillait beaucoup, courageux et modeste. Il recherchait avant tout la consolation du devoir accompli et ne trouvait de satisfaction vraie que dans la poursuite du bien commun, auquel il brûlait de se livrer. Il était apprécié, connu. Son oeuvre comptait déjà. Deux romans, deux titres de contes de fée, marquent les débuts de sa carrière, si brève et si noblement terminée, comme l'expression d'un rêve très doux qui serait presque d'un enfant: *La Princesse Alice*, *La petite Lampe*. Ce furent ses premiers essais. Nous regrettons de ne pas connaître ces pages où, en passant, il apaisait sa sensibilité vive par des jeux d'esprit.

Sa jeunesse s'était éveillée et mûrie, son esprit s'était formé, pendant une période troublée, déchirée de luttes. Il avait appris au collège l'histoire héroïque de la France, histoire splendide, "attachante et merveilleuse comme une fable;" et il en avait subi l'influence sans réserve. L'éclat des victoires passées faisait tressaillir son âme et réchauffait sa volonté croyante. Dans le recul des temps, tout servait d'aliment à son imagination ardente et fière: batailles éperdues, mêlées gigantesques, panache de la chevalerie, charme de l'expression, prière des cathédrales, beauté du geste, patience du travail, audace de la pensée, humanité du sentiment. Facettes d'une pierre dont il recueillait tous les feux. Ces éléments, ces richesses, légitimaient l'orgueil qu'il ressentait d'être né français, lui, le fervent de la France immortelle. Cela, il l'a exprimé avec chaleur: "Je sais, écrit-il, ce que l'on enseignait, il y a vingt ans, aux petits enfants que nous étions alors, et j'en suis encore ébloui. C'était une épopée qui commençait à Vercingétorix pour finir à Napoléon. Bayard, du Gesclin, Jeanne d'Arc, Roland à Roncevaux, Saint-Louis sous le chêne de Vincennes, le sourire d'Henri IV, le génie de Condé, la douceur grave de Turenne, et nos écrivains, nos penseurs, le rayonnement du grand siècle, l'éclair du Premier Empire, quelle splendeur! quel enchantement!"

Ce passé dans les yeux, il s'élança vers la vie. Il heurta aussitôt la réalité vivante et multiple. Quoiqu'il les possédât en lui-même, il ne sentait plus autour de lui les grandes forces d'hier. Le présent se matérialisait en des oeuvres de passion, parfois de haine. Il s'exerçait à comprendre son temps au prix de ses aspirations épuisées. L'âpreté de la lutte pour la domination, la course à la richesse, le tourment de paraître, la mesquinerie des moyens, toutes ces contingences d'où jaillit souvent, par réaction, une beauté et que l'histoire atténue et néglige, qui sont le bouillonnement d'où monte l'avenir, lui faisaient croire à une sorte de décadence prochaine. Il eut peur, sans cesser un instant d'espérer; il eut peur, et il eut conscience de sa tâche. La France lui apparut désorientée, menacée. Ce ne fut qu'un moment. Son regard, plus habitué, comprit. Son pays, comme naguère, entrainait l'humanité sur les chemins de l'expérience, s'offrant lui-même aux aspérités. Il vit partout des rêves s'agiter dans un souffle de révolte. L'industrialisme-roi fomentait des systèmes qui se tournaient contre lui; l'usine fabriquait des idées, qui venaient saper les vielles contraintes d'un passé impuissant; la question sociale, que l'on ne pouvait plus nier, se posait, impérieuse, aux anxiétés de tous. Celà même détermina sa résolution. Au matérialisme de l'heure, il opposa l'idéalisme de tous les temps. Il écouta son coeur et sa raison. Il prit rang parmi l'école nouvelle des sociologues. Résolu à servir, il se jeta dans la bataille et se choisit un chef, Marc Sangnier, qu'il aima profondément et dont il fut un des plus beaux lieutenants. Il écouta son coeur et sa raison: il se fit apôtre.

De cette époque, il nous reste de lui les *Chroniques françaises et chrétiennes*, petit recueil où sa pensée, inquiète et confiante tout à la fois, s'arrête un instant. Ces quelques pages sont détachées du journal où il collaborait. Ce sont des chroniques: l'oeuvre d'un jour, mais qui n'offre pas uniquement l'intérêt de l'actualité. Elle est révélatrice. Les faits qu'elle retient et commente se complètent: leur variété forme un tout; ils précisent une situation d'ensemble; ils s'additionnent en un argument final; chacun se précipite, parle, plaide, convainc. Ils laissent chez le jeune écrivain, attentif à les recueillir, une trace vive; ils ont en lui des répercussions qui manifestent la persistante unité de ses préoccupations, ses façons identiques de regarder et de comprendre les sommets de la vie. Il est là tout entier, avec ce qui faisait la marque et le charme de sa personnalité: sa sensibilité saine, son bon sens averti, narquois; son esprit large, curieux de tout, au tour volontiers philosophique; son ironie sans lourdeur comme sans méchanceté; sa foi inébranlable, guide et soutien de son énergie; sa dignité; son amour décidé, passionné, de la justice, de l'ordre, de son pays, de la France. Son oncle, l'éminent historien Henri Welschinger, lui consacrait, au lendemain de sa mort, ces lignes émues qui le font revivre: "Il avait reçu du ciel les plus beaux dons: la générosité de l'âme, la franchise du coeur, la finesse de l'esprit, la conscience du vrai et du beau. Il écrivait des articles qui, dans la *Démocratie*, apportaient aux lecteurs des pensées aussi profondes que justes. Parmi les jeunes gens qui sont morts au champ d'honneur, le souvenir d'Henry du Roure restera comme celui d'un soldat sans reproche et d'un chrétien modèle." Leçon dernière de la petite croix de bois, inclinée sur une tombe.

Les luttes politiques de l'heure se retrouvent dans ce livre, court reflet d'une vie d'incessante activité. Ces querelles se sont apaisées dans l'harmonie d'un effort commun, quand la grande voix de la patrie a rallié les volontés et fondu les coeurs. Sans les rouvrir, nous pouvons y chercher la pensée d'Henry du Roure, qui s'y intéressait par devoir plus peut-être que par inclination. Lorsqu'il écrit ses "lettres familières," si vivement spirituelles, à Soeur Candide ou à M. Millerand, ministre de la guerre, à l'aviateur Védrines ou à un sergent de ville; lorsqu'il taquine M. Clémenceau, "soigné par une religieuse;" lorsqu'il s'arrête, soudain plus grave, à méditer sur la catastrophe du Titanic, du "Titan foudroyé," ou sur les stupéfiantes audaces de la bande Bonnot; ce sont des idées qu'il poursuit, qu'il rencontre, qu'il défend. Il est à l'affût de la réalité, pour lutter avec elle, la surprendre; et montrer en elle l'épreuve, et parfois la défaite, des plus beaux systèmes, des plus béates théories.

Avec bonne humeur, sans étroitesse de vue, et sans cette amertume chronique qui marque la manière de certains polémistes, il rétablit, dans un style vivant et coloré, les traditions françaises. La tradition: le mot naguère était mal venu. Qui oserait en sourire aujourd'hui, quand le clairon réveille dans l'âme du troupier toutes les vaillances d'autrefois; quand les vieux noms de batailles, accumulés dans la gloire du passé, indiquent encore la route aux mêmes armées victorieuses. La tradition, c'est le "dépôt sacré" de la nation, disait hier le Président Poincaré, en remettant aux soldats français l'emblême qui la symbolise; c'est l'obéissance active des siècles. La logique de l'histoire, sa première éducatrice, paraissait à Henry du Roure la meilleure école, la règle la plus sûre. Epris de progrès, il en cherchait la réalisation sans dépasser ses propres limites. Il comptait sur l'action, instinctive ou raisonnée, des belles qualités de sa race; sur l'équilibre des forces; sur les libertés nécessaires, qui sont le ferment du droit et sa garantie; sur les grandes disciplines morales, que le temps a dictées. Tout cela avait constitué la France d'hier; de tout cela, il voyait se lever une France plus semblable à elle-même, plus certaine d'elle-même; une toujours et indivisible, car il n'admettait pas de rupture et pensait, comme autrefois Louis XVIII, "que les victoires, mêmes remportées par un "Usurpateur," font partie du patrimoine national, au même titre que des provinces;" une France où l'idéal continuerait de régner, quand même il serait banni du reste de la terre. Ecoutons-le: "Je hais la stupidité de nos classifications humaines, nos jugements bornés, nos clichés, nos récompenses imbéciles, le néant de nos admirations. Il n'y a pas de mot qu'on ait prodigué plus sottement que celui de héros. Et depuis que les journaux à grand tirage en font usage, pour les besoins de leur vente ou les intérêts de leurs partis, il traîne après lui, ce mot magnifique,—au lieu d'évoquer les êtres surhumains de la Grèce,—je ne sais quel relent de café-concert. On a galvaudé cette folie sublime, l'enthousiasme, exploité l'émotion, souillé les larmes. Tout cela est odieux et vil; sous ces mascarades, sous ce fard, je ne reconnais plus l'idéal."

Cette France, il souhaitait par-dessus tout qu'elle fut grande et respectée. La politique extérieure, réduite par un ministre aux étroites dimensions "d'une affaire," à n'être plus qu'une pesée d'intérêts soi-disant économiques, lui arrachait ce cri: "Ce n'est pas assez de condamner la politique d'affaires. Il faut la haïr. Il n'y en a pas de moins nationale. Il n'y en a pas de plus mortelle au patriotisme ....qui ne peut tenir, dès qu'on lui dérobe son âme d'idéalisme." Il exultait à célébrer le véritable héroïsme, dont la guerre des Balkans marquait le réveil. L'incident d'Agadir lui apportait la confirmation de ses plus ardents espoirs. Il y voyait la restauration de la France militaire. On sait à quel point il avait raison. Ceux qui ont approché la France, à ce moment de silencieuse angoisse, peuvent dire avec quel courage, avec quelle unanimité d'idées et de sentiments, elle avait résolu de lutter. Elle a, ce jour-là, vaincu moralement. Sa dignité à triomphé définitivement d'une trop longue bravade. Le peuple français a, sans s'y tromper, obéi stoïquement aux "exigences sentimentales du patriotisme." Les raisons de fortune, d'intérêt financier, de colonisation lointaine, passaient au second plan: la nation défendait sa terre et ses morts. "Notre pays a repris conscience de sa force, constatait Henry du Roure, en 1911. Il a repris conscience de lui-même: il a retrouvé ses qualités de fierté, de bravoure, d'élan.... Si la guerre éclate, nous sommes en état de l'affronter. Notre patriotisme, sans avoir perdu ce quelque chose de grave et de concentré qu'il acquit dans l'épreuve, s'est exalté, échauffé. Par la force des choses, devant la menace de la grande bataille, les querelles intimes se sont tues. L'unité française s'est resserrée."

Le danger est venu; et la France était unie devant lui. Lorsque l'appel aux armes retentit, la nation put l'entendre dans le calme de sa décision, et l'accepter. Elle fit l'admiration de tous. Ceux qui ne la connaissaient que de surface, qui n'avaient pas pénétré son âme, riche et multiple, avaient pu un instant douter d'elle, tout en lui conservant leur amicale sympathie. Mais la France s'était relevée de sa défaite; depuis 1870, elle avait refait ses forces. Ce pays, où s'agitait un esprit libre, mobile, volontiers frondeur; pays de la pointe et du mot, où d'aucuns ne voulaient voir que raillerie, élégante facilité, insouciante gaieté; ce pays, par pudeur, ne se livrait pas. Pour le juger, ceux qui avaient pu l'étudier d'un peu près cherchaient à définir sa pensée abondante, ses activités intellectuelles, la générosité de son coeur; à expliquer la hardiesse, si souvent féconde, de ses arts, la plénitude de sa vie populaire, où fourmillent les idées, les espoirs, les rêves. Ce pays, si léger qu'un ennemi inattentif a cru pouvoir le vaincre au seul bruit de sa lourde course sur ses routes blanches et riantes de soleil, a pourtant donné l'exemple du plus pur héroïsme. L'univers s'est aperçu soudain que la France vivait toujours; et il en a été ravi, plus encore que le Français lui-même. Et la France armée gagne en ce moment deux batailles, l'une sur l'Allemagne coalisée, l'autre sur le monde conquis par sa vaillance.

Henry du Roure avait déjà expliqué cette apparente contradiction, ce mélange de force et d'élégance, de charme et de virilité, de crânerie et de gravité: "Le goût des vertus militaires est plus vif chez nous que jamais. "On revient toujours à ses premières amours," dit un proverbe qui est bien nôtre. Volages et fidèles, il nous dépeint tels que nous sommes. La France, de tout temps, ne fut-elle pas amoureuse des grands soldats? De Roland à Napoléon, que de héros dans sa légende!.... Et notre plus chère héroïne, c'est Jeanne d'Arc, une guerrière. On a pu croire que nous avions oublié tout cela. Après 70, la France ingrate se détournait des soldats vaincus, trop vaincus; l'étranger, qui ne nous connait pas et ne nous connaîtra jamais, s'y méprenait. C'était fini, nous avions répudié la guerre pour épouser la paix! Et quelle paix!.... La paix à tout prix, la paix de la mollesse et de la peur. On le croyait au delà des frontières; on y prenait Hervé et l'*Internationale* au sérieux. N'étions-nous pas le pays des antimilitaristes et des sans-patrie, le pays où un homme avait osé dire, sans être lynché par les passants: "Le drapeau dans le fumier?" Cela n'a pas duré longtemps. Qu'a-t-il fallu? Les morts du Maroc, le prestige de l'aéroplane, l'héroïsme des aviateurs, la maladresse allemande, et puis l'entrée en scène d'une génération nouvelle. Aujourd'hui tous les Français, blancs et bleus, rouges et jaunes, font assaut de patriotisme. Les instituteurs, la Sorbonne, les juifs, les socialistes, la C. G. T. et le gouvernement. "Vive l'armée!...." n'est plus un cri séditieux. Et monsieur Gustave Hervé demande tout étonné: "L'hervéisme, qu'est-ce que c'est que ça?..... Voilà, nous sommes revenus à nos premières amours. Nous serons encore infidèles et nous reviendrons toujours."—Nous serions tentés de rapprocher ces lignes de l'article, désormais célèbre, où le *Times* de Londres saluant les soldats de la seconde Grande Armée, s'excuse noblement d'avoir méconnu la France!

"L'entrée en scène d'une génération nouvelle"....Henry du Roure en était . Il fut de ceux qui, les premiers, se sont offerts à la patrie. A cause de cela, nous voudrions pénétrer davantage l'intimité de sa pensée et nous arrêter un peu plus longuement sur les *Réflexions*, qui terminent les *Chroniques françaises et chrétiennes*, comme une méditation. Nous en retenons un couplet sur les *bleus*, où, sur un ton plus familier, presque attendri, s'affirment son respect du service militaire et son amour de l'armée; et des considérations sur la guerre, qui nous font toucher le ressort de cette volonté, la beauté virile de cette âme. Quel n'est pas l'intérêt de cette révélation? N'allons-nous pas trouver ici, dans ces mots enfiévrés, dans la chaude exaltation de ces sentiments, la source profonde des suprêmes audaces, le secret merveilleux de la résistance française?

Les *bleus*! Quel joli mot la langue populaire a su conserver pour exprimer l'hésitation un peu gauche, un peu naïve, de ceux qui laissent leur pays et leur enfance, pour entrer dans la vie de la caserne et recevoir le baptême du drapeau! Avec quelle sympathie ne les ai-je pas suivis, ces bleus, qui vont par groupes bruyants. C'est leur première liberté d'étudiants. Il leur faut montrer du courage, et cela ne va pas sans gaieté. Ils chantent: peut-être pour étouffer le regret d'avoir quitté le foyer aux douces habitudes. La population de Paris les accueille, amusée, goguenarde, intéressée quand même. Les gamins pensent à leur tour prochain. Les vieux disent: "Voilà les bleus;" et ils les regardent longuement, en fermant les yeux, comme on fait pour admirer un tableau préféré; et leur coeur renait aux heures lointaines, où ils n'avaient pas senti peser sur eux la première inquiétude de la responsabilité. Ce sont les fiancés de la Patrie. Apprentis d'un métier glorieux, ils vont connaître la grande discipline des armes, l'égalité que le devoir impose et que la volonté accepte. Ils sont grandis; ils sont des hommes; ils sont soldats. Henry du Roure en fait un dessin charmant, comme un artiste amusé brosse une pochade avec un souvenir:

"Ils arrivent un matin d'octobre, las, inquiets et tristes.

"Il y en a qui viennent de loin, et qui ont passé toute la nuit en wagon, parmi les rires et les cris, pressés contre des inconnus, tristes comme eux, et qui chantaient. A l'arrivée, on les a conduits de la gare à la caserne, en troupeau.

"Il y en a qui sont venus tout seuls. Avec des ruses enfantines, ils ont échappé, pour gagner une heure, au terrible adjudant qui surveillait les billets militaires.......

"Qu'importent leurs noms, leurs visages, et leurs pensées?.... Ils sont la *classe*. Ils sont les *bleus*, ahuris et tondus.

"Ils errent dans les rues moroses, et leur valise les désigne aux regards, parfois aux lazzi, des gamins.... Ils vont, par une rue longue et fatale. Et c'est, après un tournant, la caserne.

"Encore un moment, de grâce!....crie en eux quelque chose qui pleure et qui supplie. Et leurs jambes, comme si elles n'obéissaient pas, comme si elles n'étaient pas à eux, continuent de marcher, d'un pas d'automate, d'un pas déjà militaire....

"La grille....Arrêtons-nous....Hélas! Elle est déjà franchie ....Adieu, l'enfance!.... Ils sont soldats.

"Après le grand effroi de l'arrivée, quand le premier réveil les arrache à leurs lits étroits, ils ont l'âme toute changée. Ils s'habillent le plus vite qu'ils peuvent, avec une hâte fébrile et gauche. Ils descendent dans la cour, et leur coeur bat quand l'adjudant inspecte leur tenue. Le lieutenant leur parait un surhomme et le capitaine, un dieu. Ils écoutent et ils croient de toutes leurs forces ce qu'on leur dit. Ils apprennent ardemment à saluer, à marcher, à pivoter. La première fois qu'ils se montrent en ville, en détachement, bien alignés, et marquant vaillamment le pas, une fierté leur fait lever la tête.

"Le chef armurier leur remet un fusil, surmonté de sa baïonnette, un long et lourd fusil, tout recouvert de graisse. Ils le prennent avec une maladresse religieuse. Ils traversent la cour en le portant comme un cierge....Mais c'est *leur* fusil, une des rares choses qui soient à eux, bien à eux, dans cette armée où tout est en commun. Et puis, qu'est-ce qu'un soldat sans fusil?....Le fusil évoque les combats, les glorieuses blessures, le tableau des Dernières Cartouches. Avec un fusil dans les mains, ils ressemblent davantage aux soldats de la légende.

Quelques mois passent, et "les *bleus* deviennent des *anciens*. Pauvres bleus! Restez ce que vous êtes!....Le service militaire, l'impôt du sang, c'est une réalité très dure, mais une idée magnifique. On vous demande un long effort. On vous demande cet acte héroïque au nom de la patrie. Pourquoi mettriez-vous votre orgueil à n'y consentir que par crainte?

"Pourquoi rougir d'être traité en héros?"

Aujourd'hui les bleus sont devenus les *poilus.* Ceux qui ont résisté à la rafale, tiennent toujours, dans la tranchée impatiente. Henry du Roure les y avait conduits, accompagnés. Toute sa vie, il avait repoussé les doctrines antimilitairistes et les rêves pacifistes, qui se mêlaient, aussi légers, à la fumée des usines de guerre. Il aimait la paix, mais non pas jusqu'à lui sacrifier l'honneur. Il ne croyait pas d'ailleurs, pour reprendre le vocabulaire des sans-patrie, que la guerre fut uniquement une boucherie, dont l'effroyable horreur satisferait dans le sang les ambitions de quelques hommes. Pour lui, comme pour le poète, c'est:

Le grand embrassement du mort à sa Patrie.

C'est sortir de soi-même; s'oublier, oublier la vie de chaque jour, les mesquineries qu'elle traine avec elle; les ambitions qu'elle aguiche et bafoue. C'est faire partie d'une force immense, totale; défendre les foyers, protéger les faibles, venger les injures, lutter pour le droit, donner la vie en recevant la mort. C'est un orgueil sublime où sombre la volonté individuelle. C'est se donner tout entier à une idée; et, la faisant triompher par soi, dûrer dans l'immortalité de ce triomphe:

"A l'amour comme à la guerre, ce qu'on demande, c'est une ivresse. Oui se griser, perdre la tête, sortir de soi, s'oublier, ne plus trainer le lourd fardeau de sa personne, se laisser emporter par quelque chose de plus fort, se confler au courant, souffrir mais palpiter, mourir mais avoir vécu.... Rêve si beau qu'il n'y en a pas de plus attirant sur la terre, et même qu'il n'y a que celui-là. Tous les autres relèvent de lui. Où tend l'effort des mystiques, sinon à se perdre, à s'anéantir dans le torrent de l'amour divin? C'est l'ivresse de l'amour que le musicien, le poète, l'artiste, demandent à leur art. C'est l'ivresse de la bataille que l'homme d'action demande à l'ambition, aux affaires. Sans la passion, que deviendrait le monde? Telle est la loi des individus et telle est la loi des nations. Ainsi naissent les grandes passions collectives, ces frénésies d'amour qui agenouillent des millions d'hommes devant un maître, ces frénésies de gloire et d'immolation qui jettent tout un peuple aux frontières.

"Voilà pourquoi on n'arrivera jamais à tuer tout à fait la passion de la guerre. Au fond de cet amour barbare gît un grand sentiment, l'ambition de s'élever, au-dessus d'une vie médiocre et terre à terre, vers le ciel des héros, le désir de battre des ailes, au moins une heure.... On n'a pas tous les jours l'occasion d'être héroïque; surtout on n'en a pas tous les jours le courage, dans l'atmosphère triste et grise de l'existence quotidienne. Mais on espère y être aidé par la guerre et sa mise en scène incomparable, par l'odeur de la poudre et la fanfare du canon, par l'exemple, par la présence du drapeau, et par la grande idée de Patrie qui plane au-dessus de tout cela.

"Une guerre sainte, c'est un peuple qui marche au martyre en chantant. Avilir la guerre, pourquoi ? Pourquoi ne pas l'ennoblir au contraire, lui restituer toute sa valeur morale, presque mystique, et la faire si grande qu'elle ne puisse s'abaisser à servir une mauvaise cause ou seulement une cause vulgaire ? Oui, cent fois oui, une guerre juste est seule digne d'inspirer d'héroïques folies. Exalter à l'infini la notion de justice, lui soumettre les relations internationales, la dresser au-dessus des intérêts, humilier même devant elle la vanité des peuples, voilà l'oeuvre, noble entre toutes, qui grandit le patriotisme et qui rapproche les patries. Tuer la guerre par le respect universel du droit, si cela est possible, qu'on l'essaie; qu'on n'essaie pas de la tuer par le mépris.... Souhaitons, avec les pacifistes, pacifistes nous-mêmes, que nos arrières-neveux voient disparaître les formes les plus barbares de la guerre, ces tueries atrocement glorieuses. Ces temps sont lointains. Peut-être, s'ils doivent venir, l'humanité pacifiée, se retournant vers les guerres du passé, comprendra-t-elle ce qu'il y avait de grand dans leur cruauté. Plus indulgente que certains hommes d'aujourd'hui, peut-être s'inclinera-t-elle très bas devant les générations qui auront connu la douleur et la gloire de verser leur sang pour une idée."

Gloire et douleur, il vous a connus. Il traçait ainsi, d'une main sûre et hardie, sa propre destinée. On trouve, dans une de ses chroniques, cette phrase, saisissante prophétie: "Le sang français répandu est le sceau qui rend valable les traités." Il a subi la douleur; il possède la gloire. Il est mort pour une idée; il a répandu son sang sur la page honteusement déchirée d'un serment; il a vengé l'honneur de la parole donnée. Il s'y était préparé depuis de constantes rêveries, de profondes méditations. Nous le savons. Aux pages ardentes que nous venons d'écrire sous sa dictée, il convient pourtant d'ajouter ces lignes où il se met au service de son pays, en lui abandonnant sa vie; où il prononce le mot d'ordre de sa génération: faire son devoir, quoi qu'il advienne. Tous les mots en ont été pesés; et l'ensemble est superbe de résolution contenue. C'est comme le testament d'Henry du Roure, sergent au 369e d'Infanterie, mort au champ d'honneur:

"Sans aller jusqu'à prévoir, avec les Allemands, le moment où le dernier Français aura disparu de la surface du globe, nous n'avons pas le droit d'écarter sans examen toutes les sombres hypothèses dont peut gémir notre amour-propre. Méditons au contraire sur ce thème douloureux! Et que de cette méditation patriotique, sincère, courageuse, souvent renouvelée, jaillisse une résolution virile, une bonne volonté toujours vive. Sans doute chacun de nous, lorsqu'il se considère lui-même, se sent découragé et presque dispensé de l'effort par la faiblesse. En présence des forces immenses qui menacent de s'entrechoquer, que pouvons-nous? Comment soulever de nos deux mains le poids infini des fatalités historiques ?. . . . Comme une immense pierre, posée en équilibre sur une base étroite, hésite, chancelle, est d'abord à la merci du vent ou de la poussée d'un enfant, et puis, quand elle s'est enfin abattue, défierait l'effort des géants, ainsi la destinée des hommes et des nations, avant de devenir irrévocable, dépend peut-être d'une parcelle de courage, d'une étincelle d'héroïsme.

"Il se peut que nous soyons à la veille d'un de ces conflits gigantesques d'où les peuples sortiront renouvelés, où des pays et des civilisations seront écrasés: que la grandeur du péril ne nous fasse pas croire à notre impuissance! Que chacun de nous fasse son devoir, avec une immense espérance, comme s'il devait être la petite main qui fait basculer la pierre."

Ainsi la vie d'Henry du Roure avait été une longue veillée des armes. L'ordre de mobilisation ne le surprit pas. Il était prêt: il partit. Il fit la campagne de Lorraine, sur la terre du souvenir, où chaque pas en avant est une revanche; où la bataille est plus intense, parce qu'elle marque les étapes d'un retour, retour du tricolore aux murs des anciennes mairies et sur les places publiques où, dans un décor d'architecture française, nous écoutions, il y a de cela deux ans, des musiques allemandes sanglées de bleu, jouer, avec une raideur calculée et des éclats de cuivre, *Poète et Paysan.* Il est mort à Flirtey, près de Pont-à-Mousson, au mois de Septembre, à l'automne, au moment où les *bleus* arrivent à la caserne apprendre l'héroïsme. Il est mort à son poste, frappé de cinq balles, en chargeant à la baïonnette, avec ce fusil "qui fait ressembler davantage aux soldats de la légende." Dans une lettre de douleureuse et fière résignation, son père nous a fait le récit de ses derniers instants: "Il était parti pour l'armée avec la résolution inébranlable d'être un modèle d'endurance et de courage. Assez délicat de tempérament, épuisé par les longues marches, par le manque de sommeil, il répondait à son capitaine, qui lui conseillait de demander quelques jours de repos: "Je suis sergent, je dois donner l'exemple; je tiendrai jusqu'à ce que je tombe." Un de ses officiers m'écrivait: "Constamment sur la brêche, il se dévouait pour tous; toujours le premier à marcher, il entrainait les autres de la voix et de l'exemple. Aux heures de lassitude et de découragement, j'ai été souvent heureux de pouvoir causer avec lui: il m'a toujours donné du coeur et remonté le moral. . . . J'en conserve un impérissable souvenir." Atteint de trois blessures, au bras, à la jambe et à la tête, il refusa l'assistance d'un caporal, qui voulait l'aider à se transporter à l'arrière, et il tomba enfin, frappé d'une balle en plein coeur. Peu de temps avant, il avait retrouvé, sous l'uniforme de brancardier, un Père dominicain qu'il connaissait; et il avait pu recevoir les sacraments. Ses camarades l'ont pieusement inhumé à la place même où il est tombé; c'est là que j'irai chercher ses restes, après la fin des hostilités." . . . Admirable France qui produis de tels hommes! Henry du Roure a été fidèle à son rêve; il le garde en lui, dans la mort. Il a vécu, il a connu "la présence du drapeau," soldat de la première heure, enfant reconnaissant jusqu'au sacrifice de sa jeunesse. Il est mort pour la France, conscient, et lui donnant, dans une dernière parole d'amour, son dernier soupir: "il a battu des ailes, au moins une heure." Il est parti trop jeune pour mourir complètement. Son souvenir demeure. Ceux qui l'ont aimé, le vénèreront comme un héros de la grande guerre. Il avait écrit: "La seule croix qui vaille de vivre est celle qu'on voit sur les tombes." Cette croix, il vit éternellement en elle.

A côté de lui, quatre frères ont combattu, suivis dans les batailles par le coeur ému, palpitant, de leur noble père. Ils ont fait tout leur devoir. René du Roure, qui fut des nôtres, gît maintenant, blessé, derrière les lignes allemandes. Il fut tour à tour repris et perdu par les armées françaises. Il reviendra sans doute reprendre sa place au milieu de nous, le sourire un peu plus triste, le coeur un peu plus vieux; mais avec quel orgueil nous saluerons son retour, lui que la victoire aura grandi et qui aura connu la gloire d'être de la grande lignée des soldats de France.

* * *

Défenseur d'idées, homme d'action avant tout, Henry du Roure s'était tenu éloigné de la littérature, objet de ses premières aspirations. Tout l'y destinait: ses qualités d'observation, sa facilité, la maturité de son esprit. Il se sentait pourtant attiré vers l'oeuvre d'apostolat qu'il s'était imposé d'accomplir, à laquelle il sacrifiait toutes ses inclinations, afin que rien ne vint l'en distraire. L'heure était trop solennelle, et trop lourdes les responsabilités qui pesaient sur la jeune génération, pour que l'attention se détournât un seul instant du devoir immédiat. Il resta lié à sa noble tâche jusqu'à l'épuisement de ses forces. Maintes fois il a fait reculer la mort. La lutte semblait multiplier ses énergies: elle les raidissait dans la constance d'un effort quotidien. Lorsque le repos lui fut enfin ordonné, il le reçut fort mal. Il redoutait d'être inactif, ressentant une sorte de gêne à ne plus combattre. Il revint aux lettres, au roman; mais il en tira un nouveau moyen de plaider, de convaincre. Il entreprit de faire servir la fiction au rayonnement de la vérité. "A aucun moment de sa vie, nous disent ses derniers éditeurs, il n'avait considéré que son talent d'écrivain lui appartînt plus en propre que son temps, son courage ou ses forces physiques. Sa plume, comme sa parole, n'avait été qu'une arme vouée à la cause qu'il servait en vrai chevalier. Epuisé cependant par les fatigues surhumaines d'un apostolat de dix ans, et plusieurs fois frôlé par la mort, il avait enfin consenti à se soigner. Mais le repos était pour une telle nature un trop pénible effort, aggravé de remords. Ne s'imaginait-il pas, dans le silence de la halte, entendre au fond de son coeur la voix qui condamne le serviteur inutile? C'est alors qu'il se résolut à produire l'une des oeuvres de longue haleine dont il portait en lui le dessein." L'oeuvre est intitulée: *Vie d'un heureux*. Des mains pieuses l'ont publiée, peu de temps après la mort de l'auteur. Elle porte deux dates: 24 février, 17 juillet 1914. Les dernières lignes en furent écrites quelques jours seulement avant la mobilisation générale des armées; elles sont encore chaudes de la pensée d'Henry du Roure. Il se pressait, comme s'il eût entendu l'appel prochain du clairon passer sur la grande ville, comme s'il eût senti, sur son front penché, le frôlement du drapeau, tout seul, dans la nuit. Jean des Cognets et Léonard Constant, ses amis, ont, dans une très belle préface, en des pages d'une émouvante sincérité, marqué les étapes suprêmes, parcourues avec une décision que rien ne pouvait troubler, par le jeune écrivain-soldat, pour "atteindre jusqu'au rendez-vous de la mort."

La *Vie d'un heureux*, c'est le journal d'un homme arrivé, d'un homme politique, puissant roi du jour, dont l'existence est tissée de succès; une éclatante réussite, une belle aventure, en même temps qu'un profond néant.

Robert Lescoeur, élevé d'abord par la piété inquiète de sa mère et confié, à cause de sa santé, à des précepteurs, est envoyé à Paris, à l'âge de onze ans, poursuivre ses premières études au Lycée Louis-le-Grand. Déjà le désir de parvenir, d'être quelqu'un, de dominer, hante ses jeunes rêveries, dont il sent obscurément l'ordinaire futilité. Il devient avocat, "comme tout le monde," et se dirige tout de suite vers la politique, "la voie commune," dont les sinuosités l'ont vite rebuté. Secrétaire du député Lorgeril, il renonce à des fonctions qui l'irritent et le dégoutent. Possédant quelque fortune, il accueille un instant l'agréable diversion de "jouer le Mécène." Des poètes pauvres cherchent une revue où paraître et se lire: il la leur donne, au prix de leur ingratitude. Ces choses arrivent. Double déception: les tracasseries de la politique et les rêves, un instant réalisés, des poètes, tout cela se ressemble en vanité. Il revient au barreau, de bonté lasse. Il a de l'avenir, comme on dit de presque tous les jeunes gens. Il a de la volonté, ce qui vaut mieux. Il réussira.

Invité à Verceil par son ancien patron, il entre, au hasard d'une promenade et poussé uniquement par une subite curiosité, dans la vieille église, dont la courbe romane lui plait. Il ne croit plus, mais il s'abandonne au souvenir qui remue encore son âme, restée jeune: rythmes lointains, gestes oubliés, impressions perdues qui renaissent soudain dans ce cadre immuable, où flotte de l'encens. Eglise silencieuse, où s'attarde son regard distrait, où, dans l'ombre qui monte doucement, de très vieilles statues posent l'immobilité de leurs attitudes recueillies. Il va sortir, quand il aperçoit une jeune fille, vêtue de blanc et qui prie. Cette vision l'arrête, l'envahit: cette piété sans pose le fait communier en l'infini de la pureté: "Elle restait immobile sur sa chaise; seules ses lèvres tremblaient en disant les *Ave*, et ses doigts faisaient glisser, grain à grain, le chapelet dont la petite croix d'argent se balançait et brillait sur sa robe. Toute immobile qu'elle était, jamais je n'ai vu personne qui parût vivre plus intensément, mais d'une vie purement spirituelle,—et je crois à l'âme depuis que j'ai vu de regard fixé sur l'éternité."

Louise est la fille de Lorgeril. Ce dernier, excellent coeur, mais un peu mou, hésitant. A la maison, ce représentant du peuple, ce manieur d'homme, abdique. Il gâte sa fille, qui lui ressemble physiquement, et qui l'aime à cause de sa bonté timide. Douce, compatissante, sans rien de la raideur puritaine et sèche de sa mère, Louise grandit dans une moitié d'obéissance, gardant la liberté de suivre les penchants peu dangereux que les sourires complices de son père cultivent en elle. Plusieurs fois, lorsqu' il était secrétaire de Lorgeril, Robert a dû s'ingénier à satisfaire les mille caprices de la petite. Il ne la remarquait pas: une enfant! Mais aujourd'hui qu'elle a changé, que sa grâce s'est révélée, qu'elle a souri à ses vingt ans, il se sent porté vers elle de tout son être, de tout son coeur, subitement, pleinement épris. Jusque-là, Robert n'avait rencontré que des complaisances, aussi décevantes que faciles: il n'avait pas aimé. Cette fois, il connait la grande passion, l'amour-vérité, l'amour-conquête, qui brave jusqu'au ridicule, qui souffre de ne pas trouver, pour s'exprimer, des mots aussi nouveaux que lui-même. Et Robert Lescoeur, amoureux, heureux comme jamais il ne l'a été, comme jamais il n'avait cru pouvoir l'être, décrit, dans l'exaltation d'un romantisme débordant, sa folie, le sentiment qui l'étonne et l'enchante, qui le possède tout entier, pour la vie.

Par timidité, par amour plutôt, il a gardé son secret. Les quelques heures d'intimité charmante qu'il a vécues auprès de Louise, il les a données uniquement au bonheur d'être près d'elle, de l'observer, de la suivre des yeux dans ses gestes familiers. Il doit aller faire une période de service à Chartres; sa décision est prise: il parlera au retour. Hélas! la désillusion le guette, en plein bonheur. Il revient pour apprendre le mariage de Louise avec Georges Dargeau, gendre du choix de Madame Lorgeril, très à sa main, de la plus épaisse fatuité d'ailleurs, et muni pour l'existence de toutes les ambitions, y compris celle de succéder à son beau-père quand, fatigué de la politique, celui-ci aura tiré son chapeau à la fidélité émue de ses dévoués électeurs.

Le désespoir de Robert est immense: c'est le premier. Peu fait au bonheur, il éprouve à le perdre une amertume rageuse. Un instant, il pense à la revanche, au coup d'éclat. Puis il retourne à Verceil, le temps de murmurer à Louise cet aveu, qui est une acceptation: "Je vous aimais!" C'est fini. Dans le cahier rouge, désormais enfoui au fond d'un tiroir comme une chose qui aurait appartenu à un mort, il écrit ses confidences pleines de regrets; il enferme sa jeunesse, sans plus d'espoir. Il oubliera. Il faut qu'il oublie. Il lui reste une consolation, un bonheur toujours possible: l'action. Il vivra, obéissant au rêve de puissance qui le fascinait tout enfant. Il n'est pas très sûr pourtant que ce rayon s'éteigne tout à fait : l'amour qu'il a connu sera le ressort secret de sa vie, la sourde volonté qui le conduira; une raison persistante d'éblouir celle qui l'a négligé et de lui prouver, en conquérant la gloire par surcroît, tout ce qu'elle a perdu.

Les années ont passé sur cette douleur et l'ont endormie. Robert Lescoeur s'interroge. Il cherche maintenant la grande voie de l'avenir. "Je viens d'avoir trente-trois ans, écrit-il sur un nouveau cahier, celui de l'ambition. Il est grand temps que je m'oriente.... J'ai pris la ferme résolution d'agir. Je n'ai que trop sacrifié aux rêveries vagues, aux mélancolies funestes, à tous les romantismes du sentiment et de la pensée. Ils me conduisaient à la porte du tombeau, et je veux vivre. Agir pour vivre, vivre pour agir, telle est la formule de bonheur à laquelle j'ai fini par aboutir, soit que j'aie réfléchi dans l'abstrait à la condition humaine, soit que j'aie considéré mon propre tempérament et ses vicissitudes. Agir, agir. L'action est saine et salutaire. Elle chassera les fantômes qui trop souvent m'attristent et m'obsèdent; elle disciplinera la violence de mes désirs. Je suis comme une capricieuse machine, dont la marche est tantôt trop lente et tantôt trop hâtive, je veux lui imprimer le rythme égal et harmonieux de l'action." *Je veux*, telle sera donc la devise qui stimulera, qui justifiera son effort. Vivre, c'est vouloir, c'est agir. Vivre, n'est-ce pas plutôt oublier ? Lisons, par-dessus son épaule, ces mots, les derniers de sa confidence du 2 mars 1886: "Laissons dormir dans un tiroir ce cahier que je n'ai le courage ni de brûler, ni de relire, ce cahier rouge, couleur d'incendie. Maintenant, j'ai reconstruit pièce à pièce ma maison ravagée par le feu; je la crois capable de durer, d'abriter du bonheur....Espérons! Agissons."

Il agit. Il s'oriente. Ne parlons pas des affaires: finance, bourse, industrie, commerce; rien ne l'attire de ce côté. Le barreau l'ennuie: s'epuiser chaque jour au service des autres. Le métier militaire, le journalisme, à quoi bon? Reste la politique, les bras toujours ouverts de la politique. Il s'y jettera. Il sera l'élu du peuple, excellent point d'appui d'où s'élancer. Il se laisse porter à Lervin contre M. Palandier, un avare et qui vieillit. Il croit être un candidat convenable: très souple, accomodant, riche et suffisamment éloquent pour affirmer qu'il n'a pas l'habitude des grandes phrases....et pour en faire, à l'occasion. Il passe, au second tour. Premier bonheur que lui apporte l'action . A dire vrai, il en est un peu déçu. Les nécessités de cette existence de lutte à outrance, où il faut souvent marcher sur soi-même, et, parfois, se faire une arme de la souffrance des autres, le chagrinent et le blessent. Il s'étonne surtout de ce qu'il faut laisser dire et faire: c'est la cause qui commande. Et puis, après tout, son sort est-il plus pénible que celui d'un autre? Il agit! L'action ne permet pas qu'on s'attarde à des hésitations sentimentales. Il est gardien des intérêts de la nation. Il porte une auréole: il l'a bien vu quand l'employé de chemin de fer s'est incliné à ce seul laissez-passer, impératif et bref: député.

Le voilà à la Chambre. Son regard se pose avec satisfaction sur ce décor dont il sera quelque chose, aux jours de grande séance. Quelques collègues sont là qui l'acclament, l'ayant pris pour un autre: c'est une miette du festin, qu'il remasse avec contentement. Devant lui, du papier où brillent les mots fatidiques, affirmation de sa conquête: *Chambre des Députés*. Il fréquente les couloirs, la buvette. Les huissiers se courbent sur ses pas. Son nom est dans tous les annuaires. Il est bien de la maison: il a voté une première fois.

Aussitôt, le désir de monter l'aiguillonne. Il dit de ses collègues "qu'ils ne sont pas forts." Il les juge, c'est donc qu'il s'arroge le droit de les conduire. Son ambition lui a déjà réussi. Pourquoi lui imposerait-il un répit qui serait une défaite? Il a pourtant trop attendu des circonstances, qui sont aveugles. Il n'a pas percé. Son nom est toujours suivi de la seule mention: député. Il n'est rien de plus que ce Georges Dargeau, qui a succédé à M. Lorgeril, et qui lui tend chaque jour sa main grasse. Le grand public l'ignore. Devant ce résultat, trop maigre à son gré, il s'inquiète de nouveau. Se serait-il trompé? Agir, est-ce attendre? L'homme doit-il rester en place et se laisser emporter par l'occasion, quand elle passe? Au contraire, pourquoi ne pas assurer soi-même sa propre fortune; créer les situations; forger les idées et provoquer les faits; faire sa vie, enfin, comme disent les philosophes de notre siècle. Etre le maître de sa destinée, c'est la dompter à sa fantaisie.

La réalité semble aussitôt lui obéir: il connait enfin l'enivrement du succès. Un duel agite autour de lui l'opinion, un instant intéressée. Sa photographie est dans les journaux, en assez bonne place, avec un mot, trop bref sans doute, mais sympathique. Un fonctionnaire a été renvoyé sans qu'on en sache au juste la raison. Lescoeur interpelle. Il monte en tremblant à la tribune. Son début est embarrassé; puis, il se ressaisit sous tous ces regards qui portent jusqu'à lui les sentiments les plus divers. Il est le centre d'une agitation, d'un remous. Son action s'additionne cette fois de toutes les convoitises qu'elle suscite. Et puis, Dargeau est sous-secrétaire aux Beaux-Arts: s'il allait le renverser de ce demi-piédestal où il n'est monté que de la veille; s'il allait, du même coup, servir sa vengeance et son orgueil? Tout cela l'agite au point de la porter jusqu'à l'éloquence. Il tient son auditoire; et il le sait. Avocat, rompu aux joutes de ce genre, il a gardé, pour la réplique, les documents accablants. Les applaudissements couvrent sa péroraison. Le vote est pris. On chuchote d'avance le résultat. La partie est gagnée. Robert Lescoeur a renversé le ministère.. Et les camelots de Paris portent au peuple le nom d'une idole nouvelle. Et puis, à quoi bon insister maintenant? C'est l'avenir promis dès le lendemain par toute la presse. Lescoeur passe aux hommes d'Etat. Il sera ministre, plusieurs fois, et Président du Conseil. Ses discours seront affichés; il publiera ses oeuvres; il sera peut-être de l'Académie française. Il est parvenu au sommet de son rêve; au pinacle du temple qu'il s'est élevé de ses mains. Rien ne peut s'ajouter à sa renommée, consacrée par Paris. A-t-il, dans une telle satisfaction, épuisé l'ardeur qui le ronge? Est-il seulement heureux? Possède-t-il, au sein de ces richesses et de ces honneurs, une parcelle du bonheur qu'il a convoité?

Pas même. Il est atrocement malheureux. Sa vie, sa pauvre vie intime, auprès de laquelle l'autre n'est qu'emprunt, est misérable, déchirée, pantelante. Autour de lui, nous cherchons une affection qui trouve un écho dans son coeur. Si, peut-être son fils, le petit Paul, dont les sourires sont la seule vérité de sa vie. Il l'aimait. Son secret désir de durée renaissait en celui qui devait le prolonger. Son égoïsme désarmait devant ce petit coeur d'enfant. Tout au moins trouva-t-il des larmes pour pleurer sa mort. Car il est mort, un jour de grande séance. Lescoeur défendait son ministère contre la ruée des inassouvis. "Hâtez-vous, venez!"...."Mais tu vas répondre à Touraine?"....Ces deux phrases, appels tourmentés de ses deux vies, se heurtaient en lui. Il a voulu répondre à Touraine, satisfaire l'action, sacrifier à la lutte. Il est venu trop tard. "Il y a deux êtres en nous, explique-t-il, l'homme public et l'autre, l'être intime, celui qui aime et qui souffre. Ils s'arrachent l'existence par lambeaux, comme une proie.... Quinze ans de vie publique resteront concentrés à mes yeux dans cette dernière séance, où je défendais mon portefeuille pendant que mon fils mourait et m'appelait en vain. Au retour de la Chambre, tandis que je pleurais en baisant ses petites mains glacées, on me téléphonait de là-bas ma victoire, plus de cent voix de majorité, et je tremblais de honte de l'avoir désiré." Supplice de l'acteur, forcé de jouer la comédie avec la douleur rivée à son rire.

Sa femme, Elisabeth, qu'il n'a pas connue, ou si peu, morte aussi, peu de jours après Paul. Il la tenait pour étrangère; mais il lui savait gré d'être une épouse parfaite et une mère attentive. Il avait besoin de ce dévouement, dont il était sûr. La dépêche annonçant sa mort est venue des montagnes de Suisse: à peine a-t-elle produit chez Robert le même petit déclanchement sec que l'appareil qui, de loin, la transmettait.

Ses amis ? Ils sont beaux, ses amis. Il est entourée de convoitises et de trahisons, d'intrigues à peine voilées, de flatteries énormes. Personne à qui se fier: le pouvoir a-t-il des amis ? C'est un radeau dans un naufrage. Après une longue maladie, suite d'un second duel, Lescoeur prend la ferme résolution de couper les liens qui l'attachent à la politique. Il a regardé, il a touché la mort, le brusque arrêt, la fin de tout. Un éclair de raison lui a fait voir l'inanité de son existence de fièvre. Il a retiré de cet abîme un désir encore, destructeur de tous les autres, un désir de liberté, d'indépendance. Il démissionne. Il cède la place, non sans dessein, à l'ineffable Dargeau: "Adieu, Messieurs! Ramez seuls sur les galères de Sa Majesté! Le forçat libéré vous bénit, et que Dieu vous garde!"......

Il se retire à Verceil, où il sait qu'il retrouvera Louise. Verceil! son premier amour, né à l'ombre romane de la vieille église. Son coeur tari, épuisé, se reprend à espérer. La douceur de ce retour le réchauffe. Il vivra, à côté de Louise, en ami de toujours. Leurs paroles ressusciteront le passé. Ils n'ont pas été heureux: peut-être trouveront-ils une consolation à chercher ensemble les raisons de leur infortune ? Le calme d'une telle retraite, n'est-ce pas enfin le vrai bonheur ? Tout le reste est fausseté. Ils le savent: ils en sortent. Aussi Robert entoure-t-il de ses soins jaloux cette frêle promesse de paix. Mais, dans le silence de cette intimité, son imagination parle encore. Son esprit se torture. Pour Louise est-il autre chose qu'un malade qu'il faut soigner, autre chose "qu'une oeuvre de charité ?" quelle preuve a-t-il reçu de son amour ? Des mots, seulement des mots, aussi trompeurs que ses attitudes sont voulues. La passion, qui ne le quitta jamais, s'avive sous la morsure du doute. Il veut savoir. Mais le vase trop plein déborde du pétale qu'il y jette. Pour le satisfaire, il achève de briser son amour, jouet de sa vie. Louise s'enfuit, meurtrie de regrets. Et Robert s'avoue vaincu devant cette dernière désolation qu'il a semée: "pour la première fois de ma vie peut-être je m'oubliai moi-même."

Il retourne à sa maison, à sa vieille maison de Presseval, abri fidèle, cadre paisible où il est venu endormir ou bercer chaque illusion. Naguère, elle lui disait, en son langage de chose: "Va, tu vieilliras aussi, et tu seras content, fatigué de vivre, de revenir te blottir dans mes bras pour mourir." Il y revient, en proie à l'inquiétude de la vieillesse, évoquer le souvenir de ses morts et poser ses yeux sur le grand inconnu. Tout le fuit, tout l'abandonne. Il s'enfonce dans la nuit qui vient, comme un grand arbre mort, dépouillé, éperdu.

Il lui reste une fille, Mireille. Où est-elle? dans quel chemin de hasard? Sa mère est vite devenue une courtisane. Elle est morte, un matin, en revenant de la fête: Robert a vu cela dans les faits-divers de la grande vie. Où a-t-elle laissé son enfant, qu'elle avait gardée? Il apprend, par une lettre de sa fille, qu'elle s'est réfugiée dans la solitude heureuse du cloître, en Angleterre, et qu'elle porte maintenant le nom de Soeur Angélique. Pour revoir celle qu'il avait autrefois repoussée, pour se faire pardonner l'injustice de ses soupçons, il part pour Newhaven. Dernier désir sitôt brisé par la mort. Il succombe pendant la traversée. Dans sa main glacée, il tenait encore l'*Année spirituelle*, petit livre qu'il avait reçu de sa mère; sur lequel il avait médité durant son agonie morale; où il avait retrouvé, avec le nom de Dieu, la confiance dans l'éternel pardon.

Dans nos campagnes canadiennes, quand le froid mord et pénêtre, les bûches rugueuses sont, chaque jour, approchées du foyer. Les lourdes pièces, échevelées, tordues, sont, une à une, jetées aux flammes et projettent, à demi-consumées, des ombres fantastiques qui réchauffent nos rêveries. Par la cheminée, courte et solide, les étincelles jaillissent, affolées; elles s'élancent droit vers le ciel, avec force. Elles ont la forme de petites étoiles que la vent fait briller d'un reflet très vif où l'on devine la mort, d'un feu qui se fait, un instant, plus intense. Puis elles retombent, légères, invisibles, dans le soir. Le lendemain, sur la pierre refroidie du foyer, sous les chenets, un peu de cendre seulement, de cendre grise, menue, inutile. C'est la vie, la vie d'un heureux: tous les désirs, toute l'action dévorante, et rien! Feu de paille, dit la langue populaire.

La course au bonheur, à tous les bonheurs! Vieille chanson, vieux sujet que renouvellent très heureusement le talent, la sureté de main, l'esprit pénétrant, la sincérité d'Henry du Roure. Ce qui fait la beauté de cette oeuvre, ce qui la rend émouvante, c'est sa vérité tragique. Certes, Robert Lescoeur pourrait n'être pas l'homme que l'on sait; et l'auteur eut pu se complaire à le peindre sous des dehors plus avantageux. Il ne l'a pas voulu: il a eu raison. Il a pris son bien où il se trouve: dans l'existence quotidienne. Il suffit que cet homme soit possible, moyen; qu'il soit vrai. Tous ses actes sont humains, profondément humains. Il n'est pas une exception, quoiqu' on en puisse dire. Ce n'est même pas un type. C'est un homme. L'ambition, qui semble la maîtresse de sa vie, n'est pas l'unique objet auquel il soumette sa volonté. On se tromperait singulièrement à ne rechercher en lui qu'un modèle d'arrivisme. Il y a de cela: c'est le côté action de sa double vie, qui s'épuise dans le néant des grandeurs. Il agit et il souffre. A peine a-t-il connu, à peine a-t-il touché ce qu'il rêvait d'atteindre, qu'aussitôt le réel le détourne vers un autre rêve. L'ambition le déçoit; et, de sa déception même, nait une ambition nouvelle: et rien ne peut calmer l'avidité de son âme. Tout lui est désir et lassitude. Dans son coeur, possession et dégoût se suivent, s'unissent. A ce jeu cruel que n'a-t-il pas sacrifié ? Il a tout perdu. Il reste seul, sur des ruines. Et c'est seulement sur un livre de méditation qu'il trouve enfin, épuisé, la vérité de cette parole: la paix, c'est l'accord avec soi. Serait-ce là le bonheur: la paix, ce mot qui monte comme un soupir de la tombe de son petit Paul ? La paix intérieure par la discipline de la volonté, l'acceptation de l'ordre, l'amour des autres, le repos de la conscience, la suprême ressource de la foi ? Ainsi pensait Henry du Roure. Il prêchait l'amer bonheur du renoncement, ayant conscience d'apporter à la jeunesse française une raison d'espérer.

* * *

Il y a quelques semaines, parlant de la France nouvelle, André Beaunier comparait les aspirations d'hier aux résultats d'aujourd'hui. Le fait brutal s'est imposé qui a entraîné toutes les énergies. Il fallait défendre la France attaquée. Pacifistes et socialistes, hommes de système et propagateurs d'idées, tous ont agi. Demain, les mêmes réalités s'imposeront dans leurs conséquences durables: elles auront désormais déterminé les hésitants et convaincu les sophistes. L'armée victorieuse de Joffre a réinstallé la confiance en terre française en y apportant la victoire, une des gloires familières de la France, son plus sûr élément historique. Confiance irréductible, inébranlable et comme cimentée, qu' Henry du Roure exprimait naguère avec force, et que les écrivains de France redisent à l'envi. Elle aura été l'arme morale de la guerre; la devise acceptée par tous; mieux encore: le devoir de chacun. Tous les Français auront ainsi servi leur pays en ayant foi en lui. Tout le peuple aura vaincu par l'espérance.

Cette France nouvelle, oeuvre de demain, non pas régénérée, mais renouvelée, se retrouvant elle-même, des hommes comme Henry du Roure l'ont préparée. Leur mort a été une résurrection, leur sacrifice une semence. On ne croyait plus guère à l'héroïsme et les vertus guerrières pâlissaient dans le recul d'une histoire lointaine. Ils les réveillent soudain en eux. Ils se lèvent; ils courent aux frontières ; leurs voix se mêlent et leurs volontés se confondent; leurs gestes, mûs par une même ardeur, se précisent, identiques, dans la mêlée; ils sont toute la France et toute la jeunesse française, hardie, fière, vaillante, exaltée. Ont-ils, dès les premières heures de la guerre, senti naître en eux une telle âme ? Les luttes politiques les avaient lassés. Ils n'y voyaient pas d'emploi à leurs énergies spontanées. L'inutilité de certaines querelles déconcertait leur ambition; et leurs visions d'avenir déchiraient les horizons étroits d'une existence encerclée par des appétits et des ruées. Ils s'étaient arrachés à une vie de tourments pour se reporter, d'eux-mêmes, vers des espoirs plus purs et des activités moins terre à terre. L'attaque des barbares les trouva prêts: ils allèrent à la conquête et à la défense d'un idéal enfin retrouvé, et dont la beauté se manifestait davantage à côté des horreurs que la philosophie allemande, réalisée dans ses aboutissants logiques, accumulait sur les champs de bataille. Jeunesse de France, dont j'ai compris toute la générosité en lisant un jour, à Nancy, près de la statue de Carnot, un appel aux armes en pleine paix. Ame de frontière, disait Henry Houssaye; âme de frontière, dont j'ai suivi le déploiement magnifique, depuis les lignes gracieuses de la place Stanislas, aux aspects reposants, jusqu'aux défenses, semées de morts, de la Trouée des Vosges; jusqu'au Lion de Belfort, creusé dans le roc, impassible et rouge.

EDOUARD MONTPETIT.

Montréal, Mai 1915.

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SECTION II

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Presidential Address.

By R. W. McLachlan.

(Delivered May Meeting, 1915).

Gentlemen,

When our General Secretary advised me that, as chairman of Section II, I was expected to give an opening address, I concluded that I could not do better than present one phase of Numismatics—my favourite study.

While money, with which the subject deals, is designed in the main for the economic purpose of providing counters by which the barter of commodities can be arranged between parties, often unknown to each other, sometimes living far apart, it is possible to view it from other standpoints. One of these, which may be styled the artistic, deals with the art displayed in the designs, embossed by the makers, on their metallic counters. This display is more notable in the money of ancient Greece than on that of any other country.

Another view point, from which the circulating medium of a country can be studied, is the greater or lesser incidents of history thereon recorded, either designedly or incidentally. Thus the coinage of a people, as that of Rome under the Empire, may be truly regarded as their condensed and enduring metallic history, or, as in the coins of the same people under the Republic, a repertoire of their genealogy, or, as in the money of Bactria, serve to reveal long forgotten and otherwise unknown kings and dynasties.

And further, from that of the numismatist, who takes up the classification and arrangement of these counters chronologically, geographically and politically; as well as economically, artistically and historically.

Now, as there are some here better able to speak on the economical side of this question, and as the artistic side does not well come within the province of this Society and as the numismatic side, dealing mainly with technical details, will not prove interesting to laymen, I have thought it best to take up the third of these phases, and, as the subject is so extensive, to confine my remarks to

"THE MONEY OF CANADA FROM THE HISTORICAL STANDPOINT."

This, too, while Canadian money offers few if any references to great events in our history, and as, until comparatively recent years, few coins were struck by the Government for circulation in Canada.

The main fact in our history, to be learned from the few legal coins issued, was the neglect of those in authority to provide an adequate and stable currency for the needs of the Country.

This carelessness or impotency on the part of the Government greatly hindered the material advancement of the Colony as well as retarded the growth of trade; consequently, to provide for their own pressing needs, many traders illegally issued unauthorized private tokens, which proving profitable, brought about such a redundancy of change that it became discredited, to the ultimate financial loss of the people as well as causing a want of confidence in their circulating medium.

The earliest coinage especially struck for Canada, in Paris, in the year 1670, is known, from the first two words of the motto inscribed thereon, as the *Gloriam regni* series. This motto, which differs from the *Sit nomen* of the regular French coins, telling us, in words quoted from the 11th verse of the 145th Psalm, that: "They shall speak of the glory of Thy Kingdom," is an indication of the greatness, now coming to be realized, anticipated by Louis XIV regarding his pet colonial project which he did so much, in his own egotistical way, to foster.

Before passing from the early days of the old regime it may be well to refer to the money of necessity issued by Intendant deMeules, in 1685, which, although not coin, has a historical interest all its own. It was paid out, in default of any available coined money, to the soldiers, sent out in the defence of the country, who were clamouring for their arrears. This, coming in advance of any regular issue of paper money, proved to be not only the forerunner but the example on which was based the promissory currency of the American Colonies, as well as that of the Bank of England. It also tells us of the insufficiency of the supply of paper in Canada suitable for a currency of the kind, as well as the absence of a printing press. These first notes were inscribed by hand on the backs of playing cards, from which this currency got the name of "Card Money." So conservative were those connected with the Colonial treasury that each subsequent issue, for over thirty years, was written on playing cards, although ordinary cardboard could easily have been imported for the purpose, from France. On the reissue of card money, after it had been in abeyance for twelve years, while the shape and size were retained, the use of the playing card was abandoned.

The ordinances of Bigot, the money of the boodlers of the last years of the old regime by means of which the habitants were defrauded, deserves mention. They are simply promises, signed by Bigot, that the king's treasury would be held responsible for the amount thereon inscribed.

The first coin directly referring to this country, an English token, inscribed "Copper Company of Upper Canada," dated 1794, shows that at that early date the copper mines to the North of Lake Superior had been explored and had sent supplies of that metal to England.

A coin bearing the date 1811, known as the *Vexator Canadensis*, inspired an article on the administration of Sir James Craig, by the late Dr. Kingsford. He, in deciphering its obscure legend, found it to be satirical in character, and, taking the date to the the true one, believed the coin to have been issued by those French Canadians who were dissatisfied with the autocratic rule of that Governor. But, when this coin is viewed from a numismatic standpoint, Dr. Kingsford's interesting story is dissipated. It has been demonstrated that the coin could not have been issued as early as its date would seem to imply, but, like most of the tokens struck at Montreal between the years 1832-1836, it was antedated, and refers to William IV as the oppressor of Canada.

Between the years 1813 and 1817, because of the dearth of copper change that at that time prevailed, there were issued by Montreal importers, a series of tokens, which from their chief design, have become known as "Wellingtons." These, while they give us some inkling into the condition of the currency of Canada at that time, also, by displaying the bust of the hero of Waterloo and the figure of Britannia, tell us of an intensely patriotic sympathy of Canadians, French as well as English, with the Mother country in her titanic struggle with Napoleon; similar to the conditions of to-day in our herculean effort to overcome German military ascendency. From the fact that the first issue of the Wellingtons was struck over an English token, which was circulated in large quantities, in 1811, by a Bristol nail manufacturer named Guppy, we are reminded that Bristol at one time was the rival of Liverpool in an effort to control the Canadian overseas trade, and that it was from that port that Cabot set out on his expedition as the discoverer of Canada.

Issued at the same time, there circulated among the Wellingtons, a token similar in appearance which is deserving of notice. While, like them, displaying on one side the figure of Britannia, the other side shows the eagle of the United States silver coinage. As this coin cannot be classed as patriotic, especially coming so closely after the war of 1812, are we to conclude that it indicates evidence of a coquetting, on the part of Canadians with the nation whose encroachments they had resisted for two years, almost single-handed? Nay, rather, that it was issued by a merchant from Boston, who, having settled in Montreal at the close of the war substituted the eagle of his native country for that of the Wellington of patriotic money-grubbing Canadians.

The Magdalen Islands penny, dated 1815, records the most interesting fact, that, at the beginning of last century, the inhabitants of these Islands did not own allegiance to any of the other Provinces. The Islands had been granted, by George III, to Sir Isaac Coffin, who, before setting out for his only visit to his "Kingdom," as he called it, ordered a large coinage of these pennies from Sir Edward Thomason, of Birmingahm. These he took with him and distributed them as loans to a number of his subjects. Although he was apparently well received by them, or his loans appreciated, they, as he was about leaving their shores, shouted after him "*Fouettez* King George and King Coffin." He never visited his "Kingdom" again.

Coming to the Province of Nova Scotia, where a similar condition of the currency existed, we find more variety in the historical subjects displayed on the merchants' tokens, issued at Halifax, than on those at Montreal, evidencing much greater enterprise on their part. There was the same expression of intense patriotism on their tokens. While most of them bear the bust of George III some are inscribed "Genuine British Copper" or "Great Britain" and one the "Broke" token, dated 1814, has a local patriotic reference, commemorating, as it does, the bringing into Halifax harbour of the American frigate "Chesapeake," as a prize of war after its capture by the "Shannon." This was the first and most signal naval victory of the war of 1812. The token displays the head of Captain Broke on the obverse, with a figure of Britannia, watching the naval engagement in the distance, on the reverse.

Besides these, six Halifax merchants perpetuated their names on the tokens they issued. They are John Alexander Barry, a stormy petrel in those days of intense political strife in Nova Scotia. He was several times expelled from the Provincial Legislature and as many times re-elected; W. and A. S. Black, who were sons of an early Presbyterian Minister; John Brown, who on his token displayed the Scottish thistle and motto in such a manner that Lindsay classed it among his "Coins of Scotland;" Carritt and Alport, who display a war vessel, probably the Shannon, on their token; Hosterman and Etter, whose tokens give a view of the Provincial building, still standing; Star and Shannon, with a representation of an Indian, with bow and arrow and dog; Miles W. White, an extensive hardware merchant and W. L. White, a dry goods merchant.

These tokens, having been issued in excessive quantities, became so discredited, that, in 1817, an act was passed prohibiting their further circulation, so, unlike the neglect of the authorities of Lower Canada, the Provincial Secretary, in the year 1823, took the remedy into his own hands and issued the Thistle series. This reminds us of the Scottish name of the province and of the original grant to Sir William Alexander and his Barons of Nova Scotia.

A curious mistake was made in one of the Thistle coinages, dated 1832, for it bears the bust of George IV, two years after the accession of William IV.

In 1856, another coinage of the Thistle tokens was ordered; but before it could be exceuted Mr. John S. Thompson, a professor in the High School of Halifax, who had instituted a regular propaganda for the adoption of a special flag for Nova Scotia and the Mayflower (*Epigea repens*) as the Provincial emblem, had so interested the Provincial Secretary, that this emblem replaced the thistle on the reverse of the new coinage.

Again, on the adoption of the decimal coinage, in 1861, the wreath on the reverse was, at the last moment, made to display the Mayflower entwining roses. Dies had been prepared for the coinage with the wreath composed of roses and rose leaves alone.

Another fact revealed by the coinage of half cent pieces, as well as of cents, is, that the standard of Nova Scotia was based on the rate of five dollars to the pound sterling, which while it called for no silver coinage, the British shilling passing current for twenty-five cents, necessicated a half cent piece to make change for the sixpence, which circulated at twelve and a half cents.

In Upper Canada, where the brunt of the battle of the war of 1812 occurred, one of the events of that war was commemorated by the Brock tokens, which, in a long inscription covering the whole reverse, relates that this coin was struck in memory of "Sir Isaac Brook (sic) Bart. the hero of Upper Canada, who fell at the glorious battle of Queenston Heights on the 13th October, 1812." Another shows an urn on a low pedestal supported by two angels with the legend "Sr. Isaac Brock the Hero of Upr. Canada."

The "Sloop" tokens remind us, that, in the second decade of the last century the commerce of the Province was mainly carried on over the great lakes in sloop-rigged sailing vessels.

Lesslie and Sons is the only Upper Canada firm made historical through a token bearing its name. These coins, which are plentiful, show that the main business house of the firm was located at "York" with branches at Kingston and Dundas. A later and larger token, issued by the same firm in the year 1832, anticipated the re-naming of the capital of Ontario, "Toronto," by two years. It had heretofore been known as "Little York" often qualified by the derisive term "muddy."

Coming back to Lower Canada, we find a flood of home made coins, issued between the years 1832 and 1836. Of these the chief varieties were:—The "Tiffins," the "Harps" and the "Blacksmiths," all antedated.

The "Tiffin" tokens, so designated because issued by Joseph Tiffin, an extensive grocery merchant of Montreal, were put into circulation on account of the lack of copper change that at that time prevailed in Canada. This merchant took the remedy into his own hands and ordered a supply of halfpenny tokens from England; but instead of calling for a special design of his own, he had a copy, struck on a lighter flan, of an anonymous English trade token, dated 1812, bearing on the obverse a bust of George III within a wreath of oak leaves and on the reverse an allgorical figure of commerce seated. These tokens, which, although issued thirty years later, bore the date of the original, became so popular, that in a short time many imitations or rather counterfeits in brass, more or less barbarous in execution, made their appearance and circulated freely among the genuine.

The "Harps," on the other hand, while not attributed to any firm as issuers, are not slavish copies of any English prototype. The obverse was impressed with the bust of George IV and the reverse with a harp, which gave them their name, without other emblem or inscription than the date "1820." The first issued, a very rare copper coin struck in England bore the date 1825, but the die was altered to 1820 by over charging the "5" with "0", as examples occur with faint traces of the five under the zero. This alteration in the date clearly proves that antedating was done purposely to deceive the people and bears out the contention, previously stated, to the same effect regarding the "Vexators." The "Harps" like the "Tiffins" were so popular as currency, that immense quantities of brass counterfeits were circulated, some of them of such inferior workmanship, that the bust of George IV became a hideous caricature. So great was the quantity issued, that old dies were refurbished and used to strike fresh coinages after they had been thrown aside as useless and allowed to rust.

The "Blacksmiths", so called from their unfinished and often rough appearance, were imitations of halfpenny tokens of George II and George III, worn almost smooth, which at the time formed the only legal copper currency. They were impressed with a faint outline of the King's bust and a similar figure of Britannia or a harp for reverse, without any inscription. Many varieties were struck from dies more or less worn and rusted, some of them so much so as to be beyond all recognition; and in one case a worn and rusted die was employed, conjointly with the discarded die of a United States trade token, to strike an additional supply producing a strange mule variety.

These show that people accept almost anything as money, so long as its currency remains unquestioned; and that, when these coins, which were a source of great profit to the issuers, were put into circulation in such vast quantities as to become a burden to traders and to form the only currency of the Province, they were suddenly rejected and, based on neither Government nor a private guarantee, turned out a complete loss to the holders. Strange as it may appear, the lead in this movement against the autonomous tokens was taken by the market "hucksters" who, for the time being, became the self-constituted censors of the currency. To overcome the want of change caused by this demonotizing of the private coppers, the Bank of Montreal, issued a coinage of *un sou* pieces in which the word "*sous*" was erroneously inscribed thereon with the plural inflection. These had no sooner become popular than an American exchange broker named Dexter Chapin, having his office on St. Paul Street, Montreal, imported large quantities of imitations of this *sou* piece, coined at Belleville, New Jersey, on which the word *sou* was correctly written. In a short time, the quantity became so excessive that they too were rejected by the same censors, who, although illiterate, were able to distinguish by their error, the genuine from the false. The same broker issued a shin plaster or fractional note, which an error in the gender, makes it read "*une*" instead of "*un chellin.*"

Several French Canadian writers, on this subject, claim these tokens as "*LES SOUS DES PATRIOTES*" but without foundation, as may be perceived from the facts above stated, save that a *sou* was issued by *La Banque du Peuple*, bearing a wreath of five maple leaves, among which was surreptitiously inserted a star of hope and a Phrygian cap of liberty. From this the coin has ever since been named the "Rebellion Token."

During this period four Montreal firms and a Quebec one struck coins bearing their names. There was that of T.S. Brown and Co. Mr. Brown who was a leader in the uprising of 1837, and a general at St. Charles, was given by his opponents the sobriquet of "Copper Tommy" which clung to him for many years afterwards. Another token that of Thomas and William Molson brings us back to the days when the Molsons were Montreal's most enterprising citizens, one issued by R. W. Owen commemorates the founder of the first Canadian

Rope Walk, which developed into the Canada Cordage Company. A fourth that of Francis Mullins and Son represents a firm that never existed. It was struck in anticipation that the son should be admitted into partnership, which, owing to some hitch, never came to pass.

In 1837, through an ordinance, passed by the special Council, the four banks doing business in Lower Canada were authorized to issue regular bank tokens. As these bore the figure of a French Canadian farmer on the obverse, they are known as the "habitant" tokens. They came to be recognised and accepted as a regular provincial coinage. In 1838, the Bank of Montreal alone, ordered a second coinage; but this was rejected, and therefore never put into circulation, as well as was a coinage struck in 1839 because, as the Manager claimed, of their lack of artistic merit.

After the union of Upper and Lower Canada, coinages were struck, under the permission of the Government, by the Bank of Montreal, in 1842 and 1844, by the Quebec Bank, in 1852, and by the Bank of Upper Canada in 1850, 1852, 1854 and 1857.

It may be well here to mention the coinage proposed for British Columbia during the gold fever of 1862. The Province, then separate from Vancouver Island, was a crown colony, with the executive appointed by the Home Government. The Provincial Treasurer, Captain (afterwards General) Gossitt, who was a man of numismatic tastes, conceived the idea of establishing a mint, and coining the gold as it came from the mine, rather than have it exported in the crude state. He therefore ordered a complete outfit of coining machinery, and had dies prepared for twenty and ten dollar pieces, by a die sinker named Küner of San Francisco. This man had made the dies for many of the private gold coins that circulated in the Western territories of the United States, from 1849 to 1860. Now, just as he was ready to proceed, he received word from the Colonial office that, as coining was a prerogative of the crown, he must stop all further proceedings. "But," as the Provincial Secretary wrote, in 1883, "Captain Gossitt, determined to have sample coins struck, brought the work to completion" and further "I well remember meeting him immediately after he had achieved his object. He had the coins in his hand jingling and admiring them as a child would a new and very attractive toy."

Five or six of each of these coins were struck, one set of which he kept for his own collecion, one he presented to the British Museum and the others to friends in British Columbia.

The Beaver skin currency for trading with the Indians was first introduced in 1820 by the North West Company. These were simply coin checks representing the value of a beaver skin. Later a similar currency struck in brass was issued by the Hudson's Bay Company for 1, $\frac{1}{2}$, $\frac{1}{4}$ and $\frac{1}{8}$ "made beaver." The term "made beaver" was the unit by which the value of furs was reckoned. This currency, never popular among the Indians, who preferred to depend on their accounts as kept in the Company's books, rather than on these checks, which were subject to be lost, was soon withdrawn.

The story of the introduction of the decimal currency, which in Canada was gradual and marked by four stages, is in part told by the money of the period. The first stage was ushered in by the ordinance of 1774, proclaiming Halifax currency to be that of the Province of Quebec. This fixed the pound currency at $4.00 and the shilling at one fifth of a dollar. All subsequent issues of Canadian Bank bills were expressed in dollars rather than in pounds. The second stage, under the currency act of 1854, made it legal for banks and other public institutions to keep their accounts in dollars and cents as well as in pounds, shillings and pence. But this stage being permissive, was not marked by a special coinage, so did not advance the change to any appreciable extent.

The third was a much larger step for, by the act of 1858, it was ordered that all government, as well as bank accounts, be kept in dollars and cents alone. This called for an authorized silver and copper coinage, for the purpose of properly carrying it out. For the British shilling, while for convenience it circulated for one shilling and three pence, or twenty-five cents, was really only worth $24\frac{1}{3}$ cents, hence this need for Canadian silver. Like the Maccabean shekel used only for the Temple contributions, it was solely employed as a banking currency, being considered too valuable for vulgar circulation. This gave occupation to a host of money changers that swarmed around the banking centres of the larger cities.

The fourth and final stage was reached, when the law made it obligatory for all the people to use the decimal currency. To facilitate the change in the manner of reckoning, it was necessary to prohibit the circulation of the old private coppers, that had crept back into general use, although they had once been discredited and rejected and to call in the bank tokens. There was another difficulty, for through the depreciation of the paper currency of the United States, such vast quantities of the silver coins of that country, were unloaded in Canada that it became a drug on the market, that while circulating freely in ordinary trade, it was subject to a discount of 5 or 6% in banking currency.

The remedy could only be readily effected by the government stepping in and assuming the loss involved in the withdrawing of both the coppers and the United States silver, and substituting therefor a Canadian silver coinage.

This project was suggested by the late William Weir, of Montreal, and adopted and carried out by Sir Francis Hincks, the then Finance Minister, through Mr. Weir, as his agent. This involved a large coinage of silver during the years 1870 and 1871. But as the Royal Mint was not at that time able to keep pace with the Canadian orders, besides supplying the home demand, a fractional 25 cents paper note was issued and the Bank Tokens instead of being withdrawn were raised in value to five halfpenny pieces in place of six for five cents as formerly.

I well remember furnishing Mr. Weir with specimens of the different Bank tokens, to be illustrated in the circular he issued on behalf of the Government, raising their value, while calling in the old coppers for redemption.

Thus did Sir Francis Hincks effect, in the short space of a year, by one stroke of statemanship, the change in the currency system that had been dragging along for years. The tables of the money changers were thus overthrown, and for the last forty years, the people have but one stable currency, equally acceptable by the banks and for general circulation, instead of two as formerly.

EXPLANATION OF THE PLATES.

Plate I.

A. Playing card money, twelve livres.
B. Playing card money, 30 sols, quarter card.
C. Ordonnance, 96 livres, the money of the boodlers of the Old Regime.

Plate II.

1. "Gloriam Regni" coinage, struck for Canada in 1670, 5 sol piece.
2. Halfpenny token of the Copper Company of Upper Canada, dated 1794. The first coin relating to Canada struck under the British regime.
3. "Vexator Canadensis" first issue.
4. "Vexator Canadensis," second and lighter issue. These, although dated 1811, were probably not issued until about 1836.
5. Undated Wellington token, issued about 1813. Struck over a Guppy token of 1811.
6. Second and lighter issue of Wellington token, dated 1814.
7. Third issue, dated Montreal, 1816.
8. Token displaying the figure of Britannia on obverse, similar to the Wellington tokens with the eagle of the United States currency for reverse.
9. Magdalen Island penny, issued by Sir Isaac Coffin, seigneur of the Islands.
10. "Great Britain" halfpenny, anonymous, issued in Nova Scotia.

Plate III.

11. Genuine British Copper, anonymous for Nova Scotia.
12. Genuine British Copper, anonymous for Nova Scotia. Different design.
13. Halfpenny token, issued in commemoration of the bringing into Halifax harbour of the captured Chesapeake by Captain Broke of the British man-of-war "Shannon."
14. Halfpenny token issued by John Alexander Barry, Halifax.
15. Halfpenny token, issued by W. A. & S. Black, Halifax.
16. Halfpenny token, issued by J. Brown, Halifax.
17. Halfpenny token, issued by Carritt & Alport, Halifax, with a view of the "Shannon."
18. Halfpenny token, issued by Hosterman & Etter, Halifax. with a view of the Provincial building.
19. Halfpenny token, issued by Starr & Shannon, Halifax.
20. Halfpenny token, issued by Miles W. White, Halifax, hardware merchant.

Plate IV.

21. Farthing token of W. L. White, Halifax.
22. Halfpenny token, Province of Nova Scotia, dated 1823, bearing head of George IV on obverse and thistle on the reverse.
23. Penny token, similar to the last, but bearing head of George IV, although issued in 1832, the second year of the reign of William IV.
24. Halfpenny token, Nova Scotia, displaying the mayflower, the Provincial emblem suggested by John S. Thompson.
25. Proposed design of the new decimal coinage of Nova Scotia, suppressed because not displaying the mayflower.
26. Accepted design of the cent of Nova Scotia, displaying on the reverse a wreath composed of roses and mayflowers combined.

Plate IV.

27. Half cent of Nova Scotia, issued to make change for the British sixpence, which circulated in Nova Scotia for twelve and a half cents.
28. The token issued in Upper Canada to commemorate the death of Sir Isaac Brock, who fell at the battle at Queenstown Heights, on 13th of October, 1812.
29. Another token commemorative of the same event issued in 1816.
30. Halfpenny token, issued by Lesslie & Sons at "York," the former name of Toronto.

Plate V.

31. A twopenny piece of Lesslie & Sons, the largest copper token issued in Canada. The name Toronto appears on this token two years before it was officially adopted as the name of the city in 1834.
32. Sloop token, issued in Upper Canada in 1820, evidently by a hardware merchant.
33. Sloop token, bearing a cask inscribed "Upper Canada." Another variety has the cask inscribed "Jamaica," which shows that both were evidently issued by a grocer in 1821. Other varieties were issued 1823 and 1833.
34. The Tiffin token patterned after an anonymous English token of 1812, issued by Joseph Tiffin between the years 1830 to 1836.
35. A counterfeit Tiffin token of fair workmanship.
36. A barbarous Tiffin token, evidently home-made.
37. A Harp token, dated 1825, the first issued.
38. A Harp token, dated 1820, in which traces of a "5" under the "0" indicate that the coin was issued at least five years subsequent to the date it bears.
39. A barbarous imitation of the Harp token issued between 1830 and 1835.
40. A Blacksmith token struck in imitation of a worn halfpenny token of George III.

Plate VI.

41. Another variety of the Blacksmith token struck from a broken die after it had been much worn and rusted.
42. Another Blacksmith token, struck from the same obverse die as the last, muled with a worn die of a United States trade token.
43. A variety of the Blacksmith token displaying a harp on the reverse.
44. A token issued by T. S. Brown & Company of Montreal, one of the leaders of the patriots at the battle of St. Charles.
45. A token issued by Thomas & William Molson, one of Montreal's most enterprising firms.
46. A token issued by R. W. Owen, founder of one of the earliest cordage works in Montreal.
47. A token issued by Francis Mullin & Son, Montreal.
48. A token issued by J. Shaw & Co., Quebec.
49. "Un Sous" token, issued by the Bank of Montreal, with the grammatical error the first of the Bank's issues.
50. One of the many varieties of the Un Sou tokens issued by Dexter Chapin.

Plate VII.

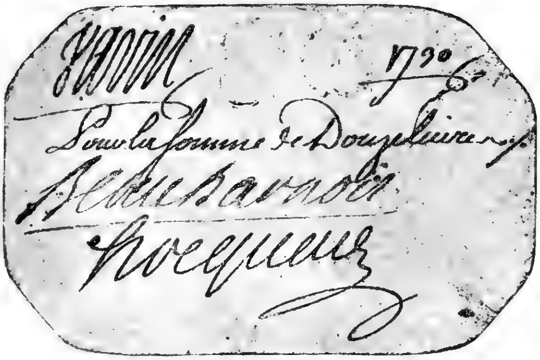
51. Un sou token, issued and struck by Jean Marie Arnault, an early medallist of Montreal.
52. Un sou of La Banque du Peuple, known as the Rebellion token with a star and Phrygian cap of liberty introduced into the design, made by Arnault.
53. A penny of the Bank of Montreal, 1837.

Plate VII.

54. A penny of the City Bank, 1837.
55. A penny of La Banque du Peuple, 1837.
56. A penny of the Quebec Bank, 1837, displaying the arms of the city of Montreal.
57. A halfpenny of the Bank of Montreal, 1837.
58. A halfpenny of the Bank of Montreal, 1838, showing a corner view of the Bank building from which it is known as the side view token. The whole coinage of pennies and halfpennies of this date was rejected because of inferior workmanship.
59. A penny of the Bank of Montreal, similar in design, dated 1839, also rejected for the same reason.
60. A halfpenny, Bank of Montreal, dated 1842, displaying a front view of the Bank building. There are pennies of the same date and halfpennies dated 1844.
61. A halfpenny of the Bank of Upper Canada, 1850. There are pennies as well as halfpennies of the same design dated 1850, 1852, 1854, 1857.

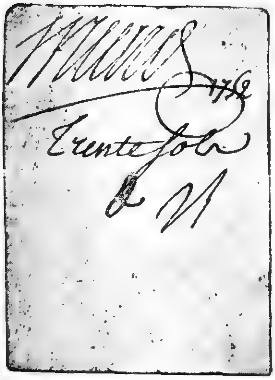
Plate VIII.

62. Halfpenny token of the Quebec Bank dated 1852, There are pennies of the same design.
63. Beaver currency token, issued by the Northwest Company, dated 1820.
64. Token of the Hudson Bay Company for one made beaver.
65. A similar token for a half made beaver.
66. A quarter made beaver.
67. An eighth made beaver. The initials on these tokens when filled out may read as follows:—H(udson's) B(ay) C(ompany) E(ast) M(ain district) 1 N by mistake for M(ade) B(eaver). The made beaver was the unit by which the Company traded with the Indians.
68. A twenty-dollar gold piece, British Columbia.
69. A ten-dollar gold piece, British Columbia. This is the gold coinage proposed to be issued in 1862, by Colonel Gossitt, Provincial Treasurer.
70. A twenty-cent piece of the first decimal coinage for Canada, issued in 1858.



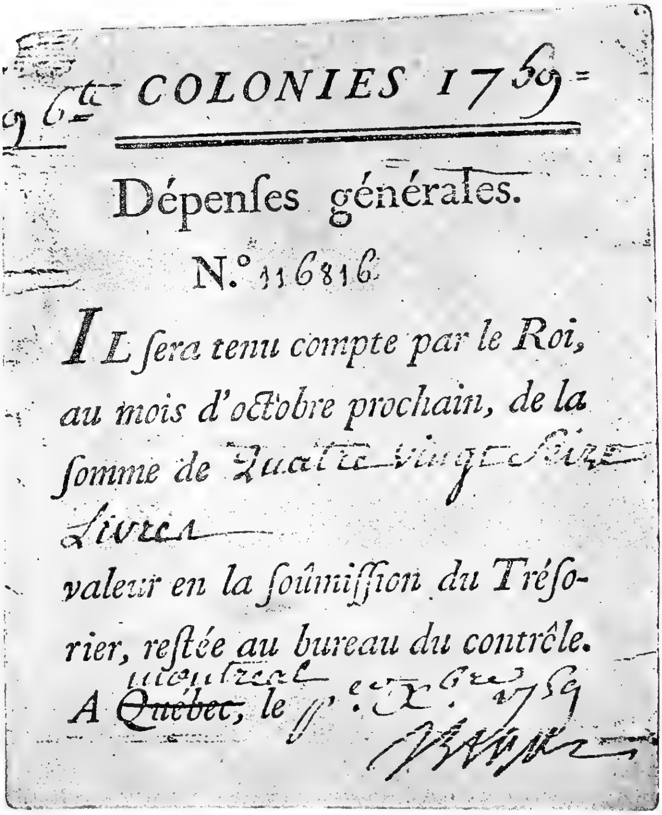
Pour la somme de Douze livres

A.



Trente sols

B.



96# COLONIES 1759

Dépenſes générales.

N.° 116816

IL ſera tenu compte par le Roi, au mois d'octobre prochain, de la ſomme de Quatre vingt Seize Livres *valeur en la ſoûmiſſion du Tréſorier, reſtée au bureau du contrôle.*

A ~~*Québec*~~ Montreal, *le* 1er 8bre 1759

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PLATE III.

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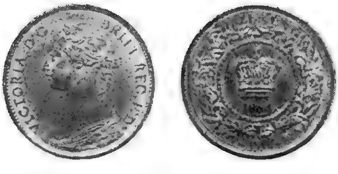

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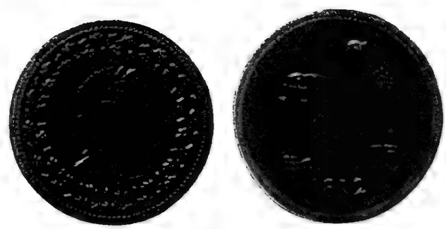
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Treaty of 1825—Correspondence Respecting the Boundary between Russian America (Alaska) and British North America.[1]

By JAMES WHITE, F.R.S.C.

(Read May Meeting, 1913.)

The correspondence contained in the following paper is an interesting contribution to the inner history of the negotiations that culminated in the signing of the Treaty of 1825 and which determined the boundary between Alaska and Canada. For a proper understanding of these documents a brief statement of the occurrences prior to February 1825, is necessary. Anyone desirous of further information should consult the Case, Counter-case and Appendices of "His Majesty's Government before the Alaska Tribunal," 1903.

September 16, 1821, Alexander I, Emperor of all the Russias, signed a ukase granting "the pursuits of commerce, whaling, and fishery, and of all other industry" on the northwest coast of America between Bering strait and *latitude 51° N.* to Russian subjects exclusively and prohibiting foreigners, under heavy penalties, from approaching these coasts within less than 100 Italian miles (geographical miles).

In November following, this decree was officially communicated to the Government of Great Britain by Baron de Nicolai. Sir Charles Bagot, British Ambassador at Petrograd (St. Petersburg), was informed by Count Nesselrode that "the object of the measure was to prevent the 'commerce interlope' of the citizens of the United States," who not only carried on an illicit trade in sea-otter skins but traded prohibited articles, especially gunpowder, with the natives of Russian America. Sir Charles reported to the British Government that "this extraordinary pretension has been adopted from, and is supposed to be justified by, the XIIth Article of the Treaty of Utrecht."[2]

[1] A summary of the below paper was presented to the Royal Society of Canada in 1913. Through the courtesy of Dr. A. G. Doughty, Dominion Archivist, the correspondence which forms the paper was copied from the Bagot papers in the Archives. In the hope that it might be supplemented and the record thus made more complete, publication was suspended pending an attempt by Mr. H. P. Biggar to procure additional correspondence in England. As Mr. Biggar was unsuccessful, the contributor intended making a personal attempt to secure it when in Great Britain in the summer of 1914. Unfortunately, the outbreak of war necessitated the abandonment of the idea. The correspondence is, therefore, published as presented two years ago.

[2] By Art. XII, French subjects were excluded "from all kinds of fishing . . . . . within 30 leagues" of the coasts of Nova Scotia.

In December, 1799, the Emperor Paul had signed a ukase granting to the Russian-American Fur Company exclusive rights to hunt and trade on the northwestern coast of America between latitude 55°N. and Bering strait and on the islands in the vicinity. This grant was not protested by other powers and the ukase of 1821 was virtually an extension of it southward and seaward. Between December, 1799, and September, 1821, however, the North West Company of Montreal and their successors, the Hudson's Bay Company, had reached the Pacific and established themselves on the coast and in the interior of what is now British Columbia.

Doubtless, principally at the instigation of the Hudson's Bay Co., the Government of Great Britain protested these extraordinary claims to jurisdiction over territory containing British trading posts and to the open ocean far beyond limits acknowledged by international law.

The United States also protested against the attempt to exclude American traders and whalers from this territory.

September 10, 1822, Count Lieven, Russian ambassador to Great Britain, suggested confidentially that Great Britain bring forward her claims to territory on the northwest coast of America "so as not be shut out by any agreement made between Russia and the United States."

January, 1823, Count Lieven informed George Canning, Secretary of State for Foreign Affairs, that he was instructed to propose "that the question of strict right be temporarily set aside on the part of both" and that the differences "be adjusted by an amicable arrangement to be negotiated at St. Petersburg."

April, 1823, John Q. Adams, United States Secretary of State, suggested joint negotiations by Great Britain and the United States at St. Petersburg, and stated that the United States had no territorial claims as high as 51°N. lat. Canning wrote Sir Charles Bagot, British ambassador to Russia, that a joint negotiation would be mutually advantageous, as two maritime powers acting together could probably secure greater concessions than if acting separately.

In August, 1823, Bagot wrote Canning that Count Nesselrode considered "the proposed concert of measures between Great Britain and the United States" as the most agreeable mode in which the question could be brought under discussion."

Two months later, however, he wrote that, notwithstanding Adams' statement, the United States were "fully prepared" to assert an equal pretension with Great Britain and Russia to the whole coast as high as 61°N. basing their claim as the successors in title to Spain by virtue of the Treaty of Florida Blanca, 1819.

In December, 1823, President Monroe, in his Message to Congress, set forth the so-called "Monroe doctrine" which declared that the American continents were, thenceforth, "not to be considered as subjects for future colonization by any European power."

In the same month, Rush proposed that Russia be limited on the south by latitude 55°, that Great Britain be limited on the west coast to latitude 51°N. to 55°N. and the United States on the north by latitude 51°N. As Great Britain had repeatedly refused to accept 49° and, as she was in joint occupation of the country as far south as 42°, this proposition did not err on the side of modesty.[1]

Thenceforth, the negotiations proceeded separately.

April 17, 1824, the United States and Russia signed a treaty whereby it was agreed that citizens of the United States would not form any establishment upon the northwest coast of America north of latitude 54° 40′ and that Russian subjects would not form any south of the same parallel.

In April and in August, 1824, Bagot made further concessions, but his proposals were rejected; doubtless owing to George Canning's strong opposition to the Holy Alliance which had given great offence to Russia.

As it was evident that Bagot could not accomplish anything, he was transferred to The Hague. Stratford Canning succeeded Bagot in December, 1824, and the treaty was signed February 28, 1825.

The correspondence contained in this contribution was confidential and has not hitherto been published. It throws considerable light upon the secret opposition of the United States and demonstrates the insincerity of Middleton, the American minister.

Sir Charles Bagot to Mr. George Canning

St. Petersburgh, Oct., 5, 1823

* *

> I have had one or two preparatory and informal conversations with Mr. Poletica upon our North West Coast business, but we are purposely delaying matters to give time for the arrival of Mr. Hughes, the American Charge d' Affaires at Stockholm, who is expected here every day with instructions for Mr.

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[1] On January 23, 1824, Stratford Canning, British minister, to the United States, wrote Sir Charles Bagot: "there are so many points of rivalship between the two countries, with so much of prejudice on the one side and so much forwardness, not to say impudence, on the other, that I almost despair of ever seeing my wishes on that subject realized. I see that you are about to plunge into your Northwestern negotiations, and I congratulate you most heartily on having at least to swim in that element without an attendant Yankee offering a cork-jacket, and watching his opportunity to put your head under water."

Middleton which he has brought from Washington and which we suppose to relate to this business. To tell you the truth I am not very well content with Mr. Poletica's appointment to discuss this question—not that I object to him, but to his powers, which are nothing, as, according to a note of Nesselrode to me, he is only appointed 'à entamer avec moi (and Mr. Middleton) des pour parlers relatifs aux différends qui se sont élevés' &c—and the note goes on to say that 'ces pour parlers auront pour but de préparer les voies à l'ajustement definitif de ces différends.' In other words that he is to employ himself in picking our brains during Nesselrode's absence without having as it should seem, authority to speak in the name of the Government to any point. I have half a mind to exceed my instructions, and to try if I cannot get a degree of longitude instead of latitude for our line of demarcation. It appears to me that if we take a degree of latitude we leave Russia with undefined pretensions to the Eastward, and in the Interior of the Continent whereas a degree of longitude would describe both the boundary on the Coast and within the Continent at the same time. I do not know whether Russia would listen to such a proposition, but it would I think be a great point if we could get somewhere about the 139th degree of West Longitude as the line. This would cut the Coast about Behring's Bay,[1] to the South of which Russia has in fact no pretensions whatever, to discovery or anything else. This would make the latitude of our boundary about 59½ North instead of 57, with which you say you would be contented. If I am to secure 57 it may at all events be as well to begin by claiming something more, and I have some notion of bringing forward this idea. Before I can have your answer I shall be deep in the whole business, but I should still like to have your notions upon this point. You may depend upon it that the Americans will try to interfere somehow or other in our boundary negotiation as distinguished from the maritime jurisdiction question. Mr Middleton has already told me clearly that he thinks that the United States have an interest in the business—and upon what grounds think you? because Spain had by treaty the right to trade with our coasts in that quarter, and that the United States by their last treaty with Spain have acquired all the rights in that respect, and stand in her shoes. Is not this preposterous? Mr. Hughes and the United States put one in mind of your speech at Liverpool. I cannot tell you with what delight I read it and chiefly for a reason which was perhaps not actuating you at the moment. It was the true and only mode of replying to the childish and malignant attack made on the 4th of July last year by Adams against England. A Secretary of State speaking in the manner he did ex cathedra of a Power in amity!!! Yours was the only way of making him ashamed of himself. Had you this speech in your head when you made yours? I have not yet heard of The Jasper's arrival in England, but I hope that the next post will bring me accounts of her. Our letters from England are to the 19th of last month. I doubt whether I shall have occasion to send you a Messenger before the return of The Emperor or at least of Nesselrode for nothing—absolutely nothing is to be learnt or done in their absence. I may indeed receive news from Lord Strangford which may be worth a Courier, and in that case I shall despatch one forthwith. This is all I have to say at this moment.

I am, &c.,

CHARLES BAGOT

[1] Just west of present Yakutat bay.

Sir Charles Bagot to Mr. George Canning

St. Petersburgh
October 29th, 1823

Private, By Messenger Walsh.

"Who am I to side with? That seems to be in point of fact, the question to which Mr. Middleton's new instructions have given rise. Am I to side with America, and deny all claims of Russia to any part of the N.W. Coast South of the 61st degree of North Latitude? or am I to side with Russia, and deny all claim of the United States to any part of the coast north (for example) of the mouth of The Columbia river? or am I to side with neither—to admit that we have all three equal pretensions—and to give it to be understood that we would consent to divide the whole coast between the 42d and 61st degrees as well as we can, and according to our respective conveniences?

These are questions much too important in their consequences for me to give an opinion upon, even if I could form one in my own mind, which I can not, until I know more accurately than I do whether our principal object is to secure the fur trade on the continent for the Hudson's Bay Company, or to secure to ourselves a share in the Sea otter trade with China—or to secure both.

The pretensions of the United States are in the true spirit of their usual encroachment; and as there is something plausible in their argument, they may I think contrive to make this a troublesome business. The object of the United States is, I know, to obtain a boundary which shall give them both banks and the exclusive navigation of the Columbia River from its mouth to the Stony Mountains,[1] and, to secure this, they would desire a line drawn from about Widbegs[2] harbour, in something more than 46°N. Latitude (I use the map you sent me from the office) to the most northern bend of the river in something more than 51°N. Latitude: but I think, from a few words which Mr. Middleton let fall that they will not insist very stubbornly upon coming crankling in cutting "this huge Halfmoon, this monstrous cantle" out of the territory of the Hudson's Bay Company (who have actually a Post at Athabaska[3] at the very bend of the river), provided that they can secure the embouchure of the Columbia.

To this perhaps there would be no great objection, as, in regard to the Americans, any fixed boundary may be better than none; and the adjourned question of the Columbia river, which has, I believe, only 4 or 5 years more to sleep, would thus be quietly and finally disposed of in a general arrangement. But shall we consent, when boundaries are once established, to give freedom of trade, fishery, &c., to the other two parties in our allotment? I suspect that if we do, Jonathan will catch a world more otters than we shall—that he will get the whole of that trade with China into his own hands. And that he will contrive both to stir up and arm the Indians against us and our Company in the interior of the Country.

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[1]Rocky mountains.

[2]Whidbey harbour, now known as Grays harbour, Pacific coast of the United States, lat. 47°N.

[3]Boat Encampment, at the "Great bend" of the Columbia river, lat. 52° 04′N., long. 118° 36′W.; the west end of the portage *via* Athabaska pass.

All this however is high matter upon which I dare not open my lips till I hear again from you. I have by no means forgot that your despatch of the 12th of July leads me to expect further instructions from you so soon as you should know more precisely than you then did the views of the American Government in regard to our concert of measures, and I think it very probable that I may hear from you upon the subject even before this letter reaches England. Still however I have thought it advisable to dispatch this Messenger to you if it is only to enable you to compare the language held to me by Mr. Middleton, with that which Rush may be holding to you in London; and moreover to remind you, in case it should be necessary, that if I am to conclude any thing here jointly with Mr. Middleton, the full powers which I have are inadequate, as they were drawn up before there was any question of concert with America, and as they do not specifically empower me to treat about boundary even with Russia.

I am, &c.,

CHARLES BAGOT

Sir Charles Bagot to Mr. George Canning

St. Petersburgh, December 29, 1823

* *

"The American Minister here has drawn up a huge and lengthy memorial about N. W. Coasts which he designs to give in to this Government. But he has not done so yet, waiting I believe to know a little the nature of the instructions which I may receive from you. It is a sort of narrative to show that Russia has no real rights upon these Coasts South of the 61st degree, and is drawn from Humboldt, Lisiansky and all the voyagers in the world. He has had one conversation upon the general question with Nesselrode in which he took a very high tone, and got, as I am assured, a very sharp rap on the knuckles. He has by order of his Government given in a note to Count Nesselrode claiming indemnity for the loss of the voyage of an United States ship which had (last year I believe) entered the Port of Nov Archangelsk or Sitca, and had been warned by the Russian Governor there, under the Ukase of 1821, to quit the coast in 24 hours. He has not yet received any answer to this note but I know that he has been invited to a conference with Count Nesselrode tomorrow and I think it is probable that he may desire to see him upon this very subject.

I believe that the idea of the Imperial Court removing next year to Moscow is abandoned. The expense is found to be too great—and moreover the Prince and Princess of Orange and the Duke and Duchess of Saxe Weimar are expected to arrive here in the Summer.

I am, &c.,

CHARLES BAGOT

Sir Charles Bagot to Mr. George Canning

St. Petersburgh

Febry. 17th, 1824

Private, By Sardinian Courier to Berlin

The Sardinian [minister] sends a Courier to-night to Turin via Berlin which gives me the opportunity of sending this letter and a couple of despatches to the care of Clanwilliam and thus avoiding at least the Russian Post Offices. It sounds odd to tell the Secretary of State that I am too busy to write to him to whom it is my particular business to keep writing, but such is the fact, and like Rabelais' semiquaver friar, I must speak in monosyllables.

I had yesterday my first interview with the Plenipotentiaries Nesselrode and Poletica respecting our N. W. Coast Convention, and we meet again to-morrow. As I was getting into my carriage to go to the conference, Mr Middleton, to whom I had communicated the fact and the reasons of my being instructed to treat separately in this affair, and who had been mightily embarrassed by the intelligence, called upon me and stated totidem verbis that he should think it necessary to protest against any territorial division between Russia and England of any parts of the Coasts in question as prejudicing more or less the claims of His Government founded on the Treaty of Washington, and this, notwithstanding the assurance which I had given him that I should insist upon the insertion of a clause in any convention which I might conclude which should save those pretensions. Upon arriving at Nesselrode's I thought it my duty to acquaint him with what Mr. Middleton designed to do, and after discussing what he *could* do, we agreed to proceed in our business. The fact is that he could do nothing, nor does any agreement which we may make with Russia preclude the United States from bringing forward hereafter any pretensions which they may think they have to any privileges, or rights, territorial or other, within the allotments assigned either to us or to Russia. I do not deny that Russia would come to the discussion of any such pretensions with encreased advantage *after* a Convention of Limits with us. This Russia sees, and it makes Her as anxious as I am to conclude the business with us as soon as possible. Pray do not conceive that I am not following your prescription as to the mode of treating Middleton, or that I am not upon the best possible footing with him when I tell you that I am not sorry that he should be both defeated and disappointed in this business, not on his account, because he must ride to order and do his best, but on account of the perfidious Adams. Middleton tells me that he regrets the course which we take because he now feels in a scrape for not having sooner executed his original instructions instead of waiting to see the result of the proposal made to us for a concert of measures—and what do you imagine those original instructions were? Nothing less than to propose to Russia to proceed to divide the whole coast in question between Her and the United States to our entire exclusion. It is even so—I had it from his own lips yesterday that such were his instructions, and an hour afterwards I had from those of Poletica that he had actually made to him this proposal. Now there does appear to me to have been a baseness in this business on the part of Adams which nobody but Adams was capable of. But this trick has failed—I shall conclude certainly speedily, and I think satisfactorily, our separate arrangements, and Adams may bellow as much as he pleases.

My Powers are hardly as full as they ought to be for the *territorial* part of the question, but they have been accepted as sufficient upon my assurance that under them I should confidently sign any convention consistent with my instructions without any apprehension whatever of being disavowed.

I have left off writing to you about The Emperor. He is now in the regular train of recovery—but He has been very ill—and there was a moment of great inquietude about Him, more than you would think upon reading my despatches which, going by the post, I had tempered a little.

Many thanks for sending me the copy of your private letter of the 16th of Sept. to H. Wellesley. I will take good care not to sin in future de ce coté là. I will not send you the letter back by this occasion, but by the first perfectly safe one which occurs. I thank you also exceedingly for your letter of the 29th of last month which I received last night by the post. It was very considerate of you to write it. It has set me quite at ease. What I did, I did with reflection, but not without rage and fury in my heart. I have other letters of yours to answer and *thank* you for, but I reserve myself for a better opportunity.

I send you the answer of this Govt. to the American proposition about private property in maritime war. Nesselrode is proud of that paragraph which shows that he is not duped by the plausibility of the American overture, but I never expected to hear any more of the armed neutrality. The Greek conference despatch has been exceedingly well received here. My last letters from England are to the 30th of January. We are looking out with great interest for the King's Speech. Lieven's Courier would I suppose wait for it, but we may have it the day after tomorrow.

It is determined that the marriage of the Grand Duke Michael with The Princess of Wurtemberg shall take place on Friday in The Emperor's own room. There will be a ball at the Court in the evening, but the great Fêtes are put off till after Easter. I fear that this letter is much less legible than that of yours which you feared might be so undecypherable, but I am too hurried and busy to think of my round text.

I am &c

CHARLES BAGOT

Sir Charles Bagot to Mr. George Canning

St. Petersburgh,
Febry, 28, 1824

Private, By Colonel Loucadou to Berlin

I wrote to you on the 17th of this month to acquaint you with the protest which the American Minister had threatened to make against any territorial division between us and Russia of the N. W. Coast of America. I now write to tell you that I believe that this threat was made in the moment of vexation at learning that I had received instructions to negociate separately in this question and that, upon cooler reflection, Mr Middleton has given up the idea of carrying it into effect. When I first mentioned his menace to Ct. Nesselrode he, in order to defeat his project, wrote him the official note of which I enclose a copy.

This note was crossed by one from Middleton asking for an interview. The interview took place three days ago, and I learn from Ct. Nesselrode that Mr. Middleton abstained from making any remarks whatever upon *our* negociation, and had given in to him the projet of a convention which Ct. Nesselrode thought very moderate and reasonable. This projet contains 3 articles. The first assures to both parties the free navigation of the whole of the Pacific—thus quietly getting rid of the Russian maritime pretension. The 2d stipulates that The United States shall not make settlements North nor Russia settlements South of the 55th degree of N. Latitude, and the 3d binds the United States to sell no arms and ammunition to the natives on the Russian American coasts. This projet is, I have no doubt, the modification of that with which Mr. Middleton was originally furnished to negociate about territorial demarcation and every thing else *without* us and *to our exclusion*, and that, if he had had to act with me, and had had our appui he would have contended for much more than he now does. Nesselrode and Poletica are also of this opinion—but it is all very well as it is, and we shall each follow our respective courses without collision, as it appears to me, of any sort. The duplicity however of the American Government, as it regards us, has, you may depend upon it, been extreme, and I heartily hope that Squinty Adams may lose his election for it.

I have had three conferences with the Russian Plenipotentiaries—I shall probably have another at the begining of next week after Nesselrode has seen The Emperor, and that conference I hope may be favorable and final as far as our general agreement goes. This Government is fighting me very hard about the 55th degree which they pretend to adhere to as a point of national dignity being the limit assigned by Paul's charter to the Russian American Company. At my first conference I proposed verbally Chatham Straits, Lynn Canal and Mount Elias or the 140th degree of W. Longitude. This was taken for consideration, and at the 2d conference a contreprojet was offered to me verbally, and afterwards given to me for consideration in writing. I enclose a copy of it. You will see that it is inadmissible. But as it is evident to me that I cannot avoid giving some lisière, however narrow, upon the mainland and as I conscientiously think that there is much reason in an argument which has been strongly urged against my first projet viz: that if Chatham Straits are the boundary, the United States, under their convention with us, will have the right of visiting, to the great annoyance of Russia, all the islands and parages between those Straits and the continent. I gave in at my last conference the amended projet of which I enclose you a copy stating that I was at the end, and beyond the end of my instructions, and that I could really go no further. Much discussion took place, but Nesselrode ended by taking my new projet for reference to The Emperor, and I anxiously hope that at our next meeting I may be told that it will be assented to. If it is, the rest will be matter of easy adjustment,—and we may in a few days finish the Treaty when I shall despatch a Messenger with it to England. I know that I exceed the letter of my instructions in ceding the islands North of Prince of Wales and Duke of York[1] Islands, but I do not think that I am acting contrary to the spirit of them, and if I can get, as I thus should do, the 56th degree as the Southern boundary a lisière of about 30 miles on the continent and the 140th or 139th degree of W. Longitude, we shall effectually secure all the essential objects and interests of the Hudson's Bay Company. Ct. Nesselrode has asked me whether I should object to a stipulation not to sell arms and ammunition to the natives on the Russian Allotment. I have told him that I should not object.

[1]Present Zarembo and Wrangell islands,

I send this letter to Clanwilliam by a Colonel Loucadou, a Prussian, who goes to night en Courier to Berlin. I had not intended to report my progress in the negociation till I should do so officially and in despatch, but Loucadou's departure is a tempting opportunity to write, and it was at least desirable that you should know as soon as possible that there was an end of Middleton's protest.

Neither Count Nesselrode nor I have yet received any news from Constantinople since Minciaky's arrival.

The Emperor goes on well, but is still in His room—and I suppose that it may be still a month before He is on His horse.

I am &c

CHARLES BAGOT

Sir Charles Bagot to Mr. George Canning

St. Petersburgh,
March 10, 1824

Private, By Russian Courier

I had expected that I should by this time have been enabled if not to send you a Messenger with the definite arrangements respecting The N. W. Coasts of America, at least to have told you that I had so far come to an understanding with the Russian Plenipotentiaries, as that there remained little more to do than to put our agreement into good and due form; I still hope that I shall very shortly have it in my power to do so, but I find, since I wrote to you on the 28th of last month, that whatever disposition there may have been on the part of this Government to recede from the territorial pretensions advanced by the Oukaze of 1821, there is an invincible reluctance on the part of The Emperor to renounce any part of those advanced by The Emperor Paul to the Russian American Company in 1799. These pretensions extend, as you are aware, to the 55th degree of N. Latitude, but whatever may be the extension allowed to them so far as regards the islands upon the coast, it cannot be maintained that they extend to the same degree of latitude upon the continent, and even if it could, they would be inadmissible, under the stipulated basis of our negociation (viz: that of the mutual convenience of the two parties) as interfering directly with the *actual present* interests of England in those quarters.

In my last letter I acquainted you with the amended projet which I had offered in consequence of the contre-projet given to me by the Russian Plenipotentiaries in answer to my original proposition. This amended projet of mine has been replied to by insisting upon the first contre projet as being strictly according to our "convenances mutuelles." To this reply I have prepared a rejoinder which I shall give in at our conference the day after tomorrow. Upon this rejoinder the negotiation must depend. I dare go no further without specific orders to do so.

If by the cession of the Prince of Wales's Island, reserving to His Majesty the islands lying between it and the continent or high as the 56½th degree (the point from which it is proposed that a narrow strip shall be allotted to Russia upon the mainland, and which shall follow the bend of the coast Northward) some equivalent concession can be obtained in respect to the longitudinal demarcation to the Westward in the higher latitudes I may perhaps find it advisable to exceed (very largely I admit) the letter of your instructions by assenting to some such limit rather than submit to the inconvenience which might, and probably would arise from a protracted delay in the settlement of the question. But I shall in no case venture to make any further cession, and I shall feel it my duty to suspend the whole negotiation if any further advantage is insisted upon by the Russian Government.

When I write to you officially upon this matter I shall of course send you in greater form the details above of the negotiation, but as it has been protracted rather more than I at first expected, I have thought that you would like to know privately and shortly how we are going on.

The negotiations with the American Ministers are not yet concluded.

I am &c

CHARLES BAGOT

Sir Charles Bagot to Mr. George Canning

St. Petersburgh,
March 29, 1824

Private, by Messenger Draffin

You will perhaps think from my long despatch about N. W. Coasts that I have worked myself into a rage upon the subject. This is not so—but I now know this Government *well*, and I wish to impress upon you that in a question such as that in hand, they must be dealt with as you would deal with a horse-dealer. Their whole conduct in the late negociation has been of the most huckstering and pedlarlike character, and in my opinion they will not be brought to reason, unless they are told roundly that if they will not arrange the matter equitably and according to our mutual present conveniences, they shall not be *allowed* to settle any where upon the islands or continent South of their present lowest establishment, viz: Sitca. They have not a shadow of claim below this point, and very little above it, to stand upon. It is too much to claim to the 51st degree (they might equally well have claimed to the 42d) and then to treat their retractation of a preposterous pretension as a concession with which they may be permitted to market. The Emperor Paul's pretension to the 55th degree in 1799 was never notified to any Power upon earth. In the affair of Nootka Sound, only nine years before, the Empress Catherine told the Court of Spain (see Annual Register, 1790), that she had no pretensions on these coasts which interfered with theirs, and theirs extended to the *60th* degree. In the instructions given by Louis the XVIth (no bad geographer) to La Perouse in 1785, it was never supposed that Russia had any claims whatever upon the Continent and it was doubted whether She had the right of occupancy in all the Kurile and Aleutian Islands. These instructions are so remarkable that I cannot resist enclosing to you an extract of them.

I hope that you will read my despatch and its enclosures with the map before you, but that you may see at once how very liberally I have been disposed to deal with Russia I send you a sketch of my successive offers to satisfy Her. I certainly (whatever you and the Hudson's Bay Company may be disposed to do) could not venture further, and I suspect that if my offers had been accepted I ran no small risk of being disapproved by you.

As to the maritime question that I suppose *must* be settled and I think this Country is mad not to see that by making quietly a recantation which, if it were to stand bald and alone, would be a very mortifying thing to their pride and dignity.

Nesselrode would have been very tractable, as I know that at the bottom of his heart, he thinks the Ukaze indefensible and the line of territorial demarcation a matter of very secondary importance to either party. But Poletica having been called upon to defend the Ukaze when he was Minister in America, feels his amour propre concerned, and they are both under the dominion of the Russian American Company at the head of which is an old Admiral Mardwinoff, an honest man, but mighty obstinate, and who mistakes this obstinacy for patriotism.

I do not know exactly how Middleton is going on with his Convention upon the subject, but I believe that there is some little hitch, growing as I imagine, out of the liberty to trade on the Russian coasts upon which The United States insist very much. I know nothing else upon which there can be any hitch, as there is no boundary to fix.

As Middleton and I act separately the Russians of course try to play us off one against the other but hitherto without success.

I am &c.

CHARLES BAGOT

Sir Charles Bagot to Mr. George Canning

St. Petersburgh
Augt. 24, 1824

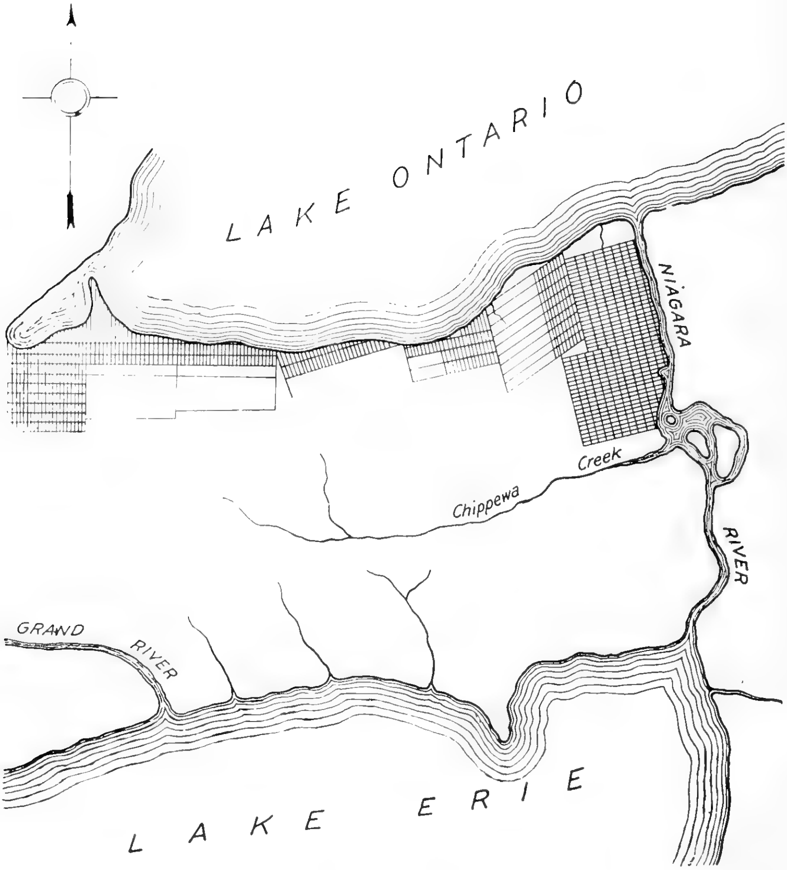
Here is pretty work, and here is pretty upshot of all your, and Lord St. Helens and my labours about North West Coasts. I can hardly figure your surprize when you first read my despatch upon the subject—but it is all true—true as Gospel, and I believe that you have as much chance of getting Moscow ceded to Great Britain as of inducing this Country to yield upon the three points on which we have split. I believe that it is not necessary for me to say more to you at present than I have said in my despatch, though I shall have much to say when we meet in England. My opinion is that both Nesselrode and Poletica are now afraid of signing any thing upon the subject in which there are not great & signal advantages secured to Russia. There has, I understand, been an immense clamour raised against them for supposed sacrifices of Russian interests in the Convention made with the United States; and they hope & believe that it will not be ratified in America. It is true that there certainly are points stipulated for in your last projet which were not in contemplation in our former discussions, but still this would not sufficiently account for my finding the P. P. so much more difficult to deal with than they were 3 months ago.

On Friday night last I gave in my projet. On Saturday we had our first conference when I immediately suspected the turn which things would take. On Sunday Mr. Poletica called upon me with the Russian Contreprojet when I told him frankly the extent of my discretion, or rather non-discretion, upon the three points most immediately at issue. We have [?had] a very long and earnest conversation which ended by his telling me, honestly enough, that he thought the case really hopeless. The conference of the next day proved it so. As to Nov:—Archangelsk they told me that they had no doubt that at the expiration of ten years, the advantages which the establishment would have derived from its having been frequented by foreign Ships would make the Russian Companies desire a further extension of time, but that they were frightened at the words *for ever.* The Points however upon which scarcely any discretion which you could have given me would have brought us to an understanding were, the perpetual freedom of trading and navigating upon the lisière, if by trading was meant trading with the natives—and the opening *at all* the coast from the 60th degree to Behrings Strait. On the first of these points they contend (Have they not some reason on their side ?) that the cession of a coast in nominal Sovereignty saddled for everlasting with such privileges to foreigners was no cession at all. And as to the second, that they were, by undisputed occupancy and possession as unquestionably Masters of the whole of that coast as of the coasts of Livonia or Courland, and that nobody should come there—sic volunt. I asked whether, by their convention with the United States; the Americans were excluded from visiting these coasts. They answered that such was their *idea* of the convention whatever might be that of the Americans, and Mr. Poletica told me privately that the Russian Minister at Washington had orders to give if it were necessary, this interpretation to the agreement, and that he thought it probably [?probable] that, upon this very point, the Americans would refuse to ratify—a circumstance which he should *not* regret.

As soon as I saw the determination which this Government had taken I affected the utmost indifference on our part as to whether was signed a treaty or not—but it was mere affectation, for I see too well that infinite inconvenience may arise, and that shortly, from our not having been able, at this particular time, to come to an understanding. I regret it greatly on public grounds and on personal grounds also, as I should like much to have been the person to sign a Treaty of such magnitude and importance and I should have ended my days here handsomely by doing so. But Dies aliter visum est, and I cannot at all see what is now to be done.

I am, &c

CHARLES BAGOT



MAP
SHOWING THE
SURVEYS IN THE NIAGARA PENINSULA
ALONG LAKE ONTARIO IN 1790
(See Third Report, Bureau of Archives,
Ontario, 1905. p. xcix.)

The Loyalists and Six Nation Indians in the Niagara Peninsula.

By PROFESSOR WILBUR H. SIEBERT.

Presented by DR. W. D. LESUEUR, F.R.S.C.

(Read May Meeting, 1915.)

FORT NIAGARA BEFORE THE REVOLUTION, 1759-1775.

The British acquired Fort Niagara from the French in 1759, through the efforts of Sir William Johnson. The post stood, as it still stands, on the eastern point formed by the junction of the river whose name it bears and Lake Ontario. The new possessors of the fort, like their predecessors, maintained it as a garrison and trading post. The place now became the scene of Sir William's activities, one of the first of which was the establishment of peace with the Indians at the great treaty of 1764. It served as the rendezvous and recruiting center for Western expeditions, and through its friendly attitude towards the Iroquois, or Six Nations, it prepared the way for the alliance between England and the tribes which a few years later "turned their tomahawks against the 'American rebels'". Fort Niagara was also an important mart for the fur trade with the Indians and the center of trade routes to the interior of the continent. The capture of the post by the English led to greater activity along these routes and to the transfer of the carrying rights over the portage around the Falls from the Seneca Indians to white men with their teams and wagons. This change in conditions on the river soon manifested itself in the formation of a small settlement at what is now Lewiston, and doubtless a few of the families belonging to the portage cultivated fields in the neighbourhood.[1]

Until Revolutionary times the country on the western, or Canadian, side of the River Niagara was a wilderness of forest and swamp, and was occupied by the Mississauguas. Their chief settlement lay opposite the fort and on the site of an earlier town, once belonging to the nation of the Neuters, which bore the designation of Onghiara. On the old clearings of the extinct Neuters, now the commons of

[1] Kirby, Annals of Niagara, 33, 34, 40, 47-49. Severance, Old Trails of the Niagara Frontier, 120; Thwaites and Kellogg, Rev. on the Upper Ohio, 245, n.; Cruikshank, Butler's Rangers, 27.

Niagara-on-the-Lake, the Mississauguas raised their crops of maize and beans.[1]

FORT NIAGARA AS A RENDEZVOUS FOR LOYALISTS AND INDIANS.

From the very beginning of the Revolution Loyalists, or Tories, from the Middle Colonies resorted to Fort Niagara, whither Captain John Butler—himself a refugee from the Province of New York—was sent by Sir Guy Carleton, governor general of Canada, in the fall of 1775. The home of Butler had been at Johnstown in the Mohawk Valley, a hotbed of loyalism, where the superintendent of Indian affairs, Sir William Johnson, had lived until the close of his life in 1774. Guy Johnson, Sir William's nephew and son-in-law, now succeeded to the Indian superintendency, and Butler was serving in the capacity of deputy to the new superintendent, while Joseph Brant, the Mohawk chieftain and head of the Six Nations, was the latter's secretary, being in turn aided by his sister Molly, who exercised scarcely less influence among the Indians than Brant himself. The battles of Lexington and Concord had stirred the Johnsons and their friends in Tryon County to various activities in opposition to the Whigs, or patriots, including the holding of a series of Indian councils. Surveillance on the part of the Whigs kept them informed of all these activities, and at length in August, 1775, Guy Johnson together with his family, the Butlers, Colonel Daniel Claus, Gilbert Tice, Barent Frey, two sons of Sir William, and 120 warriors and chiefs of the Six Nations, fearing longer to remain in the Mohawk Valley, took their departure from Oswego for Montreal by way of the St. Lawrence. At Montreal the party was received in conference by Governor Carleton, and Brant was given a commission in the British army. It was in the November following that John Butler received his orders to report for duty at Niagara . Evidently, he took with him some of those who had accompanied him in his flight.[2]

Arriving at Niagara on November 17, Captain Butler took preliminary measures at once: he set Loyalist emissaries at work gathering information in the principal villages and mingling among the Indians. One of these, a young Philadelphian by the name of William Caldwell, aided some British officers to escape from prison, and con-

[1] Kirby, Annals of Niagara, 8, 9, 11, 35; Severance, Old Trails of the Niagara Frontier, 4, 8.

[2] Niagara Hist. Soc., No. 4, 2; Jubilee Hist. of Thorold, 12; Caniff, Med. Profession in Upper Canada, 9; Van Tyne, Loyalists in the Am. Rev., 298; Cruikshank, Butler's Rangers, 8-10, 16, 17, 24-27; Stone, Life of Joseph Brant, I, 51-54, 67, 68, 71-74, 84; Caniff, Settlement of Upper Canada, 74.

ducted them through the wilderness to the frontier post. William and Peter Johnson, the half-blood sons of the late Sir William, Barent Frey, a brother of Colonel Hendrik Frey of Tryon County, and John Johnson, an Oneida trader, were some of the other agents in Butler's employ. Already fugitive Loyalists were arriving from the border settlements in sufficient numbers to be organized into a body of reliable assistants, and were especially serviceable because of their familiarity with one or another of the Indian languages. In 1776, one Thomas Smith came bringing a plan of Fort Stanwix and special intelligence to communicate to the authorities. In May of the same year Sir John Johnson, son of Sir William and leader of the Tories of Tryon County, having had various clashes with the local Whig committee, fled with 170 of his friends and tenants by way of the great Adirondack wilderness, St. Regis, and Caughnawaga to Montreal. The angry Whigs now sacked Johnson Hall and converted it into a barracks, wrecked Guy Johnson's house and carried the families of the refugees as hostages to Albany, including Lady Johnson and Mrs. Butler. These events in Tyron County help to explain the continued arrival at Niagara during the succeeding months of fugitives from the Mohawk Valley, including many persons of influence. Perhaps, too, they evoked the letters, delivered in the winter of 1776-7 by a Mr. Depue, from 70 inhabitants of the Susquehanna country proposing to enlist as rangers under Butler's command. Butler seems to have had previous communication with these persons, for we are informed that he had "already encouraged them to join him at Niagara." So far as is known this was the first suggestion of the formation of Butler's corps of Rangers, by means of which numbers of militant Loyalists were drawn to the fort.[1]

Meantime, the aid which the Indians might render was not overlooked by Butler and his superior officers. Although the authorities at Quebec remained undecided on the question of employing the savages in border warfare until the beginning of 1777, Guy Johnson and Butler appear to have anticipated favorable action on this point by making use of about 70 warriors of the Six Nations during the year 1776. If full warrant had not been received from headquarters previously, it came to hand early in June, 1777, when Butler received instructions from Carleton to collect as many Indians as possible and join Colonel St. Leger's expedition against Fort Stanwix. The task of gathering this band of savages, which was supplemented by a body of such refugees as were available, furnished Butler an opportunity

[1] Cruikshank, Butler's Rangers, 15, 27-29, 30, 31; 34-37; Third Report, Bureau of Archives, Ont., 1905, 90; Flick, Loyalism in N. Y., 86; Caniff, Settlement of Upper Canada, 67, 68.

for promoting his scheme of organizing a corps of Rangers, and before the middle of the month he was able to send the Governor General a list of five captains, nine lieutenants, and 75 privates. Some of these recruits had arrived at Niagara in small parties, and reported that many other loyalists were ready to enlist on the first chance.[1]

As our interest is confined for the present to watching the gradual assembling of those elements of society, which were later to constitute the population of the Niagara Peninsula, and as Butler's corps was one of the most conspicuous of these, we have first to trace the steps by which its ranks were filled, besides gathering such information as is available about the other Loyalists who came in, singly or in groups, footsore and weary, from the long journey through the woods. We have also to note the further associations of the Six Nations with the Niagara post until they were admitted to the reservation which was given them on the Grand River.

Before joining St. Leger at Oswego at the end of July, Butler convened an Indian council there, wbich was attended by 800 or more braves, of whom Brant and about 400 were ready to take the field. These warriors, therefore, formed part of the expedition, along with Butler's men. The Loyalist contingent was further increased by Sir John Johnson and 133 members of his corps, who came from their headquarters at LaChine. As is well known, the attack on Fort Stanwix, which occurred early in August, proved disastrous, ending in the flight of the assailants. Two of Butler's captains, Hare and Wilson, were killed in the battle of Oriskany, and after the flight most of the Rangers were despatched to the Susquehanna to capture cattle for the garrison at Niagara; but the party was surprised, Captain Peter Tenbrook, Lieutenant Bowne and 20 privates taken prisoner, and the others scattered. The following month (September, 1777), found Butler in Quebec, whither he went to settle his accounts. The bitter lesson of Fort Stanwix required no commentary, and when Butler renewed in person his proposal to enlist a regiment of Rangers to serve with the Indians, Carleton at once consented to the embodiment of eight companies, each to consist of a captain, a lieutenant, three sergeants, three corporals, and fifty privates. The kind of service these troops were to perform is clearly indicated in the requirements that six of the companies were "to be composed of people well acquainted with the woods," while the other two were to consist of persons "speaking the Indian language" and

[1]Thwaites and Kellogg, Rev. on the Upper Ohio, 65, 68, 69, 245, 246; Proceedings of the Wis. Hist. Soc., 1909, 132; Ohio Arch. and Hist. Quarterly, July 1907, 271; Severance, Old Trails of the Niagara Frontier, 92, n.; Cruikshank, Butler's Rangers, 34-37.

acquainted with the aboriginees' customs and manner of making war. The men were to clothe and equip themselves. The outcome of St. Leger's expedition and Butler's visit to Quebec interrupted the enrolment of Rangers for a brief period. Then, recruiting officers were sent out from Niagara, among them being Depue, who betook himself to the Susquehanna; but enlistments were slow, and the first company was not completed until the middle of December. By May of the next year the number had increased to 125 only, which was but 36 more than the number reported to Carleton a twelvemonth previously.[1]

The Indians, on the other hand, did not need to be solicited to come to Niagara. The activity of the Americans, stimulated by the British disasters at Fort Stanwix and Saratoga, caused numbers of the red men to flee thither for refuge; and although thousands of them still dwelt north of the Susquehanna country in the isolation afforded by the vast stretches of wilderness and the cedar swamps by which they were surrounded, no less than 2,300 Indians were at Niagara in December, 1777, making endless demands on the commissary department. By the middle of the following May this numcer had increased to 2,700, and Colonel Bolton, commandant of the fort, relates that he found it necessary "to send to Detroit for a supply of provisions, and to buy up all the cattle, etc., that could possibly be procured, otherwise this garrison must have been distressed or the savages offended." With the situation so serious in the land of the Six Nations, we can understand why the chiefs and warriors appealed to Butler at this time to conduct his corps to the frontiers of the rebellious Colonies, since they looked to their white friends to protect their settlements and harass the enemy.[2]

The collecting of Tories to serve under Butler was not confined to regular recruiting agents: it appears to have been one of the purposes with which Brant set out for Oghwaga and Unadilla early in 1778. At Unadilla, which an American officer described as "a common receptacle for all rascally Tories and runaway negroes," Brant was assisted by John Young, and at Oghwaga by a former Susquehanna settler named McGinnis, both of whom had been sent forward by Butler. From Oghwaga the Mohawk chieftain proceeded with his

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[1] Cruikshank, Butler's Rangers, 35-37, 39, 40; Severance, Old Trails of the Niagara Frontier, 59; Johnson's Orderly Book, 10, n., 4, n, 82, n.; Stone, Life of Joseph Brant, 182, 186, 209; Reid, The Mohawk Valley, 411-425; Haldimand Papers, 21, 765, 424; B. 40, 4. 5.

[2] Zeisberger, "Hist. of Northern Am. Indians" in the Ohio Arch. and Hist. Quar. for Jan. and Apr., 1910, 37, 38; Severance, Old Trails of the Niagara Frontier, 57.

forces into the Delaware Valley, where he was joined by 60 or 70 of the inhabitants, and seized horses and cattle. By June 18th Brant was operating in the vicinity of Otsego Lake, and Colonel Jacob Klock sent word to Governor Clinton that "his number encreaseth daily; many very lately did run off, moved by disaffection; others join him, moved by fear, and several are forced to take up arms, or to swear allegiance to the King of Britain. We are informed that Brant boasted openly, that he will be joined at Unadilla by Butler, and that within eight days he will return and lay the country waste."[1]

A week later Butler was said to be at Chemung. He had set out from Niagara on May 2nd to hold a council with the Indians at the Seneca village of Kanadesaga, and to fix his headquarters among the Loyalists at Unadilla. Recent letters from the frontier informed him that his recruiting officers were meeting with good success, one of them reporting an enlistment of nearly 100 men. That Butler was employing every method to gather up the Tories is apparent from the statement of Barnabas Kelly, a settler on Butternut Creek, who made affidavit about June 25th that he "heard John Young at the Butternut, read a proclamation from Butler, desiring all the friends to government to join him, and to bring in all their cattle together with their wives and families, and they would be kindly received by the said Butler." Almost at the same moment Brant appeared on Butternut Creek with a few Indians and "Green Coat soldiers," and ordered Robert Jones "with nine families who liv'd at that place to go with him, if friends to government; if not, to take their own risk. Himself and 4 families with S'd Brant went to Unadilla, the other five soon followed." Some days later Jones learned that a large number of Senecas were on the march to join Brant at Anahquago. As our deponent made his escape on the day this news was brought in, he was unable to report the actual arrival of these warriors. Meantime, at Unadilla Butler's Rangers seem to have gained a considerable accession of persons, who had been expelled from their holdings farther up the valley on account of their real or suspected loyalty.[2]

Late in June Butler and his Mohawk ally met in council at Tioga Point, where it was decided that the latter should continuef the work of collecting Loyalists and provisions, while the former should make a descent on Wyoming in eastern Pennsylvania. When Butler started on this raid his force numbered about 1,100 men, of whom 700 were Indians (largely Senecas), the remainder comprising

[1] Clinton Papers, Vol. III; Halsey, The Old New York Frontier, 207, 209, 211.

[2] Haldimand Papers, B. 96-1, p. 36; Cruikshank, Butler's Rangers, 41, 44, 45; Halsey, The Old New York Frontier, 212, 213, 215.

some of his own Rangers, some of Sir John Johnson's Royal Greens, and many of the Tories recruited by Brant in the country of the upper Susquehanna. Brant's own party of about 250 Indians and whites were not in the Wyoming expedition, but invaded the Delaware Valley as far down as Minisink instead. On his arrival in the Susquehanna country, Butler received a communication from John Buck, a Loyalist owing a large property on the Delaware, offering to supply him with beef. Thereupon, Butler sent forward Lieutenant McQuin and two Indian chiefs, who brought away not only a large supply of cattle, but also 40 of Mr. Buck's Loyalist neighbors. Subsequently, the Revolutionists drove Buck into the Indian country and he took refuge at Niagara, where he found a party of adherents of the Crown, who had been released from Wyoming by Butler. This party had followed an Indian trail through the almost unbroken forest to Oswego, whence it had coasted in open boats along the shore of Lake Ontario for nine days, living meantime on the hips of the wild rose.[1]

After the battle of Wyoming Butler returned to Niagara on "sick leave," having first placed Captain William Caldwell in temporary command. However, there was to be no cessation of effort in recruiting: Caldwell's orders were to enlist as many able-bodied men as possible who might be recommended for their loyalty. That other officers from Niagara followed the same instructions is shown by the accession of Thomas Garnett and 39 volunteers to the detachment of Captain Gilbert Tice at the German Flatts, September 1, 1778. However, the census of those who wintered at Fort Niagara, or drew rations there in 1778-79, is by no means to be regarded as showing all that was accomplished in the way of aiding Tories and their families to effect their departure from the enemy's country. In November, 1778, Governor Haldimand wrote from Quebec that 111 women and children were expected from Niagara, and several weeks later he directed Lieutenant Colonel Carleton at Montreal to send 40 of the members of this party to Machiche, but for some reason these persons were allowed to remain with their fellow exiles under Carleton's supervision. Others who were dependent upon enlisted men at Niagara may have been disposed of in the same way, for the number of Rangers in winter quarters at this post in December, 1778, was 300 men and 48 officers, constituting six full companies. In the fall of this year so many white persons had found their way to Niagara that the Indians made complaint that the whites were running away from a quarrel which they had begun and were leaving the Indians to defend. So scanty are the records that have been preserved that, de-

[1] Halsey, The Old New York Frontier, 214-216, 218; Second Report, Bureau of Archives, Ont., Pt. II, 992; Centennial of the Settlement of Upper Canada, 83.

spite the large number of persons coming in during the year 1778, we have the personal statements of only nine of them. Three of these testify that they joined the Rangers, one enlisting with his three sons. Another says more indefinitely that he "joined the British army at Niagara." Two of the nine came from Tyron County, four from the Susquehanna, one from Staten Island, one from Albany County, and the remaining one fails to tell whence he came. William MacGrosh, one of those from Tyron County, reports that he was accompanied by other refugees, and Dorothy Windron, from the Susquehanna, testifies that she arrived with her own and other families. By a census of February 12th, 1779, it appears that 1,346 people were drawing rations at the post, of whom 445 were red men, while 64 are set down as belonging to "distressed families," most of them from the Mohawk Valley.[1] Deducting the number of savages, Rangers (348), and troops of the garrison (200 in December, 1778), there still remains over 350 persons out of the total mentioned above, and most of these must have been white refugees.[1]

During the year 1779 there was no cessation of flights to Niagara, so far as we can tell; and the destruction of 40 Indian villages with their fields of maize in the Genosee Valley by General John Sullivan and his forces in August and September increased the number of savages at the post to more than 5,000. Even though war parties were at once sent out, there were still 3,678 of these hungry and homeless red men on the ground in October, and during the ensuing winter the Superintendent of Indian Affairs, Guy Johnson, was heavily burdened with the task of distributing clothing to more than 3,000 of his wards, while the supply of provisions gave out. To make matters worse, the season became so severe that the Niagara River remained frozen from January to March, and the camps of the Indians were decimated by cold, as well as starvation. Numbers of the survivors never returned to their former abodes, but passed into Canada. The Senecas, however, settled in the region watered by the Buffalo, Cattaraugus, and Tonawanda creeks. Despite casualties in every one of his eight companies, Butler was able to report in November, 1779, that his corps was nearly completed. Its barracks, which had been erected a year before, consisted of a range of log buildings on the west side of the Niagara.[2]

[1] Cruikshank, Butler's Rangers, 51, 52, 58; Halsey, The Old New York Frontier, 225, 226; Haldimand Papers, B. 89, pp. 190, 200, 201; Severance, Old Trails of the Niagara Frontier, 60, 62; Second Report, Bureau of Archives, Ont., Pt. I, 392; Pt. II, 974, 979, 990; Pt. I, 470, 415, 416, 392; Pt. II, 974, 979, 990, 1,079; Centennial of the Settlement of Upper Canada, 275.

[2] Severance, Old Trails of the Niagara Frontier, 53, 58, 60, 61; Cruikshank, Butler's Rangers, 59, 64-75, 78; Caniff, Settlement of Upper Canada, 77, 79; Marshall,

Among the Loyalists who escaped to the fort during 1779 were Daniel Servos, with his father and brother from Tryon County, Jean Glasford and a number of her neighbors from the same county after they had been plundered by the Revolutionists, Jacob Caven with his family and John Middagh, both from Ulster County, and Isaac Dobson from the Susquehanna Valley in Pennsylvania. Middagh enlisted in Sir John Johnson's regiment, and Servos was appointed in the Indian Department, with a company of men under his command. Robert Land, another of those arriving in 1779, relates that he was welcomed at the Niagara River by the little band of refugees settled there, and that he applied for and received 200 acres at the Falls.[1]

THE BEGINNINGS OF THE NIAGARA SETTLEMENT, 1780-1784.

The settlement which Land mentions could scarcely have been the Loyalist colony formed on the west side of Niagara River under Governor Haldimand's orders, since that did not come into existence until late in the year 1780. It is true that the Governor had proposed the establishment of a colony at Niagara nearly two years before, and had requested Lieutenant Colonel Mason Bolton, commandant at the post, to find out what leading men in his neighborhood thought of the plan as a means of supplying part of the provisions for his fort. On March 4, 1778, the Commandant had written that the scheme might prove displeasing to the Six Nations, if carried out on the New York side of the Niagara, and that it would be attended by great expense, from which no advantage could accrue to his post for some years to come. However, he had ventured the suggestion that the distress of Loyalist families lately arrived might be relieved by locating them on the west side of the river in the country of the Mississaugua, where both the soil and situation were "by far preferable." Bolton had explained further that, with the little stock these Loyalists had brought in, they might possibly support themselves in the third year after being settled. The problem of supplying large quantities of provisions to the upper posts, in consequence of the numbers of Indians and Tories collecting there, did not permit Haldimand to overlook the desirability of procuring local supplies, if possible. Bolton only furnished fresh proof of the pressing need by sending a new contingent of Loyalist families down to Quebec in the middle of August, 1779; and conditions were certainly not improved in this respect

Sketches and Local Place Names of the Niagara Frontier, 8, 36, 37; Haldimand Papers, B. 105, p. 148; Carnochan, Niagara One Hundred Years Ago, 23, 24.

[1] Second Report, Bureau of Archives, Ont., Pt. II, 957, 1,112; Pt. I, 397; Pt. II, 1,256; Niagara Hist. Soc., No. 8, 43.

by Haldimand's proclamation to the inhabitants of the back settlements, in 1780, to surrender themselves at the frontier posts, with a view to being sent into the interior parts of Canada until peace should be restored, or by the two expeditions conducted into the Mohawk Valley by Sir John Johnson in the same year, for the purpose of enabling Loyalists to escape. As the result of the second of these expeditions at least one group, comprising 29 persons, came in from Schoharie, and was at once (November 20) forwarded to Lower Canada on board the *Seneca*. From the country west of the upper Ohio refugees were also coming in: in the preceding July, Lieutenant Joseph Ferris wrote from Tuscarawas Town that he was on his way to Niagara with a party of 23 white men, most of them Loyalists, and that Sergeant Brass was likely to bring in many more.[1]

By this time Haldimand had made up his mind that the refugees at Niagara could be best supported by colonizing them on the land of the Mississauguas. Accordingly, Colonel (Guy) Johnson was instructed to purchase this land for the government. Those settling were to receive grants proportional to their merits, to be held without rent; they were also to receive provisions for a twelvemonth, the necessary implements of husbandry, and the use of horses. If they should remove at any time, they were to be paid for their improvements; but while they remained they were to sell any produce they might raise beyond their own needs to the garrison. Lieutenant Colonel Butler, who was at Quebec on official business at this time, was to engage prospective settlers among the refugees in and about Montreal, and thought he might supply others skilled in agriculture from his corps of Rangers. The plan of colonizing the Loyalists Haldimand decided to extend to the other localities in the Upper Country, including Detroit and Michilimackinac to the westward and Genesee and Cataraqui to the eastward. At Carleton Island, near the head of the St. Lawrence, the plan was already in a state of "some forwardness," according to the Governor. Indeed, he expected that the settlement there would be able to supply a quantity of potatoes to Niagara in the fall. By December, 1780, the new settlement across from Colonel Butler's headquarters was beginning to take form; as yet it consisted of only four or five families, already occupying houses, and anxious for a forge and the implements and seed necessary for the spring planting.[2]

In the meantime, there had been more than the usual amount of sickness among the troops and Loyalists at the fort, due in the

[1] Haldimand Papers, B. 96-1, pp. 248-250; B. 96-2 ; B. 100, p. 165; B. 220, p. 173, 174; B. 147, p. 195; B. 100, p. 391; B. 103, p. 372; B. 100, p. 320.

[2] Haldimand Papers, B. 105, pp. 191, 376.

one case to the hardships of campaigning and in the other to long journeys through the Indian Country, often with insufficient food. In April, 1781, Dr. R. W. Causland, the regimental surgeon at Niagara, wrote that during the two previous years and part of the third he had constantly under his care the sick of the detachments of the various corps at the post, namely, the 34th, 47th, 84th, and Sir John Johnson's regiments, besides Captain Brant's Volunteers, that during 1780 the 34th Regiment alone had 245 sick, and that he was far from exaggerating in saying that from 1776 to 1781 the sick at the fort had amounted to more than 100 each year.

Doubtless, all this illness, no less than the casualties in the field, prevented Colonel Butler from completing his corps of Rangers; but in May, 1781, the Colonel sent word to Quebec that he expected to fill his ranks soon, as some of his men had gone to bring in 30 Loyalists who had enlisted during the previous winter, and that he had yet to hear from three other recruiting parties. Evidently Butler's expectations were more than fulfilled, for a little later he had asked permission to add the ninth and tenth companies to his corps. That such permission was granted appears from the fact that he was able to report, July 2, 1781, that the ninth company had been completed and mustered three days before. On Januray 12th, seven more refugees arrived and joined the Rangers, the tenth company being filled in the following September.[2]

While Butler's corps was thus attaining its maximum strength, the new settlement across the Niagara was making but slow progress. Late in May, 1781, Butler acknowledged the receipt of various articles forwarded from Quebec for the settlers, but reported that they were much in need of a blacksmith and forge and iron suitable for plowshares. He suggested that he could find the smith among his Rangers, and that if Governor Haldimand would supply the forge and iron for a year the settlers might be able after that to help themselves. As it turned out, some of the families in the little colony were already in a position to "subsist themselves" by September, and Haldimand expressed himself as being much gratified with the prospect that was opening before the settlement. On December 17th Butler wrote that the winter thus far had been so moderate that the farmers had found it possible to clear the ground and prepare it for planting and sowing early in the spring, and that they had in fact maintained themselves since the previous September, although they had been allowed only half rations from the beginning.[3] A party of refugees

[1] Haldimand Papers, B. 100, pp. 287, 359, 407; B. 101, pp. 30, 38, 114.
[2] Ibid., B. 105, pp. 215, 221; B. 101, p. 117; Cruikshank, Butler's Rangers, 97.
[3] Niagara Hist. Soc., No. 17, 6, 7.

that arrived almost naked during this period, if not earlier, entered Colonel Guy Johnson's company of Foresters. When spring opened Colonel Watson Powell, who had succeeded Lieutenant Colonel Bolton at Niagara, set Butler's men at clearing some ground on the western side of the river, which was intended to produce part of the garrison's supply of corn, another tract on Buffalo Creek being destined for the same use on account of its exceptional fertility. As eight or nine of the Rangers had secured their families from the frontier in the previous autumn, they together with some of their comrades, were sufficiently charmed by the approach of summer in the lake region to seek their discharge with leave to settle in the neighborhood, provided they could be supplied with provisions for one year and such smith work as might be necessary. As these men were farmers, Butler thought that they would soon prove themselves useful to the post, besides supporting their families comfortably. He was the more willing to release these prospective settlers, since he was expecting a number of recruits from the frontier, which would enable him to keep his corps complete. Toward the close of August, 1782, the little colony at Niagara comprised 18 men, 17 women, and 49 children, or a total of 84 persons. Seven of the families seem to have come from the Susquehanna Valley in Pennsylvania, and the remaining nine from various parts of Tryon County in New York. They had among them 49 horses, 61 cattle, 30 sheep, and 103 hogs, and had cleared 236 acres of land, on which the produce for the year was 926 bushels of Indian corn, 630 of potatoes, 206 of wheat, and 46 of oats. Already two members of the colony had planned to build a saw mill and a grist mill near the Rangers' Barracks, but were prevented from carrying their plan into effect by the government's refusal to sanction private ownership of the proposed mills. However, Governor Haldimand offered to supply the building material and pay for the work of construction, and Lieutenant Brass erected the mills under these conditions. It was expected that they would be ready for operation by June 1, 1783; but unforeseen delay in transporting the iron work from Montreal retarded their completion for some days. Meanwhile, the farmers began bringing their wheat to the fort to exchange for flour, and although the quantity was double that produced by the settlement during the previous year, it remained of no use to the garrison until the grist mill could be finished.[1]

By March, 1783, the refugee colonists were showing their dissatisfaction with the uncertain tenure under which they held their

[1] Haldimand Papers, B. 147, p. 298; B. 101, p. 195; B. 169, p. 1; Niagara Hist. Soc., No. 17, 6-9, 11, 41; Cruikshank, Butler's Rangers, 109-111.

lands and improvements, and with some other local conditions. In a petition which they presented to Butler a little later they explained that they had received only a part of the year's provisions that had been promised them, and that they were still without a blacksmith; they declared their willingness to dispose of their produce to the garrison at a reasonable price, but pointed out that they were now selling at prices fixed by the commanding officer and were suffering a disadvantage in being prevented from selling to the traders from whom they bought their goods. They asserted that they were liable to eviction at the will of the commandant, who was changed frequently, and preferred a lease system, being willing to pay rent after a term of eight years. Butler himself thought that should a small rental be required of the settlers some of them, even among those owning property in the States, would no longer think of leaving the settlement.[1]

Although the definitive treaty of peace contained an article on behalf of the Loyalists, it was by no means reassuring to those who had been inclined to return to their former homes; and when in June, 1783, the settlers had an opportunity to read and discuss the resolutions adopted by inhabitants of the district of Saratoga, which were printed in an Albany newspaper of May 26th, they must have realized that their return would be anything but welcome to their old neighbors in the States. These resolutions declared that any person who had voluntarily joined the British, and should hereafter return to the district, would be treated with the severity due to his crimes and infamous defection; that any person who had returned since Januray 1, 1783, and failed to depart before June 10, would be dealt with in like manner with those who might presume to return later; that the militia officers of the district make diligent inquiry in their beats for defected persons who might have come back, and report such, if any, to the inhabitants in order that they might be expelled, and, finally, that any resident of the district who should countenance a former adherent of the enemy would be held in comtempt. The American intolerance for Tories was demonstrated in actions as well as in words, for they sent back deserters from Butler's Rangers and Sir John Johnson's corps, while allowing those from the regular regiments to remain among them. The effect of these things was noted by Major Potts of the King's or 8th Regiment in his report, after inspecting the battalion of the Rangers in August: he said that the men no longer contemplated seeking their old localities, but were now chiefly concerned with Butler's promises to promote their settlement on the neighboring lands of Lake Erie and the Niagara River, that they hoped to obtain grants there, and that he believed most of them were

[1] Niagara Hist. Soc., No. 17, 9-11; Cruikshank, Butler's Rangers, 110, 111.

disposed to settle. A census accompanying this report showed that the corps comprised 469 men, 111 women, and 257 children. Already, many of the officers were selecting lands. Towards the close of September the families attached to the corps were increased by the arrival of two of the wives of its officers and a number of children from Schenectady, where they had been detained. Colonel Allan Maclean, who had now succeeded to the command of the garrison, asked for lots in the little settlement for six of his men, remarking incidentally that of the 70 lots which Lieutenant Colonel Butler had marked out, 30 had already been set aside for various persons. By April 18, 1784, the number of families in the colony had increased to 46, all but two of which had built houses for themselves. Of the 731 acres that had been cleared, 123 were sown with winter wheat and 342 more were plowed for spring crops. Of livestock the colony now had 124 horses, 160 cattle, and 332 swine.[1]

Early in 1784 Colonel Maclean obtained leave of absence, and was succeeded by Colonel Arent Schuyler DePeyster, formerly commandant at Detroit, who received instructions (March 29) to reduce the 8th and 34th Regiments to a peace footing and disband the provincials under his command. In these instructions Haldimand expressed his intention of settling as many of Butler's Rangers on the land opposite to Fort Niagara as possible and the rest at the head of Lake Ontario toward the Grand River upon a new purchase. De Peyster was also directed to take the names of all officers and men of the corps who might wish to settle in the districts indicated, in order to prevent retractions, or claims, in the future. Lots were to be granted only to such as would cultivate them. Until farms were assigned, the Rangers were to be permitted to occupy their barracks; but they were expected to winter on their respective possessions, and were to receive provisions in specific proportions from the date of their disbandment until further orders. Such of the men as might decline to locate at Niagara were to be sent down the St. Lawrence, except those who might choose Cataraqui as their place of settlemtnt. Major Ross was instructed to receive those stopping at the point just named. Later (May 20), Haldimand wrote that inasmuch as there would not be enough land opposite the fort for the accommodation of all the Rangers, especially as he would have to reserve the eastern part for the Crown, he had decided to call those unprovided for down to Cataraqui.[2]

[1] Niagara Hist. Soc., No. 17, 13, 15; Cruikshank, Butler's Rangers, 113; Haldimand Papers, B. 105, pp. 353-379.

[2] Haldimand Papers, B. 63, 163-165; Can. Archives, 1886, 417, 463.

THE INDIAN SETTLEMENT AT "LOYAL CONFEDERATE VALLEY," AND THE PURCHASE OF LANDS FOR THE SIX NATIONS.

Haldimand's decision to effect the purchase of a new and extended tract in the Niagara Peninsula had grown out of Brant's demands for territory upon which the sadly reduced Six Nations might settle. Since the summer of 1782 these people had dwelt in a temporary settlement on the American side of the River Niagara, eight miles south of the fort and two miles east of the landing (that is, Lewiston). The place had been appreciatively christened "Loyal Confederate Valley" by Colonel Powell when visiting there during the first summer, at which time he had found the Indians comfortably situated and their fields well planted with maize. The omission of any mention of Brant and his warrors in the preliminary treaty between the United States and Great Britain caused discontent among the red men, in view of the fact that their ancient country lay within the boundaries granted to the Americans. In order to quiet their fears Colonel Maclean met them in council at Niagara, December 12, 1783, but could do no more than try to convince them that they were better off than the Loyalists, since the latter had suffered banishment and loss of property, and in many instances loss of friends.[1]

The Senecas now came forward and offered the Mohawks a tract of their abandoned possessions in the Genesee Valley; but the Mohawks, like most of the Loyalists, would not consent to live within the boundaries of the United States, being determined to "sink or swim" with the English. They therefore declined the offer of the Senecas, and Brant proceeded to Montreal to confer with the Superintendent General of Indian Affairs, Sir John Johnson, and thence to Quebec to claim from Governor Haldimand the fulfilment of a pledge he had made to the Mohawks in April, 1779, to restore them to as good a condition as they had been in at the beginning of the war. The Governor was as good as his word, and when Brant indicated a tract on the Bay of Quinté, on the north side of Lake Ontario, Haldimand consented to its purchase and conveyance to the Mohawks. In the latter part of May the Governor, in compliance with this arrangement, sent Major Samuel Holland, together with Brant, to examine the region at Cataraqui, or the Bay of Quinté. On the return of the Mohawk Chief to Niagara, the Senecas objected to the removal of their friends to so great a distance from them, inasmuch as they thought they might be oppressed by the United States government and hence need a place of refuge. Under these circumstances the Mohawks decided that Captain Brant should pay a second visit

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[1] Stone, Life of Joseph Brant, II, 238, 239; Niagara Hist. Soc., No. 17, 8, 9.

to Quebec, and request the grant of another and less distant reservation. This time Brant asked that Lieutenant Colonel Butler be empowered to purchase a tract of land extending six miles on either side of the Grand River throughout its length, for the use of the Mohawks and such other tribesmen of the Six Nations as should join them in settling there. He also suggested that since the Mohawks has sustained losses amounting to nearly 16,000 pounds, New York currency, a part of this sum be distributed among its members, in case of delay in effecting their settlement, and that provisions also be furnished the Indians until they should become well established in their new homes. In reply to these proposals Haldimand gave definite assurance that the tract of country between the three lakes, Ontatio, Erie, and Huron, would be purchased; that a reservation on the Grand River would be granted to the Six Nations by deed, the remainder being retained for occupancy by the Loyalists, or for some other purpose; that he would recommend to the King the indemnification of the Six Nations for their losses, but would relieve their present distress by advancing to them 1,500 pounds and sending them clothing, provisions, and utensils while waiting for instructions. In fulfilment of these promises Butler was instructed to purchase the tract in question, and Sir John Johnson was directed to appropriate 1,500 pounds for the Mohawks.

In pursuance of his orders Butler, with many officers of the garrison, met the Mississauguas and the chiefs and warriors of the Six Nations in council May 22, 1784, and experienced no difficulty in securing a deed in favor of the government for an immense tract containing 2,842,480 acres, in return for which the sum of 1,180 pounds was paid. The boundaries of this tract were described as beginning at Lake Ontario four miles southwesterly from the point opposite to Fort Niagara, called Mississaugua Point, running thence along the said lake to Waghquata Creek, thence by a northwest course until striking the River La Tranche (Thames) and so down stream to the place where a due south course would lead to the mouth of Catfish Creek on Lake Erie and from that place down Lake Erie to the lands heretofore purchased from the Mississaugua Indians, thence following the boundary of that purchase back to Mississaugua Point.[1]

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[1] Third Report, Bureau of Archives, 1905, 486-489; Stone, Life of Joseph Brant, II, 238, 239; Haldimand Papers, B. 96-1, p. 135; B. 169, pp. 131-133; B. 56, 66-68; B. 63, 143-145; Can. Archives, 1886, 416; Haldimand Papers, B. 175, 269; Can. Archives, 1888, 793.

THE PERIOD OF ACTIVE SETTLEMENT IN THE PENINSULA.

Butler's men were disbanded in June, 1784, but up to the end of the month not more than 100 had signed the list of those desiring lots. The reasons are not far to seek: many wished to bring their families from the States, and there was no one at Niagara who felt authorized to give them permission; besides, the surveys had not yet been made, and, last but not least, the tenure was unsatisfactory. The result was that on the night of June 27th, 70 of the non-signers departed without leave and with the purpose of never returning, while 30 others took passage about the same time to obtain Haldimand's consent to their going into the States for their families. The Governor readily gave them his permission, and wrote DePeyster to extend the same indulgence to any others asking it. During the month of July the prospects of the Loyalist settlement across the Niagara greatly improved, for 258 officers and men agreed to take up lands, making with their families a body of 620 persons. Of these, 99 were women, and 263 children. The new list of signers included not only many of Butler's Rangers, but also other Loyalists, including some of Brant's Volunteers. Within a year these persons and some others found their places in the settlement, as indicated by a census covering the period of six months ending with June 25, 1785. This census gives the number of settlers as 770, 321 being men, 117 women, and 332 children. Most of these persons entered the Niagara Peninsula at the foot of King Street in the town now known as Niagara-on-the-Lake.

At the close of March, 1784, Haldimand wrote Colonel De Peyster, directing that the surveyor was to lay out the settlement in such a manner as to reserve the high ground above Navy Hall and westward to Four Mile Creek for the use of the Crown, in order that part of it might be fortified whenever necessary; and in December following, Philip Rockwell Frey, formerly a lieutenant in Butler's Rangers, was appointed deputy surveyor for Niagara and Detroit, Samuel Holland, the surveyor general, notifying Frey in January that he was much needed at Niagara to survey lots. Apparently, Lieutenant Frey did not go to the scene of his new duties until some time in the summer of 1786, or later, for Major A. Campbell, who was now commandant, wrote him early in July of this year expressing the hope that he would come and make a regular survey of the whole settlement, on account of "the irregularity allowed among the first settlers" near Niagara, as well as on account of "the number of people daily

[1] Niagara Hist. Soc., No. 17, 16, 17; Cruikshank, Butler's Rangers, 113; Haldimand Papers, B. 64, 51, 52; B. 168, 38-41.

[2] Niagara Hist. Soc., No. 4, 3.

coming in from the American States." It was not, however, until a year later that the Garrison Line was run from the hollow above Navy Hall to Four Mile Creek, whence it followed the creek down to Lake Ontario. The late arrival of the surveyor had permitted settlement to go on in many localities in the Niagara Peninsula in advance of the running of lines. This was particularly true of townships Nos. 1 and 2, afterwards known as Niagara and Stamford, the survey of which was not completed until June, 1787. In transmitting the plans of these townships, together with the first concessions in Stamford, Frey took occasion to remark that the person employed previous to himself had made few and very erroneous surveys, having laid out only a small number of lots for certain persons. He added that inasmuch as Brigadier General Hope expected him to finish the survey of the Crown lands by the winter of 1787-88, or by the end of the ensuing winter at latest, he would need two able assistants. These were supplied him in January, 1788, by the appointment of Jesse Pawling and Augustus Jones, and the work of locating the Loyalists and others, who were being admitted to citizenship in the Niagara Peninsula, was further expedited by giving Frey the authority to receive claims and applications for lands in this region.[1] In the following July, the surveyor found it necessary to carry on his surveys in those localities where the people were actually settling, in order to establish lot lines before considerable improvements were made, instead of undertaking the survey of a whole township in which only a few families had taken up their residence. Despite the economy of time thus secured and the help of two assistants, the work of surveying the settlement on the southern, or Lake Erie, side of the Peninsula had progressed by the middle of October, 1788, only to Sugar Loaf Hill, an eminence standing 17 miles west of the Niagara. The settlers had naturally chosen their locations along the shores of the Peninsula or on the navigable streams in the interior, often refusing to content themselves with a single lot in these desirable localities. The surveyor complained of this, because it prevented the compactness of the various communities; and he also complained of the frequency of changes, three or four occurring every week.[2] By 1790 the surveys in the northern part of the Peninsula stretched from the Niagara to the head of Lake Ontario, being most extensive between the Garrison Line and the Falls, where the concessions were from nine to thirteen rows deep. At the head of the Lake the surveys ran back ten concessions, and between these two localities they narrowed down to two or four concessions. (See the accompanying map.)

[1] Third Report, Bureau of Archives, Ont., 1905, 307-310.

[2] Ibid., 312-314.

Early in November, 1785, Colonel Henry Hope, who had just been appointed lieutenant governor of the Province of Quebec, called the attention of Lord Sydney to the fact that the Treasury Board had decided that the distribution of provisions to Loyalists throughout the Province, including of course the Niagara Peninsula, was to be made only to June 1, 1786, and that the settlers generally had sown the whole produce of the year's crop before they could be notified of the intended stoppage of their supplies. Thus, they would be left without grain until the harvest of the year following should be gathered. The Lieutenant Governor therefore asked for an extension of the allowance of provisions for three months beyond the limit set by the Treasury Board. This request seems to have been granted; but a later appeal for a loan of provisions for three months more, which formed part of a petition submitted to Governor General Sir Guy Carleton (Lord Dorchester) in December, 1786, and was forwarded by him to London, elicited the reply that "no further supply of provisions could be granted."[1]

Meanwhile, the settlers had made known to Lieutenant Governor Hope their dislike of the existing arrangement for the building of grist mills by the authorities at Quebec. Evidently such an arrangement did not meet the pressing needs of the new communities. Accordingly, Mr. Hope recommended that the settlers be allowed to erect mills at their own expense, and that they be indemnified by granting them the right of "banalité" for fifteen years. These proposals were assented to by the Legislative Council, which framed a regulation under which authority might be secured for the building of a grist mill in any township, or seigniory, by Novemeber 1, 1786, on the condition that the persons erecting such mills should keep them in running order and be entitled to the banalité for fifteen years, when the mills were to become the property of the government. Under these terms John Burch built a structure between Chippawa Creek and the Falls during the summer of this year, which Captain Enys described as "a very elegant piece of workmanship" and adapted for use both as a grist and a saw mill.[2]

The settlers' petition to Governor Carleton, referred to above on this page, contained a number of requests, besides the one for the loan of 90 days' additional provisions. These requests were aimed at securing tenure of land on the English basis, assistance in establishing Episcopal and Presbyterian churches where needed and a school in each district, clothing for the distressed, the survey of new townships, visits of the Commissioners of Loyalist Claims to points

[1] Niagara Hist. Soc., No. 4, 3; No. 17, 17-19.
[2] Ibid., No. 17, 19-22.

west of Montreal, and some other benefits. In compliance with this petition and Carleton's recommendation, the King in Council issued an order, October 20, 1787, by which the Governor General was enabled to grant lands in free and common soccage, no grant to exceed 1,000 acres to any person, without royal permission being previously obtained.[1]

When Governor Carleton's military secretary, Major R. Mathews, visited Niagara at the end of May, 1787, he found it to be as thriving and prosperous as the new settlements to the eastward, but learned from Colonel Butler that the leaven of democracy was beginning to manifest itself in the "McNiff party," which was demanding the rights of local self-government, or, according to Butler, the nomination of their own civil officers and the holding of "committees for the choice of them and other interior management of the settlement." Mathews also found that the settlers were complaining of not having received the same proportion of clothing and farming implements as those in other parts of the province, and that they were still disturbed about the tenure of their lands. That prospective colonists were still arriving is evident from an entry in Major Mathew's journal, under date of May 31: "This day came in eight or ten men from the States to see friends, and wishing a permission to settle with them." In August a considerable number of the inhabitants near Niagara went to Montreal to appear before the Commissioners of Loyalist Claims, and in the evidence they presented one finds mention of not a few of their places of residence, indicating that the settlement already extended from the Ten Mile Creek to Fort Erie.[2]

In the meantime, the increase of population in Upper Canada from the Niagara Peninsula to the Lake of St. Francis, 50 miles west of Montreal, induced Carleton, in July, 1788, to divide the western country into four districts for the administration of justice. The settlement at Niagara fell within the District of Nassau, the judicial and other officers of which were selected mostly from among the members of the peninsular colony. John Butler, Robert Hamilton, and Jesse Pawling were named justices of the Court of the Common Pleas, Philip Rockwell Frey, clerk of that court, as also clerk of the Peace and Sessions of the Peace, and Gilbert Tice, sheriff, John Burch, Peter Tenbrook, John Warren, John Powell, Jacob Ball, and Samuel Street were appointed justices of the Peace, and Niagara and Fort Erie were made the headquarters of superintendents of inland naviga-

[1] Niagara Hist. Soc., No. 17, 20, 21.
[2] Ibid., 21-23.

tion. The militia of Nassau, which was enrolled at this time, numbered 600 persons.[1]

The condition of the military works at Fort Erie and Niagara at this period is revealed in a report of Captain Gottier Mann, commanding engineer, who had been dispatched in the course of the summer to inspect the posts in Upper Canada and harbors suitable for naval stations. Captain Mann reported that the wharf at Navy Hall was in ruins and the building in a dilapidated state, that one pile of the Rangers' Barracks was past re-establishing, while the other was capable of being repaired at a cost of about 35 pounds. He thought that the situation of Navy Hall was convenient for purposes of transportation, although Niagara had a better command of the entrance to the river. Fort Erie, he stated, was in a wretched condition and so much in ruin that it was not easy to say which was the worst part of it. Most of the picketing was gone and the rest rotten, the storehouse almost past repair, the wharf in need of attention, and the stone wall next to the water washed away by the encroachment of Lake Erie.[2]

Concerning the transportation of merchandise, stores, etc., from Lake Ontario to Lake Erie, Mann wrote that while there was a tolerably good road from Niagara to the landing place below the Falls, a distance of somewhat more than seven miles, all goods were carried up the river in batteaux or in vessels to the landing place, whence they were drawn up the bank, about fifty feet in height, upon ways at an easy slope by means of a capstan at the top. From this point they were conveyed by wagon to Fort Schlosser, seven miles away, this post being one and a half miles above the Falls (on the American side). At Fort Schlosser the goods were again loaded into boats and carried eighteen miles to Fort Erie (on the Canadian side), to be re-shipped by vessel the length of Lake Erie to Detroit or other points. Captain Mann suggested that a wharf be built on the west side of the Niagara a little below the old landing place, where the bank was lower than elsewhere and storehouses might be erected "close to the road leading through the settlements." He thought that Chippawa Creek was superior in some respects as a point of trans-shipment above the Falls to Fort Schlosser, although the change from one to the other would necessitate bridging the creek and building a new road. However, both the road and the bridge were conveniences that the new settlers would require sooner or later for their own use. Mann called attention to the fact that the adoption of his plan would improve the transport and keep it all on the western side of the Niagara,

[1] Niagara Hist. Soc., No. 17, 23-24.

[2] Ibid., 26.

and at the same time enable the merchants to obtain the assistance of the settlers, with their teams and wagons, in times of exigency.[1] Two years later, by order of the Land Board, Captain Mann's project was carried into effect, a road being built by the inhabitants and interested merchants from the new landing place (afterwards, Queenston) to Chippawa Creek.

COMMERCE ON THE LAKES, 1790-1795.

About the time the new road was built, the superintendents of inland navigation at Kingston (formerly, Cataraqui), Niagara, Fort Erie, Detroit, and Michilimacinac reported that there were four registered merchant vessels belonging to the ports named, of which one—the schooner *Good Intent* (15 tons)—was trading on Lake Ontario between Kingston, Oswego, the Bay of Quinté, and Niagara, while two of the others—the sloop *Sagina* (36 tons) and the sloop *Esperance* (20 tons)—plied on Lake Erie between Detroit and Fort Erie. The last of the four vessels—the schooner *Weasel* (16 tons)—appears to have confined its trips to Lake Huron. Such government supplies as were brought up to Niagara from Montreal came, no doubt, on the King's ships, which seem to have carried furs, and perhaps other commodities, on their return trips. During the Revolution the British had built a few vessels at Carleton Island for the transportation of their troops and provisions from one post to another along Lake Ontario, among these being the *Ontario* which carried 22 guns. After the War closed Murray's Point and Navy Point turned out some ships for the government, including the *Speedy* and the *Mohawk*, the *Mississaugua* and the *Duke of Kent*. These ships must have been still in the service, while the merchant vessels named above were engaged in carrying cargoes that consisted chiefly of wine and spirits, cases, bales and boxes of various goods, packs of furs, and some fish, flour, Indian corn, ginseng, pearl ashes, and shot and ball. It was expected that Detroit would register six new vessels for the fur trade during the year 1780. It was not, however, until 1792 that the first Canadian vessel was built on Lake Ontario. This vessel was the *York* (75 tons), her place of construction being a dockyard lying eastward of the Niagara River and the fort. In the summer of 1795 the Duke De Liancourt saw two vessels on the stocks here, besides four others afloat, which he described as gunboats and schooners. In those days Niagara was a center of the wholesale trade and of ship building.[2]

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[1] Niagara Hist. Soc., No. 17, 27, 28.

[2] Ibid., 35-37, 39; Caniff, Settlement of Upper Canada, 148, 149, 152; Carnochan, Niagara One Hundred Years Ago, 25; Niagara Hist. Soc., No. 4, 6.

THE LAND BOARD.

The increasing immigration from the States during recent years, and the abuses connected with the distribution of lands, together with disputes over locations, led to the passing of an order in council, December 29, 1788, by which a Land Board was named for the District of Nassau. This board proceeded to examine into the loyalty, but more especially into the character, of persons appearing before it with claims for land. To such as were approved the board administered the oath of allegiance, while directing the surveyor to supply successful claimants with tickets specifying the amount of land to which they and their families were entitled. "All these claimants," we are informed, "were already settled, some on the surveyed lands, others on the waste land adjoining." Ten months later the Land Board adopted regulations for its guidance in making assignments, in accordance with instructions previously issued by the government. According to these regulations, field officers were to receive 1,000 acres each, captains, 700, subaltern, staff, or warrant officers, 500, non-commissioned officers, 200, private soldiers, 100, Loyalist heads of families, 100, while the members of the families of the different classes of persons named above were to receive 50 acres each, as were unmarried Loyalist men. This scale of allotments was according to the King's instructions of 1783; but by Governor General Carleton's instructions of June 2, 1787, all settlers who had improved the lands already granted them were to receive 200 additional acres. Therefore, the board ruled that those who had borne arms, or served in some other capacity during the war, would be entitled to 300 acres or more, in proportion to their rank, and all others, to 200 acres only. In accordance with these regulations, the board issued its first certificate, June 28, 1790, to David Secord for Lots 43 and 50 of Township No. 1 (Niagara), containing 200 acres.[1]

CONTINUED IMMIGRATION FROM THE STATES, 1789-1791.

Meantime, numerous immigrants were still coming in from the settled districts of the Eastern States, despite the attractions of the Hudson and Mohawk valleys through which most of them passed. An official enumeration made at Oswego shows that during the 18 months from May 1, 1789, to November 1, 1791, 88 men, 63 women, and 144 children, or a total of 265 persons, arrived at this point on their way "to the new settlement at Niagara." In the first decade of its history this scattered colony had grown to a population of some 3,000

[1] Niagara Hist. Soc., No. 17, 31-34.

inhabitants, who had been able to establish themselves "in a fair degree of comfort, in spite of two seasons of scarcity, which had brought some of them perilously near starvation." A considerable area of land had been cleared and brought under cultivation, roads opened, more than a dozen grist and saw mills erected throughout the Peninsula, a town laid out, and merchants had found convenient centers for their operations at four places along the Niagara River, namely, Fort Erie, Chippewa, the West Landing (Queenston) and Niagara.[1]

According to an ethnological survey, published in 1901, 250 families belonging to Butler's Rangers settled in Niagara Township and 200 more in Grantham. An unnumbered group of other Loyalists also found homes in Niagara and another unnumbered group in Louth. These were all in Lincoln County. In the County of Welland to the south Stamford Township is said to have received 140 Loyalist families, Willoughby, 60, Bertie, 145, Thorold, 100, Crowland, 80, Humberstone, 100, Pelham, 120, and Wainfleet, 115. From another source we learn that Crowland remained a part of Willoughby for township purposes until March 17, 1803, when the former township had a population of only 216. This indicates that at the time of its separation Crowland had no more than half the number of families credited to it by the survey. Only two townships in Wentworth County at the head of Lake Ontario are mentioned as sharing in the Loyalist immigration, namely, Ancaster and Beverly; and the same townships are shown on an old map in the writer's possession to have been settled by refugees. But we know from other sources that four other townships in this region should be included, namely, Saltfleet Binbrook, and Barton to the south of Burlington Bay and Flamboro to the north of it.[2]

The severer of the two seasons of scarcity, referred to in a previous paragraph, was undoubtedly the "hungry year" of 1789. The famine of this year was partly due to the failure of crops, but partly also to the increased demand for provisions by the numbers of destitute people coming in. The older settlers had reserved a supply of potatoes and cereals for planting, but by the opening of May the stock of provisions had failed, and the assistance promised by the government was not forthcoming. Harvest was still more than three months away. The settlement at Niagara was fortunate in being near the fort, for the commandant, Lieutenant Colonel Peter Hunter of the 60th Regiment, took the responsibility of opening the military stores to his neighbors across the river, although he did so without

[1] Niagara Hist. Soc., No. 17, 35, 39, 40; No. 26, 49-51.

[2] Papers and Records, Ont. Hist. Soc., III, 190, 192, 193, 195; Cruikshank, A Century of Municipal Hist., Co. of Welland, Pt. I, 7, 9, 49. See also *post*, pp. 112, 113.

orders. He issued rations in proportions recommended by two gentlemen in the settlement, who became accountable to the Crown and creditors for the provisions furnished. Others living at a distance from the fort, but near the water, could supply themselves with fish; but those dwelling inland had to forage in the woods for game, herbs, and ground nuts. The experience of one family will suffice to show the expedients resorted to by many to keep from starving. Peter Bowman, one of Butler's men, who had settled with his family and relatives in the Township of Stamford, was not so far from the Niagara but that he could walk the distance—three miles—after his day's work was done. In order to keep his table supplied with fish, he made the journey twice each week, fishing all night and carrying home his catch in the morning. The family ate this fare "without salt or bread" until the middle of June, when moss became so thick in the river as to prevent further fishing. Then, milk was resorted to as the chief article of diet, and later when the grains of wheat had grown large enough to be "rubbed out," they were boiled for the use of the family. An early harvest came as a great boon to the famine-stricken country.[1]

During the entire period of settlement the abundant supply of fish in the waters surrounding the Peninsula and the creeks emptying into these waters furnished a staple of diet to the dwellers nearby. White fish and bass were taken in great numbers, a day's catch sometimes amounting to 6,000. Captain Alexander Campbell of the 42nd Regiment tells of having witnessed the drawing of a seine containing not less than 1,000 fish, chiefly whitefish, and adds that the troops and inhabitants had stated days for fishing. The Duke de la Rochefoucauld went seining one day with the soldiers, when they made use of a net 100 feet long and 4 feet wide and caught 500 fish, including sturgeon, pike, sunfish, salmon, trout, and herring.[2]

The numerous tributaries of Lakes Ontario and Erie were not only the source of an unlimited supply of fish for the settlers, but also of power for the mills that ground their wheat and corn and sawed their lumber. No better index to the growth of the local communities throughout the Peninsula may be had than the spread of these structures. The first mills had been erected by the government in the summer of 1783 at Four Mile Creek in Township No. 1. In 1789, 1791, and 1792, three additional mills were built in this township along the same stream, namely, a grist mill by Peter Secord, a saw mill by David Secord, and another grist mill by Daniel Servos. In 1786 John

[1] Niagara Hist. Soc., No. 11, 50, 52, 53; Ryerson, Loyalists of America and Their Times, II, 268.

[2] Niagara Hist. Soc., No. 11, 34, 35.

Burch's saw mill and grist mill were erected near the Falls in Township No. 2, and five years later John Donaldson located a saw mill on Muddy Run near the Whirlpool in the same township. In 1787 Township No. 3 was provided with both kinds of mills, when Robert Hamilton completed those begun in the previous year by Duncan Murray on Twelve Mile Creek. Another saw mill was added in 1789 by Samuel Street and Colonel Butler, the location being on Fifteen Mile Creek. The westward trend of the incoming colonists is shown not only by the location of Butler and Hamilton's mills, but also by the sites selected for five others that were building about the same time. Thus, in 1788 and 1789, the power supplied by Forty Mile Creek in Township No. 6 was utilized by John Green for his two mills and in 1792 by Robert and William Nelles for their saw mill, while in 1790 that of Thirty Mile Creek in Township No. 5 was utilized by William Kitchen for two more. In the following year Philip Stedman, Sr., built a saw mill on Black Creek about 7 miles back of Fort Erie, which was supplemented by a grist mill constructed near the fort in 1792 by William Dunbar and by another in the adjoining township to the westward, near Sugar Loaf Hill, the last being erected by Christian Savitz. The interior townships, like the Head of the Lake, come late in this period of mill building. In 1791 David Secord erected a grist mill in Township No. 10, and the next year both Benjamin Canby and John Decow built saw mills in Township No. 9. Of the 24 mills acquired by the Peninsula during these years, 11 were grist mills. At Fort Erie, St. Davids, Grimsby, and Burlington the mills became centers of barter and trade, about which small villages soon developed.[1]

NIAGARA DURING SIMCOE'S ADMINISTRATION, 1792-1796.

The movement of the Loyalists and other Americans into Upper Canada resulted in the separation of this region from the Province of Quebec. The bill authorizing this separation was introduced into the House of Commons, March 7, 1791, and became law on the 14th May of following. The gentleman who was appointed lieutenant governor under this act was Colonel John Graves Simcoe, a member of Parliament during the passage of the bill and one who took a prominent part in the discussions which it evoked. Simcoe left England for the field of his new duties late in September, and arrived at Quebec, November 11. A week later, Lieutenant Governor Alured Clarke issued a proclamation designating the boundary line

[1] Niagara Hist. Soc., No. 26, 49-51; No. 5, 13, 19; Caniff, Settlement of Upper Canada, 209.

between the two provinces. Being unable to act in a civil or military capacity until the arrival of further instructions and the coming of the Queen's Rangers, Colonel Simcoe remained at Quebec until the following June. Early in February, however, he published a proclamation announcing his authority to grant Crown lands by patent to such persons as were desirous of settling in Upper Canada, on condition that the recipients would take the usual oaths, clear not less than 5 acres, build a house, and open a road across the front of their lands for a quarter of a mile. The grants were to be no more than 200 acres to each person, except in cases where the Lieutenant Governor decided that the applicant was entitled to a larger quantity up to the maximum of 1,000 acres. The proclamation also stated that townships would be surveyed, of which one-seventh would be reserved for the support of a Protestant church, another seventh for the future disposition of the Crown, and the remainder thrown open for settlement. Inland townships were to be 10 miles square, while those on navigable waters were to have a frontage of 9 miles and a depth of 12.[1]

That conditions in the States were favorable to the continued movement of settlers into Upper Canada is shown by the observations of Mr. P. Campbell, who was now traveling through the Genesee country, by the letters of Colonel Simcoe himself, and by the active immigration that took place during the next few years. Mr. Campbell found that some of those who had purchased lands on the Genesee River wanted to sell and remove to Canada, on account of their great distance from a market. He records in his interesting volume of *Travels* that while Kentucky was attracting a large annual influx from the Southern States, the Genesee from the Middle States, and New Brunswick from the Northern States, settlers were flying from the two latter to Upper Canada, "which is now deemed the paradise of the New World."[2]

Almost at the same moment (February 16, 1793), Simcoe sent a dispatch to Henry Dundas, secretary for war and the colonies, in which he reported that he had learned from a correspondent in Pennsylvania that a number of persons were disposed to emigrate to Upper Canada and he had encouraged them, and that he had seen people from Connecticut who assured him that the ecclesiastical establishment which he had already recommended to the minister would be likely to promote emigration from that State, although he remarked that the delay of Great Britain in giving a free constitution to the new province had somewhat altered the disposition of Loyalists there.

[1] Caniff, Settlement of Upper Canada, 189; Niagara Hist. Soc., No. 26, 28, 29.

[2] Campbell, Travels in the Interior Inhabited Parts of North America, 1791 and 1792, 218, 219, 224; Niagara Hist. Soc., No. 26, 26, 27.

About a month later he transmitted a return from an officer at Oswego, which was still retained as a British post, showing that during the year and a half previous to November 1, 1791, 817 persons had enrolled as settlers, of whom 265 had gone "to the new settlement at Niagara." John Munro of the District of Lunenburg on the upper St. Lawrence had written him that immigrants from the United States were flocking in with all their property.[1]

By action of the Land Board in 1791 the limits of Niagara were enlarged, Mr. D. W. Smith, the deputy surveyor general, laying out the extension of the town plot. At the close of the following February, the magistrates and principal inhabitants of the town sent a congratulatory address to the new Governor, which was accompanied by a communication from John Butler and Robert Hamilton informing him of the great abundance of the recent crops and the prevalence of good order among the people, which together with the attention of the magistrates rendered the duties of the Courts of Common Pleas and Quarter Sessions easy to perform.[2]

In the latter part of June Mr. and Mrs. Simcoe, with the Queen's Rangers, set out for Kingston, then a village of "about fifty wooden houses and merchants' store-houses," where they arrived on July 1st. Here, on Sunday, the 18th, the Governor was inducted into his responsible office with all the pomp and ceremony it was possible to command. As Kingston was neither central in its location nor capable of adequate defense, it did not recommend itself to the new executive as a proper place for the seat of government. Hence, on July 21st he embarked with Mrs. Simcoe, his staff, and the Rangers in batteaux for the journey up Lake Ontario, which resulted in the temporary establishment of the capital of Upper Canada at Niagara.[3]

When the official party landed at its destination five days later, the Governor was received in state by the assembled troops, comprising the regulars from the fort across the river, the resident militia, Butler's Rangers, and their old allies of the Six Nations under Joseph Brant. A salvo was fired by the guns of the fort and loyal addresses were presented, to which Simcoe made appropriate replies that easily stirred his appreciative audience to plaudits and cheers. As the commander of the Loyalist Queen's Rangers during the recent war, (a corps now reorganized, to be sure, but with some of the veteran officers still on its rolls,) the Governor held a warm place in the affections of his hearers. Inasmuch as Navy Hall was not yet ready for his occupancy, Mr. Simcoe and his family took up their quarters

[1] Niagara Hist. Soc., No. 26, 28.

[2] Carnochan, Hist. of Niagara, 97, 107; Niagara Hist. Soc., No. 26, 27, 28.

[3] Morang, John Graves Simcoe; Macher, Story of Old Kingston, 89-93.

in three marquees, or tents, on the hill above the hall. The village numbered not more than 100 houses at this time, and tenements were scarcely obtainable. After a search of ten days, William Jarvis, secretary to the Governor, was obliged to pay 140 pounds for a log cabin of three rooms with half an acre of ground, and even then was put to the extra expense of adding another room. The Queen's Rangers were sent up the river to build huts for themselves in the hamlet at the "New Landing," which came soon to be called Queenston, probably from being the headquarters of this corps. At any rate, Samuel Street, a well known trader in the vicinity, disputed the Rangers' occupation of their camp site. In the suit that followed judgment was given for the Crown, and it was disclosed that many other Crown reserves were occupied by squatters.[1]

On July 16, 1792, Simcoe published a proclamation dividing the Province into counties, with their subdivisions, or ridings, for the election of representatives in the Legislative Assembly. The fifteenth in the list of these counties was Lincoln, which comprised all of the Niagara Peninsula, except a rectangular area on the south side of Burlington Bay. The Long Point country, which adjoined Lincoln County on the southwest and was soon to fill with Loyalists and others, received the designation of Norfolk County. Although the Governor met with opposition from Dundas in his policy of encouraging immigration from the United States, he clung tenaciously to the obvious conclusion that "unless the province was peopled, it would be unable to pay its way for many years," but he denied any intention of offending the neighboring government by his methods of encouraging settlement north of the Great Lakes. At the same time, he maintained on the basis of his own experience that the settlers from the States were "generally superior to Europeans in their ability to take care of themselves," and he continued to report from time to time that there was every prospect of a large immigration. To the Quakers, Tunkers, and Mennonites he held out the promise, not in vain, of the same exemption from military service that they had formerly enjoyed in other British Colonies in North America.[2]

On September 17, Simcoe convened the first Parliament of Upper Canada in the presence of much the same motley assemblage of troops, Indians, and inhabitants as had witnessed the arrival of the Governor less than two months before. At mid-day the guns of the fort gave a royal salute, and Simcoe, preceded by a band of music, the colors, and a guard of honor, proceeded to the Freemason's Hall, where he

[1] Niagara Hist. Soc., No. 4, 3; No. 11, 32, 33; Carnochan, Niagara One Hundred Years Ago, 16; Niagara Hist. Soc., No. 26, 40.

[2] Niagara Hist. Soc., No. 26, 30, 31.

delivered a speech from the Throne. For nearly five years thereafter Niagara, or Newark, as its chief citizen now named it, continued to be the meeting place of this body and the abode of the government officials. During this period it could boast of a social circle comprising families of distinction, and of levees and balls given by the Governor, besides the assemblies, card parties, and other entertainments that were then in vogue among the gentry of this frontier community.[1]

In the same year in which Parliament convened the Reverend Robert Addison began his labours in the Peninsula. Before this there had been no settled clergyman at Niagara, although the inhabitants had extended an invitation to the Reverend John Stuart, who visited the place in the summer of 1788, when he preached to a large audience containing many of his old parishioners from the neighborhood of Fort Hunter in the Mohawk Valley. As Mr. Stuart was already well established at Cataraqui, where he possessed a good house and farm and the advantages of a satisfactory school for his children, he felt constrained to decline the invitation. However, he visited Niagara again in September, 1790, when he traveled through the settlements for a fortnight, "preaching and baptizing daily." Mr. Addison came under the auspices of the Society for the Propagation of the Gospel as "missionary at Niagara and for visiting the Indians," but he soon extended his ministrations to other communities in the Peninsula and even to several beyond. At the close of August, 1795, Mr. Addison reported to the Society in England that he had preached up and down the settlement, besides baptizing 97 persons, burying 12, and marrying 13 couples. He added that a small house had been built for public worship about 10 miles from Niagara and that he expected another to be erected 6 miles farther away. Among the communities visited by him were Twelve, Twenty, and Forty Mile creeks, the Head of the Lake, Ancaster, York, the Falls, Chippawa, Fort Erie, Grantham, St. Catharines, and Long Point. In Niagara Mr. Addison presided over the Parish of St. Mark's, which occupied all of 5 years (1804-1809) in building an edifice. When, however, this edifice was completed, the missionary was able to report that it was "the best in the Province," adding in explanation of the time consumed in building that his parishioners had adopted "too large a scale for their means." His service continued during a period of 37 years.[2]

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[1] Morang, John Graves Simcoe, 81-83; Niagara Hist. Soc., No. 4, 3, 4; Carnochan, Niagara One Hundred Years Ago, 9, 13, 14; Upper Canada Gazette, June 4, 1793.

[2] Canniff, Settlement of Upper Canada; Abstract of the Proceedings of the Soc. for the Propagation of the Gospel, 1796, 36, 54, 55; Niagara Hist. Soc., No. 7, 13-15, 18, 19; No. 19, 25, 51; Scadding, Church Annals at Niagara, 1792-1892, (pamphlet) 4-7; Carnochan, Hist. of Niagara, 56, 57, 64.

The Scotch Presbyterians, who were numerous in Niagara and the vicinity, built a church at Stamford in 1791, and organized for the purpose of building another at the provincial capital in the fall of 1794. The Reverend John Dun was engaged as minister, and the Land Board granted 4 acres to the new congregation for a church and schoolhouse. By March, 1796, the former structure was ready for occupancy. A number of the inhabitants of Niagara, including Colonel Butler, were contributors to the support of both St. Andrew's and St. Mark's. At the end of three years Mr. Dun withdrew from the active work of the ministry to engage in trade, and in 1802 the Reverend John Young came from Montreal to take charge of St. Andrew's Church and teach Latin, Greek, and mathematics in its school. The Reverend D. W. Eastman, a native of Goshen, Orange County, New York, entered the Peninsula in 1801 and began founding Presbyterian churches in the Niagara and Gore districts, among these being St. Ann's in the northern part of Monk County, which was established in 1809. Mr. Eastman's activities continued somewhat beyond the middle of the century.[1]

Before the erection of St. Andrew's School the only opportunity for instruction appears to have been at the garrison school at Fort Niagara. After the removal of the garrison to Fort George in 1796 various private schools sprang up, one of the best being that of Richard Cockerell, an Englishman, who opened an evening school in 1797, in which writing, arithmetic, bookkeeping, and "any branch of practical or speculative mathematics" were taught. In 1799 Mr. Cockerell removed to Ancaster, leaving as his successor the Reverend Mr. Arthur, whom he recommended as a teacher of Latin and Greek and one prepared to "take a few young gentlemen to board." Another school that was opened at Niagara in 1797 was that of James Blayney. Five years later Mr. and Mrs. Tyler, who lived between Niagara and Queenston, advertised a regular day and night school for children of both sexes from the age of four years upwards. They also announced their readiness to teach reading, writing, and arithmetic to young ladies in such amounts as were "necessary for their sex, to appear decently and be useful in the world and in all that concerns housekeeping." The advertisement closed with the statement that Mrs. Tyler had been "bred in the line of mantua making" and would receive and do her endeavors to execute her work in the neatest manner."[2]

[1] Niagara Hist. Soc. No. 7, 21-24; No. 19, 106; Carnochan, Niagara One Hundred Years Ago. (Lundy's Lane Hist. Soc.) 28, Carnochan, Hist. of Niagara, 80-83.

[2] Carnochan, Hist. of Niagara, 128, 129; Carnochan, Niagara One Hundred Years Ago, 29; Caniff, Settlement of Upper Canada, 331, 338; A Century of Municipal History, County of Welland, Pt. I, 43.

The efforts of Governor Simcoe to have suitable provision made for advanced education in Upper Canada must not be overlooked, although they were late in bearing fruit. The Governor urged the matter in his correspondence with Secretary Dundas in 1792, with the Bishop of Quebec in 1793, and with the Duke of Portland in 1795. He thought that primary education must be left for the present to the parents and relatives of the children, but strongly recommended an annual grant of 1,000 pounds for buildings and salaries to establish a grammar school at Niagara and another at Kingston and the foundation of an university at the capital. Unless some such provision were made, Simcoe argued, the gentlemen of Upper Canada would have to send their children to the United States and thereby contribute to the perversion of the British principles of the rising generation. At length, in 1797, the two houses of Parliament sent a joint address to the King requesting him to direct the government of Upper Canada to appropriate a certain portion of the waste lands of the Crown for the establishment and support of a respectable grammar school in each district and also of a college or university. The King complied with this request, and the Executive Council of the Province was prompt to respond with a recommendation that 500,000 acres be set apart as a sufficient endowment for four grammar schools to be established at Cornwall, Kingston, Niagara, and Sandwich, and an university at York (Toronto). Accordingly, land was appropriated in 1798, the actual grant exceeding the appropriation recommended by 49,000 acres. For some unknown reason, however, the district grammar school was not founded at Niagara until 1808, when it was opened with the Reverend John Burns as its first teacher. Mr. Burns was the minister of St. Andrew's Church in Niagara and the Presbyterian Church in Stamford from 1805 to 1817. His burial place is to be found in the old Stamford Presbyterian cemetery.[1]

Three years before the earliest schools made their appearance in the Niagara Peninsula the first newspaper of the Province, namely, *The Upper Canada Gazette, or American Oracle*, claimed the attention of the citizens of Niagara. The provincial capital was thus gaining within a brief space of time the agencies of public enlightenment, in other words, schools, newspapers, and churches. The founder of the *Gazette* was Louis Roy, who is said to have been sent west by Mr. John Neilson of Quebec for the express purpose of establishing a paper. The first number was issued, April 18, 1793, and the publication continued to be printed at Niagara until 1798, when it was removed to York. It contained copies of official documents and columns of

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[1] Niagara Hist. Soc., No. 11, 39; No. 26, 29, 30; Carnochan, Hist. of Niagara, 83, 128, 129, 219, 220.

news six or eight weeks old from foreign parts, but was almost wholly devoid of local items and contained but few advertisements. In size as in contents, it presented a marked contrast to newspapers of the present day, for it consisted of only four pages, which measured no more than fourteen and one-half by nine and one-half inches. The subscription price was three dollars a year. Among the advertisements was one offering ten guineas apiece as bounty money for approved recruits for the Queen's Rangers. The *Gazette* was soon followed by the *Constellation*, which was begun in June, 1799, and seems to have appeared as a weekly. It was published at first by Silvester Tiffany and later by "S. and G. Tiffany," the price being one dollar more per year than that of its predecessor. It survived until the end of the year 1800, when it was succeeded by the *Herald*, another four dollar paper, which had an equally short career, suspending in 1802. Perhaps this was due to the appearance of a new paper, to which, however, an old title is attributed, namely, *The Upper Canada Gazette*. At any rate, Caniff quotes some advertisements of the sale of negro slaves at Niagara from this paper for the year mentioned, although the paper in which these were printed may have been still located at York. In 1807 a new *Upper Canada Gazette*, with the alternative title of the *Freemen's Journal*, was started at York, and was brought to Niagara two years later. Here it continued to be published until terminated by the War of 1812. The proprietor of this paper was Joseph Wilcocks, a member of the Canadian Parliament.[1]

An agricultural society was organized at Niagara after Simcoe arrived there, and this official himself contributed ten guineas a year to further its interests. The society met at monthly dinners, which were given in turn by the various members, and on these occasions a large silver snuffbox belonging to the orgainzation was passed around with more or less ceremony. In 1797 a law society of 10 members was formed, under authority granted by an act of the provincial Parliament.[2]

The period that witnessed this development of the means of public enlightenment at Niagara also witnessed the introduction of local self-government in the same community. On August 8, 1793, the petty session of magistrates called a town meeting for the 17th to elect local officers. The list of those chosen comprised a clerk, a

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[1] Carnochan, Hist. of Niagara, 69-71, 72; Carnochan, Niagara One Hundred Years Ago, 26; Niagara Hist. Soc., No. 5, 25, 26; Caniff, Settlement of Upper Canada, 577, 578.

[2] Canniff, Settlement of Upper Canada, 590; Niagara Hist. Soc., No. 5, 29; Carnochan, Hist. of Niagara, 230, 239.

constable, two assessors, perhaps the same number of collectors, three poundkeepers, six fenceviewers or overseers of highways, and two town or church wardens.[1]

By 1795 the town plot of Niagara contained 412 numbered lots, although only 150 names of grantees appear in the list of this year. In a letter of the time, written by John Small, the statement is made that many of the lots had been forfeited. The town seems to have contained scarcely more than 100 houses in 1795. Many who came, however, were supplied with tents until they could find locations and get roofs over their heads, Simcoe being occupied much of his time with the care of these newcomers until his departure for England in in 1796. Mr. D. W. Smith, a prominent resident of Niagara at the time, records in his notebook the arrival of 19 covered wagons filled with families who intended settling "in the vicinity of Lincoln County." Their wagonbeds, he adds, had been well caulked and were used as boats in conveying the occupants and the detached wheels of the vehicles to the western side of the river. By 1806 Niagara contained about 200 houses, these being ranged along spacious streets laid out at right angles. Fort George lay nearly a mile to the southward on high ground. Beneath it on the bank of the river were several buildings, including storehouses, barracks, and the Navy Hall, and on Mississaugua Point stood a lighthouse, which had been recently erected. Many of the buildings were of brick and stone, among them being two churches, an academy, six taverns, a jail, and about 20 drygoods stores, whose prices were said to be no higher than those prevailing in Montreal.[2]

In June, 1800, the Niagara Library was established by the action of about two score persons, some of whom were residents at Fort Niagara, Grimsby, Stamford, and Thorold. Each of the original subscribers agreed to pay annually a sum not exceeding four dollars to be used in buying books. It is interesting to note that the first 30 volumes purchased were all of a religious nature, a few others being poetical and historical works. In the second year of its existence the library possessed 150 books, and by the fall of 1812 the number had been increased to 827, a large proportion being in circulation in both the town and the township.[3]

[1] Carnochan, Hist. of Niagara, 8.

[2] Niagara Hist. Soc., No. 4, 5, 6, 15; No. 11, 35-37; Carnochan, Hist. of Niagara, 17, 22, 97; Canniff, Settlement of Upper Canada, 528; Carnochan, Niagara One Hundred Years Ago, 9, 16.

[3] Carnochan, Hist. of Niagara, 46-51.

QUEENSTON

There was doubtless a small settlement on the site of Queenston before the transfer of transportation from the eastern side of the River Niagara to the western side in 1790; but this transfer gave the hamlet an importance which it had lacked before, and during 1791 the place made considerable growth. Two or three storehouses, a stone blockhouse sheathed with iron, barracks for soldiers, an inn, and some small houses sprang up simultaneously. Early in May of this year the Land Board passed a resolution ordering the inhabitants near the portage to move their fences as soon as they had gathered their crops, and open a road from the new landing place to Chippawa Creek. Within the next two months the Governor General received proposals for the carriage of government stores over this portage. One of these came from Philip Stedman, Jr., who had been the contractor for the same service on the right bank of the river, and the other was submitted by Robert Hamilton, George Forsythe, John Burch, and Archibald Cuninghame. The Loyalist inhabitants in this vicinity well understood that their interests were directly concerned, and on June 20th petitioned the Land Board to support the tender of Hamilton and his associates, on the score that the local settlement would derive essential advantages from having the transportation of goods conducted as a general enterprise, instead of having it monopolized by a single person. The plan of Hamilton and his friends was to employ in regular turn all responsible members of the colony who should offer their services, but under the limitation that no person could have more than two teams on the road at one time, unless press of business required it. After examining witnesses the Land Board recommended that the Governor General "grant the preference to the settlement over any individual or set of men on the same terms and the performance equally well secured." The matter was now referred to the Committee for Inland Navigation and Commerce, which also reported in favor of Hamilton and his associates, and these men now received the contract at one shilling and eight pence (New York currency) per quintal of 112 pounds.[1]

Doubtless, the commerce of Upper Canada was more or less injured by the war now going on between the United States and the Western Indians; but the testimony of travellers who visited Queenston in 1794, and later, does not indicate any such decline of traffic, including peltry and merchandise, as a recent writer attributes to this cause. Thus, a gentleman who stopped at the "New Landing" in November, 1794, tells of vessels discharging their cargoes and taking on furs that

[1] Canniff, Settlement of Upper Canada, 528, 598; Niagara Hist. Soc., No. 26, 3-5.

had been brought in from the back country for distances of from 300 to 1,500 miles. He speaks of having seen four vessels unloading at once and 60 wagons loaded in a single day for the upper landing at Chippawa Creek. He adds that the portage is a source of wealth to the farmers of the vicinity, who receive one shilling and eight pence (New York currency) per hundredweight for hauling from 20 to 30 hundredweight, and that they reload with furs to be carried on to Fort Erie, and thence by vessel to Detroit and other places. Robert Hamilton, the greatest merchant of this section, is mentioned as a resident of Queenston, where he owned "a very fine house built in the English style," together with a farm, a distillery, and a tan-yard. At his death this merchant left an estate estimated at 200,000 pounds. Thomas Dickson was carrying on an extensive trade at Queenston during a part of this period. A visitor who put up at Fairbank's Tavern in 1800 was impressed by seeing 14 double teams of oxen standing at the wharf, where peltries and bales lay waiting to be loaded, and where three schooners were ready for fresh cargoes. By 1807 there were 100 houses in Queenston, including six stores, and the population numbered 300 at what was probably a low estimate.[1]

It was by way of Queenston that Methodism was introduced into Upper Canada with the arrival of Major George Neale, who crossed the river at this point in October, 1786. After taking up an officer's portion of land the Major organized a class-meeting at the home of Christian Warner near St. Davids. From this beginning the Niagara Circuit, which embraced York and Long Point, developed in 1795. The first circuit rider is said to have been Darius Dunham, who was followed in 1799 by James Coleman and in 1800 by Michael Coate and Joseph Sawyer. In the next year the first meeting-house of the district was erected, being known as Warner's Church.[2]

In January, 1797, an epidemic of smallpox broke out in Queenston and toward the end of the month Doctors Robert Kerr and James Muirhead came from Niagara to make inoculations, after which they announced their desire to apply the same treatment in their own community.[3]

THE LOYALISTS AT THE HEAD OF LAKE ONTARIO.

Among all the Loyalist settlements in the Peninsula that which was to attain the most remarkable development was not to be found on the River Niagara, or along the shores of Lake Ontario, but at the western end of this great inland sea. Already in 1781 refugees

[1] Niagara Hist. Soc., No. 26, 49; No. 11, 35-38; Carnochan, Hist. of Niagara, 114.
[2] Carnochan, Hist. of Niagara, 163, 164.
[3] Ibid., 234.

were penetrating to the Head of the Lake, as this locality was long designated, the earliest of these pioneers being Richard Beasley and Colonel Robert Land. Others followed during the succeeding years in such numbers that by 1792 the shore from Niagara westward as far round as Toronto, according to the testimony of the traveller, Mr. P. Campbell, was "all settled and in some parts several concessions deep." On his way to Burlington Bay Mr. Campbell saw much rich land and "passed through many fine farms." He and the party of gentlemen with him spent a night with Mr. Beasley, whose house stood on a hill covered with large oak trees, known to-day as Dundon Park. As Beasley was an Indian trader, he had a warehouse overlooking the bay, or Lake Geneva as it was then called, in which he stored the peltries that he obtained by barter from the hunters of the Mississaugua and other tribes, who ranged the neighboring wilds. The trader entertained his guests with generous hospitality, and showed them his stock of skins, including one of a black fox with its soft and beautiful fur, which was supposed to be worth five guineas. After leaving Beasley's place for the Mohawk village on the Grand River, Mr. Campbell saw only a few habitations, although he noticed the girdling of the trees for a distance of several miles, indicating that the land had been granted to prospective settlers.

The Loyalist immigration to the Head of the Lake continued at least until the year 1800, by which time 30 settlers had received grants of land of from 100 to 900 acres, in recognition of their adherence to the Crown, the largest grant going to Beasley. Lieutenant Caleb Reynolds of Butler's Rangers and George Stewart received the next largest grants, though these amounted only to 400 acres each. Some of the grantees had lived for longer or shorter periods on the Niagara frontier, including Daniel Springer, a refugee from New Jersey, who appears to have removed to the Head of the Lake in 1798. It may be noted in passing that several years before this Governor Simcoe had had a public house, called the King's Head Inn, erected at the junction of the Stony Creek and Head of the Lake roads, in order to facilitate travel between Niagara and La Tranche, as London was then called. In 1796 Mrs. Simcoe had put up at the inn, with her children and servants, and had noted in her *Diary* that the Governor had recently had a road cut through the woods by John Green, a Loyalist living at Forty Mile Creek, or North Grimsby.[2]

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[1] Niagara Hist. Soc., No. 26, 5-13; Journals and Transactions, Wentworth Hist. Soc., 1908, 12; The Hamilton Spectator, Aug. 12, 1913, 2.

[2] Records of the Clerk's Office, Hamilton, Ont.; The Hamilton Spectator, Aug. 12, 1913, 2; Robertson, ed., Diary of Mrs. Simcoe. The names of the original patentees at the Head of the Lake are printed in Papers and Records, Wentworth Hist. Soc., 1915, p. 65.

Mr. Green, like Daniel Springer, had been a resident of New Jersey in the Revolutionary days, but had come to Forty Mile Creek not later than 1788, and had built a saw mill and a grist mill there. According to the Duke de la Rochefoucauld, who visited this region in the summer of 1795, Green's mills ground corn for all the military posts of Upper Canada. The Duke also tells that newly cleared land at Forty Mile Creek yielded 20 bushels to the acre the first year; that the farmers plowed their land after it had produced three or four crops; that laborers were scarce and were paid at the rate of six shillings a day; and that wheat brought from seven to eight shillings a bushel, while flour sold at twenty-two shillings per hundredweight. West of Stony Creek at the foot of the mountain was another mill, which belonged to Adam Green[1]

It was not until 18 years after the visit of the Duke de la Rochefoucauld to this region (that is, in 1813) that Springer's farm of 100 acres at the Head of the Lake became the first town plot of Hamilton. This was effected by Mr. George Hamilton, who moved in from the Niagara District and bought the place, which he promptly laid out in town lots. Meeting with success in his enterprise, Mr. Hamilton gave the town a block to be used as a court house square, another on John Street to serve as a market place, and a strip through the center of King Street, called the Gore. The citizens were not slow in showing their appreciation of these gifts, for they at once discarded the awkward and indefinite designation, Head of the Lake, in exchange for the family name of their benefactor. Originating thus as a small loyalist settlement, Hamilton has developed into a prosperous city now numbering more than 90,000 inhabitants.[2]

The neighboring townships on both sides of Burlington Bay gained refugee pioneers along with Barton, the township in which Hamilton is situated. The village of Ancaster sprang up in such a community as this, and by 1793 had a grist mill. In 1798, Mr. Asa Danforth, an American, came to Upper Canada, and entered into a contract with the government to open a road from Kingston through to Ancaster. This contract was completed in three years, and for a considerable time thereafter the new thoroughfare was known as the Danforth Road. When in January, 1799, Richard Beasley received orders to enrol the militia of West York, he was able to muster 100 men, most of whom were Loyalists or their sons, partly from the Fifth Lincoln and partly from the Second York Battalion. These militiamen were inhabitants of Saltfleet, Binbrook, Barton,

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[1] Canniff, Settlement of Upper Canada, 205; Robertson, ed., Diary of Mrs. Simcoe; The Hamilton Spectator, Aug. 12, 1913, 2.

[2] The Hamilton Spectator, Aug. 12, 1913, 2.

Ancaster, and Flamboro townships, and were placed under the command of Captain Samuel Hatt. Captain Hatt, together with his brother, Major Richard Hatt, had settled in the village of Ancaster only the year before. For the next two decades this community must have continued its growth, for there were twenty flourishing shops there during the years 1815 to 1818. Then, Ancaster had to share its prosperity with Dundas, Hamilton, Brantford, and West Flamboro, and later still with London, Simcoe, Ingersoll, and other towns that were growing in importance as business centers.[1]

The most remote habitation of an American exile on the lake shore was that of Roger Conant, once a student of Harvard College, who acquired a Crown grant of 1,200 acres in 1778 at what is now Darlington, some fifty miles beyond Toronto. Fleeing from the vicinity of Boston in 1777, Mr. Conant left his family in Geneva, New York, while he sought lands and built a log house on the lake front at the place named. It is related that he spent some time subsequently with Butler's Rangers, and that he did not bring his family to their new home until 1794. He then engaged in the fur trade with the Indians, and accumulated considerable wealth through the disposal of his peltries in Montreal.[2]

THE INDIAN SETTLEMENT ON GRAND RIVER.

The purchase of the great tract of land between the three lakes, Ontario, Erie, and Huron, May 22, 1784, did not result in the immediate removal of the Mohawks to the Grand River. During the summer of this year they still maintained their temporary village near the Lower Landing, or Lewiston, where they were visited by the Reverend John Stuart, former Anglican missionary at Fort Hunter in the Mohawk Valley. Mr. Stuart preached in the church which the Indians had themselves erected, besides baptizing a few adults and over 100 children. Towards the end of July the authorities at Quebec began to be alarmed over the difficulty of supplying the village and the people at Niagara with provisions during the ensuing winter. Haldimand's secretary wrote that the number of Indians near the post now numbered 1,257, that the Indian Department contained 66 persons, and that the troops and Rangers were to be provided for, besides 144 Loyalists. As it appeared impossible to furnish provisions for all these, Butler was given the strongest injunctions to reduce immedi-

[1] Canniff, Settlement of Upper Canada, 226; Journals and Transactions, Wentworth Hist. Soc., 1908, 16; Hamilton Branch, U. E. Loyalists' Assoc. of Ont., March 10, 1903, 3.

[2] Conant, Upper Canada Sketches, 27-34.

ately the issuance of supplies to the Indians, and his attention was called to the fact that the Governor had been led to believe that they had cultivated sufficient ground in their present location to support themselves without much assistance from the Government, and that as long as they remained there they were, in Haldimand's opinion, independent of the neighboring post. It was admitted, however, that when they should remove to Grand River they would doubtless require rations from the government. These admonitions had the desired effect, and before the end of the year the Mohawks, together with members of the other tribes, except the Senecas, Onondagas, and Tuscarawas, removed to their reservation west of the River Niagara. Probably at the same time Captain John and about 20 Mohawk families departed for the reservation on the north side of the Bay of Quinté, which formed a part of the purchase made in 1784 by Captain Crawford of the Indian Department.[1]

In September, 1785, the Indian settlement on the Grand River was reported by the acting superintendent of the Six Nations, Captain John Dease, as numbering 1,000 persons, an equal number having been discouraged from entering the reserve on account of the increase of provisions necessary. Captain Dease added that some disbanded soldiers had taken up their residence among the Indians in order to avoid the restraints of law, and were giving their neighbors a most unfavorable impression of the whites by their cheating and their quarrels. Several officers of the local Indian Department also settled in the reservation, including "Captain John Dochstader who acquired the greater part of the present township of Canboro, Captain Hendrick Nelles and his five sons who obtained a tract of three miles square, and Adam Young and his three sons, a smaller tract, both lying in the present Township of Seneca."[2]

In his negotiations with Governor General Haldimand after the close of the war, Captain Brant had made provision for the erection of a church and school house at the expense of the government. These buildings appear to have been supplied in 1786, and when Mr. Stuart visited the Mohawk town of New Oswego in June, 1788, he brought with him the plate and furniture formerly belonging to the church of the Mohawks at Fort Hunter, being accompanied by the Chief and several other Indians. What the population of the Grand River reservation may have become by this time is uncertain. It seems likely, however, that the thousand tribesmen, whose earlier inclination to settle with their brethren had been discouraged by Captain Dease,

[1] Niagara Hist. Soc., No. 17, 16-18, 28, 29; Haldimand Papers, B. 168, 38-41; B. 64, 93-95; Third Report, Bureau of Archives, Ont., 1905, 406, 453, 454, 493.

[2] Niagara Hist. Soc., No. 17, 28, 29.

had been admitted before this, and that they had been joined by others. Stone tells us that even some of the Six Nation Indians who had borne arms against the Crown and the Mohawks intruded on the reservation at Grand River, bringing jealousy and strife with them. However this may be, Mr. A. F. Hunter, in his ethnological survey of Ontario, gives the total population of the Indian settlers of Brant County as 3,929.[1]

In February, 1792, Mr. P. Campbell, together with a party of friends, visited the Mohawk village on Grand River, driving over the road leading back from the head of Burlington Bay. The party was hospitably entertained in the village by Captain and Mrs. Brant, who were living well on a pension and officer's half-pay contributed by the British government. Mr. Campbell noticed that the family larder was supplied with rum and various kinds of wine, that the table was furnished with handsome china and plate, that among the household possessions was "an elegant hand organ," and that the other articles of furniture were in keeping with these evidences of affluence. He was not less impressed by the appearance of the mistress of the house and her "fine family of children." Mrs. Brant was superbly dressed the Indian fashion and possessed elegance of person, besides grandeur of looks and deportment; she had large mild black eyes and expressive symmetrical features; she wore a jacket and short petticoat made of silk and fine English cloth, scarlet leggings, moccasins ornamented with beads and ribbons, and a blanket of the same materials as her petticoat, but trimmed with narrow lace. At table the family was served by two slaves in highly colored livery, set off by frills and buckled shoes.

Mr. Campbell attended service in the church, which was conducted by an Indian with entire decorum. The schoolmaster, who was an "old Yanky," taught English and mathematics to his sixty-six pupils, whom he declared to be apt scholars. Mr. Campbell visited several houses in the village, and found that each consisted of two rooms with deal floors and glass windows, and that the occupants were well supplied with the necessaries of life. The farming was done by the old people, while the young men ranged the woods for game, part of which they sold to "the white inhabitants of the neighborhood." In the evening Brant assembled the young warriors in one of the largest houses of the settlement to entertain his guests with war dances. The Indians came in their showiest apparel, bespangled with silver ornaments. The music for the dancing and bounding was a song of peculiar cadence sung by Brant and others of the tribe, Brant also keeping time by beating a drum. Later, the warriors and young

[1] Stone, Life of Brant, II, 289; Papers and Records, Ont. Hist. Soc., III, 191.

women indulged in their ordinary dances. Although rum and Madeira wine were supplied for the refreshment of the dancers, only one of the young Indians drank to excess, and he was reprimanded by Brant for so doing.

Mr. Campbell writes in enthusiastic terms of the country on the Grand River: the plains on the Indian reserve were extensive, and so free of trees as not to require clearing; the soil was a rich and deep clay mould; the river was a hundred yards broad and navigable for large batteaux down to Lake Erie, a distance of sixty miles, except for about two miles where there were shallows or rapids, through which the boats had to be poled; there was an abundance of fish in the water, such as sturgeon, pike, pickerel, and maskinonge, and plenty of game in the woods. The habitations of the Indians were close to the river on both sides, and a few whites who had married squaws, or half-bloods, lived among them. Every year the government distributed presents among the inhabitants—provisions, stores, ammunition, tomahawks, saddles, bridles, blankets, and innumerable trinkets. On his way back to Niagara, Mr. Campbell had an opportunity of visiting other settlements in the reservation for some miles down the river. He noticed as he passed along that the villages of the Indians and whites alternated, and discovered that the Indians belonged to different nations—Mohawks, Cherokees, Tuscarawas, and Mississauguas. Stopping at various houses along the way, he remarked the large quantities of Indian corn suspended from the rafters, whether merely for the sake of storage or as a means of protecting the supply from the destructive rodents of the woods and fields he does not explain. Mr. Campbell and his companions had spent two nights in Brant's village. They spent two more on the reserve before returning to Niagara, one at the house of "Mr. Ellis" (probably Hendrick Nelles) and the other with Mr. (Adam) Young, several miles farther down the river bank, both of these men being white settlers among the Indians. The travellers now turned to the north-east, and made their exit from the Indian country through a long stretch of forest "without settlements."

The presence of at least some of the whites among their red brethren had received the sanction of Chief Brant, whose policy had been to sell or lease portions of the Indian land to them in order to produce an income for his people. He also believed that husbandry would be improved and some of the mechanic arts would be introduced through the agency of the whites. This policy, however, had called out objections on the part of the provincial government, especially after the survey of the reservation, which occupied the period from the close of December, 1790, to the close of April, 1791. When

Simcoe assumed the lieutenant governorship he easily became convinced of the danger of allowing the Indians to alienate any part of their grant, and opposed Brant's policy with vigor.[1]

After numerous councils and conferences on the subject the Governor went to the Grand River in 1795, attended by his councillors, and there listened to an elaborate speech by the Mohawk Chief, after which he promised to forward the speech to Sir Guy Carleton and confirmed such sales as had been previously made by the Indians. In October, 1796, another hearing took place before Colonel Daniel Claus, the deputy superintendent of Indian Affairs, at Niagara, but without winning Claus to the support of Brant's plan. Then, the Chieftain submitted the matter to Simcoe's successor, Peter Russell, who sanctioned the sales already made, and stipulated that the lands then sold, or promised, should be surrendered to the government, which would issue grants to the purchasers, the payments to be received by trustees for the benefit of the Indians. These trustees were also to foreclose mortgages in case of default, and the mortgaged lands were to revert to the red men. When, however, the government failed to keep this agreement, Brant laid the case before the British ministers.[2]

It was at this juncture that the Chief of the Mohawks was accused of peculation, and a council held among the Senecas at Buffalo Creek by which he was declared deposed from the headship of the Six Nations. As the other Mohawk chiefs did not attend this council, the tribe being represented by only a few malcontents, the action taken was regarded as illegal, and so declared at a later council convened at Niagara in 1804. Thus, Brant remained at the head of both his own nation and the confederacy until his death in November 24, 1807. The famous warrior's closing years were spent in a commodious house, which he had built on a tract of land (a gift from the King) at the head of Lake Ontario, directly north of the beach dividing the lake from the waters of Burlington Bay. He was buried beside the church he had erected at the Mohawk village on the Grand River.[3]

As Brant was an educated man and had long been a member of the Episcopal church, his concern for the welfare of his people did not restrict itself merely to the promotion of their material interests, but extended also to the advancement of religion and education among them. The building of a church, a schoolhouse, and a grist mill at New Oswego was almost the first thing he asked of the pro-

[1] Stone, Life of Brant, II, 281-283, 287-289, 397, 398.

[2] Ibid., 399, 400, 403.

[3] Stone, Life of Brant, II, 409, 423, 424, 498, 499.

vincial government. Early in 1789 he had gone to Montreal on a mission intended to effect the removal of the Reverend John Stuart from Kingston to the Grand River in the capacity of resident clergyman among the Mohawks. He was unsuccessful in this move, and even after the Reverend Robert Addison settled at Niagara in 1792 as missionary to the whites and Indians alike, Brant had to content himself with the services of one of his own tribesmen as lay reader, and such infrequent visits as Mr. Addison and Mr. Stuart could pay to the reservation. During this period also Brant translated the entire liturgy and a primer into the Mohawk language, while his friend and fellow-chief, John Norton, translated the Gospel of John, which was published by the British and Foreign Bible Society.[1]

THE LONG POINT SETTLEMENT.

The County of Norfolk, which lies southwest of the Grand River and fronts on Lake Erie, shared in the new immigration of Loyalists and others resulting from Simcoe's efforts. It may properly be included, therefore, with the larger area of peninsular settlement. The original movement into this region, familiarly known as the Long Point country, extended to Walsingham, Charlotteville, Woodhouse, Townsend, and Windham townships, and perhaps also to Walpole, which adjoins Norfolk County on the east.

We have already seen that Governor Simcoe issued a proclamation early in February, 1792, declaring his authority to grant Crown lands to persons seeking homes in Upper Canada. This proclamation was followed a few months later by Simcoe's announcement of his purpose to occupy a post near Long Point in the spring of 1793, and by a letter to the home government expressing a preference for "brave and determined loyalists" as settlers at Long Point, "such as those from Pennsylavnia and Maryland . . . . who had sent an agent to ascertain what arrangement could be made for their removal to the province." The party referred to in this letter was probably that of Solomon Austin, comprising 12 families from Maryland and North Carolina, for which John Davis acted as emissary. On receiving a favorable report from Mr. Davis, the members of the party set out in covered wagons, bringing their household effects and some farm animals with them. The little caravan reached the Niagara frontier in June, 1793, and halted at old Niagara, while Mr. Austin continued his journey to Long Point to inspect land for settlement. He chose a place in the Lynn River valley in Woodhouse Township. On his return to the frontier Mr. Austin found his family unable to proceed at

[1] Stone, Life of Brant, II, 287, 288.

once on account of sickness, and was therefore kept from occupying the site he had selected until 1794. The other families remained in the Niagara settlement.[1]

Although the project for the military occupation of Long Point went without the approval of the British government during the next two years and more, refugee families continued to enter the townships of Charlotteville, Walsingham, Woodhouse, and Townsend, coming from New Brunswick, Pennsylvania, Niagara, New Jersey, and Long Island. Thus, in 1793, Peter Secord and Frederick Maby (Mabee) with the latter's family, including two married daughters and their husbands, came in, as did also Abraham Smith and family. Both of these parties came from New Brunswick. In the same year Lucas Dedrick and family settled in Walsingham, having journied thither from Pennsylvania. In 1794 Captain Edward McMichael and family, likewise refugees from Pennsylvania, established themselves on the lake front of Walsingham Township. For the previous decade they had lived on the western bank of the Niagara River. In March of this year, also, Jabez Culver, a Presbyterian minister, together with his wife and children, came on foot to Townsend from the State of New Jersey. The arrival of Mr. Culver marks the beginning of public worship in the new community, for he held service every Sabbath in his own house until he became pastor of the Windham Church in 1806. Another settler of 1794 was Thomas Welch (Walsh) of Maryland, who came to Charlotteville from New Brunswick, where he had been engaged since the war in surveying lands for the swarms of refugees settling in that province. On July 1, 1795, Captain Samuel Ryerse (Ryerson) of the New Jersey Volunteers arrived with his family and several hired men at the mouth of a creek that empties into the Outer Bay of Long Point. After more than ten years in New Brunswick the Ryerses had returned to Long Island in the spring of 1794, until the Captain could visit Upper Canada in search of a more congenial location. They settled at length in Woodhouse Township at a time when there were but four other families living within a distance of 20 miles along the lake shore. But during the next few years settlers came in steadily. As the lots chosen by Mr. Ryerse possessed valuable water rights, he was required to build a saw mill and a grist mill. Until these structures were completed the families at Long Point had to depend on Niagara for their flour. As the woods abounded in game of all kinds and fish were plentiful in the creeks and in the lake, tables could be readily supplied with these

[1] Canniff, Settlement of Upper Canada, 189, 190; Papers and Records, Ont. Hist. Soc., II, 44, 78; Owen, Pioneer Sketches of Long Point Settlement, 76-79.

kinds of food. So also potatoes, Indian corn, and maple sugar were familiar products of the region.

Despite the unfailing supply of these bounties during the first three years of Long Point's history, the year 1796 witnessed an almost total failure of the grain crops, and hunger drove numbers of rodents into the settlement, where they consumed the pitiable remnant of maize that had flourished. The Indians at Grand River saved themselves from a similar experience by their practice of suspending the garnered ears of corn from the rafters of their houses, and were accordingly able, as they were also willing, to share their stores with their less fortunate neighbors at Long Point. By the end of 1796 the population within 20 miles' distance of Port Ryerse had reached perhaps 100. Among those coming in were Yunkers and Quakers from the States, who usually brought more or less property with them. While these people cannot be called loyalists, they were non-belligerents who entertained a real preference for British rule. Mr. and Mrs. Timothy Culver from New Jersey joined other members of their family in the Township of Townsend in this year.

During the summer of 1795 Governor Simcoe had come to Long Point and laid out a site of 600 acres for a town, with reservations for government buildings, naming it Charlotte Villa in honor of Queen Charlotte. The formal approval of the proposed settlement was received from the Earl of Portland, December 6; but early in the following April Governor General Carleton objected to the maintenance of a military establishment in connection with the town as a piece of needless expense. Then, in the summer, followed Simcoe's departure to England. It can scarcely be claimed, however, that this incident interfered with the prospects of the settlement at Long Point, for Simcoe's successor, acting Lieutenant Governor Peter Russell, encouraged the movement of Loyalists from New Brunswick into Western Canada, and gave considerable attention to the survey of townships in Norfolk County, which were now divided into allotments. It was Russell who, in the summer of 1796, sent Mr. Hamlin and Sergeant Daniel Hazen to run the lines of Charlotteville and Walsingham townships. The former was surveyed by Hamlin and his successor, Thomsa Welch, the latter by Hazen. Both Hazen and Welch were Loyalists who had been previously employed in laying out lands for their fellow exiles in New Brunswick. Having received a large grant near Vension Creek in Walsingham, Hazen brought in his family in 1797. On July 1 of the previous year Donald McCall landed with 20 or more persons at the mouth of Big Creek. The members of this party were from New Jersey and obtained grants in Charlotteville. Among them were Lieutenant James Munro, Doctor Robert Munro, Robert Henderson, and Noah Fairchild. The settlers who had come to Long Point before 1796 were now confirmed in the possession of the farms they had chosen, and proclamations were issued inviting others, especially Loyalists, to take up lands in the new districts of Upper Canada.[1]

Immigrants from New Brunswick transported their families in open boats up the St. Lawrence and the Great Lakes to their destination; while those who came directly from the States navigated the Hudson and Black rivers to Sackett's Harbor, thence passing by way of Lake Ontario and Lake Erie to Long Point; or if they journied overland, they followed blazed trails through the forests, or the devious paths of the Indian across Pennsylvania and New York to Niagara, or some point on Lake Erie. The passage of the lake was effected in small skiffs. When, finally, the weary pilgrims found themselves in the wilderness of Norfolk County, they received no government aid beyond their land grants and the glass and iron ware for their cabins. The supplies of food, clothing, seed, tools, etc., which had been furnished, in however dilatory a manner, to the mass of refugee settlers immediately after the Revolution, were denied to those participating in this later migration. Hence, Norfolk County witnessed a "fearful struggle for subsistence" among the pioneers during the closing years of the eighteenth century.[2]

The efforts of Lieutenant Governor Powell to increase the Loyalist population of the province bore fruit in the Long Point country and probably in the surrounding regions. The evidence relating to Long Point shows that the townships of Charlotteville, Walsingham, and Woodhouse gained notably in the number of refugee settlers during the year 1798, 1799, and 1800. It is recorded that during these years the home of Captain Ryerse was never without visiting home-seekers, or "travellers", during the summer season. A summary of Loyalist arrivals for this period gives three families and four individuals for 1798, five families and four individuals in 1799 and three families and four individuals in 1800. Among the newcomers in the first of these years were Elder Titus Finch from Nova Scotia, whither he had gone in 1784, and Daniel French, a Methodist minister from New Jersey. Mr. Finch settled in Charlotteville, and became the leader of the Baptists at Long Point. He rode on circuit for many years, conducting services in various parts of the settlement. He appears to have been a popular preacher, able to draw crowds beyond the capacity of the homes in which he preached. On summer days

[1] Papers and Records, Ont. Hist. Soc., II, 45, 46, 30, 92, 93, 87; Owen, Pioneer Sketches of Long Point Settlement, 93, 194-199, 312, 382, 383.

[2] Papers and Records, Ont. Hist. Soc., II, 30, 47, 26, 27.

this difficulty was avoided by holding the meeting in an open glade of the forest. In 1804 the Baptists formed themselves into a congretion, and about six years later erected a commodious church. Many of the young people of the community joined this denomination. Mr. French also settled in Norfolk County, his chapel being known as the "Woodhouse Methodist Church." This chapel and another of the same denomination were erected before the Presbyterian church was built. By the year 1800 the number of inhabitants had so increased in Charlotteville that it became the center of population of the London District, and during the next two years the Court of Quarter Sessions convened here in the two-storey frame house of Lieutenant James Munro. It was, therefore, in Charlotteville that all matters of dispute arising in Elgin, Middlesex, Oxford, Norfolk, and parts of Brant and Haldimand counties were brought for adjudication, and from this place that tavern licenses and orders for road improvements for the vast territory indicated were issued.[1]

In all this development Captain Ryerse played an important part. By 1798 he had completed his two mills, and although his

[1] Papers and Records, Ont. Hist. Soc., II, 61, 62, 82, 95, 96-100, *passim*; Owen, Pioneer Sketches of Long Point Settlement, 65, 68, 69, 120, 154, 207, 247, 257, 277, *passim*; Ryerson, Loyalists of America and Their Times, II, 239, 242.

The arrivals for the years 1798, 1799, and 1800 were (1798) in Woodhouse, Sergeant Albert Berdan of the New Jersey Volunteers and family from New Brunswick, and Israel Wood and family, also from New Brunswick; in Walsingham, William Cope from Niagara, where he had lived since 1794, and Captain William Hutchinson of the New Jersey Volunteers and family from New Brunswick; and in Charlotteville Elder Titus Finch from Nova Scotia, whither he had gone in 1784, Lot Tisdale from New Brunswick, and Daniel Freeman, a Methodist minister from New Jersey: (1799) in Woodhouse, James Matthews of the New Jersey Volunteers from the Niagara District, Corporal Daniel Millard of the 85th Regiment and wife from Niagara, where he had settled in 1786, Josiah Gilbert of New Jersey, a corporal in the King's American Regiment, from New Brunswick; in Charlotteville, Lieutenant Joseph Ryerson of the Prince of Wales Regiment and family from Maujerville, New Brunswick, Captain Walter Anderson of the New Jersey Volunteers and family from Lincoln County in the Niagara District, Andrew McCleish and family, Levy, Silas, and Peter Montross and their three sisters from New Brunswick, Lawrence Johnson of Pennsylvania from Nova Scotia; and in Windham, Abraham Powell from New Brunswick: (1800) in Woodhouse, Captain Jonathan Williams of the Loyal Rangers and his son Titus; in Walsingham, Elias Foster of the Royal Regiment and family from New Brunswick, where he had lived since 1783; in Windham, Mathias, Henry, John, and Martin Buckner (Boughner), who travelled 500 miles or more on foot along the military highway by Lake Champlain, Fort Ticonderoga, Plattsburg, and northward to Cornwall, thence along the north shore of Lake Ontario and Simcoe's new road to Lyon's Creek in the Niagara District, whence they went to Long Point; and in Charlotteville, William Spurgin of North Carolina and Samuel Brown and family from Stamford in the Niagara District, but originally from New Jersey. (See Papers and Records, Ont. Hist. Soc., II, and Owen's Pioneer Sketches of Long Point Settlement.)

saw mill proved to be profitable, his grist mill turned out quite the reverse. The authorized toll of one bushel in twelve was insufficient to cover the heavy cost of operation and repairs, since the mill stood idle most of the summer seasons. As many of the immigrants had served with the Captain in the New Jersey Volunteers, his home became the convenient place of entertainment for not a few of the half-pay officers and men of that corps who sought lands at Long Point. In 1800 Captain Ryerse was appointed commissioner of the peace for the London District. He also became the first chairman of the Court of Quarter Sessions and judge of the District and Surrogate courts. Furthermore, he was named lieutenant of the County of Norfolk and lieutenant colonel of its militia, which he organized. It has been described as a motley company made up chiefly of "big slouching round-shouldered young men, armed with flint-lock muskets", who could be easily distinguished from the few military-looking soldiers who had served in the war of American Independence. As a magistrate Colonel Ryerse's duties were not simply judicial: he performed marriages, applied the dentist's forceps as occasion required, prescribed for the sick, buried the dead, and read the church service on Sundays to his own household and such neighbours as cared to join in the worship.

During the period from 1800 to 1812 a decline in the number of Loyalists arriving at Long Point is evident. This decline was principally due to the cessation of emigration from New Brunswick. Writing from Woodstock, in that province, in July, 1802, Colonel Edward Winslow deplored the action of "those who have lately removed with their families to other parts of the King's dominions, particularly to Niagara." A survey of the record of arrivals at Long Point after the year 1800 shows but one loyalist family from New Brunswick among the eight or nine immigrants entering during the period specified. One of these came from Adolphustown on the Bay of Quinté, three from the Niagara district, and the others from places not mentioned. All of these persons settled in the townships of Windham and Townsend, which lie in the second range back from the lake. Middleton was not settled until about 1812, when families moved in chiefly from the adjoining townships.[2]

[1] Papers and Records, Ont. Hist. Soc., II, 61, 62, 82, 84, 85, 95, 96; Ryerson, Loyalists of America and Their Times, II, 233-236, 241, 242, 247.

[2] Papers and Records, Ont. Hist. Soc., II, 118-122, 38, 39.

The accessions from 1801 to 1812, inclusive, were: (1801) in Woodhouse, John Clendenning and family from near St. Catherines in Lincoln County and Isaac Gilbert and family of New Jersey from St. John, New Brunswick (date uncertain); (1803) in Townsend, John Haviland of Butler's Rangers and family from Adolphustown, Bay of Quinte; (1805) Cuthbert Robinson and his sons, William and George, In the meantime, John Custin, a refugee from New York, erected a mill just east of Vittoria in Charlotteville Township, thus furnishing another evidence of the growth of the settlement in that district; but despite all the growth of the colony, those settlers who adhered to the English Church were left for years without a regular clergyman. Their opportunities for worship according to the forms of their own faith were confined chiefly to those supplied by Colonel Ryerse and later by Mr. Bostwick, the son of a clergyman, who made a practice of reading the service, and sometimes a sermon, on Sundays. As copies of sermons were scarce, the lay reader was reduced to the necessity of frequent repetition. In 1805 a notable event occurred for these people, when the Reverend Robert Addison came by invitation from Niagara—a distance of one hundred miles—to baptize their younger children. For 11 years some of the settlers had not heard the voice of a licentiate of their own denomination, and now with their babes in their arms and their families about them they listened to the words of the ceremonial with deep feeling, a few breaking out in a passion of tears. This affecting incident sheds a gleam of light on not the least of those trials which the Loyalists had to endure, namely, the enforced deprivation of the form of worship to which many of them clung most tenaciously. However, nearly twenty years more were to elapse before the colony at Long Point was to have a resident clergyman of the Anglican Church. This lack was supplied in 1824 by the beginning of the ministrations of the Reverend Mr. Evans. Throughout the early annals of the colony we get no hint of any provision for the education of the young. Schools were, in fact, long absent from this community, and yet the sons of some of the Loyalists at Long Point rose to eminence, among them being Sir John Robinson, who became chief justice of Ontario, and Doctor Egerton Ryerson, who attained the office of superintendent of education of the province.[1]

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with their families, from New Jersey, Peter Fairchild, and probably in the same year Sergeant Jacob Wilson and his brother Joseph, both of the New Jersey Volunteers, from the Niagara District; (1810) in Townsend, Anthony Dougherty of the North Carolina Loyalists; in Windham, Sergeant Jacob Glover of Newtown, Connecticut (date uncertain); (1811) in Windham, Hart Smith of the New Jersey Volunteers and family from Crowland, Lincoln County, previously from New Brunswick; and in Townsend, Reuben Grant of the first battalion, New Jersey Volunteers. (See Raymond's Winslow Papers, 470; Papers and Records, Ont. Hist. Soc., II, and Owen's Pioneer Sketches of Long Point Settlement.)

[1] Owen, Pioneer Sketches of Long Point Settlement, 123, 124; Papers and Records, Ont. Hist. Soc., II, 60, 61; Ryerson, Loyalists of America and Their Times, II, 248, 250.

Portion of an old Map as it was Tinted to show the Settlements of the Loyalists and Six Nation Indians in the Niagara Peninsula and Adjacent Regions.

Mémoires de la Société Royale du Canada
SECTION I

Série III SEPTEMBRE 1915 Vol. IX

La Notion du Droit.

Par Mgr Louis Ad. Paquet, M.S.R.C.

(Lu à la réunion de Mai, 1915.)

Nous assistons depuis quelque temps au spectacle tragique et aux péripéties douloureuses d'un duel qui, sans être le lot exclusif et la honte impartagée de notre siècle, n'en accuse pas moins dans certains milieux un profond abaissement moral et une réelle décadence sociale.

Deux puissances faites pour s'entendre et s'harmoniser entre elles comme l'âme et le corps, et appelées à coopérer au même effort civilisateur, sont aux prises: le droit et la force. Et telle est la perturbation produite dans les esprits, et l'étrange fortune des vocables due à cette confusion malheureuse, que des écrivains et des magistrats, des chefs d'Etat et des chefs d'armée ne parlent plus, ne savent plus parler de la force supérieure du droit, mais affirment et proclament le droit inné et irrésistible de la force. L'inintelligence d'un mot de cinq lettres scinde l'Europe en deux coalitions rivales et en deux organisations nettement opposées et génératrices de luttes et de carnages. Elle soulève jusqu'en Amérique contre des races paisibles, des multitudes honnêtes, des minorités croyantes et laborieuses, les mépris, les méfiances et parfois les agressions déloyales de politiques et de dignitaires oublieux de leurs devoirs les plus graves et transformés en véritables despotes.

C'est bien en effet d'une perversion intellectuelle qu'il s'agit, et c'est aux sources mêmes de la pensée humaine troublée, altérée et corrompue, qu'il faut aller surprendre, pour s'en bien rendre compte, ce flot d'injustices qui se répand sur les peuples, ce fleuve de douleur et ces torrents de sang qui inondent une si large portion du monde civilisé. Que de simples individus, égoïstes et jouisseurs, pensent juste et agissent mal, cela n'a rien qui étonne le psychologue averti: l'illogisme et la passion sont choses très humaines. Que toutefois des nations entières, des majorités puissantes, des classes ou des groupements d'hommes influents, soit par impulsion propre, soit par docilité, par entraînement et par servilisme, se livrent contre leurs semblables aux actes les plus injustes et commettent les abus et les excès les plus révoltants, cela ne peut s'expliquer que par une culture qui a faussé en leurs principes les doctrines les plus essentielles et qui a perverti la notion fondamentale du droit.

Nous en sommes là.

Le droit, pour une foule d'hommes, n'est plus. Et ce nom si noble et si grand dans les annales des peuples et dans l'histoire de la pensée, c'est la force qui l'usurpe: ici la force brutale, celle du bras, des canons, de l'obus, par laquelle s'exaltent les rêves ambitieux et se consomment les pires iniquités militaires; là la force légale, celle du suffrage aveugle, des associations despotiques, des législations persécutrices. En l'un et l'autre cas, les prescriptions du droit s'effacent pour faire place aux dictées et aux exigences de la force. On ne se demande pas ce que la conscience autorise, mais ce que la science peut faire.[1] On ne se soucie pas de ce qui doit être, mais de ce qui profite et de ce qui est. La fin justifie le moyen. Et cette morale à rebours, elle a ses théoriciens et ses docteurs avant d'avoir ses exécuteurs; elle s'affirme dans les livres et les écoles, avant de se traduire dans les tranchées et les parlements.

Il y a en effet, à l'heure actuelle, concernant la conception morale du monde et le gouvernement des actes sociaux, deux écoles, nées dans le passé des mêmes erreurs, et qui, à travers des vicissitudes diverses, ont grandi et se sont implantées et manifestées au sein des générations contemporaines: l'école que j'appellerai *dynamiste* et l'école *utilitaire*.

La première de ces écoles, sans recruter tous ses adeptes en un seul pays, porte assez communément le nom d'école allemande.[2] Dieu me garde de faire de tous les Allemands des tenants du système dynamiste et des partisans de cette morale sans vertu et sans entrailles où la force prime le droit! L'Allemagne a donné à l'Eglise et au monde trop de vrais savants, trop de penseurs profonds, trop d'illustres et admirables défenseurs de la vérité et de la justice pour qu'il soit permis, même dans les jours troublés et angoissés que nous vivons, de le méconnaître et de l'oublier.[3] Ce que je veux dire, c'est que la morale de la force a trouvé sur le sol germanique et, en particulier, sur le sol prussien, un terrain plus propice, semble-t-il, qu'ailleurs à l'éclosion féconde de ses principes et à l'application logique et systématique de ses théories.

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[1] Voir dans le *Correspondant* (25 oct. 1914) l'article intitulé: *La science, le droit et la force.*

[2] Cf. Alfred Fouillée, *L'idée moderne du droit*, l. I.

[3] Voir à ce sujet G. Bazin, L'*Allemagne catholique au XIXe siècle: Winthorst, ses alliés et ses adversaires.*

Des écrivains ingénieux et subtils ont recherché les origines de cette école et de ce système jusque dans les pages les plus obscures de l'histoire ancienne. César[1] parle des Germains comme d'une race formée de bonne heure, par une austère discipline, aux exercices les plus durs et aux habitudes les plus sanguinaires. Ozanam[2] a montré "que leurs lois indiquaient une nation violente, adonnée exclusivement à la guerre, rapace, avide de butin, étrangère à tout respect pour le bien d'autrui, exempte de sens moral et surtout de générosité, réduisant la femme à la condition d'esclave, admettant le meurtre des vieillards, le parricide, réservant aux forts la guerre et les bénéfices du pillage, aux faibles le travail et la servitude."

Le christianisme tempéra ces mœurs barbares par l'influence de ses doctrines et par la vertu de ses sacrements. On a même été jusqu'à lui reprocher d'avoir amolli et affaibli chez eux, par les eaux du baptême, la vigueur native de la race.[3] Ce blâme, certes, constitue un éloge. En Germanie comme ailleurs, l'action chrétienne opéra des prodiges de grâce, pliant au joug de la foi, de l'humilité, du renoncement, des âmes jusque là jalouses de leur force altière et de leur fierté cruelle.

Toutefois, plusieurs faits démontrent que même après cette époque, et malgré cette influence, le tempérament germanique gardait encore de ses énergies farouches. D'après l'aveu bien impartial d'historiens allemands eux-mêmes,[4] c'est en Allemagne que les assauts alors dirigés par le pouvoir laïque contre le pouvoir ecclésiastique offrirent le plus de gravité. Et la littérature allemande, au témoignage de critiques experts, n'est pas sans refléter cette violence du caractère national. Dans une étude récente, M. Etienne Lamy, avec cet esprit d'observation et cette puissance d'analyse qui le distinguent, établit un parallèle saisissant entre les poèmes teutons et les chansons de geste: d'un côté, l'auteur prétend discerner "l'épopée de la force matérielle", de l'autre, il est heureux de voir et d'admirer "l'épopée de la force morale."[5]

Quoi qu'il en soit, nous trouvons, de cette théorie de la force substituée au droit, des traces et des empreintes visibles dans la pensée et dans l'attitude du fondateur de la religion réformée. Le déterminisme de Luther, basant le salut sur une foi aveugle et sans tenir compte des mérites de l'humaine liberté, n'est qu'une sorte de dy-

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[1] *Comm.*, l. VI, nn. 21-22 (éd. Hachette).

[2] *Etudes Germaniques* (cit. par Albert Lefaivre, *Essai sur la Littérature allemande*, p. 4).

[3] Lefaivre, *ibid.*, pp. 5-6.

[4] Kraus, *Histoire de l'Eglise*, t. II (3e éd.), p. 135.

[5] *Revue des deux Mondes*, p. 616 (15 déc. 1914).

namisme transféré du domaine matériel dans le domaine moral et qui justifie d'avance, par la seule invocation du nom de Dieu, les plus graves excès et les plus lourdes tyrannies.

A ces conceptions religieuses et à ces influences ataviques sont venues s'ajouter, dans des temps plus rapprochés de nous, les rêveries panthéistes et matérialistes d'une philosophie brumeuse. Le matérialisme de Büchner étend et affermit le règne de la force; le panthéisme de Hégel le divinise. Dès lors en effet que tout se réduit à la matière et à une combinaison d'atomes, le mot "droit" n'a plus de sens; c'est la force seule, l'énergie physique seule qui régit l'homme et qui gouverne le monde. Et du moment que Dieu s'identifie avec le monde, tout ce que sous nos yeux la force peut accomplir même de plus violent et de plus brutal, n'est qu'une manifestation de la puissance et de la royauté divine.

Ainsi arrive-t-on à la notion exacte et à la construction logique du système monstrueux dont les pratiques et les œuvres barbares frappent le monde entier de stupeur. Dans ce système, l'âme spirituelle et immortelle est supprimée; ou, si elle subsiste, c'est pour prendre part à sa propre dénaturation et pour assister à l'évolution triomphante des principes de vie physique et de vigueur animalisée qui créent l'égotisme de l'individu, l'ambition effrénée de la race, l'orgueilleuse et intolérable prétention qu'affichent les nations fortes d'incarner en quelque sorte l'humanité entière. Cette force accrue et magnifiée ne reconnaît pas de règle. Elle est à elle-même sa loi. Elle se fait créatrice du droit qu'elle s'arroge de fouler aux pieds les faibles,[1] et du devoir imposé aux faibles de se courber et de s'anéantir sous la puissance des forts. Et dans cette force victorieuse consiste précisément, pour l'école dynamiste, la perfection du droit. "Les grands arbres étouffent les petits et leur enlèvent la lumière du soleil avec la sève de la terre; mais c'est en se nourrissant des débris de ces arbustes inférieurs qu'ils dressent de plus en plus haut leur tête, signe d'une race perfectionnée. La même loi de guerre et de sélection mécanique, d'après les dynamistes, régit l'humanité."[2] Les théoriciens du système, et de la nouvelle culture, l'avouent avec une parfaite franchise: "Dans le monde de l'homme comme dans le monde animal, ce qui règne, dit Schopenhauer,[3] c'est la force et non le droit. . . . . Le droit n'est que la mesure de la puissance de chacun."

On a là, très nettement formulée, la morale de cette religion du sabre et du canon. Et l'on s'explique maintenant la place d'honneur

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[1] "Si le fort domine le faible, c'est une inexorable loi de la vie", (Treitschke, dans le *Correspondant*, 10 nov. 1914).

[2] Fouillée, *ouv. cit.*, p. 28.

[3] Id., *ibid.*

qu'occupent, dans l'opinion des adeptes de ce culte et des adorateurs du dieu-force, le militarisme effréné et l'impérialisme conquérant par lesquels cette divinité s'affirme. Si l'historien Mommsen s'extasie devant les vertus robustes des anciens Romains et devant le génie militaire de César, c'est surtout, peut-on dire, parce qu'il voit dans ces triomphes passés de la force le symbole de conquêtes à venir. "L'histoire romaine de Mommsen, dit un auteur,[1] eut une influence immense sur l'esprit de la nation. Dans ces annales guerrières, le peuple allemand crut reconnaître sa propre destinée, et dès lors il se proposa pour objet unique de son ambition l'hégémonie militaire." Cet objectif ressort clairement des paroles suivantes de Nietzche:[2] "Le maintien de l'état militaire est le dernier moyen qui nous soit laissé, soit pour la sauvegarde des grandes traditions, soit pour l'institution du type supérieur de l'homme, du type fort." Et c'est pourquoi l'on a pu dire de cet écrivain, et on pourrait sans doute le répéter de plusieurs autres de la même école, "que ses phrases sont bourrées comme des obus par les pires explosifs de la pensée allemande."[3] Et c'est pourquoi encore, faisant de cette pensée le programme de son action, M. de Bismark, dès 1862, déclarait que "les grandes questions du jour ne sont pas de celles qu'on peut résoudre par des discours et des majorités, mais de celles qui ne se laissent trancher que par le fer et dans le sang."[4]

Puisque dans cette théorie, et d'après ces déclarations, la force fait le droit, tout ce qui concourt au succès de la force, participe nécessairement de la nature du droit. En conséquence, la ruse, le mensonge, l'espionnage deviennent des moyens louables et des exploits glorieux. La fourberie est érigée en système; la perfidie des âmes viles et des pratiques traîtresses monte au rang des vertus. Violation de la foi jurée; actes de cruauté, de violence, de barbarie; mépris insolent de ce qu'il y a de plus saint, de plus sacré, de plus vénérable: tout est bon, et tout est plausible aux yeux de ceux qui représentent la force, la race élue et dominatrice, l'humanité grandie, régénérée et ennoblie.

Telle est l'école dynamiste, et tels sont ses principes, ses maximes, ses leçons.

Devons-nous donc nous incliner béatement devant cette morale étrange, et devant cette idée du droit qui n'en est que la caricature cynique et le renversement sans pudeur? Allons-nous désormais considérer comme juste tout ce qui réussit, ratifier tous les faits ac-

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[1] Lefaivre, *ouv. cit.*, pp. 191-192.

[2] *Revue des deuxMondes*, p. 737 (15 déc. 1914).

[3] *Ibid.*, p. 745.

[4] Lefaivre, *ouv. cit.*, p. 193.

complis, applaudir à tous les succès, à toutes les conquêtes, à tous les triomphes ? Le droit s'appellera-t-il Combes poussant d'innocentes vierges sur les routes de l'exil ? s'appellera-t-il Bismark garrottant de sa main de fer les chefs et les pasteurs de l'Eglise ? s'appellera-t-il Bonaparte traînant derrière son char de victoire un Pontife désarmé ? Devrons-nous louer, exalter et glorifier tous les Robespierres et tous les Cromwells, tous les égorgeurs de rois et tous les écraseurs de peuples ? et remontant, par cette voie douloureuse, jusqu'à la colline rougie et illustrée par le sang du Juste, saluerons-nous d'un œil complaisant et d'un geste approbateur l'acte le plus infâme que l'ivresse de la force ait osé commettre et qui ait jamais souillé et déshonoré les annales du monde ?

Ce serait vraiment abdiquer ce qu'il y a de plus noble en nous. Ce serait fermer les yeux sur ce que l'histoire nous offre de plus sublime, sur ce que la foi et la raison conjointes ont entrepris de plus méritoire et accompli de plus généreux pour adoucir les mœurs des peuples grossiers et pour reculer les frontières de la barbarie. Ce serait, pour l'esprit de l'homme, s'avouer vaincu par la matière, et ce serait enfin renier vingt siècles de justice bienfaisante et de christianisme civilisateur.[1]

Et quelle perspective ouvre-t-on, par cette révolution des idées, devant le regard des foules ? "Les partisans du fatalisme germanique, remarque justement M. Fouillée,[2] ont renoncé à la vieille notion d'obligation morale en supprimant l'idée morale du droit. Le vrai sens de leur philosophie du droit, c'est qu'au fond il n'y a pas de droit proprement dit, comme le vrai sens de leur morale, c'est qu'au fond il n'y a pas de devoir. Ils ne pourront donc présenter l'idéal de la société la plus forte comme une fin dont la poursuite serait moralement obligatoire pour l'individu." Fatalement alors et nécessairement, les individus et les nations qui ont l'instinct de vivre, résisteront à la poussée hostile. Et "la civilisation future, fondée exclusivement sur le jeu fatal de ces forces, ne sera au fond que la lutte universelle. . . Le monde sera-t-il germain, latin, saxon ou slave ? vainqueurs hier, les Latins sont aujourd'hui vaincus; mais les Germains à leur tour peuvent être vaincus un jour par les Slaves. Nous voilà entraînés dans un mouvement perpétuel, image sensible de l'instabilité propre au système de la force. . . . Des armements croissants, un militarisme universel, un perpétuel retour à l'état de guerre primitif, une paix

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[1] D'après l'enseignement de la théologie et de la philosophie chrétienne, s'il est vrai que la force de l'âme mérite le nom de vertu, la force du corps, prise en elle-même, n'en est qu'un vain simulacre (saint Thomas, *Som. théol.* II-IIæ Q. CXXIII, art. 1 ad 3).

[2] *Ouv. cit.*, p. 45.

non moins inquiète que la guerre elle-même, voilà l'idéal prussien dont on veut faire l'idéal humain."[1]

Cet idéal, on en conviendra, n'est guère digne de l'humanité raisonnable.[2] Et si certains docteurs de la force osent en prendre ouvertement la défense, la plupart des profiteurs du régime qui en est issu cherchent plutôt à voiler les actes d'agression farouche et de convoitise rapace dictés par une telle conception du devoir et de la vie.

Aussi bien, beaucoup de meneurs d'hommes et de manieurs d'idées s'en montrent gravement surpris et profondément indignés. Et à cette morale exclusive de tout sens moral, et qui n'est en réalité qu'un problème de dynamique et de mécanique, ils opposent avec dédain les principes dont eux-mêmes s'inspirent et qui forment les éléments de ce qu'on a appelé et de ce qu'on appelle plus que jamais la morale de l'intérêt. Nous n'avons plus affaire avec des personnages fièrement casqués et savamment armés. Nous sommes en présence de calmes et froids utilitaires.

L'intérêt est-il donc la base de la moralité des actes ?

Entendons-nous bien sur les mots. On dit parfois: les intérêts de la religion, les intérêts de la morale, les intérêts de la conscience imposent tel devoir et prescrivent telle attitude. L'intérêt ainsi compris n'est qu'un nom différent et comme une expression humaine de la grande loi divine à laquelle tous sont soumis et de laquelle tous peuvent attendre, si elle est observée, les fruits les plus abondants et les résultats les plus précieux.[3] Ce n'est certes pas en cela que consiste l'utilitarisme dont nous parlons ici. Et, aux yeux des souteneurs de ce système, l'utilité que l'on a en vue réside beaucoup moins dans les biens de l'âme et dans les bienfaits du ciel que dans les avantages de la terre et les succès de la fortune. Ce n'est pas l'intérêt de la religion dont on s'inquiète; et c'est, par contre, la religion de l'intérêt que l'on veut créer.

On ne regarde pas ce qui est juste, on recherche ce qui est utile.[4] On ne se soucie pas des règles de la loi morale, mais des suggestions

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[1] Id., *ibid.*, pp. 48-50.

[2] Voilà pourquoi nous estimons gravement blâmables les journaux américains et même canadiens qui font, dans leurs colonnes, une si large place aux parties de boxe et aux exhibitions de force musculaire et qui faussent ainsi à la longue, dans un sens purement dynamiste, la mentalité et la conscience de beaucoup de leurs lecteurs.

[3] Il y a donc des intérêts qui se confondent en quelque sorte avec des devoirs; devoirs de l'humanité envers Dieu; devoirs de l'homme envers lui-même, d'une société envers elle-même. Individus et nations sont tout ensemble intéressés et tenus par un instinct de la nature et par un précepte de la loi morale à leur propre conservation et à leur propre développement.

[4] Fouillée, *ouv. cit.*, pp. 80 et suiv.—cf. le *London Free Press*, 29 avril 1915.

de l'intérêt propre. On juge tout d'après ce critérium. Et s'il arrive que cet intérêt vienne en conflit avec la morale, avec la religion, avec la conscience, froidement, délibérément, on sacrifie la conscience, la religion et la morale aux exigences de l'intérêt, aux préoccupations du succès, de l'ambition et de la fortune. Et pour mieux assurer ce succès, et pour satisfaire plus promptement cette ambition, et pour édifier plus solidement cette fortune, on fait appel, s'il le faut, à la force: force brutale des armes, force tyrannique des lois. Et c'est ainsi que, par une pente naturelle et une conséquence logique, l'école de l'intérêt s'associe à l'école de la force dans la lutte contre le droit.

Et sur le théâtre de cette lutte, quels acteurs voyons-nous figurer? non pas seulement des individus en qui le flambeau de la loi divine a pâli, mais des factions qui se disputent les avantages du pouvoir et chez qui la voix des appétits étouffe les réclamations de la raison et de la conscience, mais des unions économiques et des groupements ethniques qui, par une soif profonde et insatiable de suprématie, se montrent capables de toutes les audaces, de toutes les complicités, et de tous les dénis de justice. L'histoire de tous les temps s'offre ici à nous avec son formidable dossier de faits et de preuves

D'autre part, nous devons le dire à l'honneur de l'humanité, en tous les temps aussi et au sein de toutes les nations, il s'est trouvé des intelligences assez hautes pour porter leurs regards au dessus de l'intérêt, et des âmes assez généreuses pour chercher ailleurs qu'en des biens relatifs et passagers la règle de leurs pensées et l'idéal de leur vie. "Si l'utilité temporelle, observe un philosophe,[1] peut être pour l'homme un stimulant d'action, elle ne peut être la règle de ses mœurs. La conscience du genre humain qui a toujours flétri de la note d'égoïsme la doctrine que nous combattons ici, confirme notre assertion." On n'a jamais cessé et on ne cessera, Dieu merci, jamais de mentionner avec éloge l'acte d'un homme ou d'un peuple désintéressé. Et ce témoignage constant et spontané de l'opinion démontre mieux peut-être que tous les raisonnements, combien les vues et les motifs de l'intérêt répugnent à la notion même d'une morale véritable. On ne base pas la morale sur un aléa, sur une chose secondaire,[2] moins encore sur une appétition qui trop souvent doit être regardée comme déréglée et illégitime et absolument opposée à l'ordre établi par la raison.

Au surplus, pour bien saisir la nature et la portée de cette doctrine utilitaire, nous n'avons qu'à considérer de quelles conséquences, soit

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[1] *Institutes de Droit naturel* par M. B., t. I, pp. 116-117.

[2] Comme l'enseigne saint Thomas (*Som. Théol.*I P., Q. V, art. 6), les biens utiles ne sont pas désirables pour eux-mêmes, mais pour les biens honnêtes et moraux auxquels ils sont subordonnés.

à l'égard des particuliers, soit à l'endroit des collectivités, elle est la source trop féconde.

L'utilitarisme développe l'égoïsme. L'égoïsme engendre, parmi les membres de la famille humaine, les rivalités profondes, les hostilités prolongées, les violences et les rapines flagrantes. Comment demander à l'individu, fût-ce au nom de l'intérêt social, un sacrifice dont son propre intérêt le détourne? "Autant j'abandonnerai en faveur d'autrui, autant diminuera mon avoir. Si le caissier d'une société contribue à la bonne gestion des affaires, le trésor commun augmente; s'il détourne les fonds à son profit, le trésor commun diminue, mais à coup sûr son trésor particulier y gagne: posez en principe qu'il n'y a d'autre droit que l'intérêt transformé, quel raisonnement mathématique pourra, en cas d'impunité certaine, empêcher le caissier de fuir avec la caisse?"[1]

Mais l'influence du grand nombre peut intervenir. Et l'Etat se retranchant lui-même derrière cette formule de l'intérêt, de l'intérêt d'une race, de l'intérêt d'une langue, de l'intérêt d'un parti ou d'un régime, fera sentir aux individus sa force irrépressible. On aura alors comme en Pologne, comme en Irlande, comme en France, le spectacle odieux et irritant d'une majorité forte de ses succès et acharnée contre les droits personnels et familiaux les plus sacrés: "droits issus des entrailles mêmes de la nature; droits imprimés par Dieu dans la profondeur des consciences; droits conquis par le laboureur, l'explorateur et l'apôtre; droits fixés par l'histoire, consacrés par l'usage, reconnus par des actes publics; droits que la charte du pays implique, que les intérêts de la civilisation réclament, et qui se rattachent par des liens étroits, pour ne pas dire indissolubles, à la conservation nécessaire des croyances et à l'expansion légitime de la vie intellectuelle et de l'influence religieuse."[2]

"En somme, remarque justement M. Fouillée,[3] la jurisprudence utilitaire, quel que soit le libéralisme de ses partisans modernes, tend à faire de l'individu, comme dans les sociétés antiques, le simple serviteur de l'intérêt général." L'Etat institué pour protéger les droits et pour promouvoir les intérêts de ceux qui sont faibles et qui ont besoin de son secours, déploie son autorité en un sens tout opposé et dans une tâche vexatoire et despotique.[4] Aboutissement fatal d'une théorie que n'appuient ni les données de la foi ni les principes de la raison, et qui repose presque tout entière sur les visées de l'or-

[1] Fouillée, *ouv. cit.*, p. 121.

[2] Card. Bégin, allocution prononcée à l'Université Laval le 25 janv. 1915.

[3] *Ouv. cit.*, p. 112.

[4] Cf. saint Thomas, *Som. théol.*, I-IIae, Q. XXI, art. 4 ad 3. L'angélique docteur y réprouve l'idolâtrie de l'Etat.

gueil, les manœuvres de l'ambiton, les hasards et les surprises d'une élection populaire.

Que valent après cela les lois que l'on forge, et dont l'effet voulu et prévu est de lier les libertés et de violer les consciences, et que l'on présente néanmoins au peuple comme des œuvres sacrées et des dogmes intangibles ? Ce ne sont pas des lois, mais des chaînes. Et les âmes libres et fières s'en détournent et les méprisent.[1]

La loi, d'après le prince des philosophes chrétiens, saint Thomas d'Aquin, n'est ni le produit du caprice, ni l'instrument de la force, ni l'acte arbitraire d'une volonté quelconque; c'est une émanation de la raison, ou un ordre dicté par cette puissance en vue du bien commun. En effet, remarque ce docteur,[2] "la loi est la mesure des actes humains, puisqu'il lui appartient de prescrire les uns et de défendre les autres. Mais la règle ou la mesure des actes humains, c'est la raison, qui est le premier principe de l'activité humaine." Pour que donc une loi, ecclésiastique ou civile, mérite vraiment ce nom, il faut qu'elle éclose à la clarté de cette lumière que tout homme porte au fond de son intelligence et dans les replis de sa conscience, et que l'on appelle loi naturelle. Nous ne pouvons pas plus nous dérober aux rayons et aux directions de ce flambeau intérieur qu'il ne nous est permis de renoncer à notre caractère et à notre dignité d'êtres raisonnables.

C'est donc à la loi naturelle que toute loi humaine emprunte sa vertu d'obliger. Et parce que l'idée de sanction ou d'obligation légale ne se conçoit pas sans l'idée et l'autorité d'un législateur reconnu et compétent, la loi naturelle elle-même suppose une autre loi appelée loi éternelle, qui est dans l'esprit de Dieu la règle souveraine et immuable de l'ordre, et dont la conscience humaine est comme l'image et le reflet.[3] Dieu sans doute peut nous commander par des lois et des prescriptions positives; et, de fait, les tables sacrées du Sinaï et les pages inspirées de l'Evangile nous ont transmis de très graves et très importantes dispositions de cette sagesse auguste. Plus profonde toutefois, plus impérieuse, et plus digne, s'il est possible, de la vénération des peuples, est la loi éternelle, en laquelle toute loi humaine prend sa source,[4] et de laquelle découlent comme d'un principe général tous les droits et tous les devoirs.

[1] Pie IX s'est élevé avec courage contre ceux "qui ont l'impudence de dire que l'autorité n'est rien, si ce n'est celle du nombre et de la force matérielle; que le droit consiste dans le fait" (Alloc. *Maxima Quidem*, 9 juin 1862; cf. Syll. prop. 60).

[2] *Som. théol.*, I-IIae, Q. XC, art. 1.

[3] Saint Thomas, *ibid.*, Q. XIX, art. 4.

[4] Louis Veuillot a écrit: "Je défie tout législateur qui ne parlera pas au nom de Dieu de m'apprendre à respecter l'honneur, ni la loi, ni moi-même, ni surtout le législateur" (*L. Veuillot* par Eug. Veuillot, cont. par F. Veuillot, t. IV, 2e éd., p. 584).

Nous avons là les fondements véritables du droit.

Dans la philosophie chrétienne, le droit et le devoir sont des corrélatifs nés au même moment, du même rayonnement de la raison divine et de l'idéal divin sur les êtres créés, et qui, en vertu de cette suprême influence, gouvernent et coordonnent toutes les relations sociales. Ce n'est ni la force ni l'intérêt, ni la loi créée par l'intérêt et basée sur la force, qui font le droit et imposent le devoir. Devoir et droit appartiennent à l'ordre moral, c'est-à-dire à l'ordre fondé sur ce que la raison autorise, sur le vrai et sur le bien, sur l'intelligence du vrai et sur la liberté du bien. Il faut s'élever jusqu'à cette hauteur. Et c'est placé à ce point de vue, qu'un éminentissime archevêque pouvait dire dans un document désormais célèbre:[1] "Je crois à une justice immanente, et je n'admets pas, aucun esprit sensé n'admettra que, dans un pays civilisé, la force du bras et du nombre doive être considérée comme le dernier mot des choses."

L'illustre publiciste Taparelli a fort bien expliqué cette même pensée. "Le droit, dit-il,[2] est un pouvoir indépendant de la force; le droit peut exister sans la force, comme la force peut exister sans le droit. Cependant, tout pouvoir suppose une certaine force; et si le droit est un pouvoir, il faut qu'il soit au moins une force morale; car nous ne connaissons que deux forces dans la nature: l'une physique qui agit sur les corps, l'autre morale qui agit sur les esprits. Avoir un droit, c'est donc avoir un pouvoir moral, une force morale sur les esprits. Et comment peut-on agir sur les esprits? il n'y a que le vrai qui puisse agir sur l'intelligence et le bien sur la volonté; le droit est donc un pouvoir fondé sur le vrai et le bon, pouvoir irrésistible sur l'intelligence qui ne peut refuser son assentiment à la vérité connue, pouvoir qui s'exerce en présentant à la raison d'un autre une vérité qui lui montre que l'action qu'on prétend obtenir de lui, se trouve évidemment liée pour lui à l'acquisition du souverain bien. Cette vérité, base démonstrative du droit, on l'appelle ordinairement titre du droit."

Le droit et ses titres sont sacrés. Ils exigent le respect. Ils entraînent l'inviolabilité. Le droit à coup sûr n'exclut pas la force qui peut être pour lui un auxiliaire précieux et même nécessaire. Il

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[1] Lettre de S. E. le Cardinal Bégin, archevêque de Québec, adressée le 29 déc. 1914 à S. G. Mgr. Bruchési, archevêque de Montréal.

[2] *Essai théorique de Droit naturel*, t. I, nn. 342-343 (éd. Casterman).—Léon XIII a écrit dans le même sens (encycl. au clergé de France, 16 fév. 1892): "L'idée de moralité implique avant tout un ordre de dépendance à l'égard du vrai, qui est la lumière de l'esprit; à l'égard du bien, qui est la fin de la volonté: sans le vrai, sans le bien, pas de morale digne de ce nom; et quelle est donc la vérité principale et essentielle, celle dont toute vérité dérive? c'est Dieu. Quelle est donc encore la bonté suprême dont tout autre bien procède? c'est Dieu."

ne condamne pas l'intérêt sagement compris et parfaitement subordonné aux règles supérieures de la religion et de l'honnêteté. Il s'abrite avec gratitude derrière le rempart d'une loi, quand le législateur humain se rappelle et se rend compte que la loi positive est faite principalement pour servir de rempart au droit, et qu'elle ne peut ni rien prohiber ni rien décréter à l'encontre de la norme divine et du code primordial des actions et des mœurs. Mais tout effort et tout attentat contre le droit, de quelque côté qu'il vienne, et de quelque autorité qu'il se réclame, se heurte au mur solide de la conscience et au jugement implacable de l'histoire. Et tôt ou tard cette résistance convainc les esprits obstinés, et ce jugement triomphe de ceux-là mêmes qui par leurs actes, leurs arrêts et leur despotisme, en ont inspiré les justes et nobles rigueurs.

Depuis surtout l'ère lumineuse ouverte par le Christ, la notion d'un droit inviolable n'est ni le propre d'une nation ni l'apanage d'un siècle.

Oblitérée trop communément dans l'âme païenne,[1] mais restaurée providentiellement dans l'âme chrétienne, elle s'est traduite sur les lèvres des apôtres et des martyrs de tous les pays avec une audace intrépide et glorieuse. Mis en face des plus redoutables manifestations de la force, des plus troublantes perversions de l'intérêt, le droit s'est ressaisi, s'est redressé, s'est affirmé. "Il n'y a rien, selon Louis Veuillot,[2] de plus réfuté par toute l'histoire que la primauté de la force et l'anéantissement du droit." L'histoire nous montre bien, en cent pages sombres ou sanglantes, des attaques cent fois renouvelées contre le droit. Mais bientôt, sur les pages qui suivent, se dessinent en caractères fortement burinés les figures d'un Athanase, d'un Grégoire VII, d'un Louis IX, d'une Jeanne d'Arc, d'un Thomas Morus, d'un O'Connell, d'un Veuillot, d'un Montalembert, d'un Winthorst. Oui, le grand hanovrien Winthorst est à lui seul une réfutation éloquente des théories utilitaires et du dynamisme prussien.

Cette réfutation, d'ailleurs, n'est que l'écho des protestations très fermes et des revendications très variées qu'ont fait entendre successivement tous les âges et tous les docteurs chrétiens. Et il est donc faux de prétendre, avec certains écrivains modernes,[3] que la

[1]Voir notre opuscule *La Foi et la Raison*, pp. 143 et suiv.—Il y eut certes chez les païens d'honorables exceptions; et l'on cite avec raison ces belles paroles de Cicéron sur la loi éternelle, fondement du droit: "Ni le Sénat ni le peuple ne peuvent nous affranchir de ses prescriptions. Elle n'est pas autre à Rome, autre à Athènes, autre aujourd'hui et autre demain. Tous les peuples et tous les temps sont liés par cette loi éternelle et immuable. . . . . . elle est contemporaine de la divinité qui régit le ciel et la terre" (*De Republica*, III,12; *de Legibus*, II, 10).

[2] *L. Veuillot*, t. IV, p. 724.

[3] Fouillée, *ouv. cit.*, l. III-IV.

notion du droit, dans son sens le plus vrai et dans son acception la plus généreuse, ne remonte guère plus haut que la philosophie encyclopédiste et la déclaration des droits de la Révolution. Ce qu'il faut au contraire reconnaître, et ce dont tous les bons Français rougissent, c'est que la Révolution a mis en œuvre toutes les ressources de la force menaçante et tous les mobiles de l'intérêt séducteur pour porter atteinte aux droits les mieux établis et pour provoquer les abdications les plus honteuses. Ce que nous croyons devoir répéter après tous les historiens sérieux et impartiaux, c'est que la France, en cette crise sauvage, s'est démentie elle-même, et qu'elle a couvert et masqué d'un voile sanglant les plus beaux traits de son génie et les plus pures gloires de ses armes.

L'un de ses fils les plus distingués, que nous avons déjà cité, lui rendait naguère cet hommage:[1] "La tradition, l'honneur, le génie même de la France est d'aimer des forces supérieures à la force." Parlant de la France officielle, nous sommes forcés d'avouer que cet amour, dans les temps modernes, s'est souvent égaré sur des objets indignes de lui. On ne fonde pas le droit sur l'anarchie de la pensée ni sur la liberté du mal et la licence des mœurs. Et si, d'une part, il est nécessaire de rejeter tout système dans lequel le droit est nié[2] ou ravalé au niveau de l'intérêt vulgaire et de la force matérielle, de l'autre, on ne peut admettre comme saine et juste la conception d'un droit plus élevé sans doute, mais qui ne remonte pas jusqu'à Dieu[3] et qui prétend s'affranchir de toute règle et se libérer de tout frein.

Et je conclus que seule la philosophie chrétienne présente aux hommes et aux peuples une notion des droits et des devoirs qui s'harmonise parfaitement avec l'autorité et la liberté: qui s'incline volontiers devant les titres certains de la foi et de la puissance religieuse; qui laisse aux âmes et aux familles le libre jeu des mouvements honnêtes et des initiatives légitimes; qui reconnaît aux groupes ethniques le droit fondé et inné de la langue, des traditions et des croyances; qui condamne les conquêtes injustes, les procédés de guerre iniques et barbares;[4] qui fait de la loi un instrument de justice, et non un engin d'oppression; qui affermit le pouvoir sur ses bases en lui conciliant la loyauté des citoyens et en le prémunissant contre ses propres écarts.

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[1] Et. Lamy, *Revue des deux Mondes*, 15 déc. 1914.

[2] Certains positivistes, tels qu'Auguste Comte, nient carrément l'existence du droit (Fouillée, *ibid.*, pp. 194-195).

[3] Le Dr. Grasset (*Correspondant*, 25 oct. 1914) oppose au système de la force basé sur une science matérialisée l'*idée-loi* de moralité fondée sur la vraie science de l'homme. Cette science de l'homme n'est elle-même véritable qu'en autant qu'elle fait reposer la loi morale, dont elle s'inspire, sur l'ordre établi par le suprême législateur qui est Dieu.

[4] Cf. saint Thomas, *Som. théol.*, II-IIae, Q. XL (sur la *Guerre*).

Ces idées, si claires pour nous, ne le sont malheureusement pas pour tous. Et trois préjugés principaux semblent aujourd'hui obscurcir, en un très grand nombre d'esprits, l'exacte notion du droit.

Il y a d'abord le sentiment exagéré de la valeur propre, du rôle et du caractère national.

Rien sans doute, en principe, ne fixe et ne détermine d'une façon immuable les frontières et la géographie des nations; et rien non plus ne s'oppose à ce que, par des moyens licites et grâce à des contingences favorables, certains Etats évoluent, s'accroissent et s'agrandissent. L'inégalité des peuples, comme celle des conditions sociales, paraît faire partie du plan providentiel de Dieu. "C'est, remarque Taparelli,[1] un devoir pour ceux qui gouvernent les peuples de procurer leur indépendance nationale; mais la manière de la procurer est déterminée par les droits des peuples voisins. Ce serait mal servir la cause de la civilisation que de fouler aux pieds les droits qui ne s'accordent pas avec les circonscriptions géographiques ou les affections morales; car, en suivant l'instinct, le sentiment, l'intérêt, on renverserait la base de l'ordre moral." Le droit national, quelque juste qu'on le suppose, a donc sa limite dans une loi supérieure, loi morale, naturelle, éternelle, qui domine les souverains et les peuples, et qui ne permet à aucun peuple ni à aucun souverain de transgresser les droits de la propriété, de la souveraineté et de la justice.[2]

Un second préjugé trop fréquent de nos jours est ce qu'on pourrait appeler la superstition de la légalité.

A Dieu ne plaise que je veuille par la moindre parole, et dans la moindre mesure, entamer ou diminuer le prestige et l'autorité des lois. Les lois justes, même simplement humaines, positives, et déterminatives à différents degrés des principes de morale et d'économie sociale, ont droit au respect, à la déférence et à l'obéissance. Quant aux lois injustes et contraires soit aux intérêts de Dieu et de la religion, soit aux intérêts moraux et aux libertés naturelles des particuliers ou d'un groupe social quelconque, elles n'imposent par elles-mêmes aucun devoir de conscience et elles ne méritent *en soi* aucun acte de soumission.[3] Et invoquer dans ce cas, contre les victimes du pouvoir, le titre très respectable de la légalité, c'est tout simplement jongler avec les mots et jouer insidieusement à la tyrannie.

Au fond, pareille pratique n'est que la mise en acte de l'absurde théorie qui prétend soustraire la loi humaine aux directions et au contrôle de l'autorité divine,[4] et qui prétend édifier sur des vues pure-

[1] *Ouv.* et *éd. cit.*, t. IV, p. 373.

[2] Voir dans les *Etudes* (20 mars 1915) un article de Lucien Roure intitulé: *Patriotisme, impérialisme, militarisme.*

[3] Saint Thomas, *Som. théol.*, I-IIae, Q. XCVI, art. 4.

[4] Un juge d'Amérique, assez récemment, ne se faisait pas scrupule de dire: "Je ne sache pas que la loi naturelle puisse encore s'appliquer de nos jours". (Le *Droit*, 27 avril, 1915.)

ment subjectives ce qu'on dénomme du titre pompeux, fantasque, et contradictoire, de morale indépendante: morale négatrice de toute vraie morale, et destructrice de toute obligation juridique. Dieu seul en effet peut donner à l'homme le droit et le pouvoir de lier la conscience de l'homme,[1] et lui seul peut en même temps munir nos injonctions et nos législations d'une sanction efficace. Pour qui admet l'Etre divin, sa providence et ses préceptes, il est donc impossible de ne pas reconnaître au-dessus de ce que font les hommes et de ce que décrètent les parlements une règle d'action commune, invariable et fondamentale, mesure souveraine de ce qui est juste et condamnation formelle, nécessaire et autorisée, de tout ce qui est injuste. Certaine légalité aux yeux des hommes n'est qu'illégalité devant Dieu.

Et c'est en vain que pour justifier cette illégalité on allègue, en pays constitutionnels, l'opinion favorable de la majorité des électeurs et le suffrage décisif de la majorité des législateurs.

Ce raisonnement n'est autre que celui de la force s'insurgeant contre le droit. Force mécanique ou force numérique: c'est la même injustice draconienne à l'égard d'une minorité qui doit sans doute, en certaines matières économiques et administratives, subir de bon gré, l'influence prépondérante du parti le plus nombreux, mais qui ne peut ni ne doit renoncer à certains droits imprescriptibles et à certaines libertés inaliénables. "Je soutiens, s'écriait Montalembert[2] se faisant l'avocat d'une catégorie de citoyens opprimés, je soutiens que s'il ne restait en France que cinquante catholiques, leurs droits, leurs croyances, leur autorité paternelle ne devraient pas être moins inviolables qu'à l'époque où le pays et ses lois étaient leur domaine exclusif."[3]

Voilà la voix de la justice, de la vérité et du bon sens.

Nous avons cru à notre tour utile d'aborder en quelques brèves considérations ce sujet des droits inviolables. Et nous estimons que c'est en revenant à la vraie notion du droit que les sociétés ébranlées retrouveront l'équilibre et la paix, que les lois humaines se feront plus équitables, que les chefs et les hommes d'Etat garderont la foi jurée et verront dans les familles diverses et les groupements légitimes dont se composent les nations, non de simples rouages d'un mécanisme aveugle et puissant, mais des foyers de vie qu'il faut protéger en les respectant et des forces et des influences qu'il faut gouverner sans les briser.

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[1] Cf. Vallet, *Le Kantisme et le Positivisme*, pp. 299 et suiv.

[2] *Discours*, t. I, p. 10.

[3] "Les devoirs publics obligent celui qui préside aux destinées d'un peuple d'en promouvoir la nationalité et l'indépendance en conservant à chacun ses droits." (Taparelli, *ouv. cit.*, t. IV, p. 375).

La Sépulture d'Etienne Brulé.

PAR JULES TREMBLAY.

(Lu par M. D. DE CELLES, à la réunion de mai, 1915.)

Ce que les meurtriers hurons de la tribu de l'Ours ont épargné des restes d'Etienne Brulé, lors du festin anthropophagique de juin 1633 à Toanché, repose encore dans la petite fosse simple que les *aiheondé* creusèrent en un bois de *la Pointe*, fosse aujourd'hui cachée sous le terreau d'une ferme occupée depuis peu par MM. Antoine et Constant Grozelle, moitié est du lot No. I, XVIIe concession du township de Tiny, comté de Simcoe, où le défrichement et les labourages ont révélé l'existence d'un emplacement de village huron.

Contrairement à la tradition ouendate de la *Fête des Morts*, la dépouille de l'interprète n'a jamais été levée pour être placée dans l'ossuaire commun, selon le rite observé *de douze en douze ans* pour tous les ossements inhumés ou ensevelis dans l'intervalle, et elle gît à quelque mille de l'endroit où Brulé arrivait en 1610 dans le canot d'Aénons.

Etablissons d'abord le lieu où notre coureur des bois fut mis à mort, et nous verrons ensuite la date de son exécution, les raisons possibles de la condamnation, et les motifs qui peuvent nous porter à croire que la découverte prochaine de la sépulture, comme conséquence de recherches méthodiques, n'est pas une utopie.

Nous emprunterons souvent aux *Relations des Jésuites*, édition de Cleveland, à l'*Histoire du Canada* de Sagard, édition Tross, aux *Oeuvres* de Champlain, édition Laverdière, ainsi qu'aux travaux modernes du P. Arthur-Edward Jones, S.J., *Old Huronia*, et d'Andrew-Frederick Hunter, *Huron Village Sites*, et *A History of Simcoe County* Les rapports archéologiques et les archives de la province d'Ontario, les levés topographiques et les arpentages faits pour le gouvernement fédéral, ainsi que notre correspondance personnelle touchant les fouilles de ces années dernières, serviront à appuyer nos observations et à confirmer quelques-unes de nos conjectures.

UNE INDICATION DU PÈRE DE BRÉBEUF.

Jean de Brébeuf revenait en Huronie dans l'été de 1634, après une absence de cinq ans. Sa relation nous dit (Vol. VIII, pp. 88-90-92):

J'arrivé aux Hurons le cinquiefme d'Aouft . . . ayant demeuré trente iours par les chemins, quoy que d'ordinaire le voyage ne foit que de 20 iours ou enuiron *Ie pris terre au port du Village de Toanché*—90—ou de Teandeouihata, *ou autresfois nous* *eftions habituez;* mais ce fut auec vne petite difgrace. . . . Mes Sauuages . . . m'abandonnèrent là tout feul, fans viures ny fans cabane, & reprindrent leur route vers leurs villages, diftans de quelques fept lieues; le mal eftoit que le village de Toanché *auoit changé depuis mon départ,* & que ie ne fçauois pas bonnement en quel endroict il eftoit fitué, & que ce *riuage n'eftant plus hanté,* ie ne pouuois pas bien m'affeurer du chemin. . . . (92) Après aiant confidéré que cet abord eftoit défert, & que i'y pourrois bien demeurer long temps, auant qu'aucvn du village m'y vint trouuer; ie caché mes paquets dedans le bois, & prenant auec moy ce que i'auois de plus précieux, ie m'en allé chercher le village, *que ie rencontré heureufement enuiron à trois quarts de lieue, ayant en paffant* veu auec attendriffement & reffentiment le lieu ou nous auions habité, & célébré le S. facrifice de la Meffe trois ans durant conuerty en vn beau champ; comme auffi la place du vieux village, où excepté vne cabane rien ne reftoit que les ruines des autres. *Ie vis pareillement l'endroit où le pauvre Eftienne Bruflé auoit été barbarement & traiftreufement affommé* . . .

Cette citation démontre qu'il existait un *port* à l'usage de Toanché; que ce port n'était plus habité en 1634, mais qu'il était encore fréquenté; que l'ancien village, y compris la *résidence* des Récollets et des Jésuites (1629) était, sauf une cabane, remplacé par un champ; que Brulé avait été massacré à Toanché même; que le second Toanché se trouvait à environ trois quarts de lieue de l'atterrissage, et que le voyage de Québec en Huronie prenait d'ordinaire une vingtaine de jours. De Brébeuf confirme ailleurs cette durée (Vol. X, p. 88): *il vous faut attendre à eftre trois ou quatre femaines par les chemins tout au moins.* Le P. Chatelain faisait en 1637 un voyage beaucoup plus rapide (Vol. XIII, p. 20), et le missionnaire Du Perron restait vingt-cinq jours en route (Vol. XV, p. 150).

Toanché possède plusieurs noms. C'est le *Saint-Nicolas* du P. Viel, *autrement dit Troenchain* (Sagard, Hist., t. II, p. 413); *Toenchen* (id., t. I, p. 78); *Toenchain* (ib., t. III, p. 723); *Toanchain* dans la lettre du P. de Daillon (Sag., t. III, p. 809) et, comme on vient de le voir dans Brébeuf, *Teandeouiata.* Le P. Martin et l'Abbé Laverdière, plus récemment le P. Jones, ont identifié le Toanché d'avant la prise de Québec (1629) avec *l'Otouacha* de Champlain. Ce dernier écrivait (pp. 26-27, t. IV, Oeuvres):

. . . nous arriuafmes en la contrée des Attigouantan (*tribu de l'Ours*), à vn village appellé *Otouacha,* qui fut le premier iour d'Aouft, ou trouuafmes vn—27—grand changement de païs, ceftuy-cy eftant fort beau, & la plus grande partie deferté, accompagné de force collines, & de plufieurs ruiffeaux qui rendent ce terroir aggréable. . .

La description donne une assez bonne idée du voisinage de la baie de Penetanguishene, où les collines, les ruisseaux, les arborescences, sont bien propres à *rendre ce terroir aggréable;* mais cela ne suffit pas. Toute autre région de la péninsule eut été cependant trop éloignée des bourgs dont Champlain donne les distances par rapport à Otouacha. D'aucuns ont voulu placer le village sur la baie du Tonnerre, mais sa relation avec les autres bourgades de l'Ours détruit la possibilité d'une semblable supposition. Otouacha était à une lieue seulement de Carmaron (Champ., IV, 27). Jones croit que le découvreur a mal épelé *Karenaron*, et il dit pourquoi (Old Huronia, pp. 58-59), Karenaron devient *Karenhassa* d'après les Racines et la Grammaire huronnes de Potier, et signifie *L'endroit où sont disséminées plusieurs cimes d'arbres*. Karenhassa était à quelques milles seulement du Toanché des Relations. Or la présence du P. de Brébeuf et des Récollets en cet endroit, des 1626, nous permet d'identifier Toanché avec Troenchain. Si Otouacha veut dire *Le double atterrissage*, et Toanché, par contraction du mot précédent, *Un bon atterrissage* (Old Huron., pp. 60-61), selon les mêmes racines et la même grammaire, il est assez probable que le village du P. Viel, en 1626, était le même qu'Otouacha, ou du moins son successeur immédiat; car les emplacements de village changeaient de dix en dix ans (Rel., XV, 152), quand les besoins de l'agriculture, du combustible ou de la défense l'exigeaient (Champ., IV, 75). Toanché était à trois quarts de lieue de Karenhassa, comme Otouacha se voyait à une lieue (de Champlain) de Carmaron. Jones affirme que la lieue de Champlain était plus courte que celle des Jésuites; il attribue trois milles anglais à la mesure des Relations et un peu plus de deux milles et demi à la lieue du fondateur de Québec; le calcul donne dans les deux cas un résultat identique.

LE TRIANGLE DE SAGARD.

Alexander Fraser publiait en 1908 son cinquième rapport annuel des Archives d'Ontario, contenant l'érudit travail du P. Jones, *8endake Ehen*, ou *Old Huronia*. La lumière se faisait enfin sur les théories lancées depuis une cinquantaine d'années au sujet de Toanché, et pour la première fois le triangle de Sagard était logiquement utilisé au moyen d'une opération trigonométrique. Le Récollet dit dans son Histoire du Canada (Vol. I, pp. 206-7):

Il fe paffa vn affez long-temps apres mon arriuée auant que i'euffe aucune cognoiffance, ny nouuelle du lieu où eftoient arriuez mes confrères, iufques à vn certain iour que le Père Nicolas accompagné d'vn Sauuage, me vint trouuer de fon village, qui n'eftoit qu'à cinq lieues de nous . . . (207) . . . Le lendemain matin nous prifmes refolution le Père Nicolas et moy auec quelques François d'aller trouuer le Père Iofeph à fon village efloignez du noftre de 4 ou cinq lieues, car Dieu nous auoit fait la grace que fans l'auoir prémédité nous nous mifmes à la conduite de trois perfonnes, qui demeuroient chacun *en vn village, d'égale diftance les vns des autres, faifans comme vn triangle.*

Sagard habitait Tequieunonquayaé, appelé la Rochelle par les Français, à cause du port et des défenses naturelles de la bourgade.

La Rochelle est plus tard identifié par les Jésuites avec Ossassané. Le P. Martin a été le premier à placer cette localité à Point Varwood, emplacement dont l'exactitude n'est plus mise en doute depuis les observations topographiques et les fouilles archéologiques nombreuses faites dans le voisinage . Le P. Le Caron, premier missionnaire venu en Ontario, habitait au temps de Sagard le triple bourg de Khinonascarant, voisin de Carhagouha. Le P. Viel était, comme on l'a vu, à Toanché. Sagard ne prétend pas préciser en donnant ses distances, car il n'a pas encore franchi l'étape entre son habitat et Toanché ou Khinonascarant. Mais plus tard les Jésuites feront des voyages fréquents à ces diverses bourgades, et pourront ainsi supputer les trajets parcourus. L'erreur n'est pas forte si l'on tient compte des sinuosités des sentiers indiens, qui suivent les hauteurs de préférence aux vallées, des accidents de terrain, des obstacles offerts par les nombreux cours d'eau; et l'on ne doit pas oublier, en consultant *Old Huronia*, que Jones mesure à vol d'oiseau. Quatre surrections maîtresses traversent Tiny du nord au sud; elles sont séparées par de larges vallées parallèles arrosées de ruisseaux et de rivières, de sources et de lacs (Hunter, Tiny, pp. 5-6). Les triangulations de Jonse, observées sur une carte topographique de 1838, à l'échelle de quarante chaînes au pouce, dont nous avons un prussiate en main, se confirment presque exactement partout. Pour le triangle de Sagard, nous trouvons; d'Ossassané à Khinonascarant, neuf milles; d'ici à Toanché, dix milles; de Toanché à Ossassané, troisième côté, neuf milles et une légère fraction.

On confirme aussi l'emplacement donné par Jones à Toanché au moyen d'Ihonatiria et de son éloignement des autres villages de Huronie, en prenant Point Varwood, Ossassané, comme base établie d'après les repères fixes de Teanaostaiaé et de Sainte-Marie-sur-Wye (Saint-Marie I). Au retour du P. de Brébeuf, la tribu de l'Ours formait la moitié de la population ouendate; elle avait neuf villages dans la Pointe proprement dite: Teandeouiata, ou Toanché II, bientôt abandonné; Oenrio, né du démembrement de Toanché I au printemps de 1633; Anonatea, Khinonascarant, Onnentisati, Arontaen, Arenta, Touaguainchain, et Tondakhra. Ihonatiria était fondé en octobre 1634, et se grossissait plus tard à même une partie des populations de Teandeouiata et d'Oenrio, qui *allaient se cabaner autour d'Echon*, nom huron du P. de Brébeuf. Arontaen ou Karontaen occupaient l'emplacement de Carhagouha, le fort à *triple palissade* de Champlain, ou le voisinage immédiat. Dès 1626 ce fort était réduit à fort peu de chose. Khinonascarant avait alors englobé un fort effectif des Carragouhains, et le lieu où le P. Le Caron célébrait en 1615 la première messe en Ontario, le 12 août, s'était par la suite rapidement dépeuplé pour des raisons que la destruction par le feu des manuscrits du Récollet nous empêche de connaître aujourd'hui. Les Jésuites ne disent rien de cet exode. Khinonascarant revient pourtant assez souvent dans les Relations. Jones le place, à l'aide du triangle de Sagard, entre Dover ou Cedar Point et Point Cockburn, près du détroit qui sépare la péninsule, appelée la Pointe, de l'île des Chrétiens-*Ahouendoe*, dont on a fait Christian Island, et à l'ouest des lots 21, XVIIIe et XIXe concessions (Old Huronia, 272). Ces lots sont à deux lieues de Todd's Point, en ligne droite.

Toanché semble avoir été longtemps le débarcadère et l'habitacle favori des Français, certainement jusqu'à la fondation d'Ihonatiria. Brulé vivait avec la famille d'Aénons, chef de bourgade, puis plus tard chef de toute la Pointe. Lors d'un Conseil franco-huron tenu à Québec en 1633, les autres villages se plaignent de la faveur accordée à Toanché (Rel., VIII, 50):

. . . il fembloit neantmoins, que les François n'aymoient qu'vne feule de leurs Bourgades, puifque tous ceux qui montoient en leur Pays la prenoient pour leur demeure. . . . .

Mais la tribu de l'Ours, ou mieux encore Toanché, conserve une fois de plus son avantage (id., V. 254):

Bref les hõmes du village où auoient demeuré nos Pères s'adreffans au Père Brébeuf, luy dirent, ouure nous tõ cœur, ne cache rien, où veux tu demeurer en noftre païs. Veux tu eftre dans nos cabanes, ou en auoir vne à part. I'en veux auoir vne à part, dit le Père. Hé bien, repartent ils, nous irons tous nous cabaner à l'entour de toy, nous nous fommes féparés, & auons rompu noftre village à la mort du François qui a efté tué en noftre païs: chacun s'en eft allé qui deça qui dela.

De Brébeuf nous dit qu'il s'embarqua avec les gens de la Roche, domiciliés vers le lac Simcoe, mais tous descendirent au *port* de Toanché. Plusieurs autres indices de préférence se trouvent encore dans les Relations (IX, 288):

. . . s'ils auoient du cœur et de l'amour pour nous, ils nous témoigneroient autant d'affection qu'auoit fait cette Bourgade d'où eftoit Satouta.

On revoit à peu près la même chose pages 286 et 290 du même volume. Une fois rendu à Toanché II, de Brébeuf apprend que le feu a détruit deux fois le village de son hôte, et que dans chaque cas la cabane d'Aouendohié a été seule épargnée (VIII, 92); cela n'empêche pas le missionnaire d'affirmer qu'il a *vu l'endroit* où Brulé a été assommé, car il devait connaître exactement la disposition du village.

UN REPÈRE IMPORTANT.

Ihonatiria, établi tout près de Toanché II, était au bord du lac Huron, et non pas à l'intérieur des terres, comme quelques historiens on voulu le faire croire. D'ailleurs, les Relations sont précises sur ce point:

Le neufiefme (juin 1636) aborda *icy* vn Sauuage mort fous les glaces (X, 82).

Nous fommes fur le bord d'un grãd Lac (id., 102).

Il eft vray que vous ne ferez plus au bord du Lac pour receuoir les paquets qu'on vous enuoyera (242).

Jones cite la Relation de 1637, dans laquelle il est question de l'*Insula Ondiatana*, que Ducreux place exactement à l'endroit où se trouve aujourd'hui Giant's Tomb, droit en face de la baie Sawlog, formée par la péninsule de Todd's Point. Ondiatana signifie *L'Ile en face de nous*, ou *présente à notre vue*, ou *devant notre Pointe*. (Old Huron., 28-29-30). Le même auteur traduit Ihonatiria *Le petit Hameau au-dessus du Canot Chargé* (id., 185-187), l'escarpement dominant l'atterrissage. Or le lot 6, concession XXI, occupe une falaise qui surplombe une belle et spacieuse baie à fine grève, à l'est immédiat de Todd's Point, en face de Giant's Tomb. La photographie publiée par Jones accuse nettement les contours de la carte topographique de 1912, Ministère de l'Intérieur, et de celle de 1838. Le *port* de Toanché est à quatre milles à vol d'oiseau de ce dernier endroit, selon Jones. Or il existe un vieux sentier conduisant de la baie Sawlog au lot A de la XVIe concession. Ses tronçons se perdent en partie dans la forêt, mais la présence d'un bout de ce sentier dans le lot No. 1 de la XVIIe concession permet de corriger la solution de continuité. Jamais le langage figuré des Sauvages, les indications précises des Relations, la carte de Ducreux et les fouilles ne pouvaient mieux confirmer, avec la topographie du lieu, cet emplacement de Jones Des découvertes ont été faites dans le sentier qui mène de la baie Sawlog aux hauteurs de Tiny (Ont. Archæological Report, 1913, p. 39), et passe sur la falaise d'Ihonatiria. Aux trois quarts du chemin à peu près, entre le lot A, XVIe concession, et la baie Sawlog, Jones établit Teandeouiata, *Devant la Pointe de Sable* (Old Huronia, p. 56), nom bien approprié à un village qui se trouverait ainsi en ligne avec la dune de sablon qui domine l'entrée de la baie de Penetanguishene. Le P. Martin a fait une bonne aquarelle de ce goulot en 1855.

Les triangulations ont été basées sur deux repères fixes: Saint-Joseph II, ou Téanaostaiaé, où l'on a découvert dans les cendres le crucifix de la mission incendiée par les Iroquois après le martyre du

P. Daniel (Old Huronia, 21-22-250), et les ruines du fort Sainte-Marie I, township de Tay (id., 8). Jones a pris les distances entre ces deux endroits et Point Varwood, où Martin et Laverdière fixaient l'emplacement primitif de la Rochelle, et il a créé un troisième repère en consultant la description des fortifications naturelles de la bourgade; ce procédé reconstituait le triangle de Sagard en rétablissant Khinonascarant et Toanché—Jones n'attendait plus que la confirmation des fouilles.

LES DÉCOUVERTES ARCHÉOLOGIQUES.

Andrew-Frederick Hunter, secrétaire de la *Ontario Historical Society*, a parcouru vingt ans le comté de Simcoe et relevé plus de quatre cents ossuaires, emplacements de villages hurons, et caches de reliques françaises ou sauvages. Ses travaux ont rendu de grands services aux chercheurs, et les fouilles qu'il a consignées ou vérifiées ont facilité les études analytiques. On peut lire ces monographies dans les annexes aux rapports du Ministre de l'Instruction publique, années 1899, 1902, 1903, 1904 et 1907. La plaquette sur Tiny comporte quarante-deux ossuaires et emplacements de villages (1899, publiée séparément, édition épuisée, très rare). L'allotissement des terres, les levés topographiques officiels, la résurrection des sentiers indiens près des ruines, expliquent les notes de Hunter, ainsi que les recherches postérieures de Jones. La route militaire de Penetanguishene, construite en 1819 par le Génie, n'est qu'un sentier huron élargi, allant du lac Simcoe à la baie de Penetanguishene. Les itinéraires indiqués dans les Relations revivent aujourd'hui pour la plupart, en tronçons retouvés çà et là. Le chemin qui passe à la ferme Grozelle cache un sentier de l'époque huronne.

La plus importante découverte, au point de vue des débuts français en Ontario, est celle que MM. Grozelle ont faite sur leur ferme, tout récemment. En défrichant et en labourant, ces cultivateurs ont fait surgir d'une superficie de trente acres l'emplacement d'un village huron. Ce renseignement nous arrive de M. Louis Gignac, maire de Penetanguishene. Or un village huron, dans cette partie de la Pointe, ne saurait être étranger au premier Toanché. Les Relations ne disent nulle part qu'on ait construit sur les ruines de la bourgade où Brulé fut mis à mort; et la superstition huronne, si souvent en cause dans les récits des Jésuites au sujet des représailles posthumes de l'interprète, nous font comprendre pourquoi il est fort probable que les Ours n'ont jamais habité cet endroit après 1633. Oenrio était plus à l'ouest, sur le parcours d'Ihonatiria à Onnentisati. Anonatea était encore plus loin vers le Couchant. Karenhassa longeait la rive entre la baie de Penetanguishene et

Ihonatiria. Otouacha était au bord de l'eau, dans la concavité du Triangle Redoubt de l'occupation militaire.

Lorsque les fouilles s'accordent avec les Relations, les triangulations et les prévisions raisonnées de Jones, le doute nous semble impossible. Ici, des bouts de palissade; là, des fragments de poterie, des pétunoirs hurons, des amas de cendre régulièrement alignés, des ossuaires, des tomahawks, des anneaux portant le chiffre *I.H.S.* surmonté de la Croix, des colliers—tout contribue à rétablir les jalons. Ces concordances ont déjà donné l'emplacement de Carhagouha, où le P. Le Caron célébrait, le 12 août 1615, la première messe dite en Ontario: lot 20, XVIIe concession de Tiny, ferme de M. Philias Beaupré, beau-frère du curé actuel de Lafontaine, M. L'abbé P.-J. Brunelle. La ferme Beaupré était occupée par M. Télesphore Desroches en 1898, lors des voyages de Hunter. La grosse moitié de la Pointe fait partie de la paroisse de Lafontaine. M. l'abbé Brunelle est né sur une ferme qui occupe le lot 22.

Ce qui précède confirme suffisamment, croyons-nous, les prévisions et les précisions de Jones, et l'on peut aujourd'hui définir comme suit la concordance des récits contemporains, des triangulations et des fouilles:

1. *Ihonatiria*, première mission fixe des Jésuites en Huronie, fondée par de Brébeuf en 1634; lot 6, concessions XX et XXI, Tiny, près du sentier qui monte de la baie Sawlog, à l'est de Todd's Point, au bord du lac Huron, devant Giant's Tomb; abandonnée en 1638.

2. *Toanché II* ou *Teandeouiata*, deuxième habitation du P. de Brébeuf au pays de l'Ours, lot 3, XIXe concession, appartenant à Charles McGibbon, propriétaire de scieries à Penetanguishene, à trois quarts de lieue du *port*.

3. *Toanché I*, premier domicile des Jésuites en Huronie; domicile de Brulé, lieu de sa mort et de sa sépulture; lot I, XVIIe concession, ferme de MM. Antoine et Constant Grozelle, sur laquelle on a découvert un emplacement de village huron; résidence du P. Nicolas Viel, Récollet, avant la prise de Québec.

4. *Otouacha, port de Toanché*, sur la falaise et sur la grève, lot A, XVIe concession, appartenant à Charles McGibbon; ici Samuel Champlain toucha terre le premier jour d'août 1615, avec Brulé, qui le guidait dans ce voyage.

Ces emplacements s'alignent entre Todd's Point et la réserve McGibbon. C'est sur le sol de la ferme Grozelle que Brulé, véritable découvreur de l'Ontario, fut assassiné, vingt-trois ans après son arrivée dans un pays qu'il connaissait mieux que tout autre Français de l'époque.

Et le berceau des découvertes
Fut le tombeau du découvreur.

L'ÉPOQUE DU MEURTRE.

La Relation de 1636 (Vol. X) raconte les démarches des Hurons de l'Ours au sujet de la translation des restes de Brulé. De Brébeuf dit là-dessus (p. 304):

Il nous propofa donc, fi nous ferions contens de leuer les corps des deux François qui font morts en ce païs, fçauoir eft de Guillaume Chaudron & Eftienne Bruflé, qui fuft tué il y a quatre ans. . . .

Consul-W. Butterfield s'est probablement basé sur cette donnée pour affirmer que Brulé mourut en 1632 (Brulé's Discoveries and Explorations, p. 120). M. Benjamin Sulte fait mourir l'interprète *vers* 1633 (Hist. des C.-F, t. I, p. 93). M. N.-E. Dionne se contente de dire que quelques années après s'être vendu aux Anglais en 1629, Brulé fut tué par un sauvage (Champlain, Makers of Canada, Morang, p. 203).

Il nous faut donc invoquer les Relations pour préciser. Les Français revinrent à Québec en 1632. Le P. Paul Le Jeune était avec eux. Il n'y eut pas de traite. L'année suivante, les bateaux des Cent-Associés parurent. Champlain reprenait possession de la colonie, le P. de Brébeuf se préparait à remonter en Huronie, et la traite allait se renouveler. Laissons la parole au P. Le Jeune (Vol. V, pp. 238-240):

Le 27. de Iuillet Louys de Saincte Foy furnommé des Sauuages Amantacha, duquel i'ay parlé cy deffus retourna vers le fieur de Champlain qui l'auoit enuoié au deuant de la groffe trouppe de Hurons qu'on attendoit de iour en iour: il en eftoit defia venu quelques canots en diuers iours, tanftoft fept ou huit, & tanftot dix ou douze à la fois, mais en fin le 28. de Iuillet il en eft arriué cent quarãte ou enuiron tout à la fois qui portoient biẽ cinq cens Hurons, d'autres difent 700 auec leurs marchã-difes.

Pourquoi Champlain envoyait-il Amantacha au devant du contingent huron ?

. . . Les Sauuages de l'Ifle & les Algôquains, qui font deux nations qu'on rencontre venant des Hurons à Kébec, les auoient voulu diffuader de venir iufques aux François, difans—240—qu'on leur ioueroit vn mauuais party à caufe de la mort d'vn nommé Eftienne Bruflé qu'ils auoient tué. . . .

La menace s'aggravait de circonstances mauvaises:

. . . & qu'vn Algonquain de la petite nation aiant tué vn François, on l'auoit pris prifonnier, & que c'eftoit fait de fa vie, qu'on en feroit autant à quelque Huron.

Le gros des Hurons arriva donc à Québec le 28 juillet 1633 après des petits groupes qui s'étaient montrés de jour en jour. Amantacha était déjà venu le 2 (id., 224-226). Il savait la mort de Brulé, car une fois renvoyé par Champlain vers ses compatriotes, retenus chez les Algonquins, il leur parla avec autorité, leur faisant voir que les calomnies des gens de l'Ile étaient fausses (V, 240, Rel.):

Louys Amantacha se rencontrant là deffus affeura à ceux de fa Nation de la bienueillance des Frãçois, proteftant qu'il eftoit content qu'on le mit à mort au cas que les François ne leur fiffent pas très-bon accueil. Que pour Bruflé qui auoit efté maffacré, on ne le tenoit point pour François, puis qu'il auoit quitté fa nation pour fe mettre au feruice des Anglois.

Amantacha n'eut pas joué sa vie s'il n'eut été rassuré par Champlain sur les conséquences possibles du meutre.

DURÉE DU VOYAGE.

De Brébeuf dit que le voyage prend d'ordinaire une vingtaine de jours. Des Hurons revinrent en 1637 avec le P. Chatelain trois semaines après leur départ d'Ihonatiria, ce qui abrège énormément l'indication précédente. En 1633, l'état des cours d'eau était propice au canotage rapide; l'ordre des chemins hâtait les portages. Amantacha, parti de Québec le 5 juillet, revenait le 27 après avoir remonté jusqu'à l'île aux Allumettes, devançant le gros des Hurons d'une journée. Trois semaines ont certainement suffi à ce bon pagayeur pour descendre du lac Huron à Québec, étant données les conditions du voyage et la hâte du converti à dénoncer des meurtriers qui n'appartenaient pas à sa tribu. Amantacha était de la Corde. Toanché appartenait aux Ours. Les tribus se jalousaient. Le P. Le Jeune dit que Louis était arrivé le 2 et s'était confessé le 4 juillet. Il partait le lendemain en mission pour Champlain. Comptons vingt-et-un jours pleins, et nous sommes au 12 juin, date probable du départ des Hurons pour la traite. Amantacha prend la tête du cortège pour annoncer la venue des Sauvages. Comme il n'est pas de l'Ours, il n'a pas à craindre les représailles des Français pour le meurtre de Brulé. Il n'accorde donc aucune attention aux menaces des gens de l'Ile et continue sa route. Mais les autres Hurons, intimidés par l'astuce des insulaires, s'arrêtent; plusieurs même rebroussent chemin. Tous les Algonquins d'ailleurs s'employaient depuis des années à semer la discorde entre Français et Hurons pour conserver les avantages de la traite à leur bénéfice exclusif. Il faut qu'Amantacha dépêché par Champlain, insiste pour que les Ouendats reprennent leurs canots, surtout ceux de l'Ours.

Sagard et les Jésuites nous assurent souvent de la hâte excessive apportée par les Hurons à partir en voyage, soit pour la traite ou pour d'autres raisons. Exagérons ces renseignements, et donnons quatre jours aux préparatifs. Du 12, date du départ, nous remontons au 8 juin.

Aénons, accusé du meurtre, nous fournira lui-même un renseignement exact. Ce chef désirait réunir plusieurs villages en une seule bourgade, autour des Jésuites. Il en parle au P. de Brébeuf (Rel., Vol. X, p. 236):

. . . Les François ont toufiours efté attachez à moy, & m'ont aymé, ie les ay auffi toufiours affiftez en tout ce que i'ay peu, & n'ont pas trouvé en toutes ces terres de meilleur ami que moy: ce n'a pas efté fans encourir l'enuie de tout le Païs, qui m'en regarde il y a long temps de mauuais œil, & a fait tout ce qu'il a peu pour me mettre à mal auprès de vous; iufques là que, comme vous fçauez, *on m'a imputé la mort de Brulé*, & *incontinent après qu'il eut efté tué, quand il fut question de defcendre à Kébec*, on difoit haut & clair que fi i'y allois i'y laifferois la tefte.

Incontinent après qu'il eut été tué est précis. Nous sommes à la veille du départ pour la traite, avant le 12 juin, et comme l'action huronne est toujours rapide après décision prise, il n'a pas dû s'écouler plus de quelques jours entre l'embarquement et le crime. Il reste donc une marge de douze jours entre la mise en marche de la flottille et la mort de Brulé, plus de temps qu'il n'en faut pour les préparatifs, et pour nous trouver encore en deça de l'époque fixée par Aénons *incontinent* après la tragédie de Toanché.

Les Hurons, sévèrement fidèles à leur patrie, ne croient pas avoir mal fait en tuant un traître, et ils comprennent pourquoi Champlain n'hésite pas à les tranquilliser, un peu plus tard, par la bouche de son délégué, Amantacha. La certitude de l'impunité complète les amène en groupe le 28 à Québec.

Nous croyons qu'Etienne Brulé a été assommé et mangé au cours de la *première* semaine de juin 1633.

BRULÉ À ÉTÉ CONDAMNÉ PAR UN CONSEIL.

Le Frère Gabriel Sagard raconte la mort d'Etienne Brulé. Les circonstances lui en étaient certainement plus familierès que ne le comporte son bref récit (Hist., t. II, p. 431-432)

A la fin ce fortuné Bruflé a efté du depuis *condamné à la mort, puis mangé par les Hurons*, aufquels il auoit fi long-temps feruy de Truchement, & le tout pour une hayne qu'ils conceurent contre luy, pour ie ne fçay qu'elle faute qu'il commit à leur endroit, & voila comme on ne doit point abufer de la bonté de ces peuples, ny s'affeurer par trop à leur patience, pour ce que trop exercée elle fe change en furie, & cefte furie en defir de vengeance, qui ne manque iamais de trouuer fon temps. Il y auoit beaucoup d'années qu'il demeuroit auec eux, viuoit quafi comme eux, & feruoit de Truchement aux François, & après tout cela n'a remporté pour toute recompenfe (432) qu'vne mort douloureufe & une fin funefte & malheureufe; ie prie Dieu qu'il lui faffe mifericorde, s'il luy plaift, & aie pitié de fon ame.

L'oraison funèbre n'est pas longue, mais elle comporte au moins de la pitié envers un malheureux dont le Récollet lui-même avait eu à se plaindre. Champlain nous dit en effet que Sagard, de retour à Québec en 1624, après une année de séjour aux Hurons, était mécontent de la conduite de certains Français montés dans la région, et surtout d'Etienne Brulé, qui recevait alors cent pistoles par an pour (Oeuvres, VI, 81):

inciter les Sauuages à venir à la traicte, ce qui eftoit très mauvais exemple d'enuoyer ainfi des perfonnes si maliuuans, que l'on euft du chaftier féuèrement, car l'on recognoiffoit cet homme pour eftre fort vicieux & adonné aux femmes.

Si nous prenons le récit de Sagard à la lettre, il s'agit ici d une simple exécution. Le mot *condamné* évoque, dans les mœurs huronnes, la comparution devant un Conseil. Or il fallait que le crime fût d'ordre public pour que le Conseil s'en occupât; il devait être très grave pour que la sentence comportât la distribution des membres du supplicié en un festin anthropophagique, ce dernier rite s'observant pour tirer vengeance d'un ennemi de la nation, après les tortures traditionnelles (Rel., VI, 244). Mais la dépouille d'un ennemi public subissait le sort réservé aux cadavres des sorciers exécutés; elle était brulée et les cendres en étaient jetées au vent (Rel., XIV, 36). Nous savons formellement que Brulé a été enterré, puisque le Conseil de la Fête des Morts, tenu à la Rochelle en 1636, proposa au P. de Brébeuf de lever le corps de Brulé avec celui de Chaudron (Rel., X, 304), tous deux inhumés dans les bois (id., 306), et de les placer dans l'ossuaire commun. Il y a donc contradiction entre les coutumes et la conduite des Hurons à l'égard de Brulé. Brébeuf nous dit que l'interprète avait été *traîtreusement* assassiné (VIII, 92). Si le meurtre eut été le fait d'un particulier, à la suite d'un songe, ou pour d'autres raisons d'ordre privé, la victime n'aurait pas été mangée. Une vengeance personnelle aurait été punie par les chefs, surtout par Aénons, hôte de Brulé. On satisfaisait d'ordinaire à un meurtre au moyen de présents offerts aux parents de la victime (Rel., VIII, 122; X, 214-222). Le meurtre pur et simple d'un Français, à une époque où la traite allait rouvrir, pouvait entraîner des conséquences sérieuses pour le village, la tribu, même la race, qu'on ne manquerait pas de tenir responsable. Il n'y eut ni présents offerts aux Français, ni représailles de la part de ces derniers. Ni les coutumes ni les lois n'exigèrent de réparation. Champlain avait pourtant décrété que l'Algonquin de la Petite Nation, convaincu de l'assassinat d'un Français *qui ne lui avait fait aucun tort*, méritait la corde (Rel. VI, 6).

Champlain, les traitants, et même les missionnaires, perdaient un précieux auxiliaire dans la personne de Brulé, mais le silence se fit sur toute l'affaire. Les coupables étaient-ils trop importants pour être punis, ou la victime trop infime ? Un soupçon n'a jamais quitté l'esprit des Jésuites (Rel., XII, 86):

Ce Capitaine (Aénons) *eft l'un de ceux qu'õ croit qui ont tué ce miferable Bruflé,* dont les plaies font encores toutes fanglãtes, mais *il a tellement réparé cefte faute* par l'affection qu'il a depuis porté aux François, que Notre Seig. luy a faict la grace de venir mourir en Chreftien entre nos bras.

Aénons avait lui-même amené Brulé en Huronie (Rel., X, p. 308):

Le Maiftre de feftin de la Rochelle dit là deffus par condefcendance, que pour luy il n'y prétendoit rien, & qu'il eftoit content que l'autre, qui eft Chef de cette Pointe (Aénons), euft de fon cofté les corps de nos deux François. Celui-cy refpondit qu'il ne prétendoit rien à celuy qui auoit efté enterré à la Rochelle (Chaudron); mais que pour le corps d'Eftienne Bruflé il luy appartenoit, *que c'eftoit luy qui l'auoit embarqué & emmené en ce Païs.*

Aénons ne figure ni dans Champlain ni dans Sagard. On ne le voit pas non plus dans les Relations antérieures au retour des Jésuites à Québec. On sait cependant que ce Ouendat était un personnage important—chef d'Oenrio en 1634, chef de toute la Pointe en 1636. Les Sauvages ne portaient pas toujours le même nom (Rel., XVI, 202):

On me dit encor que les Sauuages changent fouuent de nom. On leur en donne vn en leur naiffance, ils le changent en l'aage viril, & en prennent vn autre en leur vieilleffe; voire mefme fi quelqu'vn eft bien malade, s'il s'echappe de cette maladie, il quittera parfois fon ancien nom comme s'il luy portoit malheur pour en prendre vn autre de meilleur augure.

Aénons protesta toujours de son innocence. S'il était coupable, on pourrait croire qu'il prévoyait l'impunité en se rendant à Québec (Rel., X, 236):

. . . ie n'en fus pas en la peine, & ceux qui s'attendoient de me uoir affommer furent bien eftonnez, quand ils virent l'honneur qu'on me fit; iufques là que quelques vns difoient, que puis qu'on traitoit fi fauorablement vn meurtrier, le vray moyen de fe faire aymer des François eftoit de fendre la tefte à quelqu'vn. . . .

Pour être seul coupable, il avait dû être poussé à bout par Brulé, mené audelà des bornes de la patience humaine, même de la patience huronne, si admirée de Sagard; car Aénons fut toujours empressé à l'endroit des Français. Il offrait son canot aux Jésuites pour transporter les nouveaux missionnaires à la Pointe (Rel., IX, 246). Il les traitait avec une courtoisie touchante (id., 250). Il se faisait l'avocat des Robes Noires dans les conseils de son propre pays, et même au plus fort des condamnations à mort prononcées contre tous les blancs lors de l'épidémie de 1636-37, il intercédait pour eux. Il fut baptisé le 6 août 1637 après un long postulat, par le P. Pijart, qu'il ramenait à Québec, et mourut aux Trois-Rivières des suites d'une indisposition prise en chemin, et négligée dans la hâte du voyage (Rel., XI, 134).

S'il était *l'un de ceux* qui tuèrent Brulé, Aénons devait avoir d'autres motifs que la vengeance personnelle. Les Sauvages embrassaient toute la tribu de l'Ours dans les accusations. Elle avait assassiné le Père Viel au Sault-au-Récollet, avec son disciple Auhaitsic (Rel. VIII, 238; X, 78), comme elle avait massacré Brulé. Les Algonquins voulaient dissuader les Jésuites d'aller en Huronie, surtout chez les Ours, et leur faisaient entrevoir un sort aussi misérable. Mais les Toanchains, connaissant ces rumeurs et ces médisances, considéraient la présence des missionnaires dans leur bourgade à l'égal d'un pardon (Rel., VIII, 98):

Bref ceux de noftre village me difoient, si tu ne fuffes reuenu, la traite des François eftoit perdue pour nous: car les Algonquains, & même les Hurons des autres villages, ne nous menaçoiẽt que de mort, fi nous y allions (à la traite), a caufe du maffacre de Bruflé; mais maintenant nous irons sãs crainte. . . .

Les Jésuites étaient comme otages dans la Pointe. Plus d'un Huron craignait d'être arrêté à Québec *pour ses fautes ou pour celles d'autrui*, mais une alliance nouvelle s'affirmait dans le retour des prêtres (Rel., VIII, 102-104). Champlain oublia tout. Son froid silence le prouve. Après la semonce donnée à son interprête, en 1629, il cesse de s'occuper de lui.

LA CONDUITE DE BRULE CHÉZ LES HURONS.

La mauvaise conduite de Brulé en Huronie est notoire. Il n'avait pas de piété, mais de fortes superstitions. Sa paillardise et son dévergondage étaient de nature à provoquer des plaintes. Venu avec le groupe de Rouen, dont on a dit tant de mal (Rel., XVII, 44; XX, 18; Champ., VI, 81), il avait les mœurs des premiers traitants et de leurs employés, gens pour la plupart sans aveu, qu'on retrouve soit chez les Français, soit encore dans les équipages des Kirkts, Rouennais qui prirent Québec pour le compte du roi d'Angleterre Citons un acte religieux de Brulé (Sagard, Hist., t. II, p. 430):

Il n'eftoit guere deuot, tefmoin ce qu'il nous dit un iour, que s'eftant trouué en un autre grand peril de la mort, pour toute prière il dit fon *Benedicité*.

Le père de Louis Amantacha, exhorté par de Brébeuf, disait au missionnaire (Rel., X, 62):

. . . les François qui auoient efté icy (Teanaostaiaé), ne leur auoient iamais parlé de Dieu, ains s'eftoiēt eux mefmes adonnez comme eux à courir & folaftrer auec les femmes.

De Brébeuf portera cette sentence sévère (id., 310):

Véritablement il y a dequoy admirer icy les fecrets iugemens de Dieu; car cet infame (Brulé) auffi bien ne méritoit pas cet honneur; & pour dire le vray nous euffions eu affez de peine à nous refoudre de faire à fon occafion vn Cimetiere particulier, & de tranfporter en Terre faincte vn corps qui a mené vne vie fi fcandaleufe dans le Païs, et donné aux Sauuages vne fi mauuaife impreffion des mœurs des François.

Qui n'a lu les remontrances de Champlain à son interprète? Le récit de la capitulation de 1629 fourmille de plaintes contre Brulé. Inconduite, irréligion, trahison, le fondateur reproche tout au transfuge. On prétendra peut-être que les Ours ont pris leur temps pour venger le Grand Oki en tuant celui qui l'avait vendu et qui leur avait par la même occasion fait perdre la traite. De 1634 à la dispersion de 1650, les Jésuites ont été plus de cent fois condamnés à mort comme sorciers, en plein Conseil; les Anciens ont poussé presque chaque jour la jeunesse au massacre des Robes Noires, mais les missionnaires ne s'en sont pas portés plus mal, la crainte du blanc était au fond de ces atermoiements.

UN ENNEMI DES HURONS.

Brulé, sans protecteur, sans amis, seul européen dans un milieu naturellement hostile, ne pouvait guère compter sur la *patience admirable* des Hurons, et encore fallut-il cinq ans de calomnies algonquines, de misère provoquée par la rupture de la traite, et enfin le retour des Français, pour établir un réquisitoire assez fort contre le truchement. A notre sens, la *cause* de Brulé commence en 1629. Les invectives de Champlain forment le premier chef d'accusation.

A la veille du départ des vaisseaux anglais pour Londres, Champlain, prisonnier des Kirkts, rencontra Brulé à Tadousac, et lui démontra l'horreur de sa conduite envers ceux qui l'avaient jusqu'alors nourri, vêtu, payé, généreusement comblé des dons du pays; envers la Patrie, qu'il avait lâchement vendue; envers la religion qu'il avait abandonnée pour accepter la facile conscience des nouveaux maîtres. Marsolet partagea ces reproches, et le fondateur laissa ce message suivant à ses traîtres (Oeuvres, VI, 267—1251):

. . . fi on vous attrappe vous qui eftes fuiets a vogayer, vous courez fortune d'eftre pris & chaftiez. . . .

sentence très grave dans un pays où Champlain était aimé à l'égal d'un Oki bienfaisant.

Louis Amantacha avait été témoin des adieux. Il remonta en Huronie avec Brulé peu après le démarrage des Kirkts, et ne manqua pas de raconter, avec enjolivures, ce qu'il avait vu et entendu. Ces aménités étaient de mise entre tribus jalouses les unes des autres. Champlain parti, la présence de Brulé à Toanché restait un incident banal; mais le retour des Français et, surtout, la réintégration de l'ancien gouverneur, changeaient la situation. Champlain pouvait demander compte à ses alliés de l'hospitalité accordée à un déserteur soudoyé. Brulé, repris par les Français, était passible de la peine de mort. L'avoir hébergé constituait une infraction réprouvée par l'alliance. Brulé, trahissant son maître, avait aussi trahi les Hurons en vendant Champlain, leur bienfaiteur, aux Anglais, alliés des Iroquois. Toanché avait droit de se protéger contre les représailles possibles du gouverneur, et comme la sentence de 1629 n'était pas oubliée, on tint conseil. Ne nous étonnons pas de ces délibérations. Elles sont quotidiennes chez les Hurons, et pour des sujets beaucoup moins graves. Deux hommes puissants avaient publiquement exprimé leur mépris à l'endroit de Brulé, deux Français aimés entre tous: Champlain, qui promettait un châtiment à l'interprète, puis Echon, le P. de Brébeuf, qui fustigeait vigoureusement et saintement toute irréligion. Ces *grands capitaines* allaient revenir incessamment, l'un pour reprendre l'administration du pays entier, l'autre pour recommencer ses prédications. Les Hurons jugeaient tout selon leurs coutumes. Ils vengeaient cruellement toute atteinte portée à leurs droits ou à leurs intérêts; ils devaient croire que la punition du traître serait formidable et qu'elle s'étendraient même à tous ceux qui avaient toléré sa présence chez eux. Le Conseil ne pouvait trouver qu'une solution, la mort. Pour excuser la décision, le festin anthropophagique démontrerait aux Français que le condamné avait été jugé comme ennemi de la nation et des alliés.

Brulé, convaincu de sorcellerie, eut été torturé, massacré, puis incinéré; sa dépouille n'aurait pas eu les honneurs de la sépulture. Un voleur encourait la bastonnade. Un débauché n'était pas condamné par un Conseil, la galanterie étant plutôt une qualité qu'un vice chez les Ouendats, malgré les objurgations des missionnaires. Le sacrilège n'existait pas dans un centre areligieux. Restait la trahison. Elle avait nui à Champlain, un ami précieux; elle avait fermé la traite à tous les villages; elle avait profité aux Iroquois, alliés des Anglais. Ces faits suffisent, croyons-nous, à justifier la conjecture suivante:

Brulé a été exécuté par des Toanchains sur décision d'un Conseil pour crime d'ordre public, ayant par sa présence en Huronie, après sa trahison manifeste, mis en danger les bonnes relations entre Français et Hurons, principalement ceux de l'Ours, et nui à l'alliance agréée par les deux peuples. Aénons présidait au Conseil.

L'exécution faite, le festin anthropophagique fini, les ossements épargnés furent enterrés près du village, dans les bois.

LA SÉPULTURE HURONNE.

En *rompant* leur village, les Toanchais fuyaient non seulement la scène de leur crime, mais surtout l'endroit où reposait *l'atisken*, âme des os de la victime (Rel., X, 140). Le meurtre n'était rien en lui-même dans l'opinion des coupables, mais la vengeance des mânes était probable, et les familles cabanées près de la fosse s'y trouveraient plus exposées. La peur des morts amena les Sauvages à établir leurs cimetières, temporaires ou permanents, en dehors des bourgades. Ils ignoraient absolument l'hygiène, et les théoriciens du *retour à la nature* ont tort de prétendre le contraire. Les cimetières étaient à une portée d'arquebuse des habitations, au temps de Sagard (Hist., III, 643), et une portée de mousquet au temps des Jésuites (Rel., X, Fête des Morts). Ces indications fixent à deux cent cinquante mètres environ l'éloignement des fosses par rapport aux cabanes. Gustave Voulquin donne une portée de deux cents mètres aux arquebuses et mousquets des débuts du XVIIe Siècle.

Les atisken allaient au *Pays-du-Soleil-Couchant* On enterrait les morts de façon que la tête fût tournée vers l'occident; l'âme voyait ainsi l'endroit où elle devait se rendre (Rel., XVI, 206). L'itinéraire atiskenien ne devait pas cependant traverser le village. En conséquence, les sépultures ne se faisaient jamais à l'est immédiat des habitations, car l'âme des os pouvait porter malheur aux cabanes qui lui fermaient passage vers l'Ouest. On ne sortait jamais un cadavre par la porte d'une habitation, mais par une ouverture pratiquée dans la cloison d'écorce à cette fin, tant le commerce des vivants et des défunts était influencé par la terreur, tant les chemins des corps et des âmes devaient différer.

Si la dispersion des Toanchains après le meurtre pouvait nous faire supposer que Brulé avait été enterré près du village, nous apprenons formellement l'existence de sa sépulture dans la Relation de 1636. Le P. de Brébeuf dit que l'Ours s'était réuni pour discuter la Fête des Morts, la plus sacrée des solennités régionales. Il s'agissait d'établir une fosse commune pour tous les morts de la tribu, mais quelques mutins de la Pointe n'y consentaient pas, disant qu'on avait autrefois *divisé la chaudière,* ou établi plusieurs fosses régionales, et que personne n'en avait souffert (Rel., X, 260-262) Voyons d'abord un incident antérieur à ce Conseil La Fête était alors à l'état de projet. Aénons vint voir Echon, au nom de tous les Anciens, durant l'hiver 1635-36, avant la division (Rel., X, 304)

Il nous proposa donc, ſi nous ferions contens de leuer les corps des deux François qui ſont morts en ce Païs, ſçauoir eſt de Guillaume Chaudron & Eſtienne Bruſlé, qui fuſt tué il y a quatre ans, & que leurs os fuſſent mis dans la foſſe commune de leurs morts.

Brulé était donc enterré.

Le missionnaire refusa la proposition du chef. Les deux Français étaient baptisés, probablement rendus au Ciel, et leurs os étaient trop dignes de respect pour être mêlés aux dépouilles des payens (id., 306):

Nous adioutaſmes neantmoins apres tout cela, que comme ils eſtoient *enterrés dans les bois,* & puisqu'ils le deſiroient ſi fort, nous ferions contens de leuer leurs corps à condition qu'ils nous accordaſſent de les mettre en vne foſſe particulière auec les os de tous ceux que nous auions baptiſez dans le Païs. . . . Nous prétendions les enterrer auec toutes les cérémonies de l'Egliſe. 4. Les Anciens de leur propre mouuement, deſiroient que nous y ſiſſions dreſſer vne belle & magnifique Croix comme ils nous témoignerent par après plus particulièrement. Quelque temps après la chaudière fut diuiſée & comme i'ay dit, cinq Villages de cette Pointe (308) ou nous ſommes, ſe reſolurent de faire leur feſte à part. . . .

Les notables de l'Ours se rassemblaient au printemps pour mettre fin au schisme. Echon était présent. La proposition d'Aénons fut renouvelée, mais comme la scission persistait, on pria le missionnaire de dire de quel côté il désirait faire enterrer Chaudron et Brulé. De Brébeuf laissa la décision aux soins du Conseil. Le maître de la fête de La Rochelle aurait volontiers cédé les deux Français au chef de la Pointe, Aénons. Ce dernier ne prétendait rien faire valoir quant à Chaudron, inhumé à Ossassané, mais il insistait sur le corps de Brulé. Quelqu'un remarqua charitablement qu'il avait bien droit en effet à cette dépouille, puisque sa bourgade avait assassiné le truchement. La querelle s'échauffa, et les deux corps furent abandonnés de part et d'autre (Rel., X, 310):

(Aénons) ſe deporta entierement du corps de Bruſlé, pour ne point aigrir & enſanglanter dauantage cette playe, de laquelle ceux de cette pointe n'ont peu encore ſe purger.

Ce qui nous fit auſſi reſoudre à faire trouuer bon à ceux de la Rochelle, que nous ne touchaſſions ny à l'vn ny à l'autre. . . .

Les restes de Brulé demeurèrent donc dans les bois. Les Relations ne disent nulle part qu'on ait levé cette sépulture. La prochaine fête des morts aurait dû se faire en 1648, mais à cette époque les incursions iroquoises, terminées deux ans plus tard par la dispersion complète des Hurons, avaient déjà sensiblement affecté les coutumes ouendates, et les gens de l'Ours, comme toutes les autres tribus, songeaient à trouver des moyens de défense contre l'invasion plutôt qu'à poursuivre des œuvres de paix.

OÙ IL FAUDRAIT CHERCHER.

Le sol de Toanché a-t-il pu garder une sépulture pendant trois cents ans ? Les monographies de Hunter et de Laidlaw sont sur ce point convaincantes. Le grand nombre des ossuaires découverts, la bonne conservation des ossements remis au Musée archéologique de Toronto, expliquent suffisamment cet aspect de la question. L'écoulement des eaux se fait rapidement dans le tamis de sable qui surjette le fond d'argile, et la succession rapide des plis anticlinaux et synclinaux de la région facilite le ruissellement, puis le drainage dans les nombreux cours d'eau. La saturation est impossible sur les hauteurs, où les villages de la Pointe étaient établis; elle est empêchée par l'ondulation du terrain et par le régime des ruisseaux, lacs et rivières dans lesquelles le surplus de la précipitation s'écoule. Hunter nous dit qu'on a retrouvé des peaux de castor assez bien conservées dans des ossuaires hurons.

Brûlé fut enterré seul. Ses ossements furent placés dans une enveloppe d'écorce et de peaux, au fond d'un trou d'environ quatre pieds de profondeur, selon la coutume huronne; il est probable que l'aiheondé, ou fossoyeur chargé des funérailles, plaça dans la fosse les armes du mort, ou quelque ustensile dont l'interprète faisait un usage fréquent. La seule autre sépulture simple de la région est celle de l'octogénaire *Tsindacaiendoua*, inhumé par les Jésuites à Ihonatiria, à plus d'une lieue de Toanché I (Rel., VIII, 136). La dépouille du converti est complète, la sépulture ayant été faite par des chrétiens; celle de Brulé ne l'est pas, ayant été enterrée par des payens après un festin anthropophagique. Le corps a été mangé, et les petits os ont dû être jetés au feu; mais le crâne, qu'on retrouvera fortement fracturé, est dans la fosse, avec le torse et les fémurs. Il n'est pas impossible de retrouver une petite croix avec les os. Brulé était chrétien, et les Toanchains ont dû lui laisser les rares objets de piété qu'il pouvait avoir; car il ne faut pas exagérer la dévotion de notre interprète. Il avait de bonne heure adopté les coutumes de ses hôtes, et même leur genre de superstition, témoin cette offrande de pétun au rocher fatidique de la rivière Mattawa (Sagard, Hist., II, 457).

Un simple hasard pourrait faire surgir cette sépulture sous le soc d'une charrue, mais nous croyons que les recherches méthodiques sont encore plus rapides. A notre sens, on recouvrera les os de Brulé, executé à Toanché en juin 1633, dans une bande de terre d'environ trois cents verges de largeur, autour des côtés sud, ouest ou nord des trente acres de ruines découvertes dans la ferme Grozelle, lot I, XVIIe concession de Tiny.

Relations de l'Eglise et de l'Etat.

PAR SON EMINENCE LE CARDINAL L. N. BÉGIN, M.S.R.C.
ARCH. DE QUEBEC.

(Lu à la réunion de mai 1915.)

L'Eglise est revêtue d'une autorité souveraine et indépendante. Reine des âmes, elle doit commander librement et être obéie librement: ainsi l'exige la nature de son gouvernement, qui est spirituel par essence et qui s'exerce au plus intime de l'âme. Mais si elle s'élève, par son aspiration et par son but, dans un monde bien supérieur aux intérêts du temps et aux passions des hommes, sa condition est cependant d'habiter au milieu d'eux. Elle n'est pas seule ici-bas; elle est la société de Dieu avec les hommes; à côté d'elle, dans les mêmes contrées, dans la même atmosphère, vivent et grandissent les diverses sociétés des hommes entre eux. La société religieuse et la société civile, l'Eglise et l'Etat, coexistent sur cette terre; les mêmes individus les composent, ou sont à la fois membres de ces deux sociétés: à chaque instant, des points de contact s'établissent entre eux; de là des relations nécessaires, inévitables.

Quelles sont ces relations entre l'Eglise et l'Etat? Voilà un problème absolument pratique, une question qui a fortement passionné les esprits dans notre temps et que le libéralisme religieux de l'Europe, suivant ses diverses nuances, a horriblement maltraitée et n'a su résoudre sans y mélanger de graves erreurs doctrinales.

Parmi les tenants de ce libéralisme, les uns prétendent que *l'Etat est tout* et que *l'Eglise n'en est qu'une dépendance, un organe.* D'autres soutiennent que l'Eglise et l'Etat forment deux sociétés complètement libres et séparées l'une de l'autre: de là la formule séduisante *de l'Eglise libre dans l'Etat libre.* D'autres enfin admettent que l'Eglise est indépendante de l'Etat et que l'Etat doit vivre en bonne harmonie avec l'Eglise, mais l'Etat, disent-ils, en tant qu'Etat, est absolument indépendant de l'Eglise et ne relève que de Dieu.

Voilà trois erreurs bien caractérisées auxquelles j'opposerai la démonstration des vérités suivantes:

1. L'Eglise, de droit absolu et divin, est indépendante de l'Etat;

2. Bien que l'Eglise et l'Etat soient parfaitement distincts, leur séparation est contraire à la raison et aux enseignements de la foi;

3. L'Etat jouit d'une indépendance véritable dans sa sphère; cependant cette indépendance n'est que relative, car dans l'ordre spirituel et dans toutes les choses connexes à la fin de l'Eglise, il lui est subordonné.

I.

La première erreur doctrinale qui se présente sur notre route est celle du libéralisme absolu, brutal. Elle consiste à affirmer que l'Etat est l'incarnation de la volonté générale, de la raison publique; que rien n'est au-dessus de l'Etat, que nul ne peut marcher de pair avec lui; que l'Etat est la justice suprême dont les arrêts sont irréformables, qu'il est le pouvoir souverain et sans contrôle, qu'il est la source d'où émanent tous les droits, qu'il est le droit par excellence renversant dans sa marche tous les droits individuels, domestiques et religieux.

Ces affirmations ne sont pas chimériques; elles retentissent à la tribune des parlements, elles se manifestent dans la conspiration journalière contre les libertés les plus saintes, dans la confiscation graduelle de tous les droits naturels et sacrés au profit d'un droit suprême, d'un Etat de pure fabrication humaine, dans l'absorption de toutes les personnalités par l'unique et exclusive personnalité de l'Etat, dans la main mise sur l'âme, sur le corps et sur les biens des peuples qu'on salue irroniquement du titre de souverains, mais qui sont taillables et corvéables à merci.

Evidemment un pareil système ne laisse plus de place pour une Eglise, société parfaite et indépendante. La religion n'est plus, alors, qu'un instrument de règne et le prêtre un salarié dont on achète la servilité. L'Eglise descend au rang d'une association civile, inférieure, qui tient de l'Etat son existence morale et dont l'Etat détermine et mesure les droits, en s'en réservant à lui-même le contrôle souverain. Les églises séparées acceptent sans rougir ce rôle humiliant; elles sont les domestiques de l'Etat: cela seul les juge.

Cette doctrine du libéralisme absolu est une doctrine d'impiété et de servitude. Doctrine d'impiété: en effet, elle nie la divinité de l'Eglise, sa mission divine, la fin suprême à laquelle elle conduit le genre humain. Elle ne tient aucun compte de l'ordre surnaturel et moral; elle est un pur matérialisme qui parle, qui agit, qui gouverne comme s'il n'y avait ni Dieu, ni âme, ni rédempteur, ni autorité spirituelle divinement instituée.

Doctrine d'impiété encore. En effet, quand J. C. vint en ce monde, la place était prise. Jésus-Christ se fit sa place d'autorité. Il ne mendia pas la liberté, il la prit: "*Toute puissance m'a été donnée. . . . . . . .Prêchez l'Evangile. . .*" Lui-même donne la constitution de son Eglise et en établit Pierre le chef suprême avec la charge de la gouverner. L'origine, la mission propre, l'objet essentiel, la fin suprême de l'Eglise, tout est nettement déterminé, rien n'est laissé à l'arbitraire. J. C. a donc institué une société parfaite, complètement organisée, une société qui tire son existence et ses droits non d'un décret humain, mais d'une institution positive et souveraine de Dieu. Là est le titre primordial de l'indépendance de l'Eglise.

On a invoqué souvent cette maxime équivoque: *L'Eglise est dans l'Etat.* Si l'on veut dire par là que les fidèles dont se compose l'Eglise doivent obéir dans l'ordre civil aux lois de l'Etat comme une partie subordonnée au tout, comme une corporation qui tient de l'Etat (de la souveraineté politique) son existence et ses droits, ou encore que l'Eglise est matériellement circonscrite dans les limites de l'Etat, cela constitue une grave erreur: car, de fait, l'Eglise franchit toutes les frontières et, en droit de son divin Fondateur, elle embrasse tous les temps, tous les lieux, tous les hommes; sa fin est la fin suprême à laquelle se rapportent toutes les fins secondaires et enveloppe dans une sphère plus haute et plus vaste la fin même de l'Etat. Il serait plus exact de dire que l'Etat est dans l'Eglise. On peut encore conserver la formule, si on l'explique de la manière de S. Thomas: L'Eglise est dans l'Etat comme l'âme est dans le corps, pour l'animer, le mouvoir, le diriger. L'âme qui donne au corps la vie, la beauté, la perfection, est-elle dépendante du corps, dans son existence et dans ses opérations, particulièrement dans celles qui lui appartiennent en propre ? Ce que Dieu a fait est bien fait: n'allons pas troubler cette hiérarchie des pouvoirs dessinée par le souverain Maître lui-même. Pour être, pour gouverner légalement, l'Eglise n'a pas besoin d'un mandat humain. Partout où elle entre, elle entre chez elle et avec tous les droits qui lui viennent de J. C. Nul n'a le droit de la regarder comme une étrangère et de l'évincer; elle n'est ni étonnée, ni troublée des sommations menaçantes qu'on lui a faites dans tous les siècles; elle poursuit paisiblement son chemin.

Un système qui ne tient aucun compte de Dieu, de l'âme, de ses destinées immortelles, qui limite les aspirations de l'homme à la sphère de la vie purement organique et matérielle, qui estime que donner aux convoitises, aux mauvaises passions une pâture de plus en plus abondante, constitue le principal souci du pouvoir de l'Etat, n'est-ce pas un système avilissant, dégradant ?

Un système qui prend pour règle de faire de la force la loi de la justice, n'est-il pas un système de pure servitude ? Dès que l'homme a pleine liberté de faire son devoir, dans toutes les sphères où peut se déployer son activité, dès lors tous ses droits, individuels, domestiques et religieux, sont sains et saufs. Mais si l'Etat fait prévaloir la loi du plus fort, tout rempart contre les envahissements du despotisme est abattu et par cette large brèche passent tous les esclavages. Peu importe que cette loi de la force soit issue de la volonté d'un seul, ou qu'elle jaillisse de l'urne électorale consacrée par des millions de suffrages, dès que la loi divine, naturelle ou surnaturelle, ne plane pas, respectée et inviolable, au-dessus de la grossière majesté du nombre, dès que l'âme ne peut pas sans entraves accomplir tous ses devoirs, dès qu'une main d'homme ou de peuple ou de majorité vient se poser sur la conscience de l'individu, prêtre ou père de famille, c'en est fait de la vraie liberté. Elle peut étinceler comme vaine et chatoyante étiquette au front des constitutions, mais elle n'est plus qu'un mensonge cruel jeté à l'humanité. Or, la liberté de l'Eglise, n'est-ce pas, en définive, la liberté trois fois sainte d'accomplir son devoir, d'atteindre sa fin, de sauver son âme, n'est-ce pas la liberté de Dieu sur la terre ?

De droit divin, l'Eglise est donc et doit être indépendante de l'Etat.

II.

Les modérés, qui ne veulent pas de la violence, rêvent un autre système, c'est celui de la *séparation de l'Eglise et de l'Etat. L'Eglise libre dans l'Etat libre*, telle est leur formule qu'ils expliquent de la manière suivante: L'Eglise et l'Etat marchent sur deux routes parallèles; à l'Etat les affaires temporelles, à l'Eglise les affaires spirituelles; chacun est libre dans sa sphère: l'Etat ne reconnaît pour tout ordre social qu'une seule *loi suprême*, la raison, ou, comme ils disent, l'opinion, l'opinion qui fait ensuite les autres lois par le chiffre mouvant des majorités. L'état peut faire abstraction de la religion surnaturelle et établit, d'après les données de la pure raison, sa constitution et sa législation; l'Etat, ayant sa fin propre—le bien temporel de la société—et les moyens suffisants pour l'atteindre, ne fait qu'user d'un droit en se posant en dehors du christianisme dans l'administration et la direction de la chose publique.

Or, ce principe est absolument faux; faux, parce qu'il ne tient aucun compte de la volonté positive de Dieu; faux parce qu'il fait violence à la nature des choses, en méconnaissant les devoirs essentiels et la fonction propre de l'Etat.

Quand Jésus-Christ envoie ses Apôtres prêcher l'Evangile, il ne les envoie pas à de simples individus, mais aux nations: *docete omnes gentes*, à ces nations qui lui avaient été promises en héritage: *et dabo tibi gentes in heareditatem tuam*, à ces nations auxquelles il assigne un rôle déterminé mais d'une exécution impossible, à moins qu'elles ne respectent la loi surnaturelle et ne s'y assujettissent. D'ailleurs, le simple bon sens ne suffit-il pas pour comprendre que le même Dieu qui impose aux individus la règle supérieure de la religion, ne peut regarder comme licite la sécularisation ou l'apostasie légale des sociétés, des Etats ? Aussi la nature des choses proteste-t-elle contre une pareille hypothèse. L'Etat n'est certainement pas la source de tous les droits et le syllabus pontifical, en condamnant la proposition contraire, a défendu la cause de la vraie liberté. Le premier devoir de l'Etat est de protéger des droits qui ne sont pas de sa création, qui dérivent de l'essence des choses ou de la volonté manifeste de Dieu, droits de l'individu, de la famille, de l'Eglise, de couvrir celle-ci de la majesté de ses lois, de l'autorité de sa justice, de la force de son épée, et d'en assurer le plein développement et le libre exercice. Ce n'est pas là une *fin*, mais c'est un *moyen*.

Procurer par sa puissance la paix temporelle coordonnée au bien suprême de l'homme, voilà la fin de l'Etat; donner à l'individu une aide, un secours pour accomplir sa destinée, voilà son rôle. D'où il est facile de comprendre que dans l'organisation de la chose publique, dans la législation, l'Etat doit nécessairement tenir compte de l'Eglise et des fins supérieures de l'humanité; il ne peut agir comme si l'homme n'avait point d'âme, comme si l'Eglise n'avait pas reçu de Dieu la charge de toutes les âmes, comme si l'Etat était tout et l'individu uniquement sa propriété, sa chose: ce serait là une grave erreur.

Sans doute, dans les sociétés bouleversées par les révolutions et où l'unité religieuse a été malheureusement brisée depuis longtemps, l'Eglise, pour éviter un plus grand mal et dans l'intérêt de la paix publique, accorde à l'erreur, dans une mesure plus ou moins large dont l'autorité spirituelle demeure juge, non pas un droit fondamental qui ne peut jamais appartenir au mensonge, mais une certaine tolérance, certains ménagements; elle allie la fermeté dans les principes à une juste condescendance dans les applications. Mais entre cette tolérance qui ne constitue pas une situation normale et le type chrétien auquel il faut ramener toute société, il y a un abîme et c'est cet abîme qu'un bon catholique ne veut ni ne peut franchir.

D'ailleurs cette séparation de l'Eglise et de l'Etat, fausse dans son principe, est pratiquement impossible. Comment voulez-vous que ces deux sociétés, gouvernant les mêmes sujets, surveillant les intérêts, différents sans doute, s'ignorent l'une l'autre, ne se rapprochent jamais, de manière que la séparation soit la loi même de leur existence? Ne voyez-vous pas que, si l'Etat est libre vis-à-vis de l'Eglise, il ne tiendra aucun compte des lois de l'Eglise et sera exposé à les violer à chaque instant? Et s'il les viole, s'il porte atteinte à sa constitution, s'il l'entrave dans l'emploi de ses moyens, dans l'obtention de sa fin, comment pourrez-vous dire que l'Eglise est libre?

Il est vrai que, dans certains cas, la protection des princes dégénérait en oppression et que l'Eglise a eu à en souffrir; mais de ce que des abus s'introduisent dans un système bon et voulu de Dieu, il s'ensuit qu'on doit travailler à obvier à ces abus, provenant de la malice de l'homme, mais non pas le rejeter pour en adopter un autre contraire au plan divin.

III.

Oui, disent nos adversaires, l'Eglise est indépendante de l'Etat; ou, bien que l'Eglise et l'Etat soient deux sociétés parfaitement distinctes l'une de l'autre, l'ordre demande leur union. Toutefois nous revendiquons pour l'Etat une indépendance absolue.

Il est facile de répondre et d'admettre que, dans les choses qui par elles-mêmes et directement, se rapportent au bien-être de la vie présente, comme les finances, le commerce, l'armée, l'administration de la justice, la paix publique, l'Etat est véritablement indépendant et peut agir en pouvoir suprême. Mais, dites-moi, l'Etat est-il tenu de conformer ses actes à la loi morale et surnaturelle ? Oui sans aucun doute. Quel est l'interprète authentique, le gardien officiel et le défenseur de la loi morale ? C'est certainement l'Eglise qui a reçu de Dieu ce précieux dépôt, avec la mission de le garder intact. Donc, si l'Etat pèche, s'il fait erreur, il appartient à l'Eglise de le reprendre et de le corriger.

L'objet propre et direct du pouvoir de l'Eglise, c'est le bien spirituel; mais par voie de conséquence et indirectement, elle peut intervenir dans les choses temporelles dont la gestion appartient en propre à l'Etat. Comme la grande fin de l'Eglise enveloppe toutes les fins secondaires, on comprend aisément comment l'Eglise, sans commettre d'usurpation, en vertu du pouvoir spirituel qu'elle tient de Jésus-Christ, peut élever la voix pour repousser les ambitions malsaines, pour flétrir les entreprises injustifiables, la tyrannie des chefs et les révoltes des peuples, pour infirmer et casser des lois attentatoires à la loi morale ou à la conscience chrétienne, lois que le Docteur Angélique appelle *des coups de force plutôt que de véritables lois.* "La puissance séculière, dit-il, est soumise à la puissance spirituelle, comme le corps est soumis à l'âme," ou, suivant la comparaison de Bellarmin, comme la chair est soumise à l'esprit. "Le pouvoir politique a ses chefs, ses lois, ses tribunaux, et le pouvoir ecclésisatique a également ses évêques, ses lois, ses tribunaux. Le premier a pour fin la paix temporelle; le second, la vie éternelle. Unis, ils forment un seul corps, et partant ils doivent coexister de manière que le pouvoir inférieur (séculier) soit soumis et subordonné au pouvoir supérieur. Par conséquent, le pouvoir spirituel ne s'immisce pas dans les affaires temporelles, à moins que ces affaires ne s'opposent à la fin spirituelle, ou ne soient nécessaires pour l'obtenir. Dans ces cas, le pouvoir spirituel peut et doit réprimer le pouvoir temporel et le contraindre par toutes les voies qui lui paraîtront nécessaires."

Ces paroles de Bellarmin font parfaitement comprendre la distinction des deux puissances et de l'indépendance relative du pouvoir civil dans les choses de l'ordre purement temporel, comme aussi sa dépendance du pouvoir spirituel dans les questions connexes à la fin de l'Eglise. Nous ne confondons pas les deux autorités, nous les coordonnons seulement. De ce que l'Etat pénètre, par autorité de justice, au foyer domestique pour y rétablir l'ordre et y assurer le règne des lois naturelles et sociales, il n'en résulte pas que la famille et l'Etat cessent de former deux sociétés distinctes.

Il n'est pas dans les desseins de Dieu que l'Eglise soit partout ni toujours ou persécutée sans trève, ou honorée sans contestation, ou libre sans entraves. Les jours de persécution ont leur grandeur, ils ont aussi leurs dangers. Il y a profit à contempler l'Eglise résistant au glaive, au bûcher, à la mort. Son courage nous étonne, nous émerveille, lorsque nous la voyons mépriser la plume du sophiste comme la hache du bourreau, l'opinion d'un peuple égaré comme la sentence de juges iniques et les règlements de ministres pervers. On convient que, pour rester vivante et glorieuse après dix-huit siècles de luttes ou de persécution, il faut à l'Eglise une vitalité qui grandisse dans les plus terribles épreuves et qui brave la terre en regardant le ciel. Elle aspire toutefois à régner, non dans les combats, mais dans la paix, et elle appelle sans cesse les jours où sa souveraineté spirituelle est agréée et reconnue par les maîtres de la terre.

Les Conseillers au Conseil Souverain de la Nouvelle-France

PAR M. PIERRE-GEORGES ROY, M.S.R.C.

(Lu à la réunion de mai 1915.)

Le Conseil Souverain de la Nouvelle-France fut établi par Louis XIV au mois d'avril 1663. La première séance du Conseil Souverain eut lieu à Québec le 18 septembre 1663. Les conseillers au Conseil Souverain, devenu le Conseil Supérieur, se réunirent pour la dernière fois, à Montréal, le 28 avril 1760, le jour même de la bataille de Sainte-Foy.

Pendant ses quatre-vingt-dix-sept années d'existence le Conseil Souverain vit un bon nombre de Conseillers se succéder.

Nous avons cru faire oeuvre utile en dressant une liste complète de tous ceux qui furent appelés au Conseil Souverain en qualité de conseillers, de procureurs-généraux ou de greffiers. Nous avons eu, sous le régime français, un certain nombre de conseillers du Roi. Plusieurs de nos historiens ont confondu ces derniers avec les conseillers au Conseil Souverain. Ce qui fait que la plupart des listes publiées des conseillers au Conseil Souverain sont erronées. La présente nomenclature a été faite d'après les lettres de provisions des conseillers, les procès-verbaux du Conseil Souverain et la correspondance officielle des gouverneurs et intendants de la Nouvelle-France. Nous osons croire qu'elle est complète et exacte.

Nous n'avons pas inclus dans cette liste les membres ex-officio du Conseil Souverain comme les gouverneurs, les intendants et les évêques de Québec.

On notera aussi que nous nous servons toujours de l'expression Conseil Souverain. Cependant, à partir du 16 juin 1703, le roi de France, dans ses actes royaux adressés au Canada, ne désigne plus le Conseil Souverain que sous le nom de Conseil Supérieur.

CONSEILLERS AU CONSEIL SOUVERAIN

Louis Rouer de Villeray.—Nommé par le gouverneur de Mézy et Mgr de Laval le 18 septembre 1663. Démis par M. de Mézy le 19 septembre 1664. Nommé premier conseiller par M. de Tracy le 6 décembre 1666. Installé le 5 janvier 1667. Continué en exercice le 14 janvier 1669. Remplacé par M. Dupont le 13 janvier 1670. Nommé de nouveau premier conseiller mais cette fois à vie, par le roi, le 26 avril 1675.[1] Installé le 23 septembre 1675. M. Rouer de Villeray décéda à Québec le 7 décembre 1700.

Jean Juchereau de la Ferté.—Nommé par le gouverneur de Mézy et Mgr de Laval le 18 septembre 1663. Démis par M. de Mézy le 19 septembre 1664. Le 6 décembre 1666, MM. d'Auteuil, de Villeray et Bourdon, démis par M. de Mézy en même temps que M. Juchereau de la Ferté, furent réinstallés mais celui-ci fut laissé de côté, nous ignorons pour quelle raison. M. Juchereau de la Ferté décéda à Québec le 16 novembre 1685.

Denis-Joseph Ruette d'Auteuil de Monceaux.—Nommé par le gouverneur de Mézy et Mgr de Laval le 18 septembre 1663. Démis par M. de Mézy le 19 septembre 1664. Comme M. Juchereau de la Ferté, M. d'Auteuil de Monceaux ne fut pas réinstallé le 6 décembre 1666. Sept années plus tard, le 25 avril 1674, il était choisi par le roi comme procureur-général du Conseil Souverain.[2] Installé le 3 octobre 1674. Le 25 avril 1675, le roi lui donna de nouvelles lettres de provisions.[3] Il décéda à Québec le 27 novembre 1679.

Charles LeGardeur de Tilly.—Nommé par le gouverneur de Mézy et Mgr de Laval le 18 septembre 1663. Au mois de septembre 1664, il trouva grâce devant M. de Mézy et ne fut pas destitué comme ses collègues. Le 6 décembre 1666, il devenait troisième conseiller. Installé le 5 janvier 1667. M. LeGardeur de Tilly fut continué en exercice le 14 janvier 1669, le 13 janvier 1670, le 12 janvier 1671, le 28 mars 1672, le 16 janvier 1673, le 15 janvier 1674 et le 7 janvier 1675. Le 27 avril 1675, le roi le nommait membre à vie du Conseil.[4] M. LeGardeur de Tilly décéda à Québec le 10 novembre 1695.

Mathieu Damours de Chauffours.—Nommé par le gouverneur de Mézy et Mgr de Laval le 18 septembre 1663. Le 19 septembre 1664, le 6 décembre 1666, le 14 janvier 1669, le 13 janvier 1670, le 12 janvier 1671, le 28 mars 1672, le 16 janvier 1673, le 15 janvier 1674, le 7 janvier 1675, il fut maintenu en charge. Le 27 avril 1675, le roi le nommait membre à vie du Conseil.[5] M. Damours de Chauffours décéda à Québec le 9 octobre 1695.

Jacques Cailhault de la Teysserie.—Nommé par M. de Mézy, le 24 septembre 1664. Il fut de nouveau nommé par M. de Tracy le

[1] Lettres de provisions dans Registre des Insinuations du Conseil Souverain, cahier 1, folio 54.

[2] Lettres de provisions dans Registre des Insinuations du Conseil Souverain, cahier 1, folio 56.

[3] Lettres de provisions dans Registre des Insinuations du Conseil Souverain, cahier 1, folio 51.

[4] Lettres de provisions dans Registre des Insinuations du Conseil Souverain, cahier 1, folio 54.

[5] Lettres de provisions dans Registre des Insinuations du Conseil Souverain, cahier 1, folio 54.

6 décembre 1666. Installé le 5 janvier 1667. Continué en exercice le 14 janvier 1669, le 13 janvier 1670, le 12 janvier 1671, le 28 mars 1672, le 16 janvier 1673. M. Cailhault de la Teysserie décéda à Québec le 17 juin 1673.

Simon Denys de la Trinité.—Nommé par M. de Mézy le 24 septembre 1664. Il resta en fonctions jusqu'au 6 décembre 1666. On ignore la date exacte et l'endroit de la mort de Simon Denys de la Trinité. Tout ce qu'on sait c'est qu'il mourut entre 1678 et 1680. En effet, on voit par l'acte du mariage de son fils Paul avec Louise-Madeleine de Peiras, le 18 janvier 1678, qu'il vivait encore. Et l'enregistrement de ses lettres de noblesse, le 13 mars 1680, dit expressément que Simon Denys de la Trinité était mort à cette date.

Louis Peronne de Mazé.—Nommé par M. de Mézy, le 24 septembre 1664. Il siégea au Conseil pour la dernière fois le 6 juillet 1665. On croit qu'il s'embarqua pour la France peu après. Il ne revint pas.

Mille-Claude Le Barroys.—Nommé le 10 avril 1665.[1] Il avait été présenté au roi par la Compagnie des Indes Occidentales, suivant le pouvoir accordé à cette Cie par le trente-troisième article de l'édit de son établissement.[2] M. Le Barrois fut installé le 25 septembre 1665. On ne peut dire en quelle année il retourna en France. Nous perdons toutefois ses traces à Québec à partir de l'automne de 1666.

Pierre de Gorribon.—Nommé par M. de Tracy le 6 décembre 1666. Installé le 5 janvier 1667. Il est dit dans le procès-verbal de nomination: "de Gorribon, cy-devant conseiller au Présidial de Marennes." Continué en charge le 14 janvier 1669. M. de Gorribon retourna en France en septembre ou octobre 1669. Il y mourut avant le 27 janvier 1670.

Nicolas Dupont de Neuville.—Nommé le 13 janvier 1670. Installé le même jour. Continué en charge le 12 janvier 1671, le 28 mars 1672, le 16 janvier 1673, le 15 janvier 1674 et le 7 janvier 1675. Le 27 avril 1675, il était nommé conseiller à vie par le roi.[3] Le 1er juin 1703, il était nommé conseiller garde-scel à la place de M. de la Martinière.[4] Installé le 29 octobre 1703. M. Dupont de Neuville décéda à Québec le 25 avril 1716.

Nicolas de Mouchy.—Nommé le 13 janvier 1670, en remplacement de M. de Gorribon, retourné en France. Installé le même jour.

[1] Lettres de provisions dans Registre des Insinuations du Conseil Souverain, cahier 1, folio 20.

[2] Edit d'établissement de la Compagnie des Indes dans Registre des Insinuations du Conseil Souverain, cahier 1, folio 14.

[3] Lettres de provisions dans Registre des Insinuations du Conseil Souverain, cahier 1, folio 59.

[4] Lettres de provisions dans Registre des Insinuations du Conseil Souverain, cahier 11, folio 140.

Continué en charge le 12 janvier 1671 et le 28 mars 1672. M. de Mouchy retourna en France au commencement de novembre 1672.

Jean-Baptiste de Peiras.—Nommé le 16 janvier 1673, en remplacement de M. de Mouchy. Installé le même jour. Continué en charge le 15 janvier 1674 et le 7 janvier 1675. Nommé à vie par le roi le 26 avril 1675.[1] Décédé à Québec le 6 septembre 1701.

Charles Denys de Vitré.—Nommé le 21 août 1673, en remplacement de M. de la Teysserie, décédé. Continué en charge le 15 janvier 1674 et le 7 janvier 1675. Nommé à vie le 26 avril 1675.[2] M. Denys de Vitré décéda à Québec le 9 janvier 1703.

René-Louis Chartier de Lotbinière.—Nommé par le roi le 29 mai 1674.[3] Installé le 2 octobre 1674. Nommé à vie le 26 avril 1675.[4] Nommé, le 1er mai 1677, lieutenant-général de la Prévôté de Québec, il abandonna son siège au Conseil Souverain en octobre de la même année. Le 1er juin 1703, M. de Lotbinière était de nouveau nommé au Conseil Souverain en qualité de premier conseiller.[5] Il succédait à M. de Villeray, décédé. Installé le 26 novembre 1703. M. de Lotbinière décéda à Québec le 3 juin 1709.

Claude de Bermen de la Martinière.—Nommé le 3 juin 1678, à la place de René-Louis Chartier de Lotbinière.[6] Installé le 26 octobre 1678. Le 5 mai 1700, le roi le nommait conseiller garde-scel.[7] Installé le 30 septembre 1700. Le 1er juin 1703, M. de la Martinière était fait lieutenant-général de la Prévôté de Québec. Il abandonna son siège au Conseil en novembre 1703. Le 5 mai 1710, M. de la Martinière était nommé premier conseiller au Conseil Souverain.[8] Instal é le 6 octobre 1710. M. de la Martinière décéda à Québec le 14 avril 1714.

Pierre-Noël LeGardeur de Tilly.—Nommé, le 24 mai 1689, en survivance de son père (Charles LeGardeur de Tilly) "pour exercer

[1] Lettres de provisions dans Registre des Insinuations du Conseil Souverain, cahier 1, folio 160.

[2] Lettres de provisions dans Registre des Insinuations du Conseil Souverain, cahier 1, folio 61.

[3] Lettres de provisions dans Registre des Insinuations du Conseil Souverain, cahier 1, folio 54.

[4] Lettres de provisions dans Registre des Insinuations du Conseil Souverain, cahier 1, folio 60.

[5] Lettres de provisions dans Registre des Insinuations du Conseil Souverain, cahier 11, folio 140.

[6] Lettres de provisions dans Registre des Insinuations du Conseil Souverain, cahier 1, folio 83.

[7] Lettres de provisions dans Registre des Insinuations du Conseil Souverain, cahier 11, folio 129.

[8] Lettres de provisions dans Registre des Insinuations du Conseil Souverain, cahier 111, folio 45.

pendant son absence et à sa mort."[1] Installé le 13 mars 1690. M. LeGardeur de Tilly abandonna cette charge, en 1695, en faveur de M. Aubert de la Chesnaye. Il décéda à Saint-Antoine de Tilly le 13 août 1720.

Mathieu Damours de Freneuse.—Nommé le 24 mai 1689, en survivance de son père, Mathieu Damours de Chauffours.[2] Installé le 17 juillet 1690. Décédé en Acadie en novembre ou décembre 1696. (Note de M. Placide Gaudet).

Charles Aubert de la Chesnaye.—Nommé le 22 mai 1696, à la place de Charles LeGardeur de Tilly, décédé'[3] Installé le 20 septembre 1696. Décédé à Québec le 20 septembre 1702.

Denis Riverin.—Nommé le 24 mars 1698, à la place de Mathieu Damours de Freneuse, décédé.[4] Installé le 6 octobre 1698. Délégué en France, en 1702, pour surveiller les intérêts des habitants au sujet du commerce du castor, M. Riverin y vécut jusqu'à sa mort. Le 17 janvier 1710, il avait été nommé lieutenant-général de la Prévôté de Québec, mais il n'exerça jamais cette charge. Sa nomination l'avait cependant fait retirer du Conseil Souverain. Il mourut en France avant le 7 juillet 1717.

Mathurin-François Martin de Lino.—Nommé le 8 mai 1702, à la place de M. de Peiras, décédé.[5] Installé le 5 octobre 1702. Le 1er septembre 1719, il était nommé premier conseiller, à la place de M. de la Martinière, décédé.[6] Installé le 14 octobre 1720. Le 19 février 1727, il devenait garde des sceaux, à la place de M. Eustache Chartier de Lotbinière.[7] Installé le 6 septembre 1727. M. Martin de Lino décéda à Québec le 6 décembre 1731.

Charles de Monseignat.—Nommé le 1er juin 1703, à la place de M. de la Martinière, fait lieutenant-général de la Prévôté de Québec.[8]

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[1] Lettres de provisions dans Registre des Insinuations du Conseil Souverain, cahier 11, folio 87.

[2] Lettres de provisions dans Registre des Insinuations du Conseil Souverain, cahier 11, folio 87.

[3] Lettres de provisions dans Registre des Insinuations du Conseil Souverain, cahier 11, folio 120. Il serait plus vrai de dire que M. de la Chesnaye succéda à Pierre-Noël Le Gardeur de Tilly.

[4] Lettres de provisions dans Registre des Insinuations du Conseil Souverain, cahier 11, folio 124.

[5] Lettres de provisions dans Registre des Insinuations du Conseil Souverain, cahier 11, folio 136.

[6] Lettres de provisions dans Registre des Insinuations du Conseil Souverain, cahier V, folio 52.

[7] Lettres de provisions dans Registre des Insinuations du Conseil Souverain, cahier VI, folio 102.

[8] Lettres de provisions dans Registre des Insinuations du Conseil Souverain, cahier 11, folio 141.

Installé le 26 novembre 1703. Un an plus tard, le 1er juin 1704, il remplaçait Alexandre Peuvret de Gaudarville comme greffier du Conseil Souverain.[1] Installé le 1er décembre 1705. M. de Monseignat décéda à Québec le 20 octobre 1718.

François Hazeur.—Nommé le 1er juin 1703, à la place de Charles Aubert de la Chesnaye, décédé.[2] Installé le 29 octobre 1703. Décédé à Québec le 28 juin 1708.

L'abbé Joseph de la Colombière.—Nommé conseiller-clerc le 16 juin 1703.[3] Installé le 29 octobre 1703. M. de la Colombière décéda à Québec le 18 juillet 1723.

Olivier Morel de la Durantaye.—Nommé le 16 juin 1703.[4] Conseiller d'augmentation. Installé le 29 octobre 1703. Décédé dans la seigneurie de la Durantaye (aujourd'hui Saint-Vallier de Bellechasse) le 28 septembre 1716.[5]

François Aubert de Maur.—Nommé le 16 juin 1703.[6] Conseiller d'augmentation. Installé le 29 octobre 1703. Il périt dans le naufrage du *Chameau*, sur l'île Royale (Cap-Breton), dans la nuit du 27 au 28 août 1725.

Augustin Rouer de Villeray.—Nommé le 16 juin 1703.[7] Conseiller d'augmentation. Installé le 29 octobre 1703. On ignore la date de sa mort. On sait cependant qu'il décéda entre le 9 février 1711 et le 11 avril 1712.

Jean-Baptiste Le Gardeur de Repentigny.—Nommé le 16 juin 1703.[8] Conseiller d'augmentation. Installé le 16 novembre 1705. Décédé à Montréal le 8 septembre 1709.

Charles Macart.—Nommé le 1er juin 1704, en remplacement de M. Denis de Vitré, décédé.[9] Installé le 16 novembre 1705. Décédé à Québec le 9 décembre 1732.

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[1] Lettres de provisions dans Registre des Insinuations du Conseil Souverain, cahier 11, folio 164.

[2] Lettres de provisions dans Registre des Insinuations du Conseil Souverain, cahier 11, folio 141.

[3] Lettres de provisions dans Registre des Insinuations du Conseil Souverain, cahier 11, folio 142.

[4] Lettres de provisions dans Registre des Insinuations du Conseil Souverain, cahier 11, folio 142.

[5] L'acte de sépulture enregistré à Saint-Vallier dit Louis Morel de la Durantaye mais c'est bien de Olivier Morel de la Durantaye dont il s'agit.

[6] Lettres de provisions dans Registre des Insinuations du Conseil Souverain, cahier 11, folio 143.

[7] Lettres de provisions dans Registre des Insinuations du Conseil Souverain, cahier 11, folio 143.

[8] Lettres de provisions dans Registre des Insinuations du Conseil Souverain, cahier 11, folio 163.

[9] Lettres de provisions dans Registre des Insinuations du Conseil Souverain, cahier 11, folio 163.

Michel Sarrazin.—Nommé le 17 juin 1707, en remplacement de M. Duchesnay.[1] Installé le 27 novembre 1707. Le 19 février 1733, il devenait garde des sceaux du Conseil.[2] Installé le 18 juillet 1733. Décédé à Québec le 8 septembre 1734.

Guillaume Gaillard.—Nommé temporairement par le Conseil, pour remplacer un conseiller absent, le 20 janvier 1710. Nommé par le roi le 5 mai 1710, à la place de François Hazeur, décédé.[3] Installé le 6 octobre 1710. Décédé à Québec le 12 novembre 1729.

Paul Denis de Saint-Simon.—Nommé temporairement par le Conseil, pour remplacer un conseiller absent, le 20 janvier 1710. Le 12 mai 1714, le roi retient la première place vacante au Conseil pour le sieur de Saint-Simon et lui donne en attendant séance au Conseil.[4] Nommé par le roi le 1er avril 1717, à la place de Nicolas Dupont, décédé.[5] Installé le 6 décembre 1717. Décédé à Québec le 14 octobre 1731.

Martin Cheron.—Nommé le 5 mai 1710, à la place du sieur Riverin.[6] Installé le 6 octobre 1710. Décédé à Québec le 26 avril 1717.

Eustache Chartier de Lotbinière.—Nommé le 5 mai 1710, en remplacement de M. Le Gardeur de Repentigny, décédé.[7] Installé le 23 novembre 1710. Nommé garde des sceaux le 3 avril 1717.[8] Installé le 29 novembre 1717. Ordonné prêtre par Mgr de Saint-Vallier le 4 avril 1726, il abandonna sa charge de garde des sceaux, mais il

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[1] Lettres de provisions dans Registre des Insinuations du Conseil Souverain, cahier 111, folio 22. Ignace Juchereau Duchesnay avait été nommé le 1er juin 1704, membre du Conseil Souverain, en remplacement de M. de Monseignat, mais il n'accepta pas la charge. L'intendant Raudot, dans une lettre au ministre, écrit: "Le sieur Duchesnay n'a pas voulu siéger au Conseil ,probablement parce qu'il croit au-dessous de lui de ne pas y occuper la première place." M. Duchesnay décéda à Beauport le 7 avril 1715. Ses lettres de provisions signées par Louis XIV étaient entre les mains de M. Gerald-E. Hart. Elles sont aujourd'hui dans la collection de la Chicago Historical Society. Elles ont été publiées dans le *RAPPORT SUR LES ARCHIVES CANADIENNES POUR* 1905, vol. 1.

[2] Lettres de provisions dans Registre des Insinuations du Conseil Souverain, cahier VII, folio 32.

[3] Lettres de provisions dans Registre des Insinuations du Conseil Souverain, cahier 111, folio 53.

[4] Ordre du Roi dans Registre des Insinuations du Conseil Souverain, cahier IV, folio 4.

[5] Lettres de provisions dans Registre des Insinuations du Conseil Souverain, cahier IV, folio 91.

[6] Lettres de provisions dans Registre des Insinuations du Conseil Souverain, cahier 111, folio 52.

[7] Lettres de provisions dans Registre des Insinuations du Conseil Souverain, cahier 111, folio 58.

[8] Lettres de provisions dans Registre des Insinuations du Conseil Souverain, cahier IV, folio 61.

garda son siège au Conseil Souverain jusqu'à sa mort. Décédé à Québec le 14 février 1749.

Jean-François Hazeur.—Nommé le 18 juin 1712, à la place du sieur de Villeray, décédé.[1] Installé le 17 octobre 1712. Décédé à Québec le 13 mai 1733.

Louis Rouer d'Artigny.—Nommé le 3 avril 1717, à la place du sieur de la Durantaye, décédé.[2] Installé le 16 août 1718. Décédé à Québec le 4 juillet 1744.

Jean Petit.—Nommé le 1er juillet 1718, à la place de Martin Chéron, décédé.[3] Installé le 15 janvier 1720. Décédé à Québec le 24 février 1720.

Charles Guillimin.—Nommé le 13 mai 1721, à la place de Jean Petit, décédé.[4] Installé le 20 septembre 1721. Décédé à Québec le 25 février 1739.

Nicolas Lanoullier.—Nommé le 10 février 1722, à la place du sieur de Lino, fait premier conseiller.[5] Installé le 12 octobre 1722. Garde des sceaux le 21 mars 1735.[6] Installé le 5 septembre 1735. Décédé à Québec le 6 janvier 1756.

L'abbé Jean-Baptiste Gauthier de Varennes.—Nommé conseiller-clerc le 4 janvier 1724, à la place de M. l'abbé de la Colombière, décédé.[7] Installé le 14 octobre 1724. Décédé à Québec le 30 mars 1726.

Jean Crespin.—Nommé le 1er mars 1727, à la place du sieur Aubert de Maur, décédé.[8] Installé le 6 octobre 1727. Décédé à Québec le 4 janvier 1734.

L'abbé Louis Bertrand de la Tour.—Nommé conseiller-clerc le 17 mai 1727, à la place de l'abbé Gauthier de Varennes, décédé.[9] Installé le 10 octobre 1729. Parti de la Nouvelle-France en octobre ou

[1] Lettres de provisions dans Registre des Insinuations du Conseil Souverain, cahier 111, folio 72.

[2] Lettres de provisions dans Registre des Insinuations du Conseil Souverain, cahier V, folio 2.

[3] Lettres de provisions dans Registre des Insinuations du Conseil Souverain, cahier V, folio 44.

[4] Lettres de provisions dans Registre des Insinuations du Conseil Souverain, cahier V, folio 55.

[5] Lettres de provisions dans Registre des Insinuations du Conseil Souverain, cahier VI, folio 1.

[6] Lettres de provisions dans Registre des Insinuations du Conseil Souverain, cahier VII, folio 52.

[7] Lettres de provisions dans Registre des Insinuations du Conseil Souverain, cahier VI, folio 20.

[8] Lettres de provisions dans Registre des Insinuations du Conseil Souverain, cahier VI, folio 102.

[9] Lettres de provisions dans Registre des Insinuations du Conseil Souverain, cahier VI, folio 130.

novembre 1731. Décédé doyen du chapitre de Saint-Jacques de Montauban le 19 janvier 1780.

François-Etienne Cugnet.—Nommé le 13 février 1730, à la place du sieur Gaillard, décédé.[1] Installé le 14 août 1730. Nommé premier conseiller le 18 avril 1733, à la place de M. Martin de Lino.[2] Installé le 18 juillet 1733. Décédé à Québec le 19 août 1751.

Jean-Victor Varin de la Mare.—Nommé le 18 février 1733, à la place de M. Cugnet, fait premier conseiller.[3] Installé le 18 juillet 1733. Le 1er mai 1749, M. Varin était nommé contrôleur de la marine et abandonnait son siège au Conseil. Il retourna en France en 1757. Banni de France à perpétuité, en 1763, pour ses malversations au Canada, il obtint, en 1780, de finir ses jours à Malesherbes où sa famille s'était fixé.

François Foucault.—Nommé le 18 avril 1733, à la place du sieur de Saint-Simon, décédé.[4] Installé le 18 juillet 1733. Fait premier conseiller le 3 juillet 1752, en remplacement du sieur Cugnet, décédé.[5] Installé le 30 octobre 1752. Décédé à Québec le 19 juillet 1766.

Thomas-Jacques Taschereau.—Nommé le 1er avril 1735.[6] Installé le 20 août 1736. Décédé à Québec le 25 septembre 1749.[7]

Jacques de la Fontaine de Belcour.—Nommé le 1er avril 1735.[8] Installé le 20 août 1736. Décédé à Québec le 18 juin 1765.

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[1] Lettres de provisions dans Registre des Insinuations du Conseil Souverain, cahier VI, folio 168.

[2] Lettres de provisions dans Registre des Insinuations du Conseil Souverain, cahier VII, folio 29.

[3] Lettres de provisions dans Registre des Insinuations du Conseil Souverain, cahier VII, folio 30.

[4] Lettres de provisions dans Registre des Insinuations du Conseil Souverain, cahier VII, folio 31.

[5] Lettres de provisions dans Registre des Insinuations du Conseil Souverain, cahier IX, folio 36.

[6] Lettres de provisions dans Registre des Insinuations du Conseil Souverain, cahier VIII, folio 1.

[7] Le 4 octobre 1749, MM. de la Jonquière et Bigot écrivaient au ministre: "Il vaque encore par la mort de MM. Lotbinière et Taschereau deux places de conseillers laïcs. Elles ne sauraient être mieux occupées que par le s. Nouchet qui est assesseur depuis deux ou trois ans et qui s'applique infiniment, et par le s. St-Sauveur qui est un garçon de famille bien né et qui ayant fait ses études a esté reçu avocat. Mr de la Jonquière l'a amené avec luy. Nous vous supplions de vouloir bien leur accorder ces deux places." M. Nouchet, comme nous le verrons plus loin, et M. de Saint-Sauveur furent nommés au Conseil Souverain le 1er mai 1750. Il n'appert pas que M. de Saint-Sauveur ait jamais présenté ses lettres de provisions au Conseil. On ne peut donc dire qu'il a été conseiller au Conseil Souverain. La charge de secrétaire du gouverneur était sans doute plus *payante.*

[8] Lettres de provisions dans Registre des Insinuations du Conseil Souverain, cahier VIII, folio 2.

Jean-Baptiste Gaillard.—Nommé le 27 mars 1736.[1] Installé le 20 août 1736. Décédé à Québec le 7 février 1742.

Guillaume Estèbe.—Nommé le 27 mars 1736.[2] Installé le 20 août 1736. M. Estèbe ayant résigné sa charge de conseiller fut fait, le 1er février 1758, conseiller honoraire.[3] A son retour en France, Estèbe fut jeté à la Bastille avec Bigot et les autres. Le 10 décembre 1763, il était condamné à être admonesté en la chambre, à 6 livres d'aumône et à 30,000 livres de restitution.

Guillaume Guillimin Fils.—Nommé conseiller-assesseur par MM. de Beauharnois et Hocquart le 20 septembre 1741. Reçu le 20 novembre 1741. Nommé conseiller le 25 mars 1744, à la place du sieur Guillimin père, décédé.[4] Installé le 12 octobre 1744. Décédé à Québec le 30 juillet 1771.

Joseph Perthuis.—Nommé conseiller-assesseur le 26 janvier 1743, par le gouverneur de Beauharnois et l'intendant Hocquart. Reçu le 4 février 1743. Nommé conseiller le 1er janvier 1747, à la place du sieur d'Artigny, décédé.[5] Installé le 14 juin 1748. Après la mort du procureur-général Verrier, arrivée le 13 septembre 1758, M. Perthuis fit provisoirement les fonctions de procureur-général jusqu'à la Conquête. Il partit pour la France en 1763. Décédé en France le 19 mars 1782.

L'abbé François-Elzéar Vallier.—Nommé conseiller-clerc le 1er avril 1743, à la place de M. Bertrand de la Tour.[6] Installé le 14 octobre 1743. Décédé à Québec le 16 janvier 1747.

Jean-François Gaultier.—Nommé le 25 mars 1744, à la place du sieur Gaillard, décédé.[7] Installé le 12 octobre 1744. Décédé à Québec le 10 juillet 1756.

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[1] Lettres de provisions dans Registre des Insinuations du Conseil Souverain, cahier VIII, folio 3.

[2] Lettres de provisions dans Registre des Insinuations du Conseil Souverain, cahier VIII, folio 4.

[3] Lettres de provisions daas Registre des Insinuations du Conseil Souverain, cahier X, folio 14. Mgr. Tanguay (*Dictionnaire Généalogique*, vol. III, p. 85) dit que Estèbe fut remplacé au Conseil Souverain par Pierre Claverie, garde-magasin à Québec. Impossible. Claverie décéda à Montréal le 21 août 1756 et ce n'est qu'en 1757 que Estèbe offrit sa résignation.

[4] Lettres de provisions dans Registre des Insinuations du Conseil Souverain, cahier IX, folio 30.

[5] Lettres de provisions dans Registre des Insinuations du Conseil Souverain, cahier IX, folio 45.

[6] Lettres de provisions dans Registre des Insinuations du Conseil Souverain, cahier IX, folio 8.

[7] Lettres de provisions dans Registre des Insinuations du Conseil Souverain, cahier IX, folio 30.

Joseph-Etienne Nouchet Fils.—Nommé conseiller-assesseur le 3 décembre 1746, par le gouverneur de Beauharnois et l'intendant Hocquart.[1] Reçu le 12 décembre 1746. Nommé conseiller le 1er mai 1750, en remplacement du sieur de Lotbinière, décédé.[2] Installé le 12 octobre 1750. Décédé à Québec le 3 février 1758.

Jacques-Michel Bréard.—Nommé le 1er mai 1749, à la place de Jean-Victor Varin de la Mare, promu contrôleur de la marine.[3] Installé le 25 août 1749. Retourné en France après la Conquête, il fut jeté à la Bastille avec Bigot et ses comparses. Le 10 décembre 1763, il était banni pour neuf ans de Paris, condamné à 500 livres d'amende et à 300,000 livres de restitution.

L'abbé Joseph-Marie de la Corne.—Nommé conseiller-clerc le 1er mai 1749, à la place de M. Vallier, décédé.[4] Installé le 25 août 1749. En 1750, il était député en France comme procureur du chapitre de Québec. Il mourut à Paris le 8 décembre 1779.

Jean-Antoine Bedout.—Nommé conseiller-assesseur le 25 novembre 1751 par le gouverneur de la Jonquière et l'intendant Bigot.[5] Reçu le 20 novembre 1752. Conseiller le 3 juillet 1752, à la place de M. Foucault, promu premier conseiller.[6] Installé le 17 décembre 1753. Retourné en France après la Conquête. Père du célèbre contre-amiral Bedout.

Michel Benard.—Nommé conseiller-assesseur le 24 décembre 1753 par le gouverneur Duquesne et l'intendant Bigot.[7] Conseiller

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[1] Lettres de nomination dans Registre des Insinuations du Conseil Souverain, cahier IX, folio 41.

[2] Lettres de provisions dans Registre des Insinuations du Conseil Souverain, cahier IX, folio 79.

[3] Lettres de provisions dans Registre des Insinuations du Conseil Souverain, cahier IX, folio 68. Le 1er avril 1757, le président du Conseil de Marine acceptait la suggestion de l'intendant Bigot de remplacer au Conseil Souverain le sieur Bréard par le sieur de Villers, écrivain principal, mais il ajoutait qu'il ne lui donnerait la commission que s'il s'acquittait convenablement des fonctions. Le même jour, 1er avril 1757, le roi signait l'ordre nommant M. de Villers membre du Conseil Souverain de Québec. M. de Villers ne fut jamais installé ni ne prêta le serment voulu. Ses lettres de provisions ne furent pas non plus insinuées. Il n'a donc jamais siégé au Conseil Souverain.

[4] Lettres de provisions dans Registre des Insinuations du Conseil Souverain, cahier IX, folio 69.

[5] Lettres de nomination dans Registre des Insinuations du Conseil Souverain, cahier IX, folio 87.

[6] Lettres de provisions dans Registre des Insinuations du Conseil Souverain, cahier X, folio 1.

[7] Lettres de nomination dans Registre des Insinuations du Conseil Souverain, cahier X, folio 2.

le 24 avril 1757, à la place de Nicolas Lanoullier, décédé.[1] Installé le 3 juillet 1758. Retourné en France après la Conquête.

Henri Hiché.—Nommé le 15 mai 1754.[2] Installé le 14 octobre 1754. Décédé à Québec le 15 juillet 1758.

Jacques Imbert.—Nommé le 15 mai 1754.[3] Installé le 14 octobre 1754. Retourné en France après la Conquête. Décédé avant le 21 octobre 1765.

Thomas-Marie Cugnet.—Nommé conseiller-assesseur le 4 octobre 1754 par le gouverneur Duquesne et l'intendant Bigot.[4] Reçu le 14 octobre 1754. Conseiller le 24 avril 1757 à la place de Jean-François Gaultier, décédé.[5] Installé le 3 juillet 1758. Il passa en France après la Conquête. En 1779, il vivait à Paris. Décédé au commencement du dix-neuvième siècle.

GREFFIERS DU CONSEIL SOUVERAIN

Jean-Baptiste Peuvret de Mesnu.—Nommé le premier greffier du Conseil Souverain le 18 septembre 1663. Démis par M. de Mézy le 19 septembre 1664. Nommé de nouveau par M. de Tracy le 6 décembre 1666. Installé le 5 janvier 1667. Lors du renouvellement du Conseil, le 5 juin 1675, Gilles Rageot, greffier de la Prévôté, fut nommé par erreur greffier du Conseil Souverain à la place de Peuvret. Celui-ci dût passer en France pour obtenir de nouvelles lettres de provisions. Elles lui furent accordées le 15 avril 1676.[6] Pendant l'absence de Peuvret, Romain Becquet et Guillaume Roger prirent provisoirement sa place. Peuvret fut installé dans ses fonctions le 25 octobre 1677 et il les garda jusqu'à sa mort arrivée à Québec le 23 mai 1697.

Michel Fillion.—Nommé greffier du Conseil Souverain par M. de Mézy le 24 septembre 1664. Il garda cette charge jusqu'au 6 décembre 1666. Décédé à Beauport le 6 juin 1689.

Denis Peuvret.—Nommé greffier du Conseil Souverain en survivance de son père, Jean-Baptiste Peuvret de Mesnu, le 10 mars 1685.[7]

[1] Lettres de provisions dans Registre des Insinuations du Conseil Souverain, cahier X, folio 12.

[2] Lettres de provisions dans Registre des Insinuations du Conseil Souverain, cahier X, folio 3.

[3] Lettres de provisions dans Registre des Insinuations du Conseil Souverain, cahier X, folio 3.

[4] Lettres de nomination dans Registre des Insinuations du Conseil Souverain, cahier X, folio 3.

[5] Lettres de provisions dans Registre des Insinuations du Conseil Souverain, cahier X, folio 13.

[6] Lettres de provisions dans Registre des Insinuations du Conseil Souverain, cahier 1, folio 81.

[7] Lettres de provisions dans Registre des Insinuations du Conseil Souverain, cahier 11, folio 41.

Nous voyons dans une lettre de MM. de Frontenac et Champigny en date du 15 septembre 1692 que Denis Peuvret mourut en revenant des Iles où il avait été employé par M. de Goupy, intendant, qui l'avait fait son subdélégué. Denis Peuvret décéda avant son père et n'exerca pas, conséquemment, la charge de greffier du Conseil Souverain.

Alexandre Peuvret de Gaudarville.—Nommé greffier du Conseil Souverain, en survivance de son père, Jean-Baptiste Peuvret de Mesnu, le 1er mars 1693.[1] Installé le 14 mars 1695. Il conserva cette charge jusqu'à sa mort arrivée à Québec le 30 décembre 1702.

Charles de Monseignat.—Nommé greffier en chef du Conseil Souverain le 1er juin 1704, à la place de Alexandre Peuvret de Gaudarville, décédé.[2] Installé le 1er décembre 1705. Il exerça cette charge jusqu'à sa mort arrivée à Québec le 20 octobre 1718. (voir plus haut).

Pierre Rivet.—Nommé par l'intendant Bégon, le 20 novembre 1718, à la place de Charles de Monseignat, décédé.[3] Nomination confirmée par le roi le 13 mai 1719.[4] Installé le 9 octobre 1719. Exerça jusqu'à sa mort arrivée à Québec le 8 février 1721.[5]

François Daine.—Nommé le 10 février 1722 à la place de Pierre Rivet, décédé.[6] Installé le 12 octobre 1722. Le 25 mars 1744, M. Daine était nommé lieutenant-général de la Prévôté de Québec. Il abandonna sa charge de greffier du Conseil Souverain en octobre 1744. Passé en France après la Conquête. Le 19 mars 1765, le roi, satisfait de ses services au Canada, de son zèle, de son désintéressement, de sa probité, accorde à M. Daine une pension de 2,000 livres dont 1000 reversibles à sa femme. Un frère de M. Daine était maître des requêtes.

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[1] Lettres de provisions dans Registre des Insinuations du Conseil Souverain, cahier 11, folio 118.

[2] Lettres de provisions dans Registre des Insinuations du Conseil Souverain, cahier 111, folio 7.

[3] Lettres de nomination dans Registre des Insinuations du Conseil Souverain, cahier V, folio 3.

[4] Lettres de provisions dans Registre des Insinuations du Conseil Souverain, cahier V, folio 43.

[5] Le jour même de la mort de M. Rivet, l'intendant Bégon commettait le sieur Barbel, notaire royal, pour faire les fonctions de greffier du Conseil "en attendant que Sa Majesté ait pourvu au dit office." Barbel remplit la charge jusqu'au 12 octobre 1722, date de l'installation de François Daine. Les lettres de nominations de Barbel sont au Registre des Insinuations du Conseil Souverain, cahier V, folio 53.

[6] Lettres de provisions dans Registre des Insinuations du Conseil Souverain, cahier V, folio 133.

Nicolas Boisseau.—Nommé le 25 mars 1744, à la place de M. Daine, appelé à d'autres fonctions.[1] Installé le 12 octobre 1744. Fut le dernier greffier du Conseil Souverain. M. Boisseau décéda à Québec le 9 février 1771.[2]

PROCUREURS-GENERAUX DU CONSEIL SOUVERAIN

Jean Bourdon.—Nommé par le gouverneur de Mézy et Mgr de Laval, le 18 septembre 1663. Démis par M. de Mézy le 19 septembre 1664. Nommé de nouveau par M. de Tracy le 6 décembre 1666. Décédé à Québec le 12 janvier 1668.

Louis-Théandre Chartier de Lotbinière.—Nommé par M. de Mézy le 24 septembre 1664. Deux années plus tard, le 6 décembre 1666, M. de Lotbinière remettait à M. Bourdon la charge que M. de Mézy lui avait si cavalièrement enlevée. M. de Lotbinière mourut en France après 1680.

Denis-Joseph Ruette d'Auteuil de Monceaux.—Nommé le 25 avril 1674.[3] Installé le 3 octobre 1674. Décédé à Québec le 27 novembre 1679. (Voir plus haut.)

François-Madeleine-Fortuné Ruette d'Auteuil.—Nommé en survivance de son père le 2 juin 1680.[4] Installé le 24 octobre 1680. Révoqué le 30 juin 1707.[5] Décédé à Québec le 10 juillet 1737.

Charles Macart.—Le 15 novembre 1706, le Conseil Souverain commettait Charles Macart, conseiller, pour faire les fonctions de procureur-général pendant l'absence de M. Ruette d'Auteuil en France.[6] Le 24 octobre 1707, le Conseil Souverain apprenant la révocation du procureur-général Ruette d'Auteuil, nommait, pour le rem-

[1] Lettres de provisions dans Registre des Insinuations du Conseil Souverain, cahier IX, folio 29.

[2] Le 24 novembre 1759, le Conseil siégeant à Montréal nomme d'office pour greffier-commis Mtre François Simonnet, ancien praticien de la juridiction royale de Montréal. Le 17 décembre 1759, le Conseil nomme pour greffier-commis le sieur Lanoullier, ancien praticien.

[3] Lettres de provisions dans Registre des Insinuations du Conseil Souverain, cahier 1, folio 62. Du 12 janvier 1668, date de la mort de M. Bourdon, au 3 octobre 1674, date de l'installation de M. d'Auteuil de Monceaux, les fonctions de procureur-général furent remplies par des substituts: Michel Fillion, 29 février 1688; Nicolas de Mouchy, 14 janvier 1669; René-Louis Chartier de Lotbinière, 13 Janvier 1670.

[4] Lettre de provisions dans Registre des Insinuations du Conseil Souverain cahier 111, folio 21.

[5] Ordre du Roi qui casse et révoque le sieur d'Auteuil dans Registre des Insinuations du Conseil Souverain, cahier 111, folio 21.

[6] Sept jours plus tard, le 22 novembre 1706, le Conseil Souverain commettait Pierre Haymart, juge-prévost de Notre-Dame des Anges, pour faire en l'absence du sieur Ruette d'Auteuil les fonctions de substitut du procureur-général.

placer, en attendant la nomination de son successeur, M. Charles Macart, qui était le dernier conseiller nommé. M. Macart exerça la charge de procureur-général jusqu'au 14 octobre 1712, date de l'entrée en charge de M. Collet. (Voir plus haut.)

Jessé Leduc des Fontaines.—Nommé le .. septembre 1709. Arrivé à Québec le 7 septembre 1710, il mourut quinze jours plus tard, le 22 septembre 1710, sans avoir été installé.

Gousse.—Le 21 juin 1712, le ministre prie M. de Beauharnois d'accorder passage à M. Collet, nommé procureur-général du Conseil Souverain à Québec *à la place du sieur Gousse.* Si ce dernier fut nommé, il ne vint jamais dans la Nouvelle-France.

Mathieu-Benoit Collet.—Nommé le 14 juin 1712.[1] Installé le 17 octobre 1712. Décédé à Québec le 5 mars 1727.

Nicolas Lanoullier.—Le 3 mars 1727, Nicolas Lanoullier fait au Conseil "les fonctions de procureur-général du Roy pour l'indisposition du dit procureur-général." A la séance du 10 mars, il agit comme procureur-général "à défaut de M. Collet, procureur-général décédé." M. Lanoullier agit ainsi jusqu'à l'installation de M. Verrier, en septembre 1728. (Voir plus haut.)

Guillaume Verrier.—Nommé le 20 avril 1728, à la place de Collet, décédé.[2] Installé le 17 septembre 1728. Décédé à Québec le 13 septembre 1758.

Joseph Perthuis.—Dans le procès-verbal de la séance du 2 octobre 1758 du Conseil Souverain on lit: "Sur ce qui a été dit par Monsieur l'intendant qu'attendu le décès arrivé de M. Verrier procureur-général du Roy le quatorze (le treize) septembre dernier, il convient que cette place soit remplie par intérim jusques à ce que Sa Majesté y ait pourvue et qu'il est nécessaire d'y nommer un des Mrs sur quoy le Conseil après avoir délibéré a nommé et commis M. Joseph Perthuis cons. pour faire fonctions de procureur général du Roy jusques à ce qu'il ait plust à Sa Majesté y pourvoir." Le 8 janvier 1759, le président du Conseil de Marine écrit à MM. de Vaudreuil et Bigot pour approuver que le sieur Perthuis fasse les fonctions de procureur-général. Il demande des éclaircissements pour le mettre en état de faire choix en France d'un sujet pour cette place. M. Perthuis remplit par intérim la charge de procureur-général jusqu'à la fin du régime français. (Voir plus haut.)

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[1] Lettres de provisions dans Registre des Insinuations du Conseil Souverain, cahier 111, folio 52.

[2] Lettres de provisions dans Registre des Insinuations du Conseil Souverain, cahier VI, folio 109.

Les Actes des Trois Premiers Tabellions de Montréal. 1648–1657.

PAR E.-Z. MASSICOTTE.

Présenté par B. Sulte, M.S.R.C.

Ainsi que nous l'avons expliqué dans ces *Mémoires*, l'an dernier (Les premières concessions de terre à Montréal, série III, vol. VIII, p. 215), M. de Maisonneuve,se conformant aux instructions qu'il a reçues en France, en 1647, commence, avec l'année 1648, à distribuer les terres de son gouvernement, puis, il institue en même temps, une justice seigneuriale avec greffe et tabellionnage.

C'est le gouverneur même ou son remplaçant qui siège au tribunal. Le fonctionnaire qui doit tenir note des procédures, autrement dit le greffier, est en plus autorisé à "recevoir tous actes et contrats des habitants," cependant, comme sa juridiction ne s'étend pas au delà de la seigneurie, il ne prend, suivant la coutume de l'époque, que le titre modeste de tabellion ou de commis au greffe et tabellionnage.

Mais la population est petite, les causes sont peu nombreuses et les actes sont rares, aussi la charge de greffier-tabellion doit-elle être à peine retribuée.

Voilà pourquoi, sans doute, qu'en neuf ans, quatre commis se succèdent ou parfois pratiquent alternativement, à Villemarie. Etant donné ces faits, nous avons cru qu'il serait préférable, au point de vue de l'utilité historique, de classifier ici leurs soixante et onze actes par ordre chronologique, en indiquant toutefois, entre crochets, au commencement des intitulés, de quelle étude provient chaque pièce.

De la sorte, on pourra, si on le désire, faire aisément le relevé des actes dressés par chacun de ces notaires seigneuriaux.

Nous nous bornons, bien entendu, à énumérer les actes de MM. de Saint-Père, Closse et Gastineau seulement, parce que Basset, le quatrième tabellion, qui devint, plus tard notaire royal, a instrumenté pendant si longtemps—de 1657 à 1699—qu'il faudrait vraiment un volume pour citer toutes les pièces qu'il a rédigées.

Nous croyons avoir établi, à l'encontre de ce qu'on a déjà dit, que Jean de Saint-Père est bien le premier notaire de Montréal.[1] Cela ressort sans discussion de l'inventaire que fait Basset le 26 octobre 1658,[2] lorsque le greffe de Montréal lui est officiellement remis

[1] Bulletin des Recherches Historiques, 1915, p. 112.
[2] Ib. p. 112.

et, mieux encore, du registre que Basset a préparé des "Minutes du tabellionnage de Montréal," en 1674. D'ailleurs, les fouilles systématiques qui ont été pratiquées depuis trois ans dans les archives du séminaire de Montréal, ainsi que dans celles du palais de justice de la même ville,n'ont démontré l'existence d'aucun document notarié antérieur à 1648.

Avant de passer à la nomenclature des premiers actes et contrats de la métropole, nous demandons la permission de donner quelques brefs renseignements sur chaque tabellion.

Jean de Saint-Père.

Né à Dormelles, en Gatinois (département de Seine-et-Marne), vers 1618, de Saint-Père semble être venu à Montréal en 1643 avec Louis Dailleboust.[1]

Le 25 septembre 1651, il épousa, à Montréal, Mathurine Godé, fille du vieux menuisier Nicolas Godé. De cette union naquirent deux enfants: un fils qui se noya à l'âge de sept ans et une fille qui épousa Pierre Le Gardeur de Repentigny. M. de Saint-Père était syndic de la communauté des habitants de Villemarie en 1651 et, trois ans plus tard, il fut nommé "receveur des aumônes qui seraient faites en faveur de la construction de l'église projetée de Montréal."

Cet excellent colon dont les annales font des éloges fut tué par les Iroquois, le 25 octobre 1657, en même temps que son beau-père et un serviteur nommé Jacques Nail ou Noel.[2]

Comme greffier et notaire, M. de Saint-Père a pratiqué d'une façon intermittente de 1648 à 1657. Entre ces années, il a des actes datés de janvier 1648 à juillet 1651, puis du 10 avril 1655 jusqu'à son assassinat, . . . et même après sa mort! ainsi qu'on le verra en note, à la suite de l'acte du 31 décembre 1657.

Le nombre de ses actes s'élève à 35 dont un au bas d'un acte de Closse.

A peu d'exceptions près, lorsque M. de Maisonneuve figure dans un acte de Saint-Père ou de Closse, c'est le gouverneur qui rédige et écrit l'acte.

Etait-ce parce que notre fondateur aimait à se mêler aux moindres détails de son administration ou bien parce qu'ayant plus de loisirs que ses subalternes, il leur évitait des tâches pour lesquelles ils n'étaient certainement pas aussi habiles que lui ?

L'écriture de M. de Saint-Père est plutôt maladroite si l'on peut ainsi s'exprimer. Il en est de même de son orthographe et de sa rédaction. On sent que son métier n'est pas de noircir du papier.

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[1] Mem. Soc. Roy., *Les Colons de Montréal, 1642-1667*, 1913, p. 7.

[2] Mem. Soc. Roy., Colons de Montréal . . . 1913, Nos. 15, 37, 293.

Lambert Closse est dans le même cas. Aussi ces deux notaires de hasard agissent-ils à la bonne franquette. Parfois, de Saint-Père commence un acte et c'est Closse qui le termine, d'autres fois c'est le contraire.

Ceci dit, nous signalons que sur ses trente-cinq actes, quinze sont de l'écriture de M. de Maisonneuve, quatorze de l'écriture de M. de Saint-Père et six d'une écriture dont l'auteur nous est inconnu.

Raphaël Lambert Closse.

Le sergent major Closse était originaire de Saint-Denis de Mogues (département de l'Ardenne[1]) et il avait, vraisemblablement le même âge que de Saint-Père. On constate sa présence pour la première fois à Montréal, dans un acte de M. de Saint-Père du mois de mai 1648.[2] Il remplace M. de Maisonneuve temporairement en 1655 et se marie avec Elisabeth Moyen en 1657. Comme son prédécesseur, il fut tué par les Iroquois, le 6 février 1662, alors qu'il protégeait la retraite d'une petite troupe de colons qui se repliaient sur le fort.

M. Closse s'est fait tabellion de juillet à décembre 1651,[3] puis de décembre 1653 à avril 1655, après cela, il signe un acte en octobre 1655 et un autre le 24 décembre 1656, sans compter celui du 31 décembre 1657 qu'il rédige, mais qui est signé par M. de Saint-Père.

Son étude se compose, en tout, de 30 actes qu'il n'a pas tous écrits lui-même, à l'exemple de M. de Saint-Père.

Seize de ses actes sont de l'écriture de M. de Maisonneuve, huit de l'écriture de Closse et, sur les cinq ou six autres documents, certains sont en copie et les autres sont de l'écriture d'un scribe que nous ignorons.

Le manuscrit de M. Closse ressemble passablement à celui de M. de Saint-Père, il en diffère par quelques fautes d'orthographes spéciales à notre militaire, et par l'écriture qui est plus légère et plus déliée.

Gastineau-Duplessis.

Nicolas Gastineau-Duplessis, d'abord soldat, avait déjà été greffier aux Trois-Rivières lorsqu'il vint occuper cette charge à Montréal. Il ne resta qu'un an et demi dans cette dernière localité et il retourna probablement d'où il venait. Quelques années après, il épousa, au Cap de la Madeleine, Marie Crevier.

Ce tabellion n'a laissé que sept actes bien qu'il ait pratiqué seul de janvier 1652 à juillet 1653.

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[1] Bulletin des Recherches Historiques, 1914, p. 184.

[2] Mem. Soc. Roy., *Colons de Montréal* . . . 1913, p. 10.

[3] *Bulletin des Recherches Historiques*, 1915, p. 113.

Il écrit lui-même tous ses actes. Sa calligraphie est agréable à l'œil et ne ressemble à aucune autre. Certaines de ses majuscules ont une forme absolument originale et elles seraient impossibles à deviner sans le contexte.

En référant à notre liste des *Colons de Montréal de 1642 à 1667*, parue dans ces mémoires en 1913, on trouvera quelques notes sur chacune des personnes qui figurent dans les actes ci-après énumérés.

Dernier détail: nous prévenons le lecteur que ce sont les intitulés inscrits sur chaque pièce que nous reproduisons, presque exclusivement; ils diffèrent assez souvent de ceux qu'on trouve dans l'inventaire et le registre du tabellionnage préparés par Basset ou qui sont cités par quelques historiens.

1648.

1 [DE SAINT-PÈRE] 1648, 4 JANVIER.—Contrat de concession de terre fait par Monsieur de Maisonneuve Gouverneur dud. Montréal. Au profit de Pierre Gadoys père.

Signe: Paul de Chomedey.

En suite: Acceptation de la dite concession par P. Gadoys en présence de M. de Saint-Père.

Signent: Paul de Chomedey, P. Gadoys, César Léger, L. Goudeau, J. de St. Père.

Nota: Cette pièce est entièrement écrite par M. de Maisonneuve. Le tabellion n'a fait que signer. Sur cette concession, voir *Les premières concessions . . . à Montréal* . . . Mem. Soc. Roy., 1914, p. 216 et seq. Pour détails sur les personnes mentionnées ci-dessus et dans les actes suivants, voir *Mem. de la Soc. Roy., 1913. Les colons de Montréal, etc.*, années 1642 à 1657.

2 [DE SAINT-PÈRE] 1648, 2 MAI.—Quittance générale et respective de part et d'autre. entre Pierre Gadoys et Cézar Léger.

Signent: P. Gadoys, Cézar Léger, S. Richôme, Challes Moine, L. Clausse, J. de Saint-Père.

Nota: L'écriture est de M. de Maisonneuve, bien que l'acte débute ainsi: Pardevant moi, J. de St. Père, commis au greffe et tabellionnage de Montréal, etc. On remarquera que le fondateur de la famille Le Moyne de Longueuil signe: *Challes Moine*, et le sergent major de la ville: *L. Clausse.* C'est la seule fois que ces deux personnages signent ainsi. Dans cette pièce, César Léger, qui avait épousé Roberte Gadois et dont le mariage fut annulé, se désiste ainsi que son ex-beau-père des droits, privilèges, etc., résultant des conventions arrêtées dans le contrat de mariage. M. Hubert Larue et après lui M. J. E. Roy ont, à tort, attribué cet acte à M. Closse et avancé que c'était le premier acte notarié de Montréal.

3 [DE SAINT-PÈRE] 1648, 18 NOVEMBRE.—Contrat de mariage entre François Godé et Françoise Bugon.

Signent: F. Goddé, N. G. avec paraphe, Françoise Bugon, P. Gadoys, Paul de Chomedey, J. Pouppé, Gilbert Barbier, Cézar Léger, J. de Saint-Père.

Nota: L'acte est écrit par M. de Maisonneuve. La future était veuve d'Antoine Vedet, maître cloutier, détail que Tanguay ne donne pas. Les initiales N. G. suivies d'un paraphe composé de cinq 8 réunis forment la signature habituelle de Nicolas Godé père.

1649.

4 [DE SAINT-PÈRE] 1649, 2 JANVIER.—Cancellation de contrat de mariage et donnation fait entre Mre Paul de Chomedey gouv. et François Godé et Françoise Bugon.
Signent: Paul de Chomedey, Françoise Bugon, F. Goddé, J. Pouppé, Jolicour, J. de Saint père (sic).
Nota: Acte écrit par M. de Maisonneuve. La raison de la "cancellation" n'est pas donnée; le mariage eut lieu quand même, neuf jours plus tard. Le témoin qui signe Jolicour, est appelé Augustin Hébert dans l'acte et l'on sait que ce dernier était surnommé Jolicœur.

5 [DE SAINT-PÈRE] 1649, 17 JUIN.—Vente d'une maison faite par Jame Bourguignon à Léonard Lucault.
Signent: Gilbert Barbier, Constantin, J. de Saint-Père.
Nota: Acte écrit par M. de Saint-Père. La maison vendue est érigée proche du fort et le prix est de 200 livres tournois.

1650.

6 [DE SAINT-PÈRE] 1650, 8 OCTOBRE.—Déclaration de Michel Chauvin par devant notte-et tesmoings.
Signent: Claude Pijart de la comp. de Jésus, Paul de Chomedey, Gilbert Barbier, J. de Saint-Père.
En suite: 1651, 7 février. Déclaration de Louis Prudhomme.
Signe: Louys Prudhomme.
Nota: Ces deux pièces sont écrites par M. de Maisonneuve. Dans la 1ère, Chauvin avoue qu'il y a 14 ans, il a épousé une femme âgée de 55 ans, nommée Louise de Lisle de la paroisse de Voutré, Mayne, proche de Ste-Suzanne; qu'après être demeuré avec elle près de 7 ans, il s'est engagé à M. de la Dauversière pour 5 ans etc. Dans la seconde, M. Prudhomme raconte qu'étant en France, en 1650, il a découvert, par hasard, que Chauvin était déjà marié. . . .
A la suite de la signature du P. Pijart est un monogramme curieux formé d'une croix entre les quatre branches de laquelle sont les lettres C. M. M. C. puis, sur le tout est la lettre S. Personne n'a encore pu expliquer ce chiffre.

7 [DE SAINT-PÈRE] 1650, 22 OCTOBRE.—Contrat de mariage de Louis Prudhomme et de Roberte Gadoys.
Signent: Louys Prudhomme, P. Gadoys, N. G. (avec paraphe), Charles D'Ailleboust, Jeanne Mance, Paul de Chomedey, Gilbert Barbier, Lambert Closse, J. de Saint-Père.
Nota: Acte écrit par M. de Maisonneuve, Louis Prudhomme était brasseur et originaire de Pomponne, proche Lagny sur Marne.

8 [DE SAINT-PÈRE] 1650, 5 NOVEMBRE. Contrat de mariage entre Gilbert Barbier et Catherine de La Vaux.
Signent: Gilbert Barbier, Catherine de la Vaux, Charles Dailleboust, Jeanne Mance, Paul de Chomedey, Louys Prudhomme, Lambert Closse, J. de Saint-Père.

En suite: 1650, 7 novembre. Acceptation par les futurs d'un échange de concession que leur propose M. de Maisonneuve.
Signent: Paul de Chomedey, Gilbert Barbier, Caterine (sic) de la Vaux.
Nota: Les deux actes sont écrits par M. de Maisonneuve. Gilbert Barbier venait de Saint-Aré de Dezise sur Loire.

9 [DE SAINT-PÈRE] 1650, 18 NOVEMBRE. Accord entre Jean Leduc et Jean Descarris.
Signe: J. de Saint-Père.
En suite: 1654, 15 décembre. Nouvel accord entre les membres.
Signe: Paul de Chomedey.
Nota: Les deux actes sont de l'écriture de M. de Maisonneuve. Dans le 1er accord, les deux amis s'obligent de bâtir à frais communs sur la terre de Descarris et d'y défricher 10 arpents; ensuite on fera de même sur la terre de Leduc. Dans le 2nd, Descarris est libéré de l'obligation d'aider Leduc en lui payant 582 livres. . . .

1651.

10 [DE SAINT-PÈRE] 1651, 5 février.—Inventaire des biens meubles de Michel Chauvin dit Ste-Suzanne.
Signent: Paul de Chomedey, de Préou Ferrolle, Lambert Closse, de Saint-Père.
Mentionnés: Anne Archambault, La Flesche, Nicola Goddé, Denis Archambault, Urbain Tessier, Gilbert Barbier, Jacques Messier, Pierre Gadoys, Blaise Juillet, Jame Bourguignon, Madle Mance, Jean des Roches, La Place.
Nota: Ecriture de M. de Maisonneuve. Sur les noms ci-dessus, voir notre liste des Colons de Mont. déjà citée. On trouvera de nouveaux renseignements sur Denis Archambault, dans le Bulletin des Recherches Historiques, 1914, p. 316.

11 [DE SAINT-PÈRE] 1651, 12 FÉVRIER.—Vente des meubles appartenant à Michel Chauvin dit Ste-Suzanne.
Signent: Paul de Chomedey, De Saint-Père.
Mentionnés: Mathurin Mousnyer, La Place, Jean des Roches, François Goddé, Nicolas Goddé, Denis Archambault, la femme de Jolicœur, Simon Moisnet, Anne Archambault, Arras, Lespine, la Vigne, Jacques Messier Barbeau, André du May, Pierre Gadoys, La Flesche.
Nota: Ecriture de M. de Maisonneuve.

12 [DE SAINT-PÈRE] 1651, 14 MAI.—Inventaire et vente des meubles de deffunt Jean Boudart.
Signe: Paul de Chomedey. (L'acte débute en déclarant que c'est Jean de St. Père qui instrumente, mais il omet de signer.)
En suite: 5 juillet, 1651. Déclaration que M. le gouverneur a préparé les comptes du défunt.
Signe: Paul de Chomedey.
Mentionnés: Gilbert Barbier, Pierre Gadoys, Jame Bourguignon, Urbain Tessier, Madle Mance, Barbeau, Laflesche, Denis Archambault, LaPlace, soldat, Jean le Duc, M. Martin, chirurgien, Jean Desroches, Catherine de la Vaux, la Vigne, André David, Charles Lemoyne, René Pineau, Simon Moisnet, Augustin Hébert, Catherine Mercier, Jacques Messier.

Nota: Ecriture de M. de Maisonneuve, dans les deux pièces. On lit dans l'acte que le contrat de mariage de Jean Boudard et de Catherine Mercier fut dressé par le notaire Lefebvre à la Rochelle, le 19 octobre 1642.

13 [DE SAINT-PÈRE] 1651, 2 JUILLET.—Inventaire des meubles de deffunt Léonnard Barbeau.
Signent: Paul de Chomedey, Augustin Hébert.
Mentionnés: Barbe Poisson, femme du défunt, Pierre Gadoys, Morice Poulain, Pierre Mors domestique des Ursulines, Jean Desroches, Mathurin Mousnyer.
Nota: Ecriture de M. de Maisonneuve.

14 [CLOSSE] 1651, 2 JUILLET.—Vente de meubles de deffunt Barbaut.
Signe: Lambert Closse.
Mentionnés: Migret, Gadoys, Laflesche, Arras, François Davennes, André Dumay, Despastys, Desroches, Desloriers.
En suite: Etat des créances et dettes de la veuve.
Signe: de Maisonneufve.
Nota: Ecriture de M. de Maisonneuve. M. R. W. McLachlan a reproduit cette pièce avec notes dans les Mém. de la Soc. Roy. de 1911, sec. II, p. 117.

15 [DE SAINT-PÈRE] 1651, 6 JUILLET.—Reconnoissance d'Anne Archambault à Monsieur de Maisonneuve.
Signent: Jean Obuchon, M. Poulain, De Saint Père.
Nota: Ecriture de M. de Maisonneuve. L'épouse du bigame Chauvin reconnait que le gouverneur a payé aux créanciers de son *ex-mari*, 174 livres et qu'il lui a remis, ensuite, 764 livres, 1 sol, le tout provenant de la vente des biens dudit Chauvin.

16 [CLOSSE] 1651, 18 SEPTEMBRE.—Contrat de mariage entre Jean de Saint-Père et Mathurine Godé.
Signent: De Saint-Père, N. G. (avec paraphe), Maturine Godé, Nicollas Godé, P. Gadoys, F. Goddée, Mance, Paul de Chomedey, Joseph de Beaussieur, Louys Prudhomme, X marque de Jean Desroches, De Ferrolle, Martin, C. Le Moyne, J. Hamare, Gilbert Barbier, Lambert Closse.
Mentionnés: Françoise Bugon, Françoise Goddé, Roberthe Gadoys, Leger Haquenier, Louise Mauger, Blaise Juillet, Simon Moisnet.
Nota: Ecriture de M. de Maisonneuve. L'acte débute: par devant Lambert *Clausse*. M. de Maisonneuve orthographie le nom de son major de cette façon, dans la plupart des actes.

17 [CLOSSE] 1651, 25 OCTOBRE.—Cession et transport réciproque entre Nicolas et François Godé.
Signent: N. G. (avec paraphe), F. Goddée, L. Closse.
Mentionné: Gaspart Regnault.
Nota: Ecriture inconnue. Le père Nicolas Godé cède à son fils François ce qui lui est dû en France par Gaspart Regnault, marchand à Bellesme, pays du Perche, en vertu d'un contrat datant de 1645. D'autre part, le fils cède à son père ce que les Messieurs de Montréal lui doivent.
En marge il est fait mention de "la depte de Rober Jurie". Est-ce bien Jurie, compagnon de Dollard ? Nous n'avons trouvé son nom dans Basset qu'en 1660.

18 [Closse] 1651, 9 novembre.—Contrat de mariage entre Gabriel le Sel Sr du Clos et Barbe Poisson.
Signent: Ch. Dailleboust, marque de le Selle (sic), Gilbert Barbier, St-Jacques (Pierre Enjouy), Augustin Hébert, M. Poullain, de Ferrolle.
Mentionnés: Jacquelines Chauboue, Adrienne Le Vivier, Marie Lucault.
Nota: Semble avoir été écrit par M. Dailleboust. Pierre Enjouis, signe parfois Enjouy et parfois St- Jacques. Maurice Poullain est dit soldat de la garnison.

1652.

19 [Gastineau] 1652, 21 janvier.—Inventaire des hardes de deffunt Daniel Archambault.
Signe: N. Gastineau.
Mentionnés: Laflesche, Sr du Clos, Saint-Pierre, soldat, Sainct-Jean, soldat, Saint-Amour, soldat, Migray, Saint Remond, soldat, La violette, soldat, La Récompense, La fortune, Desroches, La Vigne.
Nota: Ecriture de M. Gastineau. Dans l'intitulé, on a erronnément écrit Daniel pour Denis, véritable prénom du défunt et qui est correctement mentionné, du reste dans le texte de l'acte. Sur ce colon et sa famille voir nos notes dans le Bulletin des Recherches historiques, 1914, p. 316.

20 [Gastineau] 1652, 10 mars.—Vente de 30 arpens de terre faite par Janme Bourguignon et Claire Morine au Sr Lambert Closse.
Signent: L. Closse, marque dud. bourguignon, Charles Dailleboust, marque de la Morine, N. G. avec paraphe; P. Martin, C. Le Moyne, Nicolas Gastineau dit Duplessis.
Nota: Ecriture de M. Gastineau. Le vendeur, appelé "honorable personne" dispose d'une terre de 15 arpents sur 2, d'une grange, de 2 bœufs, 2 vaches, 2 cochons, 7 boisseaux de grains, 10 cordes de bois, le tout pour 1300 livres. On a vu, à la date du 17 juin 1649, que ce même colon a déjà vendu une maison qu'il avait près du fort. On ignore quand Bourguignon avait obtenu sa terre de M. de Maisonneuve.

21 [Gastineau] 1652, 1 juin.—Contract de vente fait par le sieur Lambert Closse de 30 arpens de terre à Montréal, au profit de Charles de Lozon, sieur de Charny.
Signent: Lambert Closse, Ch. Dailleboust, C. Le Moyne, Martin, N. Gastineau.
Nota: Ecriture de M. Gastineau. Le témoin Martin est un chirurgien. C'est Charles Dailleboust qui représente M. Lauzon de Charny dans cette transaction. Quel pouvait être le but du fils du gouverneur général en achetant cet immeuble à Villemarie?

22 [Gastineau] 1652, 6 juillet.—Vente des hardes de deffunt Anthoine Rouaud.
Signe: N. Gastineau.
Mentionnés: Jacques Langevin, Mousnier, St-Ange, soldat, Migray, Picot, La Vigne, Louis Loizel, Lachapelle, soldat, Arras, Louis Boussot, St-Pierre, soldat.
Nota: Ecriture de M. Gastineau. Sur Rouaud qu'on nomme encore Roos, etc., voir Colons de Montréal No. 168. On voit dans le registre du tabellionnage qu'il a existé en plus, un "estat des affaires d'Anthoine Rouaud," mais cette pièce est disparue.

23 [GASTINEAU] 1652, 15 DÉCEMBRE.—Inventaire des hardes qu'avaient en commun Henry Perrin et deffunt André David.
Signe: N. Gastineau.
Mentionné: Migray ou David dit Migray.
En suite: Estat de ce que deff. André David debvoit à quelques particuliers.
Signe: N. Gastineau.
Mentionnés: le Duc et le Houx (Descaris), Nicolas Gaillot, Louis Boussot, Nicolas Goddé, Louis Loizel, Anthoine Rouaud. Primot. Arras.
Nota: Ecriture de M. Gastineau.

1653.

24 [GASTINEAU] 1653, 15 MARS.—Inventaire des hardes de deffunt Estienne Thibault.
Signe: N. Gastineau.
Mentionnés: Guillaume l'homme de Gadois, Lafortune, M. Lambert (Closse ?), du Clos, Laverdure, Belleville, Sr de Bellecour, Pierre David, Jacques Langevin, André Du maix, Jean Millaud, Deslauriers, Baston, Presle.
En suite, sans date: Estats de quelques debtes du deffunt Estienne Thibault.
Mentionnés: Débiteurs: Baston, Jacques Langevin, Leduc, St Jacques; créanciers: Deslauriers, Nicolas Goddé, Sr Martin, Michel Tallemye, St Pierre, Laflesche, Laprade.
Nota: Ecriture de M. Gastineau.

25 [GASTINEAU] 1653, 10 JUILLET.—Procuration de Louis Prudhomme à Roberde Gadoys.
Signent: Louys Prudhomme, Martin, C. Le Moyne, N. Gastineau.
Nota: Ecriture de Gastineau.

26 [CLOSSE] 1653, 10 DÉCEMBRE.—Promesse de mariage faite de Catherine Primot par Anthoine Primot et Martine Messier à Charles LeMoyne.
Signent: Charles Le Moyne, Marque de Primot, Caterine Primot, Marque ladite Messier, Paul de Chomedey, marque de Messier, Jeanne Mance, Antoine L'hermite, P. Gadoys, P. Enjouys, David Lemoine, Michel Messier, Gilbert Barbier, L. Closse.
Nota: Ecriture d'un inconnu. La future n'a que 14 ans et n'est que fille adoptive d'Antoine Primot comme on le voit plus tard. Pierre Enjouis dit St Jacques et Antoine Lhermite dit Bassompierre sont des soldats de la garnison.

27 [CLOSSE] 1653, 11 DÉCEMBRE.—Contract de mariage entre Jacques Beauvais et Jeanne Soldé.
Signent: Marque de Beauvais, Paul de Chomedey, Jeanne Mance, P. Gadoys, Charles LeMoyne, Gilbert Barbier.
Nota: Ecriture de Closse. Il est dit au début que l'acte est dressé par Closse, mais le tabellion omet de signer.

28 [CLOSSE] 1653, 11 DÉCEMBRE.—Contract de mariage entre André Dumer et Marie Chedeville.
Signent: André Dumer, Marie Chedeville, Paul de Chomedey, Jeanne Mance, P. Enjouys, marque de Jean Dumay, P. Gadoys, Gilbert Barbier,

De Sainct-Père, Charle Le moyne, Pierre Nepveu, J. Davoust, L. Closse. *Nota:* Ecriture de M. de Maisonneuve. La future vient de Villars, en Picardie et elle est âgée de 22 ans. André Dumer, ou Du may, puis Demers est l'ancêtre de l'honorable juge P. Demers.

29 [Closse] 1653, 29 décembre.—Contract de mariage entre Jean Milot et Marie Marthe Pinsson.
Signent: Paul de Chomedey, Jeanne Mance, P. Gadoys, N. G. (avec paraphe), De Sainct Père, E. Bouchard, Louys Prudhomme, P. Enjouys, C. Robutel, Charle Le Moyne, R. Cavelier, J. Gervaisse.
Mentionnés: Nicolas Goddé, Jacques Mousnyer.
Nota: Ecriture de Closse au début, puis de M. de Maisonneuve.

1654.

30 [Closse] 1654, 9 janvier.—Ratification de certain contract passé à Belesme, entre Nicolas Godé et Michel Mauger, sieur de la Fontaine fait par Pierre Gadoys et Louise Mauger, sa femme.
Signent: P. Gadoys, Paul de Chomedey, L. Closse.
Nota: Ecriture de M. de Maisonneuve.

31 [Closse] 1654, 17 janvier.—Concession de trente arpens de terre à Jacques Beauvais dit St Jemme.
Signe: Paul de Chomedey.
En suite, même date: Acceptation du dit Beauvais et Reconnaissance de 300 lb. tournois, reçus du gouverneur pour l'obliger à demeurer en ladite Ile.
Signent: Marque de Beauvais, P. de Chomedey, C. Le Moyne, Chartier, L. Closse.
Nota: En copie par Basset, à la date du 27 janvier 1667. Voir Mém. Soc. Roy., 1914, *Concessions de terre à Montréal*, p. 219.

32 [Closse] 1654, 4 février.—Concession d'un arpent de terre, pour bastir dans la ville.
Signent: Paul de Chomedey, N. G., J. de St-Père, Nicolas Godé, L. Closse.
Nota: D'après une copie faite par Basset à la date du 15 février 1667.

33 [Closse] 1654, 4 février.—Gratification à Jean Desroches.
Signent: Paul de Chomedey, N. G. (avec paraphe) de Sainct Père, Nicolas Godé, L. Closse.
Nota: *Copie.* La minute est au séminaire de Montréal.

34 [Closse] 1654, 12 février.—Concession pour Gabriel le Selle et Barbe Poisson.
Signe: Paul de Chomedey.
En suite: 13 février 1654. Acceptation de ladite concession.
Signent: Paul de Chomedey, J. Gervaise, P. Raguiddeau, L. Closse.
Nota: Ecriture de M. de Maisonneuve. Voir Mém. Soc. Roy., *Premières concessions de terre à Montréal*, 1914, p. 220.

35 [Closse] 1654, 15 février.—Gratification à Blaise Juillet.
Signent: J. Gervaise, C. Robutel, Raguideau, L. Closse.
Nota: Copie. La minute est au séminaire de Montréal.

36 [CLOSSE] 1654, 25 MARS.—Contract de mariage entre Jean Gervaise et Anne Archambault.
Signent: Paul de Chomedey, J. Gervaise, Besnard, J. Guyet, L. Closse.
Mentionnés: Charlotte, fille de ladite Anne Archambault, Urbain Tessier dit La Vigne, René Besnar.

37 [CLOSSE] 1654, 2 JUIN.—Inventaire des biens de deffunt Augustin Hebert dit Jollycœur et d'Adrienne du Vivier, sa femme.
Signent: Paul de Chomedey, L. Closse.
Mentionnés: La femme de Gilbert Barbier, Jean Leduc, La forest, La haye, Sr de Hauteville, Louis Prudhomme, Sr le Moyne, Anthoine Primot, Sr de la Breche, Pierre Boyer, Michel Talmi, Blaize Juillet, Desloriers, Nicolas Gaillou, César Léger, François Dasvenne dit Arras.
Nota: Ecriture de M. de Maisonneuve.

38 [CLOSSE] 1654, 27 SEPTEMBRE.—Contract de mariage entre Jean le Mercher et Catherine Urelle.
Signent: Jean Le Mercher, "Signe de ladite Hurelle", Jeanne Mance, P. Gadoys, Marguerite Landreau, Gilbert Barbier, Marin Jannot, H. Perrin, R. Le Cavelier, H. Langlois, A. C. (André Charly), L. Closse.
Nota: Ecriture de M. Closse.

39 [CLOSSE] 1654, 27 SEPTEMBRE.—Contract de mariage entre Pierre Gaudin et Jeanne Rousselière.
Signe: Pierre Gaudin, "marque de ladite Rousselier", P. Gadoys, Jeanne Mance, Marguerite Landreau, Gilbert Barbier, Marin Jannot, Jean Le Mercher, H. Perrin, R. Le Cavelier, H. Langlois, J. Davoust, L. Closse.
Nota: Ecriture de M. Closse.

40 [CLOSSE] 1654, 27 SEPTEMBRE.—Contract de mariage entre Pierre Vilain et Catherine Lorrion.
Signent: P. Gadoys, Jeanne Mance, Gilbert Barbier, Marin Jannot, Marguerite Landreau, R. Cavelier, H. Langlois, Z. Desorson, L. Closse.
Nota: La première partie est d'une écriture qui nous est inconnue, la seconde est de M. Closse.

41 [CLOSSE] 1654, 4 OCTOBRE.—Contract de mariage entre Jean Dumer et Jeanne Vedye.
Signent: Paul de Chomedey, P. Gadoys, André Dumer, Gilbert Barbier, L. Closse.
Nota: La première partie de l'acte est de l'écriture de M. Closse, la seconde de'M. de Maisonneuve.

42 [CLOSSE] 1654, 24 OCTOBRE.—Concession, Le Cavelier dit Deslauriers, de 40 arpens de terre, à la charge de nourrir les enfans de défunt Hébert dit Jolicœur.
Signe: Paul de Chomedey.
Mentionnés: Pierre Gadoys, Jean Desroches, Adrienne du Vivier.
En suite, même date: Acceptation par ledit LeCavelier et sa femme de ladite concession.
Signent: R. Le Cavelier, P. de Chomedey, Jacques Dorré, Bouchard, Jehan Gervaise, L. Closse.

Nota: Ecriture de M. de Maisonneuve. Voir Mém. Soc. Roy., *Premières concessions . . . à Montréal,* 1914, p. 221.

43 [Closse] 1654, 30 octobre.—Contract de mariage entre Robert Le Cavelier et Adrienne du Vivier.
Signent: R. LeCavelier, Paul de Chomedey, Jeanne Mance, Jacques Vautie, Jehan Gervaise, Bouchard, L. Closse.
Nota: Ecriture de M. de Maisonneuve.

44 [Closse] 1654, 31 octobre.—Contract de mariage entre Eloy Jarry et Jeanne Meré.
Signent: N. G. (avec paraphe), P. Gadoys, de Sainct-Père, L. Closse.
Nota: Ecriture de M. de Maisonneuve.

45 [Closse] 1654, 31 octobre.—Contract de mariage entre André Charly et Marie du Mesnyl.
Signent: Paul de Chomedey, Jacques Dorré, L. Chartier, Jean Gervaise, L. Closse.
Nota: Ecriture de M. de Maisonneuve.

1655.

46 [Closse] 1655, 26 janvier.—Contract de donnation de deux demys arpens de terre et maison, dans la ville à Jean Milot dit Le Bourguignon.
Signe: Paul de Chomedey.
Mentionnés: Jean Milot, taillandier, Simon Richomme, Charon.
En suite, même date: Acceptation de ladite concession.
Signent: Paul de Chomedey, S. Richôme, J. Dorré, J. Davoust, L. Closse.
En marge, 11 décembre 1661.—Concession d'un demi arpent de terre.
Signe: Paul de Chomedey.
Nota: Ecriture de M. de Maisonneuve. Voir Mém. Soc. Roy., *Premières concessions . . . à Montréal, 1914*, p. 221.

47 [Closse] 1655, 7 mars.—Vente par Gabriel le Selle à Julien D'aubigeon, avec une ratiffication au bas de Barbe Poisson femme dudit le Selle, du 25 octobre 1658.
Signent: J. Dobigeon, Paul de Chomedey, Marin Jannot, Jehan Gervaise L. Closse.
En suite: 1658, 25 octobre.—Ratification dudit contrat par devant Basset.
Signe: Basset.
Mentionnés: L. Closse et L. Chartier.
Nota: Le premier acte est écrit par M. de Maisonneuve.

48 [Closse] 1655, 30 mars.—Marché entre le sieur Estienne Bouchard chirurgien et plusieurs particuliers habitans de Villemarie.
Signent: Bouchard, Gilbert Barbier, André Dumer, P. Piron, Marin Jannot, J. Gervaisse, Jean Obuchon, J. Millot, Louis Boussot, René Bondy, M. Langevin, J. Lemercher, Pierre Gaudin, Paul de Chomedey, J. Dobigeon, L. Closse.
Mentionnés: Urbain Tessier dit la Vigne, Louis Gueretin, Nicolas Millet Simon Galbrun, Jacques Mousseaux, Gabriel le Scel dit du Clos, Jacques Archambault, Gilles Lozon, Jacques Beauvais, Jean Valays, Jean Olivier, Robert Godebou, Jean Grimart, Sébastien Odio dit la flesche, Louis de la

Saudraye, Bertran de Rennes, Jacques Morin, Jean Descarries, André Heurtebize, Estienne Lair, Pierre Chauvin, Marin Heurtebize.
Au verso, à la date du 4 avril 1655, d'autres habitants souscrivent ou sont mentionnés en rapport avec le susdit contrat.
Signent: Bouchard, Paul de Chomedey, Jacques Picot.
Mentionnés: Jean Leduc, Toussaint Hunault, Blaize Juillet dit Avignon, Pierre Richomme, Jean Frenot.
Nota: Ecriture de M. de Maisonneuve. Faillon, *Hist. de la Colonie* II, 198, attribue, par méprise, cette pièce à M. de Saint-Père.

49 [CLOSSE ET DE ST-PÈRE] 1655, 30 MARS.—Vente par Urbain Tessier, de cinquante perches de terre et maison, à Gilles Lauson.
Signent: R. Le Cavelier, J. Gervaisse, L. Closse.
En suite: 1656, 5 novembre. Quittance du vendeur à l'acheteur.
Signent: Nicolas Hubert, N. G. (avec paraphe) de Sainct-Père.
Nota: Le premier acte est écrit par M. Closse, le second par M. de Saint-Père.

50 [DE SAINT-PÈRE] 1655, 10 AVRIL.—Reconnaissance de Jean Desroches de la somme de cinq cens livres au profict de Françoise Godé sa femme.
Signent: Paul de Chomedey, R. Giroust, de Sainct Père.
Mentionnés: Nicolas Godé, L. Closse.
Nota: L'acte est écrit par M. de Maisonneuve, il débute en déclarant qu'il est fait par devant Lambert Closse et il est signé par Jean de Saint-Père!

51 [CLOSSE] 1655, 18 JUIN.—Contract de mariage entre Jean Simon et Catherine Lorion.
Signent: Paul de Chomedey, J. Davoust, L. Closse.
Nota: Ecriture de M. de Maisonneuve.

52 [DE SAINT-PÈRE] 1655, 1 AOUT.—Contract de mariage entre Marin Jannot et Françoise Besnard.
Signent: Paul de Chomedey, Marin Jannot, Jeanne Mance, Zacharie Desorson, Gilbert Barbier, Paul Bourbault, J. Davoust, René Bondy, Nicolas Godé, C. Robutel, de Sainct-Père.
Nota: Ecriture de M. de Maisonneuve.

53 [DE SAINT-PÈRE] 1655, 5 NOVEMBRE.—Cession et transport d'une maison et arpent de terre par André Dumers à Pierre Gaudin.
Signent: Gilbert Barbier, Nicollas Goddé, Pierre Gaudin, André Demer, de Sainct-Père.
Au verso: 1659, 15 avril. Ratification dudit contrat:
Signent: Pierre Gaudin, André Demer, Jean Obuchon, Gendron, Basset, nore (notaire).
En suite: 1661, 28 octobre. Autre ratification.
Signent: Marie Chedeville, Millot, Basset.
Nota: Le premier acte, celui qui nous occupe, est de l'écriture de M. de Saint-Père.

54 [DE SAINT-PÈRE] 1655, 12 DÉCEMBRE.—Obligation de Jacques Beauvais dit St Jemme à Jean Godefroy Sr. de Linquetot.
Signent: L. Godefroy, Nicollas Goddé, de Saint-Père.

Mentionné: Louis Godefroy, sr de Normanville.
Nota: Ecriture de M. de Saint-Père. Beauvais s'engage à payer 110 livres tournois pour un bœuf acheté de "Louis Godefroy sieur de Normanville, fils dudit sieur de Lingtot de présent à Villemarie."

1656.

55 [DE SAINT-PÈRE] 1656, 12 MARS.—Vente d'une maison et demy arpens de terre par Jean Chappeleau et sa femme à André Charly dit Saint Ange.
Signent: N. G. (avec paraphe), Nicollas Godé, de Sainct Père.
Mentionnée: Jeanne Gangnon épouse de Jean Chappeleau.
Nota: Ecriture de M. de Saint-Père.

56 [DE SAINT-PÈRE] 1656, 2 JUILLET.—Cession et transport de terre par Jacques Messier à André Heurtebise.
Signent: -N. G. (avec paraphe) Chevacet, de Sainct Père.
Mentionnés: Jean Descarries, Jean Leducq.
Nota: Ecriture de M. de Saint-Père. La terre est sise entre celles de Jean Descarries et de Jean Leduc.

57 [DE SAINT-PÈRE] 1656, 16 AOÛT.—Descharge de service de Jean Auger dit Baron par Estienne Bouchard.
Signent: Bouchard, N. G. (avec paraphe) R. Le Cavelier, de Sainct Père.
Nota: Ecriture d'un inconnu.

58 [DE SAINT-PÈRE] 1656, 25 SEPTEMBRE.—Saisie et arrest fait entre les mains d'Urbain Tessier dit la Vigne, sur ce qu'il doibt à Estienne de la Fonds habitant des 3 Rivières, à la requête de Jean Gervaise.
Signent: Pierre Gaudin, Nicollas Gaudé, de Sainct Père.
Nota: Ecriture de M. de Saint-Père. C'est la première saisie-arrêt que l'on trouve à Montréal. La procédure n'était pas compliquée à cette époque. Le papier mesure six pouces en carré et il n'y a que cinq lignes d'écriture.

59 [DE SAINT-PÈRE] 1656, 11 DÉCEMBRE.—Vente de trente arpens de terre par Jean Chappeleau et Jeanne Gagnon, au proficț de Nicolas Godé.
Signent: N. G. (avec paraphe), P. Raguideau, C. Le Moyne, de Sainct Père.
Nota: Ecriture de M. de Saint-Père.

60 [CLOSSE] 1656, 24 DÉCEMBRE.—Marché entre Marin Jannot et Jean Le Mercher.
Signent: L. Closse, Marin Jannot, Jean Le Mercher.
Nota: Ecriture de M. Closse.

1657.

61 [DE SAINT-PÈRE] 1657, 1er JANVIER.—Contract de mariage entre Nicolas Milet et Catherine Lorion.
Signent: Nicollas Millet, L. Closse, Gilbert Barbier, Marin Jannot, Pierre Gaudin, de Sainct Père.
Mentionné: Jean Simon.

Nota: Nous ignorons qui a écrit cet acte. M. Closse y figure en qualité de commandant de l'île de Montréal. La future, bien qu'âgée de 19 ans seulement, est déjà veuve de Pierre Villain tué accidentellement en 1655 et de Jean Simon qui se noya en 1656. Nicolas Millet mourut, lui aussi, victime d'un accident en 1674 et sa veuve convola, pour la quatrième fois, avec Pierre Désautels dit Lapointe. Par son mariage avec Jean Simon elle fut mère de Léonard Simon, ancêtre de la famille Léonard.

62 [DE SAINT-PÈRE] 1657, 13 FÉVRIER.—Procuration de Jacques Archambault à R. Père Jean de Quen.
Signent: Chartier, Gilbert Barbier, de Sainct Père.
Nota: Ecriture de M. de Saint-Père.

63 [DE SAINT-PÈRE] 1657, 25 MARS.—Marché entre Pierre Piron et Jacques Messier.
Signent: P. Piron, Nicolas Godé, C. LeMoyne, de Sainct Père.
Nota: Ecriture de M. de Saint-Père.

64 [DE SAINT-PÈRE] 1657, 3 AVRIL.—Bail à ferme par Gabriel Selle dit le Clos de Jean Cadieu.
Signent: N. G. (avec paraphe) Nicollas Goddé, de Sainct-Père.
Nota: Ecriture de M. de Saint-Père.

65 [DE SAINT-PÈRE] 1657, 6 MAI.—Contract de mariage entre Pierre Gadoys et Marie Pontonnier.
Signent: P. Gadois, N. G. (avec paraphe), Nicolas Godé, Marie Pontonnier, J. Baptiste Gadois, B. de Boullongne, P. Gadoys, L. Closse, de Sainct-Père.
Au verso, signent, en plus: Loys Prudhomme, Marin Jannot, L. Chartier, F. Piron, J. Tavernier, J. Davoust, de Sainct-Père.
Nota: Ecriture d'un inconnu. Ce mariage eut lieu à Montréal le 12 août suivant et non à Québec, comme dit Mgr Tanguay; il fut annulé par Mgr de Petrée le 30 août 1660. Voir Colons, etc.: No. 83.

66 [DE SAINT-PÈRE] 1657, 3 JUIN.—Contract de mariage entre Guillaume Estienne et Marguerite Rousée.
Signent: B. de Boullongne, L. Closse, P. Gadoys, Jean Gervaisse, Marin Jannot, Chartier (chirurgien), Davoust, de Sainct Père.
Nota: Ecriture d'un inconnu.

67 [DE SAINT-PÈRE] 1657, 24 JUILLET.—Contract de mariage entre noble Lambert Closse et damoiselle Elisabeth Moyen.
Signent: L. Closse, Paul de Chomedey, Issabelle Moyen, Jeanne Mance, Paul Ragueneau, Marie Moyen, Claude Pijart, François le Mercier, François Duperon, Jacques Vautié, Marin Jannot, P. Gadoys, N. G. (avec paraphe), R. Le Cavelier, Jehan Gervaise, Nicolas Hubert, Marguerite Landreau, Gilbert Barbier, Jacques Picot, Catherine Primoit (Primot), Maturine Godé, Catherine de la Vaux, Janne Lemoine, Chartier.
Nota: Paraît être de l'écriture de M. de Maisonneuve. Cette pièce que l'abbé Faillon et autres chercheurs ont parcouru et qui se trouvait dans les archives du palais de justice de Montréal est disparue de cet endroit entre 1885 et 1890. Elle serait, actuellement, en la possession d'une société

d'archéologie de Chicago où M. Doughty, l'archiviste du Dominion, a pu en faire photographier la dernière page et dont il nous a bienveillamment transmis copie. La signature de M. de Saint-Père n'apparaît pas au bas du document, mais comme tous les auteurs qui ont vu ce contrat s'accordent à l'attribuer à M. de Saint-Père, il faut croire qu'au début, il est déclaré qu'il est dressé *par devant* ce tabellion, comme il y en a d'autres exemples.

68 [DE SAINT-PÈRE] 1657, 5 AOÛT.—Bail à ferme de la terre de Pierre Gadoys, à Michel Théodore.
Signent: P. Gadoys, Nicolas Hubert, Dageney, de Sainct Père.
Nota: Ecriture de M. de Saint-Père.

69 [DE SAINT-PÈRE] 1657, 23 AOÛT.—Contract de mariage entre Jacques de la Porte dit Saint-Georges et Nicolle Duchesne.
Signent: Jacques de la Porte, Paul de Chomedey, Nicolas Hubert, de Sainct-Père.
Nota: Ecriture de M. de Saint-Père. Jacques de la Porte venait de Nocé, pays du Perche, proche de Bellesme et sa femme de la paroisse de Valvaude (?) près de Paris.

70 [DE SAINT-PÈRE] 1657, 25 AOÛT.—Vente d'une maison et un arpent de terre, par Louis de la Saudraye à Fiacre Ducharne.
Signent: De La Saudraye, N. G. (avec paraphe), Nicolas Godé, de Sainct-Père.
Nota: Ecriture de M. de Saint-Père.

71 [DE SAINT-PÈRE] 1657, 31 DÉCEMBRE.—Convention au profict de Léonnard (Simon) par Nicolas Milet.
Signent: Nicollas Millet, L. Closse, Pierre Gaudin, Gilbert Barbier, Marin Jannot, de Sainct-Père.
Mentionnés: Feu Jean Simon.
Nota: Par leur contrat de mariage, du 1er janvier 1757, Millet et sa future déclarent s'en rapporter pour les conventions à la coutume de Paris et c'est tout. Rien n'est prévu relativement à l'enfant issu du mariage de Catherine Lorion avec Jean Simon, et Lambert Closse, parrain de cet enfant, dut présenter des objections. Cela expliquerait pourquoi le mariage n'eut lieu que le 9 avril suivant et qu'une convention spéciale ait été faite. Dans ce nouvel acte, Lambert Closse intervient au nom du mineur avec l'approbation de Marin Jannot syndic de la communauté des habitants de Villemarie. Il stipule que si Millet prend possession des biens du défunt, il devra s'obliger à vêtir, entretenir et faire instruire le jeune Léonard Simon jusqu'à l'âge de 12 ans, etc. C'est une suite ou un complément du contrat de mariage, sans doute jugé trop vague.

Jusqu'ici il n'y a rien d'extraordinaire, mais voici un détail qui touche à l'énigme.

Le document est évidemment écrit par M. Closse, mais il est signé par M. de Saint-Père et il est déclaré, au début, fait par devant lui, et après le *mariage contracté.* Or M. de Saint-Père est mort depuis le 25 octobre précédent! Faudrait-il conclure qu'il y a erreur de mois ou bien qu'on s'est servi d'un papier signé d'avance par M. de Saint-Père?

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SECTION II

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Elba, a Hundred Years After.

By GEORGE M. WRONG, M.A., F.R.S.C.

(Read May Meeting, 1915).

There are striking parallels between Napoleon's struggle for world power a hundred years ago and that of Germany a century later. It was only in the period of the Revolution that France had begun to attain a vital national union. The older France had not been really united. Many provinces had come under the sway of the French crown, by conquest or by inheritance; but though they had one ruler they still retained in many respects their old character as separate states. There was not even free trade between these provinces. They had different modes of government, different systems of taxation and of laws. There was, it has been said, a French state but not a French nation. The ferment of the Revolution produced a France "one and indivisible" with an intense national spirit. It was Napoleon who organized this France, who gave it unity of system, and who made its national life a homogeneous reality. Under him France had found a head who directed all the energies of the nation. He did not give France freedom. He was the Emperor of the French, their leader and war-lord. In his mind was the thought that he was the successor of Charlemagne, the great world-ruler. The realm of Charlemagne had stretched eastward far across the Rhine. Napoleon felt called upon to revive this old dominion, for the successor of Charlemagne ought to rule over the territory that Charlemagne had ruled. The Empire thus meant expansion, reunion with peoples who had been separated from it by the incidents and accidents of history.

The Imperial idea involved of course aggression against neighbours. The Empire of Napoleon was military and in military equipment and method was far in advance of any other state of the time. At the head was one of the greatest soldiers of any age, a military genius, who evolved new conceptions of strategy and tactics. An army makes its strength effective, he said, not merely by mass of numbers but by the velocity of its blows. Strike in overwhelming force and strike quickly the enemy's weakest line. Take the initiative and keep it, so that the enemy must fight not as he wishes but as you wish. The France of a century ago, like the Germany of to-day, led the world in military equipment and efficiency.

In his methods Napoleon showed no pity and no respect for international law. "Such men as I do not commit crimes" he said; "they do what is necessary." He told the Venetians, in 1797, that he would be to them a new Attila, the very phrase that the German Emperor has used of himself. His diplomacy was conscienceless. When he was offering Hanover to Prussia, he was also offering it to England. He violated the neutrality of Spain and marched a hundred thousand troops across that friendly country in order to be able to strike a blow at England. He plundered without restraint and sent to Paris the treasures of art of the conquered countries. His soldiers lived on the people whom they mastered. At times he was guilty of ruthless massacre. He burned villages, executed civilians, and sent hundreds of them into captivity in France. For him international law did not exist.

He was spoiled by success and came to despise all his neighbours. The English are not a military people and he regarded them as mere traders who cared only for their money bags, a nation of shop-keepers. He underestimated the power of his opponents. He took little care to treat possible enemies with diplomatic skill. To him it seemed a matter of slight moment whether one nation more or less was at war with him. In the end, as a result, he was face to face with Europe in arms. England was his arch-enemy—the tyrant of the seas as he called her. He tried to strike England by striking at Egypt. He had the fixed idea that if he could reach England, London would fall in three days and that the British Empire would then be prostrate. He believed that the Irish would help him to conquer England. He even thought that there were elements in the British Empire which would look upon him as a liberator.

In pursuing his ends Napoleon showed no patience or self-restraint. Frederick the Great, with vast ambitions, had yet moved cautiously step by step towards his goal. Napoleon would not leave anything to time. All must be done quickly by the striking of shattering blows. He could conquer people and hold them indefinitely under a military yoke. He had no belief in liberty, no insight into the fact that a strong empire can be built up only by the consent and union of those who compose it. He showed little capacity to estimate rightly political or even military forces. He fought on too extended a line, from the south of Spain to the interior of Russia. He raised up so many enemies that in the end it was certain they would overwhelm him. They knew his strength. They feared him and offered to compromise if he would abandon his dream of world-conquest. Even after the disaster in Russia it was possible for him to have retained in the north the left bank of the Rhine and in the south Nice and Savoy; but he blindly refused such terms. He would have all or nothing, and in the end his enemies saw that their only safety lay in crushing him completely. His final failure after the return from Elba was due to the universal conviction that he could not be trusted. He had so outraged and violated Europe that Europe would not tolerate even a Napoleonic dynasty. The dream of a Bourbon world power ended with the death of Louis XIV in 1715. That of a Napoleonic supremacy over the world ended at Waterloo in 1815. It is quite possible that the year 1915 will see decisions even more momentous than those of these earlier dates. It seems as if the finger of God has written in large letters at regular intervals across the pages of history the fate which attends the ambition for world-mastery.

Napoleon arrived in Elba on May 3, 1814, and left it on February 26, 1815. By the treaty signed at Paris on April 11, 1814, Elba, which had been under French rule for a time, became a separate and independent state with Napoleon as its despotic sovereign. After a momentary hesitation Elba went into transports at the arrival of its new ruler. The islanders had been given no notice of their destiny. Many of them believed that, in the new settlement of Europe, Elba would go to Great Britain as Malta had gone at an earlier period, and some bold spirits had talked of making a declaration of independence and of building up Elba as a nation. The arrival of Napoleon satisfied, however, the highest aspirations of the Elbans. Not only would the island now be an independent state; the fact that the conqueror of the world had come to rule the Elbans was staggering in its appeal to their pride. The civic officials welcomed Napoleon with florid eloquence. Island poets burst into song. The representative of the Church praised God for this crowning mercy; it would, he said, inundate the island with riches. The people of Elba were only too ready to believe that now for them a new era was dawning. They were to bask in the sunshine of endless prosperity. There should be no more taxes. All injustices should be righted, all grievances remedied. It was said that the Elbans could not have been more enthusiastic if a god had come to dwell among them. The joy was without discrimination, and later, when Napoleon insisted on the payment of taxes, his popularity suffered an eclipse with many of the islanders. But it was a happy multitude which crowded the strand at Porto Ferraio when Napoleon landed. He issued a proclamation saying that he had chosen to become the sovereign of the Elbans because of the gentleness of their manners and the softness of their climate. He selected for Elba a national flag based on an old Tuscan banner; it was white with a red stripe running diagonally across it; on the stripe were three golden bees. "The bees will sting some day," said one of his grenadiers.

A new life had begun for the neglected little island. Even in that backward age the agriculture, the industry, the communications, the education of Elba were all especially backward. Napoleon lost not a moment in getting to work. He had already devoured what reading matter on Elba he could find and knew more about Elba than did the Elbans themselves. Even before his official reception at Porto Ferraio on the day after his arrival he had rowed to the south side of the bay and had begun to spy out the land. A day or two later, at five o'clock in the morning, he was leading a party to the only other natural harbour in Elba, Porto Longone, on the south shore, and was asking eager questions about the iron mines at Rio, a few miles away, about the marble and granite quarries, about the fisheries. Those who came into contact with him heard not a word about his leaving the island. It is, of course, easy to suggest that he was all the time concealing his thoughts and working towards such an end. This is, however, to fail to grasp his character. Napoleon was a sublime opportunist. When, in 1798, he went to Egypt he was uncertain whether he should go on from Egypt to India or turn back through Turkey and attack Europe in the rear. He was only resolved to make some great stroke when the occasion offered. Now, whatever may have been his lingering hopes, he well knew that the remainder of his days might be spent in Elba and he was imperiously determined to reconstruct the life of the island. This was not due, as Sir Neil Campbell, the British commissary in Elba, charges bluntly, to merely selfish aims; a great organizing intelligence such as Napoleon's could not rest when problems for his energy lay before him. Within a few days he had discussed with many farmers sweeping improvements in methods of culture. He planned and at once began the building of new roads. He cleaned Porto Ferraio and made the little place sanitary for the first time in its troubled history; it has continued the tradition and remains one of the cleanest towns in Italy. Elba was to take full advantage of its insular position to attract sea-going commerce and should become one of the shipping centres of the world. She should grow wheat to feed her own people, for, as it was, bread was too dear; she should grow potatoes; the Elbans believed that the chestnut and the olive would not flourish in the island, but he would prove to them that this was an error; Elba, too, should grow the mulberry tree and men must be brought to the island who knew how to cultivate it; her fisheries should be developed; she should revive her production of coral and anchovy. Rio needed a harbour and should have it; Napoleon himself went out in a boat, made soundings with the lead, and came back drenched to the skin.

He was not less zealous in regard to military defence. His thoughts dwelt perpetually, indeed, on problems of war. In the end he had in Elba an army of sixteen hundred men. As the total population was only twelve thousand it is clear that about one-half of the adult males of the island were in the army. Most of the men were old soldiers who had come to serve still under Napoleon; but three or four hundred were recruited in Elba. Napoleon would spend five or six hours at a time at the barracks. He talked to the men familiarly, tasted their soup and enquired about their comfort. He had not only an army but also a small navy of five ships. He believed that if attacked in Elba he could retire to the mountains and hold out for two years.

Sir Neil Campbell says that Napoleon seemed like the incarnation of perpetual motion. Lord Ebrington spent an evening with Napoleon alone and the Emperor kept his guest walking up and down in the salle for hours while he talked. When he gave an order he expected it to be carried out instantly. If a road was being built he required to know each day how much had been achieved. He was up often at three o'clock in the morning and he showed little consideration in requiring others to adjust themselves to his own rapid and eccentric movements. "He did what he wished, as he wished, and when he wished" says Pons, one of those in Elba who were driven by this restless master. He wrote little in Elba but read insatiably and complained of the inadequacy of his library. He was always ordering books to replenish it.

It would hardly be accurate to say that Elba still preserves any vivid memory of this imperious master. Napoleon is, indeed, not much in evidence in the island. There is, it is true, one little street in Porte Ferraio with Napoleon's name. But, after all, his sojourn here was brief and the heart of Elba is Italian not French; it is the heroes of modern Italy, Victor Emmanuel, Garibaldi and Cavour, whom Elba loves to commemorate. Some streets in Porto Ferraio are named after Italian literary men—Manzoni and Carducci for example. The names one sees are Italian or, in some cases, Spanish. There are still families in Elba who bear the honoured name of Dante, and some with that dishonoured one which came from Spain, Borgia. It was at Porto Longone on the south coast that the Spanish chiefly settled and there to this day are found such names as Perez, Lopez and Rodriguez. France's brief sway has left but few traces. Of Napoleon himself the most permanent memorial in Elba is the festival in his honour celebrated on May 5. It is the anniversary of his death in St. Helena.

The iron mines were in operation in Elba two thousand years before Napoleon came and they are still the basis of the chief industry of the island. Their annual output is about 600,000 tons. Across the narrow stretch of the Mediterranean at Piombino are smelting works fed by these mines. Porto Ferraio itself has three great blast furnaces and a Bessemer steel plant. The tall chimneys standing on the strand of the beautiful bay pour out their black defilement on the air. They may grieve the soul of the artist but they delight that of the trader for they make Elba prosperous. Wages are high in the island. The well known rule applies that in the vicinity of a manufacturing industry the wages of the agricultural labourer advance. Florence has no great industries and, in consequence, the labourers in the lovely vineyards on the hill-side of Fiesole receive two francs a day and count themselves happy. In Elba such labourers are paid as much as four francs a day with a flask of wine added. The island has every evidence of well-being. There are almost no beggars: one sees no bare-footed and ragged children in the villages; work is abundant: the manager of a small estate told me that he could not secure enough men. The people too are proud and independent. The housewife of Porto Ferraio has great difficulty in getting domestic servants, for the Elbans scorn this form of labour.

During Napoleon's stay in Elba he naturally dwelt chiefly at Porto Ferraio. At first he lived in the civic Hotel de Ville; but there he could get no privacy and on the heights between the two hills he reconstructed a house that had been used as a mill and was known as the Mulini. It became for him an imperial palace, for he was still Emperor in Elba. It stands to-day, little changed in structure from what it was in Napoleon's time, but in a pitiable state of neglect and desolation. With some difficulty I found in a neighbouring street the woman who had the key and she seemed frankly amused that I should take an interest in Napoleon. There is only one good room in the house, a salle built by Napoleon with four great windows looking out towards the sea and four towards the land. It is empty but for the busts of two Grand Dukes of Tuscany, brothers of Marie Antoinette, and, by an odd turn of fortune, uncles, by marriage, of Napoleon through his wife Marie Louise. The rooms are untidy and uncared for; the kitchen, with its cooking apparatus on a scale truly imperial, is laden with débris. I stepped out into the little neglected garden. It is hardly as spacious as the deck of a man of war. There were a few straggling flowers and a few trees, among them the laurel. I plucked a branch of the laurel leaves which Napoleon so delighted to see on his own brow. A railing encloses the garden at the edge of the cliff and at the base, more than a hundred feet below, the sea was beating in a white foam. Napoleon used to take the steep climb down to bathe in the salt water. From the garden he often watched with a glass the shores of Italy a dozen miles away and also the ships on that unstable element which had baulked so many of his plans.

The Mulini palace was well enough, perched on its rocky height, but it gave little chance for free movement. Napoleon could not stir out without being haunted by petitioners and sightseers. He planned to have residences at every important point on the island. At Porto Longone he made one of the existing houses his own; at Rio he caused Pons, the Director of Mines in the island, to vacate his house and go elsewhere. The place, however, which he made especially his own was the little villa at San Martino, three or four miles from Porto Ferraio. It was to be the St. Cloud to the urban imperial residence of the Mulini. It is perhaps the most beautiful spot in the island. The bay of Porto Ferraio is surrounded by a natural amphitheatre of mountains. Napoleon found a cottage built at the point in this amphitheatre which would correspond to the spot exactly fronting the centre of the stage in a theatre. The mountains curve round the bay on either side and the blue waters, and Porto Ferraio in the near background and the high coast of Italy in the distance, furnish the scenery on which the observer looks. The setting is perfect. Napoleon, barbarian though in many respects he was, had a real eye for beauty. He bought this place, and spent upon it in all about 180,000 francs. He added to the house; but its two floors contain only a dozen rooms. A Russian prince, who had married the daughter of Napoleon's brother Jerome, acquired the property in the course of time, and built on a lower level than the house a great museum for Napoleonic relics. The roof of this museum has been added to the garden of Napoleon's house. The objects formerly in the museum have long been scattered; the great building alone remains and the whole property has passed into the hands of a Florentine gentleman who is generous in allowing visitors to see it.

An avenue lined with richly laden orange trees furnished the approach to the house. I found the caretaker working in a vineyard. Other visitors had been there a few days earlier—some of the officers of the British fleet which had made a visit to Porto Ferraio: the terrible Briton haunts even the memorials of Napoleon! The caretaker unlocked doors for me and opened windows. Here, too, Napoleon built a hall, the size of a modest drawing-room in a country house.

A fountain was arranged in the centre of the room and the walls were decorated with frescoes. They are Egyptian scenes, a memory of Napoleon's sojourn there. At St. Helena he said that the best artists of Italy had competed for the honour of painting the frescoes; but this was one of his many bursts of grandiloquence, for the frescoes are not greatly beyond the resources of a village painter. The dining-room is in front of this hall and has a beautiful view of the bay and of Porto Ferraio. Napoleon's own bedroom is at the right of the dining room as the observer looks towards the bay; Bertrand and Drouot, his faithful companions, had rooms on the left. Minor members of the staff slept in the three or four small rooms on the lower level and there, too, was the imperial kitchen. The food was carried up an outside staircase in the open air and then through the hall to the dining-room. One could hardly imagine an arrangement more inconvenient and Napoleon must often have had the grievance of Louis XV, who, since his food had to travel far before it reached him, could rarely get anything served hot. Napoleon's bathroom on the ground floor below his bedroom is reached by a staircase so narrow that it must have been a trial to his corpulence. On the wall by the bath is a fresco of a naked woman looking at herself in a mirror and the phrase is painted on the wall, "*Qui odit veritatem odit lucem.*" The figure of the woman is not unlike Canova's statue of Napoleon's sister, Pauline.

The lower levels of Elba are warm in summer and by August Napoleon found the heat stifling. The remedy was a flight to the mountains. His realm was, as he said, small, but it did not lack variety. It was on the heights above Marciana that Napoleon took refuge from the heat and thither the visitor to Elba follows him. The road strikes inland from the head of the bay at Porto Ferraio, crosses a high neck of land, and then descends to the open sea on the north shore of the island. The road now used was planned by Napoleon. It is a costly task to create great stretches of highway and Napoleon's means were not equal to his ambitions; but later generations have completed what he began. At times the road winds along the edge of high cliffs from which one looks down upon the surf far below, a gleaming white, bordering the changing blues and greens of the rolling sea beyond it. At Marciana Marina the road comes down to the sea and the great waves dash in at one's feet. This little town has a long and checkered history. There is no harbour but only an open roadstead. Its virile people have long clamoured for the building of a harbour and the work is now going on slowly. It throws some light on Italian politics that an election placard on one of the walls read: "If you want the harbour built, vote for—." One seems to have heard of similar cries elsewhere.

I drove the score of miles to Marciana in a little two-wheeled cart behind a gaunt but strong horse. My driver I found to be a keen politician, a Radical who would go so far in his reconstruction of society as to start with anarchy. When I tried to find out what he meant by anarchy and how it would pave the way to a better order his answers were not illuminating; but this at least was clear, that he was profoundly discontented with things as they are. "There are too many thieves at Rome," he said with conviction. He declared that in a recent election in this constituency the government had spent corruptly three hundred thousand francs on behalf of their candidate. The taxes are an ever-growing burden and nearly everything is taxed. On a four-wheeled vehicle the tax is sixteen francs a year, on one of two wheels eight francs, on each horse six francs, on a donkey or a mule four, on a cow two, on a goat one and a half, and so on. I suggested that modern governments do much for the people by way of education, building roads, and preserving order, and need, therefore, a large revenue; but this explanation did not satisfy him. "It is kings that are costly," he said, "what we need in Italy is a republic." I told him that I thought I could name two great republics in modern times which are even more costly than monarchies; but he would not be convinced. He had words of approval for the policy of Napoleon. The Emperor, he said, was right in trying to build Europe into one great realm. There should be but one state. In this all men would be united; that vile thing patriotism would disappear; and there would be no more war. I do not think that this Elban Radical represents a powerful section of his countrymen, for the monarchy is generally popular in Italy, even surprisingly so when we consider that the reigning house has been for so short a time connected with most of the people over whom it rules. But the republican propaganda is open and avowed. Perhaps this fact only shows that the monarchy is so strong that it does not fear attack.

We met on the road the great motor omnibus now in use for mails and passengers; there are no private motor cars in Elba. A primitive mode of conveyance is still general. The donkey is traditionally a patient and strong little beast and in Elba he has need of both qualities. We passed a donkey with only his legs visible; the rest of his body was concealed by his burden of an old man, an old woman and two immense paniers. Sometimes a couple of children are added. It is wonderful that the slim little legs can patter along under so heavy a load. The people whom one meets are invariably well dressed. The women are surprisingly handsome; in the faces of most of the old women even there are traces of earlier beauty; Cupid must be busy in Elba.

It was not at Marciana on the sea-shore that Napoleon found his summer haven but at Marciana Alta, Marciana on the mountain. It is perched high up, not far from the jagged ridge of granite which marks the sky line. The grey stone houses as seen from below are numerous enough to indicate a considerable village, clinging like a human nest to the rock. Even down to the nineteenth century the coasts of Elba were haunted by pirates from the Moorish sea-ports in North Africa. When the alarm was raised, and to fight seemed futile, the inhabitants of Marciana Marina seized their valuables and made the long climb up the mountain side to Marciana Alta. There they remained until the danger was past. The high village served, too, as a refuge from the heat of summer. It thus happened that families often had two houses, one by the sea, the other on the mountain. In some measure the practice endures still. Except at times of festival, Marciana Alta is almost a deserted village. The men and often the women are away at work elsewhere. Those who farm have a house on their little bit of land far from the village. Usually they stay there at their tasks, but for festivals they come back to Marciana Alta or its neighbour Poggio about a mile away. My companion was eloquent upon the joys of life in Marciana Alta when its inhabitants return for a *festa*.

The road winds up to the high village in a steep and complex zigzag until one looks down on the sea three thousand feet below. The scattered houses and trees on the mountain side, the brown earth, the human occupants working in the vineyards, and, colouring all, the sparkling Mediterranean, unite to form a beautiful scene. Marciana Alta, when we reach it, proves to be enclosed in a strong wall and this shows that even its height on the mountain did not suffice alone to protect it from the marauder. Its streets are a confused tangle of narrow stone passages and stairs. At first the village appears deserted; but an occasional head peering from a window shows that the arrival of the strangers has been noted. In time two or three curious boys are in evidence. The horse is taken out of the cart and put in an empty stable, for a wheeled vehicle can no farther go. The boys are eager to carry the luncheon basket, and we set out with them upon our farther climb up the mountain, for Napoleon went beyond the village to a more remote and lonely spot.

The road now resembles an ancient walking place of giants. It is made of heavy stones thrown down roughly like an old Roman road. Possibly this pavement of boulders was laid in Roman or even in Etruscan days. Napoleon was short and stout and, if he walked, he must have found distressing this climb of nearly a mile up to the Hermitage where he dwelt. It could be done, however, on horse-back.

The piety of an earlier age has erected a dozen little stone shelters at regular intervals along the route. Once they held crosses and were places for devotion; but now the crosses and the prayers have alike ceased to be, a sign perhaps of the spirit of this age. The end of the walk is at a chapel in honour of the virgin. Close to the chapel is a long stone dwelling of four or five rooms. This is the Hermitage. The "hermit" is an old man, dwelling here with his wife, caring for the chapel and living on the alms of visitors.

Hither came Napoleon for a part of August and September, 1814. It is a wild and rugged spot. To supplement the rooms in the Hermitage he brought with him military tents and they were put up on the few patches of ground not cumbered with granite boulders, There was always work to be done when Napoleon was about. He had, after all, a little realm to rule and messengers were coming and going all the time that he was here. Many letters written from "La Madone" have been preserved in his Correspondence. Some of them are long and minute in regard to petty details of administration; all show a perfect clearness of intellect and an eye that saw everything, big and little. The opinion that, by this time, disease had undermined Napoleon's powers is surely unfounded; no intelligence could have been more alert and fruitful than his appeared to be in Elba. His activity even at La Madone was ceaseless. He went out shooting on these rugged heights; he visited spots of interest in the neighbourhood; he superintended the planting of trees. Though he was not much given to introspection, one thing here was likely to call up memories. A few hundred yards beyond La Madone the stony path comes to the high point on Mount Capanne where the view to the west is unbroken. There, forty miles away, lies the long, high, sombre mass of the island of Corsica. I saw it when it was misty and black in the distance. Napoleon must have looked upon it when its lofty peaks, rising eight thousand feet from the sea, were gleaming in the sunlight. It was less than twenty years since "the whiff of grape shot" directed against the Church of St. Roch in Paris had brought him fame. Assuredly he had been the chief actor in amazing scenes since Corsica had ceased to be his home.

The two members of Napoleon's family who came to live in Elba were singularly different in type. His mother Madame Mère had remained at heart the member of a Corsican clan with clannish feelings like those sometimes shown by a Highland Scot. She was a majestic and rather terrible person in demeanour, a veritable mother of him who had made himself a king of kings. Visitors stood in even greater awe of her than of the Emperor. Napoleon furnished her with a separate house and establishment. In manner of speech, in habits, and in outlook she was so unchanged from the time of her youth in Corsica that it might well have seemed as if she had never left Ajaccio. She tried to have Pons removed from his post, to be replaced by a Corsican. When two companies, one Genoese the other Corsican, competed for a monopoly in Elba in respect to the export of minerals, she worked to secure the privilege for the Corsican. Her servants, her cooking, her mode of life were Italian. She rarely invited anyone to her table, and rarely went out except to spend her evenings with her son. Napoleon's sister, the Princess Borghese, "the nymph Pauline" was of quite another type. She was in spirit a Pagan Greek. Notwithstanding the manifold scandals of her private life she was loyally devoted to her brother and her generous and impulsive nature possessed great charm. She could not be happy without trying to make those about her happy. At the Mulini she turned a former stable into a theatre and trained a company of amateur players. The little theatre has now relapsed into its primitive condition.

It was a strange gathering of people whom Napoleon collected about him. General Drouot, the director of military affairs, was a man of great rectitude of character. He was very devout and, to the surprise, almost to the scandal, of his fellow officers, carried the Bible with him and constantly read it. As a soldier Drouot was something of a martinet. He had, indeed, his softer side and, though he was already becoming a grey-haired veteran, he fell in love with a young Elban lady. When, however, he wrote to his mother to announce his happiness, her reply was to forbid the marriage, and filial piety led him to obey the admonition. The feelings of the jilted young lady were soothed and in the end she made a prosperous union. Every kind of person haunted Porto Ferraio. Old companions in arms came looking for work; persons with grievances threw petitions into Napoleon's carriage; one woman threw herself under the feet of his horse to ensure attention; women of rank, some of them English, came to see and admire the great man; courtesans came to ogle him; and assassins, dressed sometimes as officers or priests, lay in wait to kill him. Less and less as time went on did Elba seem to be the island of the blessed.

At first, however, Napoleon seemed perfectly content in Elba. For more than two years he had scarcely known rest. After the strain and horror of the Russian campaign, after the succession of terrible battles with the allies which had followed and which had brought his ruin in the end, Elba may well have seemed a paradise of quiet for a tired man. Exhausted nature craved for repose and repose was all the more delightful because he had come to Elba in the beauty of the spring time. But we all know that for men accustomed to active life retirement soon becomes oppressive. The court at Elba must have bored Napoleon to desperation. With an imperfect sense of humour he tried to keep up the regal etiquette of the Tuileries. Only some fifty island bourgeois were eligible for the court circle, and the hands of some of them were so horny with toil that they could not draw on gloves. Campbell saw, among the elect, the seamstress who had repaired his uniform. Elba was miserably poor and the courtiers found it hard to keep the pace required of them. Incomes remained small but prices went up and the usurer was called on to redress the balance. Napoleon, like his great rival Wellington, had no small talk. When ladies were presented to him he asked them abrupt questions about their fathers if they were unmarried, and about the number of their children if they were married. He carried an absurd pomp even into religious ceremonies which he attended in state. He thought, as he said, that this was necessary to keep up his imperial dignity and to impress the world.

At times, Napoleon's dignity in Elba suffered woefully. Among those who came into daily touch with him was Pons de l'Hérault. He was a Frenchman, an old soldier and a rugged republican. He had been director of Mines in Elba before Napoleon's time and continued to hold that office. Pons had a prickly conscience and the courage to stand out for its dictates. Napoleon wished him to hand over all the moneys derived from the profits of the mines. Pons declared that the balance in his hands at the time Napoleon became sovereign of Elba did not belong to Napoleon but to the French Legion of Honour which had been granted this source of income. One day Napoleon sent word that he was coming to the mines and Pons knew that he was to have the struggle of his life. The Emperor came in with a stern face. He sat at one end of a long table. Pons sat at the other end facing him. General Bertrand was on the right, Peyrusse, Napoleon's treasurer, on the left. Napoleon began by saying that the funds in question were Government property and that all Government property in Elba belonged to him. The answer of Pons was that up to April 11, when Napoleon became ruler of Elba, the funds from the mines belonged to the Legion of Honour.

"You will do what I tell you to do," said Napoleon.

"I will not," said Pons.

"Sir, I am always Emperor," said Napoleon.

"And I, sire, am always a Frenchman," answered Pons.

"You have been ordered," said Napoleon, "to hand over the funds and you refused to obey."

"I have received no such order, but if I had I should not have executed it and I ought to tell your majesty so . . . I will do nothing against my conscience."

It is to the credit of Napoleon, that, in spite of this rebuff, he treasured no rancour against Pons. They became fast friends. At times, Pons acted as Napoleon's secretary. The Emperor had practically forgotten how to write and called upon any one at hand to take down his words. Pons was distressed that he could not write fast enough but Bertrand told him that his own practice was to catch the sense of what the Emperor said and to put it in his own words, a liberty that shocked Pons. Yet he rather delighted in exhibiting to the Emperor his stiff republicanism. But Pons, like so many others, was conquered by the fascination of the master-will and he followed Napoleon back to France.

It is Pons who has recorded the most elaborate notes of Napoleon's life in Elba. He declares that only in this narrower scene could the Emperor be really studied. The result of this study is certainly the drawing of a complex character. Taine said that Napoleon had the moral outlook of an Italian of the fifteenth century, that is of a Borgia or of a Lorenzo de Medici. Side by side with this we should remember that the early Napoleon was undoubtedly a young man of austere life, who made great sacrifices in his honourable poverty to help the other members of his family, sacrifices which received from them but scant recognition. It is, of course, prosperity and not adversity which chiefly tries character and the prosperous Napoleon suffered a moral decline. Pons, a man of rigorous virtue, finds something, but not much, to blame in Napoleon. He only hints at sexual vices. Oddly enough Pons is most emphatic in blaming Napoleon's love of petty gossip, his eagerness to know what people are saying and his weakness in being influenced by it. He had, too, no mastery over his temper. There is a story that when he was annoyed in Elba at the binding of some books which had not been properly decorated with the imperial "N", he flew into a furious passion and even called in soldiers to tear the books in pieces with their bayonets. Both Pons and Campbell agree in saying that Napoleon had no control of his tongue. Often he spoke such biting words that some of his victims could never forgive him; on the other hand, he showed contrition after such outbursts and seemed anxious to make amends. He could not bear to be beaten at anything, even at cards; that would be, to his singular superstition, an omen of disaster; accordingly he cheated in order to win. He showed a truly Corsican parsimony in money matters; spoiled flour which his soldiers would not eat he forced, in spite of the protests of Pons, on the miners at Rio; one hundred of them fell ill, and all were bitterly indignant. For the rights of property he cared nothing. A sister had a furnished palace at Piombino. He sent over a vessel and stripped the house for his own use in Elba. His brother-in-law, Prince Borghese, sent south by ship the furniture of a palace at Turin. When the ship was driven into Porto Longone by a storm Napoleon took all the furniture. "It does not go out of the family," he said. But even when he was a robber his love of order appeared; he caused accurate inventories of his stealings to be made.

For the rest, here, according to Pons, is a truly admirable man. He has a devouring mental curiosity. When he sees a ship drawn up on the shore, he wants to know how it has been brought there, how it is put in the water, how it is handled in a storm. He has the will to create; "We shall see," he says, when Pons speaks doubtfully about doing anything considerable for fisheries, commerce, agriculture and forestry in the island. He is magnanimous; he treasures no rancour against those who oppose him honestly. For England, his great foe, he has, in Elba, words of generous praise, and he likes Englishmen; it was St. Helena which embittered him against the island state. At Elba Napoleon believed that he had many supporters in England: "Upright Englishmen honour me. If I went to England the Government would fear my influence and would force me to leave." In this saying Napoleon showed the lack of imagination which was, perhaps, the chief cause of his ruin, for, owing to this defect, he could never realize the vigour of national feeling. He took too seriously the party cries of the *Morning Chronicle* and other Whig utterances in which he was only a weapon to smite the Tories. Himself a man almost without a country, he could not understand that, against the foreigner, all Englishmen would unite. To our surprise we find Napoleon emotional. When his mother and his sister Pauline arrive in Elba he sheds tears of joy; Pons adds admiringly that he had shed no tear of grief when he lost an empire. One day, in turning over a bundle of newly-arrived prints, he comes upon portraits of Marie Louise and their son, and is moved so deeply as to startle every one in the room. Perplexing or bad news makes him morose and silent; when, on the other hand, he is merry or interested, he has the contagious enthusiasm of an eager boy; on one day he sits through dinner without a word; on the next he talks volubly of his campaigns. When work is being done in his house, he is among the workmen from morning to night. He cannot wait for the plaster to dry at the Mulini but moves in despite the protests of his physician. It is the sign of a fine spirit that he takes delight in the beauties of nature. He has singular dislikes. Black he cannot endure; it is the colour of death; white too he detests; it is in white that the victim for the sacrifice is arrayed. Though without religious emotion he still thinks the attending of mass has somehow a bearing on his own well-being.

Winter drew on and no word fell from Napoleon that he was other than resolved to end his days in Elba. Meanwhile the restored Bourbon rule in France was steadily helping the cause of its enemies. Men were found to say in blind adulation that when God made Louis XVIII He paused for rest after labour so great. Officers who had served under Napoleon were objects of scorn and contempt and were dismissed by hundreds and even thousands from the army. Their men were treated with similar derision. The returned nobles began to clamour for the revival of the feudal rights over the peasantry which they had enjoyed before the Revolution. They alarmed the thousands of innocent purchasers of lands, which had been seized and sold during the revolution, by demanding that these new owners should be dispossessed. The restored royalists indulged in many foolish acts of revenge. The restored Church was eager to persecute those who had raised their hands against it. From all this came a state of opinion which would have alarmed any but the blind and the deaf. Soldiers and peasants in France were alike growing eager for a change, and were turning in thought to the old leader. Napoleon knew what was happening in France. Newspapers came freely and there was constant communication with the Continent.

Nothing was spared by an incredibly stupid government to make Napoleon resolve to attempt his own restoration. By a truly barbarous tyranny his wife and his son were not allowed to go to him. It was openly debated at the Congress of Vienna whether, for greater safety, he should not be sent to some remoter island. In this connection the ominous name of St. Helena was already mentioned. St. Lucia, too, was suggested on the ground that the deadly climate would soon kill him. High circles made it quite clear that his assassination would be welcome, and base hirelings lurked even in his garden, awaiting a chance to kill him. Though Napoleon could easily have frustrated so wild a plan, it is quite certain that encouragement was given to Moorish pirates to make a sudden descent upon the island and kidnap him. The island swarmed with spies and some of them lived in the domestic circle at the Mulini. The treaty made with him was not regarded as binding. Though by it he was to have an income of 2,000,000 francs a year, France was fatuous enough to break faith and to pay nothing; Talleyrand said it would be folly to give Napoleon the means to carry on new intrigues. He had taken about 4,000,000 francs to Elba. This was a small sum for a sovereign, and he was soon face to face with dire poverty. He reduced some of the meagre salaries of his officials; he sold off part of his stable; he cut down the scale of his receptions and, in a hundred ways, with the Corsican frugality of his early youth, tried to live within his means.

But he could not administer the island and keep up his little army and navy without resources from outside. There was no prospect that these would come and he was face to face with the danger of an empty treasury.

Probably the exact nature of the attempt he should make at restoration was dim in Napoleon's mind until almost the moment of departure. Italy was a promising field for effort, for he had been King of Italy; and the Italians, in their renewed disunion under the aegis of hated Austria, turned in thought to the man who, with all his faults, had given them their first breath of national life. But it was in France that grievances against the restored rule were most acute and to France he returned. He did not set out from Elba until Sunday, February 26; but on Friday the 24th, the Elbans knew that he was going away. On that day couriers were sent all over the island to prevent any one from leaving. Even fishing boats might not go out. There were many spies in Elba. One of these, a professed oil merchant, tells us that he tried to get away on the 25th but was sternly called back when he had induced a fisherman to make a start. All Elba knew that Napoleon was going before his mother and his sister were told. But his bearing was so read by his mother's instinct on Saturday night, February 25, that she questioned him and he told her. She only said, after a pause, that she thought his repose in Elba unworthy of him, and expressed the hope that if he must perish he would die not by poison, but with his sword in his hand. On Sunday morning Napoleon went to mass. He had already received farewell official visits, and had provided for the government of the island during his absence. He was taking with him not only his old soldiers from France but also some Elban recruits. On that Sunday afternoon, mothers, sisters and sweethearts stood on the quays to bid farewell to those who put off in small boats to the ships that lay at anchor in the harbour. Pons says that there was no weeping; there was only a silent tension, a mingling of saddening fears and high hopes. Men of Elba were now going off to follow Napoleon, as, according to Virgil, three hundred of them had gone more than two thousand years earlier to follow Æneas. An adverse wind delayed the ships in getting out of the harbour. It was after midnight of the 26th when they had gone; by noon on Monday there was no sight of them on the horizon.

Elba mourned to see Napoleon go. Elban traders had serious reasons to regret many of the departed warriors, for they went off heavily in debt; but the island had had ten months which were to remain forever vital in its history. Napoleon had gone, but his work remained. Under the hammer of his energy the old Elba had been shattered. After his fall the island was annexed to Tuscany, a natural political tie, and was ruled by the brother of Marie Antoinette. No longer was it divided among three or four Italian states. For the hundred years that have followed, Elba has been happy in having few annals. When the movement for Italian unity developed, Elba shared the enthusiasm for the leadership of Victor Emmanuel and, as a part of Tuscany, accepted him as sovereign in 1860. Ten years later the Elbans saw a chance to revive a tie with the house of Bonaparte. After Sedan they offered the fallen Emperor Napoleon III as asylum in the island. He replied courteously to the official letter sent to him from Porto Ferraio, but the Elbans had overrated the attractions of their island, and he preferred England. The island has now about 30,000 inhabitants, nearly three times as many as it had in the days of its imperial ruler. They have keen strife; there are clericals and anti-clericals, monarchists and republicans, conservatives and socialists; but this is only to say that Elba is a microcosm of Italy. It has never had any great landed proprietor; the holdings are small and the people are, in a rustic way, extremely well to do. Elba is, indeed, a good example of the proud independence which the ownership of land brings to a peasantry. Some of Napoleon's hopes have not been realized. The olive and the mulberry do not flourish in Elba as he hoped they would; Marciana and Rio still lack the harbours which he planned; and Elba is not yet the home for sculpture which he thought its excellent marble might help to make it. But, even if Napoleon is only a vague saint in the Elban calendar, his achievements are real enough.

Some Notes on the First Legislative Assembly of Ontario and its Speaker, Hon. John Stevenson.

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(Read May Meeting, 1914.)

The year 1867 may properly be regarded as the most important year in our national development since 1759. The latter gave to Great Britain the sovereignty over the northern half of North America; the former determined the form of government that sovereignty was to assume. In 1867 we entered upon an era which, it was hoped, held great possibilities for the new Dominion. It was an experimental year a year viewed with nervous apprehension by all our great statesmen. Precedents were to be established and all who participated in the public events of that year were pioneers in laying the foundations of our national institutions as they exist to-day.

The inevitable destiny of the colonies of British North America was a confederation or union of some kind. This appears to have been fully realized long before the Fathers of Confederation took the first steps in that direction, and, now that it has been successfully accomplished, the wonder is, not that it was brought about, but that it was not brought about at an earlier date. For more than half a century the question had been seriously discussed more or less in different quarters and from different standpoints.[1] It may fairly be argued then that all the more honor is due to those who found a satisfactory solution of a problem that had baffled the statesmen of the colonies for over fifty years. Many proposals had been suggested, much oratory spent and spirited correspondence carried on over the question of confederation; but its formal adoption was not sanctioned by any legislative body until 1854 when the assembly of Nova Scotia passed a resolution that "The union or confederation of the British provinces while calculated to perpetuate their connection with the parent state, will promote their advancement and prosperity, increase their strength and influence and elevate their position."

Then too for the first time the imperial government seriously took up the question and frequently during the next decade, when discussing colonial matters, favored the federation movement. The agitation continued in Nova Scotia, New Brunswick and Prince Edward

[1] See "Alphabet of First Things in Canada" by George Johnson, 3rd Edition, 1897, page 55.

Island until 1864 when it took a more definite form by the legislatures of all three provinces passing resolutions providing for a conference of delegates to discuss the question so far as those provinces were concerned. Meanwhile there had been a feeling of unrest in Upper and Lower Canada, and the years immediately preceding confederation witnessed many a ministerial crisis, and at times, the very peace of the country seemed to be threatened. All the colonies had before them the object lesson of the great republic to the south; a federal government legislating upon all matters affecting the commonwealth as a whole, with the state legislatures caring for the needs of the individual states. Even the dark clouds of the civil war had not obscured the advantages incident to such a union as existed across the border. A great many forces both from within and from without were leading the several provinces towards the same goal. Great Britain and the United States were on the verge of war, and an invasion from the south would have found us in an almost helpless position to offer any serious resistance. The interprovincial trade was not organized upon a business basis and the imminent danger of the threatened denunciation of the reciprocity treaty and the abrogation of the bonding privilege by the Republic to the south threatened to bring on a financial crisis. There was no united effort to improve transportation facilities by land or water. The lack of uniform laws was a drawback to the expansion of trade, and in some measure, to the administration of justice. As each province felt more keenly the effect of these disadvantages it was drawn more closely towards its neighbours and they were the more disposed to seek a common remedy.

In Canada the vexed question of representation by population had begun to assume a serious aspect and our public men of all shades of politics were prepared to welcome any scheme that would relieve the critical situation.

It thus happened that when the representatives from the Maritime provinces were convened at Charlottetown in September, 1864, to discuss the question of confederation, Canada seized upon the opportunity and despatched eight delegates to seek admission to their deliberations and to discuss the question of a greater confederation, to include Upper and Lower Canada as well. They were cordially received by their brethren down by the sea, and so successful was their mission, that it culminated in the historic meeting at Quebec on the 10th of October of the same year, when the delegates, with a few notable additions to their number, reassembled and, behind closed doors, formulated the plan of confederation which was subsequently embodied in the British North America Act which came into force on July 1st, 1867.

There was a singular unanimity of sentiment upon the question in Upper Canada. Upon the motion before the Legislative Assembly proposing an address to Her Majesty, praying that a measure be submitted to the Imperial House embodying the principles of the resolutions of the Quebec Conference, out of sixty-two representatives from Upper Canada only eight recorded their votes against it.

Politics were for the time forgotten and Liberals and Conservatives worked hand in hand to secure the desired end. That the first government of the province of Ontario should be a coalition of the opposing forces, which had divided the province for years, was the natural consequence of the new order of things. The new province was fortunate in securing the best men in public life as its first representatives, and these representatives, without violating any party affiliations, selected for the executive the best men of both parties returned to the House. The choosing of a Speaker was a very important matter, for, as the new body of legislators set out in the beginning of their career, so they were likely to continue. To find a man capable of filling the position and free from party prejudice was the first consideration. Their choice fell upon John Stevenson, who had been returned as Independent member for Lennox and Addington.

Standing side by side in an old graveyard at Sennett, Cayuga county, in the State of New York, are two plain tombstones, upon which the lettering may still be easily deciphered. The one is to the memory of "Arthur Stevenson, died Nov. 1st, 1821, aged 70 years" and the other to "Rachael, his wife, died July 9, 1852, aged 92 years, 5 months and 27 days." In a genealogical sketch of the family of Arthur Stevenson published in 1903 by one of his descendants, Dr. John R. Stevenson of Hoddonfield, New Jersey, the author does not pretend to trace his lineage with any degree of certainty beyond the ancestor whose remains are buried at Sennett. By a series of inferences, by no means conclusive, he argues that he was in all likelihood a son of Samuel Stevenson of Hunterdon county, New Jersey, and grandson of Thomas Stevenson, who migrated from Newton, Long Island, to Buck's county, Pennsylvania. From other sources, perhaps quite as reliable, we are told that the Stevensons were originally of English descent and settled in Pennsylvania shortly after the arrival of William Penn, and that the first representative in this hemisphere was Surveyor-General of the state, that one branch of the family went to New Jersey and others to Virginia, and that Andrew Stevenson, at one time Speaker in the United States House of Representatives and afterwards Minister to the Court of St. James, was a descendant of the Virginia branch.

Among the illustrious men who claim their origin from the old quaker surveyor, we find two Governors, several judges and a host of eminent army officers. It will not serve our present purpose to trace the history of the family farther back than Arthur Stevenson of Cayuga county, New York, and we are interested in him only to such extent as his history may throw some light upon the life of one of his grandsons, the Honorable John Stevenson, the first Speaker of the Legislative Assembly of the Province of Ontario.

Arthur Stevenson was married, according to the traditions of his family, some time prior to 1785 to Rachael Yard and lived in Hunterdon county New Jersey, until about 1815, when he moved to the State of New York. During the revolutionary war, the people had been harassed and impoverished by the soldiers marching and countermarching across that section of the country and many families migrated to Canada and western New York; but Arthur Stevenson was not among the number who left for this reason. No doubt he was moved to a certain extent by the injuries sustained by his neighbours and may himself have suffered more or less from the same causes. He probably kept in touch with some who had moved away. It is not surprising, therefore, in after years, when the family had grown up, to find some members following the course of their former neighbours and taking up their homes in northern New York. Arthur's eldest son, Edward, accompanied him to the new home and settled at Eldridge in New York state. Edward had five sons and three daughters. A younger son, Charles, was elected Governor of the State of Nevada in 1889 and another son, Edward, was in the same year elected Governor of the State of Idaho.

At the time Edward Stevenson accompanied his father to his new home in the State of New York he had two sons, Arthur and John. John, the younger of the two, was but three years of age at that time, having been born on August 12th, 1812. This young son was destined to carve out for himself a place in the history of our province.

A few years later the father made another move and this time settled in the county of Leeds in the Province of Ontario. In making this journey to their new Canadian home the boy travelled 300 miles on horseback, crossing the boundary line at Cape Vincent. A short course at the public school in Brockville was the best provision his father could make for his education and there he had as one of his schoolmates a bright young lad who afterwards became the Honorable Sir William Buell Richards.

Young Stevenson was a voracious reader and had a remarkably retentive memory and while he was denied a higher education, in the sense in which we understand the term to-day, yet, by his faithful application to a very wide range of reading, he acquired a large fund of useful knowledge, surpassing in its practical usefulness many of the courses in our University curricula of to-day. He was well versed in literature and his well selected library, the accumulation of a life time, bore testimony of his good taste in that direction. Science, both theoretical and applied, received his attention and he digged deeper still in the realms of political economy and jurisprudence.

While not yet twenty years of age he taught school a few miles from Brockville and boarded with a grandson of Benedict Arnold.[1]

In 1831 he left his father's home and started out in life to seek his fortune, having no other capital than a fairly robust constitution, such education as he had acquired in Brockville and a strong will that knew not failure. Thus equipped, with a few shillings in his pocket, he came to Bath and entered the employ of Henry Lasher as a clerk in a general store. He devoted himself assiduously to his new occupation and at the expiration of five years, upon the death of his employer, he had acquired such a mastery over the details of the business that he and John Lasher, son of Henry, formed a partnership and took over the business under the name of Lasher and Stevenson. This partnership lasted for fourteen years, during the last few years of which period a branch store was opened in the village of Newburgh under the management of John D. Ham, who had also served his apprenticeship behind the counters of Henry Lasher.

Bath at this time was a thriving village and promised to be the most important business centre in the county of Lennox and Addington. It was the educational and commercial centre of a rich and extensive farming community settled by the most progressive families of the United Empire Loyalists. All roads in the neighbouring townships lead to Bath. It was on the main thoroughfare connecting York and Kingston, in fact, the first stage line between Kingston and York was put in operation by Ralph Purdy of Bath. The Finkle shipyard was located at the outskirts of the village and from its ways had been

[1]The story of Arnold is known to all. Having made his escape to the British lines, he received a military appointment and a grant of several thousand acres of land. There were many Loyalists who remembered him as the first American who proposed the invasion of Canada, and they protested against the Government for according him such generous treatment. His son, John and his sister, Hannah, settled in the township of Kitley. John died in 1819 leaving three sons, Henry, John and Richard, each of whom owned at one time a portion of the land included in the grant to their grandfather. John B. Arnold, reeve of the township of Walford and son of the last mentioned John Arnold, is the only male descendant of Benedict Arnold living in the county of Leeds to-day. The military coat worn by Benedict during the American revolution is still preserved in the family.

launched many good ships, among them the first steamboat seen upon Lake Ontario.[1]

The shipping industry of Bath, most of which was handled by this enterprising firm, was an important item and brought the partners into close business relations with many of the leading merchants of Montreal, Oswego and other cities where there was a demand for the lumber, grain, potash and other products of the Bay of Quinte district.

Upon the dissolution of the partnership with Lasher in 1849 Stevenson formed a new partnership with Ham and took over the Newburgh business which was thereafter carried on under the name of Stevenson and Ham.

Mr. Ham resided at Newburgh and devoted his time to the supervision of the store, while Mr. Stevenson first moved to the same village, but shortly afterwards took up his home in Napanee, where, a few years later, he built a handsome residence which is still looked upon as one of the finest and most substantial in the town.

They launched out into the lumbering business and purchased large tracts of timber lands in the northern parts of Addington and Frontenac and operated mills at Petworth and Napanee on the Napanee river. Mr. Ham was the more conservative member of the firm and did not altogether relish the new ventures into which his partner was drawing him. Lumbering could not be carried on to advantage upon a small scale and large sums of money had to be locked up in the timber berths and the cost of cutting and getting the logs to the mills and marketing the product before any returns could be expected. Sometimes months and even years would intervene between the initial purchase of the standing timber and the receipt of the first cheque for the lumber. This was the part of it that did not appeal to Mr. Ham, who had been accustomed to turn over his stock in a few months. A light investment, quick return and small profits appeared to him to be a safer business than the slow moving returns from the lumber business. To appease his partuer Mr. Stevenson from the first purchased the timber limits in his own name and held them at his own risk, repaying himself for his outlay when the lumber was sold. After working together successfully for five years the partnership was dissolved, Mr. Ham retaining the Newburgh store and Mr. Stevenson the lumbering business.

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[1] The Steamer *Frontenac*, the first steamboat that plied upon the waters of Lake Ontario, was launched from the shipyard of Henry Finkle at Bath, on September 7th, 1816. Henry Gildersleeve, a young man newly arrived at Kingston from New Haven, Connecticut, worked upon the steamer. He was the founder of the Gildersleeve family which has ever since been closely identified with the navigation of our lakes and rivers.

The latter soon formed a new partnership with George Lott, which lasted for twenty years, and the saw mills were soon busier than ever under the management of the new firm of Stevenson & Lott. The junior member was just the man to take charge of the shantying and river driving end of the business. He was small in stature with a piping voice but absolutely fearless and perfectly at home in handling both oxen and men and when he gave an order it was done in such a way that those to whom it was addressed asked no questions but proceeded to execute it.

The senior partner acted as financial agent, and exercised a general supervision over the mills and marketed the product. In reviewing a mass of correspondence, carried on between him and the Crown Timber Office and the various firms with which they dealt, the writer was impressed with his keen business methods and his evident ability to hold his own in any negotiations in which he was involved.

The details of this business were sufficient, one would think, to occupy the time of a man of ordinary business capacity; but it is quite evident that he did not belong to that class. Shortly after he left Bath we find him negotiating with the Cartwright estate for the lease of a flour mill in Napanee and in a few months he was soliciting the grists from the surrounding country and doing all manner of custom grinding.[1]

As soon as his partner Lott was seated securely in the saddle and had demonstrated that he could relieve his senior partner of all responsibility in connection with the cutting and driving of the logs, Mr. Stevenson thought he could safely embark in another line. He opened a new general store in Napanee and was to a certain extent a rival to his old partner at Newburgh. This return to the first business in which he engaged when a young man perhaps suggested to him that he again put into practice the knowledge acquired in another line while in Bath. The shipping industry was assuming large proportions in Napanee and he saw no reason why he should not enjoy a portion of it; so it was taken up in conjunction with his other lines and proved to be very profitable. So profitable indeed was the chartering of ships that he went one step further and built and launched upon the Napanee river the schooner *John Stevenson*. Laden with the products of his own mills and such other freight as could be obtained at the bay ports,

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[1] Napanee had long been famous for its flour. In 1786 the Government erected at the Appanee Falls the second grist mill built in what is now the province of Ontario. So celebrated did this mill become that in the Indian tongue the word Appanee lost its original signification and took on the secondary meaning, flour. The Honorable Richard Cartwright purchased the site of the town of Napanee from the Government in 1792 and the mills and waterpower remained in the family until 1911, when they were sold to the Seymour Power Company.

a fleet of schooners was kept busy carrying out the directions of the busiest man in the county of Lennox and Addington.

There was apparently no limit to his activity and the scope of his undertakings. With all his other interests upon his hands, we find him the successful tenderer for a portion of the construction work upon the Grand Trunk Railway. For several months this important work called for his personal supervision. Later on we find him negotiating for and securing a contract for utilizing the convict labor of the penetentiary and, so successful was he in this new venture, that he crossed the line and performed a similar service for the state of New York by turning to good account the prison labor of that state.

Later on in life he took in hand a languishing brush factory in Napanee and under the most adverse conditions placed it upon a sound business footing. He organized and operated successfully a piano factory in Kingston and dealt extensively in real estate in the northern townships where he had carried on his lumbering operations. In fact, nearly all of the lands handled by him were originally purchased as timber berths and, when he had no further use for them, he placed them upon the market as farm lands and the title to many a good farm in the townships of Portland and Hinchinbrooke may be traced back to John Stevenson as the original owner.

About the time he moved to Napanee he was appointed a Justice of the Peace. It could not have been with a view of providing himself with some congenial occupation that he accepted the commission, as at no time in his history did he appear to have an idle moment. He entered actively upon his magisterial duties and it was not long before Squire Stevenson became a terror to the evildoers of the town and surrounding country. The records of many of the cases tried before him and other associate justices of the period are still preserved. These are written in a clear round hand and are in keeping with the regular system used by him in everything he undertook. In perusing the evidence taken down in several cases tried before him for infractions of the liquor licence laws I observe that the character of the testimony in such cases has undergone no change during the past sixty years. Witness after witness was called. They all admitted they had been frequently upon the premises in question, had seen some sort of liquor sold over the bar; but their feelings were hurt when it was insinuated that it was intoxicating liquor or that they might reasonably be expected to know what it was. The justices appear to have had a proper conception of the weight to be attached to such evidence and invariably convicted in all liquor cases.

In the month of June 1860 the Magistrates' Court, over which Mr. Stevenson presided, was forcibly reminded that it was not always safe to pursue this policy. Upon an appeal against two convictions made against individuals for selling liquor "contrary to the statute and by-laws of the village," it was discovered that the by-law in question contained no prohibition against selling liquor without a license. Mr. J. J. Burrows, County Crown Attorney and afterwards Judge of the United Counties of Frontenac, Lennox and Addington, administered a rather severe reproof to the convicting justices in a letter from which the following is taken: "Surely, when a man is convicted and punished for an act done contrary to the provisions of a by-law, it is expedient to inquire whether there is any such by-law, and not to take it for granted."

Among the Stevenson correspondence is one letter which may throw some light upon an incident in the history of the Limestone City that most Kingstonians would like to have forgotten. Mr. Stevenson was a member of the Committee of the Council of the united counties appointed to render such services as they could in tendering a suitable reception to the Prince of Wales upon the occasion of his visit to Kingston. The letter reads as follows:

"Kingston, Aug. 11th, 1860."

"Sir.

"I am directed by the Prince of Wales Reception Committee to send the following copy of a resolution adopted at its meeting this day.

"On motion of D. D. Calvin, Esq., seconded by Col. Cameron:

"Resolved, that this committee deeply regrets that any differences or antagonism should arise between it and the committee of the Counties Council; that it is the wish of this committee to co-operate fully with the committee of the Counties Council believing that the reception of His Royal Highness would be defective were the Agriculturists represented by the counties council not represented therein and that as many bodies corporate or otherwise as possible unite in presenting their addresses to His Royal Highness in this City."

"I have the honor to be, Sir,
"Your obt. servant,
"M. FLANAGAN,
"for David Shaw,
"Secy. P. W. R. C."

"John Stevenson, Esq., Napanee."

It would appear from the foregoing that the want of harmony, to use a mild expression, among those providing for the reception of His Royal Highness on the 5th of September was not a condition that came suddenly to the surface a day or two before the intended reception, as the correspondence published at that time would indicate, but that it had been brewing for some time, which made it all the more indefensible. It is quite possible that this letter had no direct connection with the determination of the Orangemen to display their colors before the Prince; but it proves beyond any doubt that as early as August 11th the committee were quarrelling among themselves. This ill feeling would render a compromise on September 5th all the more impossible.

Although Mr. Stevenson took no active part in politics before he moved to Napanee, yet he was a close observer of what was going on in the political world. Had he been disposed to disregard the strife that was being waged between the Family Compact and the champions of responsible government, he could not have lived in Bath without having his attention most forcibly called to the great issues of the day. It was at Bath that the rebel banner, as it was called, of Marshall Spring Bidwell was first flung to the breeze. Bidwell and Peter Perry, two uncompromising opponents of the "Family Compact," were familiar figures upon the streets of Bath. Bidwell had been brought up in that village, which was his political headquarters, and Peter Perry lived but a few miles distant in the township of Fredericksburgh. Polling day was not such a tame affair in 1836 as it is to-day. There was only one polling place in the riding and that was at the village of Bath and the voting extended over the entire week from Monday noon until Saturday night. A board platform raised about six feet from the ground, with a railing of boards around it and covered by a board roof, a flimsy temporary affair known as the "hustings," was erected on a vacant lot at the west end of the village but near to the main street. The nominations took place on Monday morning, the returning officer presiding. The respective candidates mounted the hustings and presented their arguments to the voters, who stood upon the ground about the platform and proclaimed their opinions upon the several points scored by the speakers with shouts of applause or catcalls. At one o'clock the nominations were closed and the voting began under the direction of the returning officer, who at that time was Isaac Fraser, former representative of the riding and the first registrar of Lennox and Addington. He and his poll clerk sat behind a table on the same platform from which the speeches had been delivered and before them was an open book containing the names of all electors entitled to the franchise with columns ruled to receive the entries of the votes. About the platform were two or three constables to preserve order and one or more of the four candidates and their representatives, who followed closely the movements of the voter until the fatal word was spoken indicating the candidates of his choice.

The contest was waged over the doubtful voters who, then as now, constituted a large percentage of the electors. All doubt was removed the instant the vote was cast and the announcement was received in the street with triumphant shouts by one party and hisses and jeers by the other. Dozens of tents were pitched throughout the village from the poles of which floated the colors of the respective candidates, and a welcome was extended to all voters known to be friendly to the color, or likely to be amenable to such influences as might be brought to bear upon them. The over-crowded taverns were the main recruiting grounds and as the voter arrived in the village he promptly made his way to the tavern which was recognized as the headquarters of the candidate of his choice. If he had no choice, as was frequently the case, he would be promptly taken in hand by an agent of one of the candidates and conducted to one of the tents or the tavern. Refreshments were provided on a bountiful scale, especially those of a liquid character. Representatives of the opposite party were always lurking near, ready to spirit away the victim to the other camp. The more irresponsive the voter the more unremitting in their attentions were the respective agents of the opposing candidates. The less inclined the voter to go to the booth and poll his vote the more industriously was he plied with whiskey.

The scene about the village tavern can readily be imagined. There were scores of voters in all stages of intoxication. Those who had already polled their votes were endeavoring to induce their friends to do likewise, or, if overcome with their exertions and libations, were lounging drowsily in a corner of the bar-room or curled up in a stall of the tavern barn, oblivious of their surroundings. Fights were as common then as arguments, and few ever thought of interfering to separate the participants, who, as a rule, were too drunk to do each other much harm. As the poll closed on the evening of the first day the votes were summed up and couriers were despatched to the farthermost points of the riding to anonunce the result. The party in the lead would despatch messengers to see that the indifferent voters were hurried to the poll on the following morning in order that they might retain the advantage they had gained, as many a voter was influenced by the state of the poll and preferred to be on the winning side, as that meant that he would be a participant in the feast that followed the victory. The losing side sent forth their messengers on equally important errands, bearing messages of encouragement to the faint-hearted and to the indifferent they carried persuasive messages of another kind, generally conveyed in two gallon jugs.

The second day of the polling witnessed a renewal of the strife and so on from day to day, the feeling growing more bitter, the fights more frequent and the liquor flowing more freely, with the usual attendants. Such was the election of 1836 as described by Mr. Peter Bristol of Napanee, now in his ninety-fourth year, who resided near the village and was an eye-witness of the scenes. He remembers distinctly the bitter invectives of the speeches of Peter Perry who felt that he was fighting a losing battle against the cool and sarcastic "aristocrat," John Solomon Cartwright. Bidwell denounced the Family Compact in scathing terms and George H. Detlor, the other government candidate, had little to say but chose to rely upon the strength of Cartwright, his running mate, to carry him to victory. The Government had been smarting for years under the lash of Bidwell and they entered this contest with a grim determination to win and singled out him and Perry as two candidates who at any cost were to be defeated.[1]

John Stevenson at that time had become fairly established in the new firm to which he had been admitted as a partner and had just begun to make himself known in the commercial world. Such a struggle as he thus witnessed between the opposing forces could not fail to leave its impression upon him. He was a great admirer of Bidwell and his political leanings in after years clearly indicate that he regarded him as his model of a true statesman. The two retained a friendly and business relationship until the death of Bidwell in 1872. Among the Stevenson collection of papers belonging to the Lennox and Addington Historical Society are many letters and documents relating to various parcels of land in Kingston and the surrounding townships which were managed by Stevenson for the famous New York jurist. Among them is a letter of November 13, 1872, from G. R. Prentiss conveying the intelligence of Mr. Bidwell's sudden death.

It was shortly after the dissolution of Stevenson and Ham that the separation of Lennox and Addington from Frontenac became a very

[1] John Solomon Cartwright and George H. Detlor, the Family Compact candidates, were elected, defeating Peter Perry and Marshall Spring Bidwell who had represented Lennox and Addington for eleven years. Perry afterwards removed to Whitby and became a prominent figure in Ontario county. Port Perry on Lake Scugog was named after him. Bidwell, for four years Speaker of the Legislative Assembly of Upper Canada, was a thorn in the side of the Governor, Sir Francis Bond Head, who succeeded in driving him from the country. He went to New York and became one of the most prominent members of the New York bar. Mr. Bidwell's own explanation of his leaving Canada was as follows: "I have left Upper Canada forever, at the request of Sir Francis Head, to whom I have given a written pledge not to return. I was not implicated in the recent revolutionary movement, but was an object of suspicion on account of my political opinions and supposed influence." This is taken from a letter written by Marshall S. Bidwell from New York, Jan. 20, 1838, to Mr. James Larned, Washington, D.C. The original letter is in the possession of Mr. C. M. Warner, of Napanee, Ont.

live question. Concerning the advisability of a separation there was but one opinion throughout Lennox and Addington, and the only question upon which all parties could not agree was the selection of a county town. At one time Bath would have been an easy winner but the course of the Grand Trunk Railway which was chosen several miles north of the village placed it out of the running. Newburgh and Napanee each sought the coveted prize and left nothing unsaid or undone to defeat the ambitious aims of the other. The county was divided into two opposing forces and at their respective heads were the former partners Stevenson and Ham. They were first drawn into the fight from a purely business standpoint; but finally they both entered the arena of municipal politics and studied the question of separation at close range from their places as members of the council of the united counties, the one having been elected Reeve of Napanee and the other, Reeve of Newburgh. The struggle was a long and bitter one, which for nine years defeated the main object they had in view; but in the end the Stevenson forces were victorious, the separation became an accomplished fact and the fighting Reeve of Napanee was elected the first warden of Lennox and Addington in 1863, held the position for three successive terms and was followed in the warden's chair by his old partner and opponent who held the office for two years. To the credit of both men it can be said that when the decisive step was taken and the county town finally selected, they laid aside their differences and worked together, shoulder to shoulder, for the good of the county.[1]

Stevenson seemed to recognize the fact, which many men have learned at great expense and often to their great sorrow, that politics is not a very good stepping stone for a young man just embarking upon a business career, and, while he closely observed what was going on in the political world and formed his own opinions upon the issues before the people from time to time, he steadfastly declined to be drawn into the fighting lines. It was not until he had established himself in several business enterprises and had begun to install his sons as managers of them that he allowed his name to be placed in nomination even for municipal honors, and then only at the request of the business men of the village of Napanee who believed him to be the strongest man to handle the question of separation, and so he proved to be.

During his term of wardenship, all of the difficult problems arising out of the separation were disposed of in a most satisfactory manner. The apportionment of the debts of the former united counties, the

[1] Lennox and Addington is the only example in the province of a double name for one county as the true name is "The County of Lennox and Addington." The separation from Frontenac was finally effected in 1863.

erection of new buildings, the creation of new offices and the selection of competent officers to fill the new positions and a hundred other matters all arising out of the new order of things, had all to be settled satisfactorily under the guidance of Mr. Stevenson. He always had been a reformer and an ardent admirer of George Brown. In 1860 when arrangements were being made to get Mr. Brown to address a meeting in Napanee, the correspondence was carried on with Mr. Stevenson. Mr. Brown imposed only one condition, and that was, that he be not asked to speak in the open air.

In the election of 1863 he was placed in an awkward position. He was strongly urged to support Augustus Hooper instead of R. J. Cartwright (afterwards Sir Richard) but the local issue of a county town over-shadowed all other considerations and he cast in his lot with the latter. Sir Henry Smith made a strong personal appeal to him in which he belittled John A. Macdonald's government and Cartwright's qualifications and concluded his letter with the following:—

"I consider that we shall soon have a dangerous crisis in Canada unless moderate men of all parties unite for the general good. The fact is, the names of Reformer and Conservative are obsolete and the real name should be 'Moderate' men of all parties." It was this anxious feeling on the part of all public men of Upper Canada that rendered a coalition government possible.

While the new county had been busy in putting its house in order the greater question of confederation had been threshed out upon every hustings from the Great Lakes to the seaboard. As warden of the county Mr. Stevenson was naturally a man of considerable importance in his own county; but he was also recognized as a man who was bound to attain to greater honors. In the parliamentary election of 1863 his advice had been sought by, and he had kept in close touch with, the leaders of the reform party. When the proclamations were issued for the elections to the Legislative Assembly of the new Province of Ontario, Mr. Stevenson was easily the man of the hour in Lennox. Had he not brought about a separation of the counties? Had he not brought order out of chaos and established the county of Lennox and Addington upon a good business footing? This feeling was naturally much more pronounced in Lennox than in Addington, for, while the fight over the county town was not strictly a family quarrel between Lennox and Addington, the great majority in Lennox favored Napanee as the county town and Mr. Stevenson as the hero of the long fought battle, which resulted in awarding the prize to Napanee. The successful manner in which he carried on his numerous business enterprises had also won for him the reputation of being a shrewd business man.

It was not at all surprising therefore that he should be presented with a petition signed by one hundred and fifty men of all parties requesting him to accept the nomination. Although the elections were not to be held until August the old parties began in April to hold their conventions and select their candidates. As the province was starting out with a clean slate there were no clearly defined issues between the parties, no battle cries, no political scandals. There was, however, a determined effort to revive the old party lines and, in many instances, where party feeling had formerly been high, the old following fell into line under the old leaders; but, if asked why they did so, no better reason could be assigned than the personal feeling for the respective local leaders and a long nourished antipathy towards the other side. A local paper published in Napanee under date of April 25th, 1867, in commenting editorially upon the party affiliations said: "We have waded through a great deal of heavy reading of late in perusing the proceedings of the various conventions and the speeches of candidates to learn on what principles the parties now base their foundations; but so far the search has proved a futile one. Nowhere have we seen principles of either party laid down, nor do we much expect to see it."

It was not many weeks before the same editor had returned to the old party fold and filled his columns with matter, which must have commended itself to his mind, as showing good and sufficient reasons why the candidate of his party should be supported; but in reading over the editorials and correspondence at this late date, unbiased by the prejudices of his day, our search for the underlying principles has also "proved a futile one." The air was full of elections both provincial and federal; but there was no general policy distinguishing one party from the other. At first there were four candidates in the field in Lennox for the local house; but a few weeks before the election one retired in favor of Stevenson, leaving in the field the regular nominees of the two old parties, at least so they announced themselves, and Stevenson, the independent candidate. The party lash was freely used and, lacking other pertinent matter, the orators of the day did not hesitate to indulge in personalities that had little or no bearing upon such public questions as were discussed or upon the fitness of the respective candidates. As the polling day approached the party lines were tightly drawn; but the voters displayed better judgment than the party leaders and the party press and voted for the man they believed would best serve their interests. This independent spirit, which we occasionally witness in the masses and which enables them to rise above party affiliations, inspires a confidence that, in spite of the politicians, the people as a rule may be relied upon to do what is right.[1]

At the close of the first day's voting, for the polls at that time were kept open two days, there was great rejoicing in the Stevenson camp. Dodgers were printed and sent out to all parts of the riding. These contained an analysis of the votes cast during the first day showing Stevenson in the lead by 222 over the straight reform candidate and 486 ahead of the candidate claiming to be the nominee of the conservative party and concluded with "Vote for Stevenson and save your votes." His election was a foregone conclusion; but his friends stood by him the second day and rolled up such a majority that there was no room for doubt that he was the choice of the electors.

The Legislature met on the 27th of December, 1867. The old buildings on Front Street, Toronto, which had been built by the Legislature of Upper Canada and occupied by that body from 1832 to 1841, had been overhauled and fitted up for the occasion. Since the union of Upper and Lower Canada in 1841 they had served respectively as a court house, medical school, insane asylum, the Upper Canada home of the peregrinating Parliament of the united provinces, and from 1861 to 1867 as a military barracks. At the appointed hour Major-General Henry William Stisted, the first Lieutenant-Governor, attended by his military staff, was driven in state to the main entrance, where he was received by a guard of honor from the Queen's Own Rifles, Tenth Royal Grenadiers and a Grand Trunk battalion. Two military bands softened the deafening roar of the salute of eighteen guns as his Honor entered the old chamber and took his seat. The floor of the House and galleries were crowded with high dignitaries, officials and the elite of the city. The Honorable M. C. Cameron, Provincial Secretary, announced that the Royal Speech could not be delivered until the House had elected its Speaker. His Honor, according to ancient custom, withdrew, and it was no small compliment to the recognized ability of Mr. Stevenson that out of eighty-two members, among them being many prominent and experienced parliamentarians, he was chosen the first Speaker. The compliment may be appreciated all the more when we reflect that, as far as appears by his correspondence, he was the spontaneous choice of the members and the position was not solicited by him. He was without experience save such as he had acquired in presiding over the deliberations of the county council of Lennox and Addington, and the free and easy methods

[1] Benjamin C. Davy, Napanee's first lawyer and first Mayor, came forward as the champion of the old Conservative party and Thomas W. Casey was endeavoring to march to victory under the Reform flag. Mr. Stevenson was more in accord with the spirit of the times and shrewdly declined to profess allegiance to any party.

which prevailed in the debates of that body would scarcely serve as models for the more important body now placed under his control.

The position calls for qualities not possessed by the ordinary individual. While he is not privileged to participate in the debates, he must patiently follow the lines of argument and be prepared at a moment's notice to give his ruling when a point of order is raised. As a rule the Speaker is a strong party man, as such an appointment is one of the prizes to be awarded only to the faithful; yet he must avoid any display of favoritism and extend the same courtesy to his bitterest foe that he would to his warmest friend. Mr. Stevenson did not pose as a party man at the time of his election although he had always been regarded as a staunch reformer. An analysis of the vote shows that he made greater inroads in the ranks of the conservatives than he did with the reformers. This might have been due to the unpopularity of the conservative candidate who did not poll one vote to Stevenson's three. A contemporary, when asked why Stevenson was chosen Speaker, replied, "He was chosen by the good and patriotic premier, the late Sandfield Macdonald: I don't exactly know, but I presume it was because he had the necessary qualifications as well as being a good Liberal."

In his new rôle, the Honorable John Stevenson, for as such he was ever after known, acquitted himself most admirably. Of the many decisions given by him, involving nice distinctions in the interpretation of the Rules of Procedure, no less than eighteen are still preserved as precedents and published in The Members' Manual for the guidance of succeeding Speakers. Appeals were made against only three of his most important decisions, and his rulings in every instance were sustained. Among the leaders in the debates of the first Assembly were such stalwarts as John Sandfield Macdonald M. C. Cameron, E. B. Wood, Edward Blake, Sir Henry Smith and William Lount.

Robert Christie, a member of the first legislature, writes of the first Speaker in a letter bearing date January 27th, 1914, "During that formative period of our political history questions of importance as to procedure had to be determined satisfactorily and with due regard to British Parliamentary practice; but I do not recollect any decision of his in such matters as being questioned or disapproved generally by the members. He was always courteous and gentlemanly in his bearing while in the discharge of his official duties."

Thomas Murray of Pembroke, who was returned to the local legislature in 1869 at a bye-election speaks kindly of the Hon. John Stevenson in a letter of January 31st, 1914. "Speaker Stevenson was popular with both sides of the House. His rulings were respected, and he had no trouble in keeping order. The leading debaters in my time were on the Government side,—Sandfield Macdonald, E. B. Wood (known as "Big Thunder"), M. C. Cameron, A. W. Lauder, Wm. Lount, R. W. Scott, J. C. Rykert and others; on the opposition side, Blake, Lauder, Pardee and McKellar; in fact, the members generally in the first Provincial Parliament were of great debating ability."

In the general election of 1871 the old parties in Lennox found each other again at the polls. John T. Grange (who is still living in Napanee) came forward as a straight Conservative candidate and Stevenson was the nominee of the Liberal party. The prestige that the latter had gained by his elevation to the Speaker's chair was more than offset by a certain amount of dissatisfaction among the Liberals as to the policy of the Government. Grange belonged to one of the oldest families in the County with extensive business connections. He polled 276 votes more than Stevenson. A few days after the election John Sandfield Macdonald wrote Stevenson as follows:—"I was shocked at the result of your election as indeed I was with regard to many others in which my friends have been slaughtered. I find you take the defeat philosophically. On the whole you have not much reason to complain. Elected as you were for the first time you became the unanimous choice of the first representatives elected under the Confederation Act for Ontario, and you discharged your duties faithfully."

A few months later John Sandfield himself displayed the same philosophical frame of mind when under date of 21st of December, 1871, he wrote:

"Affairs have taken a sudden turn. It is impossible to resist the combination which brought about our defeat. Most frantic appeals were made and herculean efforts added to pile up a sufficient force to vote us down. The defection among the Conservative party completed the thing.

"I am packing up my traps to-day and sorting my papers preparatory to resigning the office to my successor. I shall always continue to cherish the liveliest feelings of gratitude towards yourself for the uniform kindly expression of opinion which you have been pleased to utter in my behalf."

The correspondence of Mr. Stevenson makes it clear that the life of the politician fifty years ago was little if any freer from the importunities of political friends than it is to-day. The result of the election had no sooner been announced than applications began to pour in from all quarters, from all classes, from clergymen to tavern keepers, asking for appointments.

One is quite patronizing and makes his wants known in the following language:—

"Allow me to inform you of my intention to apply for the post of Librarian to the Ontario Legislature. The appointment will be made I am told by the House. . . . . Your favorable consideration of my claim will be gratefully acknowledged."

Another committee man writes as follows:—

"Allow me to introduce to you my father who is residing in Toronto. By your securing him some appointment worth $600 or $700 a year you will greatly oblige and I shall in duty bound be your political as well as your private friend, as I am at present."

Another applicant wastes no words in making his wants known:—

"Can you give me an appointment? You will scarcely meet with one who requires a helping hand more. Accept congratulations on election to Speaker's Chair."

Another applicant shows good cause why he should be remembered.

"I do think that the Hon. J. S. Macdonald should not pass me over. On a former occasion he served me. That situation I lost by working to keep Mr. Campbell out of the Upper House and smash the coalition administration which came in after Mr. S. Macdonald's and I have stuck to him ever since."

A needy friend very frankly assigns a good reason why he should be appointed.

"I would esteem it a great favor if you would kindly give me some appointment as I am in need of some assistance, my pecuniary affairs being much embarrassed."

One of the faithful is willing to offer up three of his sons for the good of the public service.

"As I have three sons who are trusty and faithful and have had a good education I thought that perhaps you might be able to find a situation for some of them in which case I would be greatly obliged."

That one good turn deserves another is the policy of the writer of the following:—

"I herewith send you the names of five parties who I with many others think ought to receive some substantial token that their services in the late election have been appreciated. Hoping that these names will meet with your approbation."

After tendering his congratulations upon Mr. Stevenson's elevation to the Speakership another states his case most skilfully as follows:

"You have noticed that I was defeated at our last municipal election but you are not perhaps aware, that it was the efforts to secure your return that caused it. Now as you have from your position a large amount of patronage to dispose of, it has been suggested by your friends and mine that you might do something for me. I am not an office-seeker but to settle the taunts of your enemies and mine I would be happy to receive some mark of your consideration."

Thus do we find letters from relatives, friends and public officials urging in most cases their own personal applications and assigning all manner of reasons why they should receive some consideration. One by reason of his family connection thinks that he is "entitled to something creditable, permanent and remunerative." It is a wonder how the representatives found any time to devote to the more serious matters that came before them. John Sandfield Macdonald with a government founded upon a coalition basis must have found the question of patronage very embarrassing. In discussing the demand of the Conservatives for certain appointments he says in a letter to the Speaker dated March 4th, 1869, "The selection of a Reformer would prove that this Government would not make appointments of that party unless when the representative has a legitimate right to the patronage. Conservatives have now three-fourths of the patronage of Ontario in their hands and they ought to be satisfied with that share." The Speaker was besieged with applications for messengers and in his desire to please everyone as far as he consistently could he evidently overstepped the limit and nettled John Sandfield who wrote, "I find that the extra messengers are still loitering about the House. I repeat that they are not wanted."

Mr. Stevenson was married in October 1841 to Miss Phoeba Eliza Hall of New York State. Seven children were born of this marriage, two of whom died in infancy. George, an active and efficient business man who relieved his father of the management of his business affairs in Napanee, died in June 1873. Edward, who was educated at Toronto University, studied law for a time but was obliged to abandon the profession owing to ill health. He undertook the management of the piano factory in Kingston; but it was too great a tax upon his strength. He spent the winter of 1873-4 in Florida but died in the autumn of 1874 while on his way to Colorado in search of a climate that would benefit him. William, another son, has spent most of his life across the border and is at present a resident of California. Mrs. Maria Hall Archibald, wife of the Hon. A. W. Archibald of Trinidad, Colorado, only daughter of Mr. Stevenson, died at her home in April, 1882. John H. Stevenson, eldest son of the deceased, at one time a partner with the late G. Mercer Adam in the publishing firm of Adam & Stevenson, is now engaged in the civil service at Ottawa.

Mr. Stevenson continued to live in Napanee until the time of his death. His home was that of a cultured and courteous gentleman, and while he was not a lavish entertainer his guests were always made to feel that their hosts enjoyed their presence. After his defeat in the election of 1871 he did not again offer himself as a candidate for any public office. The declining health and death of his two sons cast upon his shoulders again the burden of his many business interests and he resumed to a large extent the management of them. His wife died in January 1882 and he survived her by a little over two years, dying in April, 1884, and was buried in the Riverside Cemetery at Napanee.

ADDENDA.

Of the eighty-two members who assembled at the opening of the first Legislature of Ontario, not one is living to-day. The last two survivors were J. C. Rykert and Robert Christie.

John Charles Rykert, K.C., was educated at Upper Canada College, where he was a class-mate of the late Hon. Edward Blake. He sat in the old parliament of Canada for several years before confederation, having been elected twice by acclamation. At the time of Confederation and twice again, in 1871 and in 1876, he was elected to the Legislature of Ontario. His political career was not always as smooth as the above record might indicate. He was defeated on several occasions and unseated more than once. He was of U. E. L. descent, a Conservative, and died on December 27th, 1913, in his 83rd year.

Robert Christie was born in the Orkney Islands, Scotland, in 1826, and came to Canada in 1833 with his uncle, Robert Christie, who settled in the township of Dumfries in the county of Waterloo. As he grew up he was engaged in farming and lumbering in the townships of Flamborough and Beverly in the county of Wentworth and also had an interest in a general store. In 1867 he offered himself as a candidate and was elected to the first Legislative Assembly as the representative of North Wentworth. He was re-elected in 1871 but in 1875 was defeated by Thos. Stock who secured a majority of 22 votes. In 1881 he moved to Wiarton with the intention of engaging again in the lumbering business but, being offered the position of inspector of public institutions in 1882, he accepted it. In 1890 his duties were narrowed down to an oversight of the hospitals for the insane. He was a man of an extremely kind disposition, and his heart went out to the unfortunates placed under his superintendence, and the many improvements in their care and maintenance are laregly due to the adoption of the recommendations made by him on their behalf. He discharged the duties of his office until he attained his four score years when he tendered his resignation and lived a retired life in Toronto until March 8th, 1914, when he passed away in his 88th year.

Thomas Murray of Pembroke is the only survivor of the first legislature of Ontario. He was not a member at the time of Confederation but was returned at a bye-election in 1869 to fill a vacancy in North Renfrew occasioned by the resignation of the late John Tupper, who gave up the seat as a compromise to have Mr. Murray withdraw his candidature for the Commons as an opponent to Sir Francis Hincks.

He is a native of Carleton County, Ontario, having been born in 1836. His father was a merchant on the Rideau Canal during its construction, but owing to ill health he gave up the mercantile business and retired to a farm. Thomas, the eldest of eight sons, was educated at the common school and the Grammar School at Smith Falls, after which he served four years as a clerk with W. R. R. Lyons of Richmond, Carleton County, and later for two years with Porter Bros. of Ottawa. In 1854, while yet in his teens, he opened a store at Ottawa, where he continued in business until 1858, when he moved to Pembroke and set up as a general merchant and dealer in lumber and real estate and has been associated with that thriving town ever since. He was noted for his straightforward business methods and his history is largely the history of the town and he is affectionately regarded as the veretan political war horse of North Renfrew. His life has been a most active one. During the construction of the Canadian Pacific Railway he was connected with several firms furnishing supplies and taking over grading contracts along the line. He owned, subdivided and sold a very large portion of the townsite of Pembroke and Murray ward is still the most flourishing part of the town. He owned four hundred acres of the land upon which the town of North Bay is built and, forseeing its future possibilities, he subdivided it, built dwellings, hotels and stores and induced the government to erect a court house and other public buildings. That North Bay is the busy railway, commercial and municipal centre that it is to-day is due largely to the enterprise of Mr. Murray.

His political career has been as full of interest as his business life. He has in all contested fourteen parliamentary elections, not to mention a dozen or more municipal fights, as he has served his own town in every capacity within the gift of its citizens. Five times he was placed in nomination for the House of Commons in Pontiac, three times in North Renfrew and six times he was a candidate for local legislature in North Renfrew.

He sat in parliament about twenty years, in all, the greater part of this time as the representative of North Renfrew in the local legislature. Mr. Murray is a Liberal in politics, a believer in reciprocity and a strong advocate of the Montreal, Ottawa and Georgian Bay canal and of the abolition of the Senate. Although he is crowding his four score years he is erect in his bearing and his intellect is clear and to all appearances he has many active years yet before him.

Time has wrought as great havoc among the officials of the Legislature, and now only two remain who received their appointments in 1867.

F. J. Glackmeyer was born in Montreal but went to London in 1855 where he was living at the time the Hon. (afterwards Sir) John Carling was Minister of Public Works for the New Province. When the office of Sergeant-at-Arms was discussed among the members of the new Cabinet the member from London nominated his friend Mr. Glackmeyer and the province has known no other Sergeant-at-arms from that day to this. The Ontario Chamber has not been altogether free from the lively scrimmages that occasionally disturb the equanimity of the best regulated legislative bodies in the world; but Mr Glackmeyer has never been called upon to remove an unruly member. When one looks into that kindly face it is difficult to picture the owner of it applying force to anyone and, if he were directed to perform that unpleasant service, he unquestionably would find a pleasant way to do it.

Arthur H. Sydere entered the service of the Province of Ontario in October 1867, and from all appearances has many active years ahead of him still. He was born at Wymondham, Norfolk, Eng., in 1841. He was admitted to the bar and although he has never practised his profession he has made good use of his legal training in the important offices he has held. He has been during his long term of service Clerk of Routine and Records, Clerk Assistant of the House, Clerk of the House and Clerk of the Crown in Chancery, which latter two positions he still fills. Mr. Sydere is a clear-headed methodical official whose chief difficulty is in teaching the ever changing body of legislators to observe the prescribed rules and regulations which to him have become a second nature.

Among the departments there remain only a few who have been in the service since Confederation.

George Brownly Kirkpatrick now in his seventy-ninth year, was born at Coolmine House, County Dublin, Ireland, and completed his education at Trinity College, Dublin. He was midshipman for two years on ocean going vessels, visiting among other places Cape of Good Hope, Melbourne, Mauritius, and Madras. He came to Canada in 1857 and for two years was engaged on the construction of the Grand Trunk Railway from St. Marys to Sarnia. He studied surveying for three years with A. B. Perry, P. L. S., at Violet in the County of Lennox and Addington, became a licensed surveyor in 1863, practised his profession for three years in Kingston and entered the Department of Crown Lands as draughtsman in 1866 and has been connected with that department ever since. He was appointed Director of Surveys in 1878, which position he still fills. He was Secretary of the Board of Examiners of Land Surveyors from 1869 to 1886 when the Association of Ontario Land Surveyors was formed. He was the first president of the Association and has since its organization been Chairman of the Board of Examiners and Chairman of the Board of Management. In 1890 he devised for the government a system of exploration of Northern Ontario which resulted in making available for settlement and mining operations sixteen million acres of valuable agricultural and mineral lands.

The following gentlemen have also been connected with the civil service of the province since 1867: C. H. Sproule, Assistant Treasurer; D. G. Ross, accountant of the Department of Lands, Forests and Mines; T. P. Edwards, Accountant and Law Clerk of the Department of Public Works and J. M. Ridley of the Provincial Secretary's Department.

Memoires de la Société Royale du Canada
SECTION I

Série III DECEMBRE 1915 Vol. IX

La littérature française au Nord-Ouest.

Par M. le juge L.-A. Prud'homme, M.S.R.C.

(Lu à la réunion de mai 1915).

Ce n'est que par communication de privilège qu'on peut, à bon droit, qualifier de littérature les modestes efforts de quelques écrivains qui se sont aventurés, comme à leur insu, en ce domaine presque inexploré dans les régions de l'Ouest.

Situé sur la frontière de la sauvagerie, d'où il vient d'émerger, cet immense territoire a éprouvé bien du mal à trouver des assises constitutionnelles qui s'harmonisent avec sa population polyglotte. C'est qu'avant qu'une forme définitive de gouvernement se moule sur les traits vivants des races diverses qui y ont dressé leur tente, des travaux de retouche s'imposent.

Des problèmes graves et irritants agitent les esprits et créent une maladie de croissance et une tension pénible dans ces milieux encore mal affermis.

La vague des milliers de colons qui se déverse à tous les ans sur nos prairies, a déterminé la fièvre d'une spéculation intense qui étouffe le libre essor de nos jeunes talents littéraires. Aussi bien peut-on compter facilement les rares exceptions de ceux qui résistent à cet entrainement fébrile et ferment leurs portes aux séductions de la richesse, demeurent fidèles au culte du beau, dans leur cabinet de travail. Dans notre civilisation de première pousse, la chronique, pressée de noter au passage les événements du jour, tient le premier rang.

Je salue ici nos historiens qui ont donné à l'Ouest le fruit de leurs longues et patientes recherches.

Ce léger bagage littéraire constitue notre légitime orgueil et sollicite de notre part des sentiments de profonde gratitude pour les auteurs de ces travaux.

Toutefois, si je le compare aux trésors si variés de nos aînés de la province de Québec, je sens le besoin d'implorer votre indulgence pour la pauvreté relative de nos cadets.

Dans votre vol hardi vers les hauteurs intellectuelles où planent vos lauréats, vous tiendrez par la main votre Benjamin de l'Ouest, afin de mieux favoriser les premiers battements de ses ailes.

Après que vous aurez prêté l'oreille aux mélodies enchanteresses échappées de la lyre de vos poètes et aux accents émus de vos brillants orateurs, vous nous permettrez de vous chanter, sur un modeste pipeau, les travaux, les luttes et les espérances de vos frères de là-bas.

Paulo minora canamus.

Nos premiers écrivains datent de la découverte de l'Ouest. LaVerendrye et LeGardeur de Saint-Pierre nous ont laissé des mémoires sur leurs expéditions périlleuses. Leur récit, adressé au gouverneur du Canada ou au ministre des colonies, est rédigé sans prétention de style, avec un laconisme tout spartiate. Jetées rapidement entre les haltes de longues courses, tantôt sur la *pince* d'un canot qui serpente entre des rives surprises d'y voir l'homme blanc, tantôt sous la loge enfumée d'un chef de tribu, après un pénible *portage*, ces notes de voyage n'indiquent que sommairement les difficultés innombrables affrontées par ces hardis pionniers qui firent, pour la France et la civilisation chrétienne, la conquête d'un pays dix fois plus vaste que la France.

Toutefois, que de détails, d'anecdotes, de descriptions, d'annotations jettent tout un jour sur cette époque déjà reculée. Ces documents sont d'un prix infini pour reconstituer l'histoire des Sauvages et peindre sur le vif les obstacles semés sur la marche de la civilisation vers l'Occident.

Le *Journal* de LaVerendrye, surtout, mérite une étude spéciale. On y sent palpiter le cœur d'un preux chevalier animé d'un patriotisme ardent et désintéressé et d'une sainte audace dans les dangers. Ni la mort de son fils aîné et de son neveu, ni les calomnies de ses envieux ne purent abattre cette âme d'élite. La prudence dans ses rapports avec les chefs sauvages dont l'esprit soupçonneux est toujours en éveil, éclate dans toutes les pages de ses mémoires. Sa voix ne s'enfle jamais en descriptions fantaisistes, ni en périodes oratoires. Il semble négliger à plaisir les beautés du style pour nous retenir par le charme de la justesse de ses appréciations et la sincérité de son récit. Parfois on serait tenté de croire qu'il attenue à dessein ses expressions, de peur qu'elles ne dépassent quelque peu l'exactitude mathématique des faits qu'il raconte. Fidèle à Dieu et à son roi, il le demeure encore, avec une rigueur presque décourageante, dans son journal. Au lendemain du massacre de son fils, de son missionnaire et de dix-neuf de ses serviteurs, il adresse une note de deux courtes pages au gouverneur de Beauharnois pour lui annoncer ce drame sanglant. On sent bien, çà et là, que sa poitrine se soulève de douleur, qu'il comprime difficilement les sanglots qui l'étouffent et ne demandent qu'à éclater. Mais cet homme de devoir est plus fort que la douleur. Il la maîtrise, voile ses larmes et, après avoir immolé les siens, il immole encore son propre cœur pour la patrie. LaVerendrye est un guide sûr et consciencieux pour les écrivains qui désirent faire revivre et peindre, d'après nature, la période française au Nord-Ouest.

LeGardeur de Saint-Pierre était un officier brillant, fougueux et, parfois même, emporté. Son style, plus châtié que celui de LaVerendrye, donne peut-être un peu plus de vie et d'entraînement à ses *Mémoires*. Ses jugements *a priori* indiquent néanmoins un esprit moins pondéré que celui de LaVerendrye.

Ses opinions ont besoin d'être contrôlées.

Aux chroniques des découvreurs succèdent les relations des missionnaires sur leurs travaux apostoliques. Ces matériaux épars dans "*les Missions des Missionnaires Oblats de Marie-Immaculée*", surnommées *les Grandes Annales*, sont palpitantes d'intérêt. Ces annales ne datent que de 1862; mais on y a consigné, comme dans un registre, les courses apostoliques des Oblats depuis 1845.

Lorsque ces hommes de Dieu pénétrèrent dans l'Ouest, ils trouvèrent les tribus errantes au sein des prairies ou des forêts vierges, vivant de la chasse ou de la pèche, sur un sol inconquis, conservant l'éternelle jeunesse des races nomades. Une nuit épaisse s'étendait sur l'intelligence de ces pauvres Sauvages. Aucune idée de stabilité, aucune occupation fixe ou sédentaire ne les attachait au sol. Au printemps, le guerrier farouche, dont le sang coule plus vite comme la sève dans la nature rajeunie, sent s'éveiller en lui le désir de secouer l'ennui de sa torpeur hivernale, de s'agiter et de scalper ses ennemis héréditaires. La bande de ces braves part, pleine d'une joie cruelle et d'une ardeur qui déborde. Elle satisfait dans de rapides excursions ce besoin inquiet de mouvement qui la tourmente. Elle va où l'appelle l'appât du butin ou la soif de la vengeance. Voler quelques chevaux, suspendre à sa ceinture le scalpe ensanglanté d'un ennemi, tel était le rève de ces terribles maraudeurs. Et puis, l'ardeur de jouir de toutes choses sans contrainte morale, avait créé chez eux une dépravation des mœurs qu'on soupçonne à peine. Ces infortunés païens étaient entrainés dans le mal avec l'emportement d'une fougue indomptable. Ils ne se livraient qu'à leurs forts en médecine qui apparaissent entourés de philtres meurtriers et de potions empoisonnées, plus hideux que la Médée antique. Ajoutons à ce tableau le spectacle navrant des traiteurs qui, pour satisfaire leur soif de l'or, répandaient des barils de rhum, avec les conséquences funestes que l'alcool entraîne.

Le Sauvage dont le sang est échauffé par l'alcool est une bête fauve, livrée à toutes les fureurs et prêt à tous les crimes que lui suggèrent ses instincts grossiers. Les orgies sans nom, les assassinats et les scènes macabres qui résultaient de ces désordres ont souillé nos prairies bien plus souvent qu'on ne l'imagine en général. Ces crimes et ces abus paralysèrent longtemps la marche de la civilisation dans cette contrée. On ne se fera jamais une idée précise de la tâche héroïque que durent entreprendre nos missionnaires pour mettre fin à tant de maux, relever des caractères si déprimés et infuser une vie nouvelle chez des êtres aussi déchus. Et tous ces missionnaires, je me hâte de le dire à la gloire de notre race, dont plusieurs sont morts victimes du devoir, étaient de notre sang. Les souffrances et le dévouement de ces hommes de sacrifice se révèlent dans leur rapport à leur supérieur général. Ils y déversent le trop plein de leur tristesse dans l'œuvre si ingrate de la régénération des Sauvages. Il faut parcourir ces rapports pour comprendre combien sont insensés les écrivains qui s'imaginent que les Sauvages, avant leur contact avec les blancs, coulaient leur existence dans la paix et le bonheur, comme jadis Adam dans le séjour de l'Eden. Cette légende mensongère est démolie par tous ceux qui ont connu les Sauvages dans leurs habitudes primitives. La vérité, c'est que le règne de la force brutale, de la violence, de la cruauté révoltante, de la haine héréditaire, de l'esclavage de la femme réduite à la condition de bête de somme, de l'abandon des vieillards et des malades était établi dans presque toutes les tribus. Les meilleures tribus ne valaient pas encore grand' chose. En lisant la correspondence des missionnaires qui ont évangilisé ces barbares, le lecteur est averti qu'ils cherchent le plus souvent à cacher les misères qu'ils endurent, de crainte que leur supérieur, justement alarmé pour leur santé, ne les rappelle du champ de leurs travaux. C'est ainsi que l'un d'eux se contentera de dire qu'au printemps les provisions étaient rares et qu'il dût jeuner parfois. Lisez plutôt que, pendant des semaines, il dût se contenter des balayures du grenier où se trouvaient des parcelles de poisson plus que faisandé.

Si vos yeux tombent sur une lettre du Père Grollier, perdu à l'extrémité nord de la rivière Mackenzie, dans laquelle vous apercevrez des larmes brûlantes mouiller ses paupières au souvenir de sa patrie et de ses parents, comprenez bien que ce furent les suprêmes adieux de ce vaillant athlète du Christ, qui, sur son lit de mort, désirait, comme dernière faveur, pouvoir goûter une pomme de terre, sans qu'on pût la lui procurer. Si ces écrits étaient réunis en volume, nous aurions, pour l'Ouest, un véritable trésor d'annales historiques qui seraient le pendant des *Relations* des Jésuites. On peut s'en convaincre d'ailleurs en feuilletant les vingt années de mission de Mgr Taché.

Ce grand apôtre de l'Ouest, dont le souvenir plane encore sur nos prairies, était un intellectuel. Son âme tendre et vibrante a des accents qui nous émeuvent. Sa phrase coule sans effort et caresse comme la main d'un enfant. A certains moments, ses pensées prennent des envolées qui décèlent un penseur et un maître dans l'art de saisir ses lecteurs. On s'étonne de trouver le style d'un auteur classique chez un missionnaire qui, pendant une grande partie de sa vie, coudoya sans cesse la sauvagerie. On se demande parfois comment ce grand évêque, dans ses légendaires courses en raquette ou en canot d'écorce, a pu acquérir tant de connaissances et semer sous sa plume une si grande richesse de style. C'est que le silence des déserts est une école féconde pour la formation des caractères et un champ favorable aux profondes méditations. La nature vierge semble solliciter davantage les pensées originales, Il y a des pages, dans ces annales des temps apostoliques, qui sont de vrais modèles de littérature. Qui pourra jamais relire les adieux de Mgr Taché à sa mère, sans sentir ses yeux voilés de larmes ?

Ce jeune oblat de 21 ans venait d'atteindre la hauteur des terres, à l'ouest du lac des Chiens. Désormais les eaux sur lesquelles il allait naviguer, au lieu de s'écouler vers Boucherville où sa mère pleurait son départ, allaient l'emporter vers la Rivière-Rouge. A l'écho des lacs et des forêts, son âme plaintive adresse ainsi sa douleur et ses regrets:

> Nous arrivions à l'une des sources du Saint-Laurent; nous allions laisser le grand fleuve, sur les eaux duquel j'eus la première pensée de me faire missionnaire de la Rivière-Rouge. Je bus de cette eau pour la dernière fois; j'y mêlai quelques larmes et lui confiai quelques-unes de mes pensées les plus intimes, de mes sentiments les plus affectueux. Il me semblait que quelques gouttes de cette onde limpide, après avoir traversé la chaîne de nos grands lacs, iraient battre la plage près de laquelle une mère bien aimée priait pour son fils, pour qu'il fût un bon oblat, un saint missionnaire. Je savais que, tout occupée du bonheur de son fils, elle écoutait jusqu'au moindre murmure du Nord-Ouest, jusqu'au moindre bruit de la vague comme pour y découvrir l'écho de sa voix, demandant une prière, promettant un souvenir. (*Vingt années de mission* p. 8)

Ecoutez-le encore, racontant les souffrances d'une marche forcée à travers la neige de nos prairies et la tristesse du campement auprès d'un feu qui le protège à peine contre la rafale glaciale du nord. C'était au jour même où sa cathédrale était détruite par une incendie:

> Vers les dix heures, nous nous arrêtâmes pour prendre un peu de nourriture. La rareté du bois ne nous permit de faire que très peu de feu. Je m'assis auprès, un peu sérieux. J'avais froid, j'avais faim, j'étais fatigué. Dans cette position quelque peu pénible, à plus de trois cents lieues de Saint-Boniface, il me vint en pensée de regretter mon habitation, l'espèce de bien-être que j'y aurais goûté, si quelque enchantement féerique m'y avait tout à coup transporté. Hélas! Pourquoi faut-il donc que nous soyons si facilement portés à désirer ce que nous n'avons pas, à regretter le sort que nous fait la Providence, pourtant si bonne et si paternelle.

Comme l'on sait peu quelquefois ce que l'on souhaite. Dans cette circonstance, auprès d'un petit brasier qui me réchauffait à peine, j'étais porté à regretter les calorifères de l'évêché de Saint-Boniface, et, à cette même heure, ces mêmes calorifères réduisaient et mon évêché et ma cathédrale en un immense brasier dont la violence détruisait en quelques instants ces édifices qui m'étaient si chers. Je trouvais désagréable le sifflement du vent agitant avec bruit les cîmes des arbres décimés de la forêt, me glaçant moi-même, et j'aurais voulu être là. J'aurais entendu le craquement de nos édifices religieux s'affaissant sous le poids de la destruction en lançant à ceux qui les environnaient des torrents de feu et de flamme. J'étais tenté de trouver pénibles quelques souffrances physiques et Dieu m'épargnait les tortures morales, les déchirements du cœur que m'aurait coûtés la vue du désastre qui venait fondre sur nous. (*Ibid.*, p. 145).

Les pénibles travaux de Mgr Taché ne purent éteindre la gaieté naturelle de son caractère et volontiers on sent pétiller l'esprit gaulois dans les descriptions de sa vie de missionnaire:

Le 27 février 1854, écrit-il, l'évêque de Saint-Boniface laissait sa pauvre demeure de l'Ile-à-la-Crosse pour commencer une excursion qui devait durer plus de trois mois. Je dis pauvre demeure, puisque la description suivante est littéralement exacte. J'ai un palais épiscopal aussi qualifié pour cet emploi, que je le suis pour le mien. Ledit palais a 20 pieds de long, 20 pieds de large et 7 de haut. Il est enduit en terre. Cette terre n'est pas imperméable, en sorte que la pluie, le vent et les autres misères atmosphériques y ont libre accès. Deux chassis de six verres chacun éclairent la pièce principale; deux morceaux de parchemin font les autres frais du système luminaire. Dans ce palais où tout vous paraît petit, tout au contraire est empreint d'un caractère de grandeur. Ainsi mon secrétaire est évêque; mon valet de chambre est évêque, mon cuisinier lui-même est aussi quelquefois évêque. Ces illustres employés ont tous de nombreux défauts, néanmoins leur attachement à ma personne me les rend chers et me les fait même regarder avec complaisance. (*Ibid.*, 60.)

Son esquisse sur le Nord-Ouest est une exposition des ressources de cette contrée, de son organisation politique et des tribus qui l'habitent, suivie d'une histoire naturelle abrégée. Mgr Taché y déploie son rare talent d'observateur et touche certaines questions délicates avec ce doigté qui est le propre de l'écrivain supérieur. A l'occasion il sait venger les anciens du pays d'odieuses accusations lancées par un homme alors en vue. Il aimait passionnément ses chers Métis, s'indigna de ces outrages et lança à leur auteur un trait acéré qui le frappa en pleine poitrine. Dans cette réponse se trouve une phrase lapidaire qui ferma pour toujours la bouche à cet audacieux. Les élus de Dieu ont parfois de saintes colères, comme le bon Maître qui un jour chassa les profanateurs du temple. Au reste, l'appréciation des écrits de Mgr Taché a été faite avec tout le soin voulu dans l'ouvrage presque monumental de Dom Benoît. *La Vie de Mgr Taché* contient quinze cents pages. Dans notre siècle de fièvreuse activité, un tel ouvrage peut effrayer le lecteur qui manque de loisirs. Je puis dire toutefois que l'auteur a su rendre justice à la mémoire de ce grand prélat. C'en est assez pour faire l'éloge de cet ouvrage qui constitue à lui seul une bibliothèque des événements qui se sont déroulés dans l'Ouest de 1845 à 1894. Le lecteur trouvera dans ces pages un arsenal de renseignements coordonnés avec une patience de bénédictin, qui mettent en pleine lumière le mouvement catholique de ce demi-siècle. Pour quiconque désire se bien pénétrer de cette période difficile à saisir cette étude est devenue quasi-indispensable. L'auteur de la *Cité Anti-Chrétienne* et des *Erreurs Modernes* est trop bien connu comme penseur et philosophe pour qu'il soit nécessaire d'insister. Son style sobre et sans recherche ne manque néanmoins ni de coloris ni de richesse. Esprit classique et nourri de fortes études, Dom Benoît a su donner à son œuvre l'ampleur et l'attrait de la forme, aussi bien que la majesté et la consistance du fond. Ce livre nous venge du fanatisme de certains écrivains et de la partialité voulue ou inconsciente de quelques autres.

Le doyen, et peut-être aussi le mieux connu des historiens de l'Ouest, est sans doute l'abbé Georges Dugas, ancien missionnaire de la Rivière-Rouge. Tous ses ouvrages sont instructifs. Mais sa *Vie de Mgr Provencher*, l'*Histoire des troubles de 1870* et l'*Histoire du Nord-Ouest* sont les pages les plus importantes et les plus profitables au lecteur. Ces livres devraient se trouver au foyer de toutes les familles qui désirent se renseigner sur les faits et gestes des pionniers de la civilisation chrétienne dans l'Ouest d'autrefois.

La perte des archives de l'archevêché de Saint-Boniface, disparues dans l'incendie de 1860, a rendu la biographie du premier évêque de la Rivière-Rouge difficile à écrire. Heureusement que Mgr Taché eut la bonne pensée de faire copier, dans la province de Québec, la correspondence de son prédécesseur avec Mgr Plessis et Mgr Lartigue. Ce sont ces documents surtout que l'abbé Dugas a utilisés dans le portrait qu'il nous donne de Mgr Provencher. Quelque précieux que soient ces écrits, ils ne sauraient nous consoler complètement de la perte du journal tenu jour par jour par Mgr Provencher. Hélas! si nous possédions ce mémoire intime tracé de la main de ce pieux prélat tous les soirs de sa vie d'épreuve, que de pages émouvantes nous pourrions ajouter à celles déjà si belles que nous présente l'abbé Dugas. Pour n'être pas aussi complète et aussi fouillée que la vie de Mgr Taché, celle de Mgr Provencher n'en est pas moins attachante et nous donne les traits saillants de sa physionomie. En lisant cette vie, on comprend que lorsque Dieu veut fonder une œuvre durable, il choisit, pour poser les premières assises, un homme de sa droite. Cet homme, qui doit être le premier soutien et la pierre fondamentale de l'édifice, il l'élève jusqu'à lui en le broyant, pour ainsi dire, sous le poids des épreuves. En contemplant le spectacle navrant des malheurs qui tout à tour accablent cet évêque, on touche mieux du doigt la sollicitude de la divine Providence qui se joue des calculs humains et féconde si généreusement les efforts de ceux qui se confient à elle. Voilà les pensées consolantes qui se dégagent de ce beau livre qui contient en substance l'histoire de l'Ouest de 1816 à 1853.

L'histoire des troubles de 1870 est bien documentée et elle devait l'être pour détruire la masse de préjugés qu'on a accumulés sur la prétendue révolte de 1870. L'auteur a fait là une œuvre utile, nécessaire même, et il l'a exécutée avec soin, preuves en main. Il a eu l'avantage d'être le témoin oculaire des faits qu'il raconte.

L'abbé Dugas a été le premier écrivain à publier en français une histoire étendue du Nord-Ouest. Le lecteur y trouvera un exposé synthétique des principaux événements de l'Ouest qui méritent d'être enregistrés. L'auteur ne vise pas précisement à la recherche du style, mais s'applique surtout à la philosophie de l'histoire, et c'est ce qui fait le mérite de ce livre. Il a su rectifier nombre de données fausses que des écrivains mal renseignés ou peu scrupuleux étaient en train d'acclimater au milieu de nous. Il faut avouer cependant qu'il n'est pas tendre pour la Compagnie du Nord-Ouest. Le jugement qu'il porte sur la bataille des Sept-Chênes n'est pas sans appel et soulève des controverses où le dernier mot n'a pas encore été dit. *Adhuc sub judice lis est.* Dans ses *Légendes du Nord-Ouest* et *Un voyageur des pays d'en haut*, l'abbé Dugas fait revivre les scènes de cette contrée et met en relief les mœurs et les dangers de cet âge de transition entre la semi-sauvagerie et une civilisation plus avancée.

Le Père E. Jonquet O.M.I. a enrichi la littérature de l'Ouest d'un livre remarquablement bien écrit: *Vie de Mgr Grandin*, premier évêque de Saint-Albert. Le Père Jonquet est un écrivain de marque; on le sent à chaque page de cet ouvrage. C'est l'épopée des courses apostoliques de 1854 à 1902 que l'auteur chante, plutôt qu'il n'écrit, avec un charme ravissant et dans un vocabulaire copieux et habilement nuancé.

Une monographie, si artistement préparée qu'elle soit, ne saurait être complète si l'écrivain ne présente que les traits principaux et néglige les mille détails qui, comme autant de facettes d'un verre transparent, projettent une lumière plus pénétrante et nous montrent l'homme dans les suprises de son intimité. Aussi bien le Père Jonquet a-t-il la main heureuse dans ces études psychologiques. Sa phrase châtiée et vivante entraine le lecteur à sa suite. La partie consacrée au soulèvement de 1885, puisée aux sources, est d'une grande valeur historique.

J'arrive maintenant au Père Morice O.M.I., un érudit plongé dans des études scientifiques sur l'origine des tribus de l'Ouest, doublé d'un linguiste et d'un historien élégant qui contrôle avec la rigueur d'un savant les sources de notre histoire. Ses appréciations sont toujours appuyées sur des textes de première valeur auxquels il réfère constamment. Nous lui devons le *Dictionnaire historique des Canadiens et des Métis français de l'Ouest* et l'*Histoire de l'Eglise catholique du Nord-Ouest.* Son dictionnaire mérite tous les éloges qu'on en a faits. On y trouve une réponse victorieuse à ceux qui seraient tentés de croire que les nôtres n'ont été que de simples manœuvres, bons au plus à suivre la traîne à chien ou le gibier dans la forêt.

L'auteur tient une plume alerte, vigoureuse et d'une précision mathématique. Le second ouvrage, qui fut publié d'abord en anglais, comprend une vue d'ensemble sur l'établissement des missions et des paroisses, et une forte analyse des troubles de 1870 et 1885. Il a buriné de main de maître les événements de ces deux dates. On sent à chaque ligne le bouquiniste infatigable qui vérifie tout ce qu'il avance. Le calme exposé des faits, présenté par l'auteur dans un style sobre mais remarquable de précision, constitue la meilleure réfutation des erreurs semées à pleines mains par des historiens anglais. Ceux qui, comme l'abbé Dugas et le Père Morice, ont travaillé à cette œuvre de réhabilitation des nôtres contre cette conspiration de l'erreur, ont droit à notre profonde gratitude. Ils ont fait là une œuvre vraiment nationale.

Les livres du Père Petitot ne se comptent plus. Il en a publié sur le lac Athabasca, la langue Déné, le grand lac des Esclaves et les mœurs des Esquimaux. Le Père Petitot fut longtemps missionnaire dans ces régions désolées. Il adressait ses lettres au *Bulletin* de la Société géographique de Paris, qui les fit imprimer.

L'auteur, dans de nombreuses et savantes citations et des rapprochements comparatifs, cherche à établir la provenance asiatique de la grande famille montagnaise. A l'appui de sa thèse, il cite une foule de traditions et de légendes de ces Sauvages. Ce religieux possède une facilité merveilleuse. Ses descriptions sont emportées lestement; et, parfois même, après une docte discussion sur un thème scientifique, il embouche la trompette lyrique et nous régale de très jolies pages. Somme toute, cet auteur est d'abord un savant qui s'échappe parfois en incursions sur le domaine de l'histoire.

Un autre missionnaire non moins distingué dans tout le Canada est le bon Père Lacombe. A coup sûr, cet excellent religieux n'a aucune vanité littéraire. Il a surtout cultivé les lettres Crises et Pieds-Noires, et l'on dit même qu'il a enrichi la langue Crise d'expressions nouvelles fort goûtées des Peaux-Rouges. L'Université Laval pourrait lui décerner le titre de Docteur ès Lettres Crises, si tant est qu'elle puisse accorder un pareil titre avec les règles de sa constitution. Toutefois, dans ses causeries intimes, le Père Lacombe n'a pas d'égal. Une fois lancé dans son sujet il charme et captive son auditoire. Nos revues littéraires, et surtout l'honorable juge Routhier, après avoir un tantinet poli sa phrase un peu négligée, ont publié quelques-uns des drames touchants dont il a été le témoin, ou qu'il a recueillis de la tradition indienne. *Femme abandonnée, Foin de senteur, la Conversion d'un chef Pied-Noir*, pour ne citer que trois de ses légendes, sont réellement des morceaux de littérature qui sentent la fraîcheur de nos prairies et qui seront encore lus au coin du feu, longtemps après que le Père Lacombe sera disparu.

Je veux terminer cette nomenclature en citant deux de nos hommes d'Etat qui sont sans doute les écrivains les mieux connus de notre province; l'honorable Joseph Royal et le sénateur Bernier. A vrai dire, le journalisme militant et les tréteaux politiques furent le théâtre principal de leur action. Ils ont été longtemps sur la brèche, frappant d'estoc et de taille pour la défense de nos droits religieux et nationaux. Tous deux appartenaient à la race de ces écrivains de forte envergure, possédant un style personnel. C'étaient des maîtres dans les joûtes du journalisme qui requièrent tant de connaissances et d'aptitude diverses. De temps à autre, ces esprits vigoureux venaient se reposer de leurs luttes dans l'atmosphère plus calme de nos revues littéraires. Leur fine plume, exercée dans les tournois de la veille, nous a laissé des études pleines d'actualité. On sent, en lisant les thèses qu'ils soutenaient, qu'ils étaient des intellectuels auxquels l'expérience et la pratique des hommes et des choses publiques avaient donné une maturité de jugement et une sûreté de coup d'œil vraiment providentielles dans les temps difficiles que nous traversions alors.

A Dieu ne plaise que j'oublie notre ami M. L. Hacault, ancien directeur du *Courrier* de Bruxelles. Sa plume, exercée dans les luttes pour la cause catholique en Belgique, n'a pu se reposer au Manitoba. M. Hacault est un penseur, un érudit et un clairvoyant en histoire, qui tient une plume alerte et vigoureuse.

Je serais presque tenté de mentionner ici la collection des lettres du Père Aulneau, qui ont été traduites et publiées en anglais. Je me contenterai, pour le moment, d'exprimer le désir qu'on nous donne cette correspondence dans le texte original.

Si l'Ouest ne peut se flatter d'avoir produit des poètes consacrés par les Muses et la voix populaire, notre indigence ne va pas cependant jusqu'au dénûment complet. Nos quarante-cinq degrés de froid n'ont pu éteindre tout à fait le souffle poétique parmi nous, encore fu'ils n'aient produit, il est vrai, que des vers de la classe du folk-lore.

Le premier effort de ce genre, en date de 1817, aboutit à une chanson assez cocasse. C'est toujours plus gaie que la complainte de Cadieux; mais je ne voudrais pas dire qu'elle a autant de mérite. Pierre Falcon, brave Métis, sans la moindre culture intellectuelle, en est l'auteur. C'est déjà assez dire ce qu'elle vaut comme œuvre d'art. Ce coureur-des-bois est troubadour à sa façon. Les règles de la prosodie, voire de la grammaire, ne l'embarassent pas plus que les canons du fort Douglas. Quand on est trappeur on attrape la rime comme on peut; et quand on court la prairie, on ne s'amuse pas à mesurer les pieds d'un vers. Cette pièce originale ne manque pas cependant de piquant et de teinte locale. L'Ouest lui a fait un accueil triomphal. Elle est passée de bouche en bouche, parce qu'elle synthétise un événement historique qui eut une portée immense sur les destinées de l'Ouest. Elle raconte la victoire des Bois-Brulés, à la bataille des Sept-Chênes, la mort du gouverneur Semple et la prise du fort Douglas. Elle comprend six couplets. En voici un:

J'avons tué presque toute une armée.
De la bande quatre ou cinq se sont sauvés.
Si vous aviez vu les Anglais,
Et tous les Bois-Brulés après!
De butte en butte, les Anglais culbutaient.
Les Bois-Brulés jetaient des cris de joie.

Après Falcon, le Parnasse du Nord-Ouest fut de nouveau déserté jusqu'en 1870. L'aventure du pseudo-lieutenant-gouverneur MacDougall fournit l'occasion d'un autre chant: *Les tribulations d'un roi malheureux*, sur l'air du *Juif Errant*, amusèrent la colonie de la Rivière-Rouge. Ecoutez l'auteur qui s'est dérobé sous un pseudonyme:

Est-il rien sur la terre
De plus intéressant
Que la tragique histoire
De MacDoug' et ses gens?
Je vous la conterai;
Veuillez bien m'écouter.

Déjà de son royaume
Le sol il va toucher,
Quand tout à coup un homme
Lui défend d'avancer
En disant: Mon ami
C'est assez loin, ici.

J'ai hâte de vous présenter une poésie pleine de vie, de chaleur et d'émotion. M. Alexandre de Laronde en est l'auteur. Dans le *Chant de mort du dernier Pied-Noir*, il décrit les tristesses des Sauvages resserrés dans leur réserve, au souvenir de leur ancienne vie d'aventures au sein des prairies sans fin. La résignation chrétienne arrête, sur les lèvres du Pied-Noir, les paroles de haine qui ne demandent qu'à sortir:

Où sont mes près fleuris, mes forêts centenaires?
Où sont mes bois épais, sombres, silencieux?
Où sont mes lacs d'azur, mes sentiers solitaires?
Où s'est enfui l'élan qui paissait en ces lieux?
Pour moi tout est douleur, hélas! Où sont mes frères?
Où sont ceux que j'aimais, ceux qui m'étaient si chers?
Réveillez-vous, enfin, nobles races guerrières!
Accourez à ma voix, ranimez nos déserts!

C'est toi, pâle étranger, c'est toi qui fus le traître,
Qui causas nos malheurs, hypocrite, assassin;
Tu vins, on te reçut; de tout on te fit maître,
Nous jurant d'être ami, tu nous serras la main.
Tes rêves d'ambition, ta funeste présence,
A chassé le bonheur, a ravi ma fierté;
Oh! rends-moi ma patrie! Rapporte l'espérance!
Ramène le passé, rends-moi ma liberté!

Que t'avais-je donc fait, moi, pauvre enfant des plaines,
Pour m'arracher mon sol et mes biens, sous mes yeux,
Pour m'écraser, ainsi, sous le poids de tes chaînes?
Ne pouvais-je être libre et, toi, rester heureux? . . . .
Viens, oh! viens, de ma main, viens, ma flèche rapide,
Percer un cœur ingrat, de ta pointe d'acier;
Viens venger, sur ce cœur, une race intrépide,
Car, en vengeant ma mort, on venge un peuple entier.

Pardonne, ô robe-noire, un accès de vengeance!
Le sang de mes aïeux égare ma raison.
Pour moi, dis à ton Dieu d'accepter ma souffrance,
Tu m'as dit bien souvent qu'il était juste et bon.
Accepte, Grand-Esprit, de ma bouche expirante,
Un sacrifice, hélas! qui me vaut bien des pleurs,
Je soumets au pardon mon âme frémissante,
J'offre à ta majesté ma vie et mes douleurs.

Le 18 mars 1903, au collège de Saint-Boniface, la brise de l'Ouest caressait, pour la première fois, les plis du drapeau du Sacré-Cœur qui prenait ainsi possession de la vallée de la Rivière-Rouge. Le Père Lecompte S.J. salua le drapeau dans un hymne de circonstance. *Mon Drapeau* restera parmi nos odes patriotiques les mieux inspirées.

Mon Drapeau.

Pour mon drapeau, pure et brillante page
Portant, écrits en traits si glorieux,
Au Canadien qui vit sur toute plage,
Le souvenir et la foi des aïeux,
Je veux celui qu'au jour de la victoire
Le grand Montcalm planta sur le rempart,
Que Crémazie, au temple de l'histoire,
Auréola de son merveilleux art.
Pour mon drapeau, gage assuré de gloire,
O Carillon, je veux ton étendard!

Sur mon drapeau, je veux un autre emblême,
Une guirlande au milieu de ses plis:
Au champ d'azur il convient que l'on sème
Feuilles d'érable auprès des fleurs de lys.
Dans nos forêts, où, devant le courage
Du preux colon, le sentier s'est ouvert.
Sur mon drapeau, je veux ta noble image,
O Canada, je veux ton rameau vert!

Sur mon drapeau, comme dernier symbole
Plus beau qu'un lys, plus brillant que l'or pur,
Sur mon drapeau, je veux une auréole
S'irradiant en rubis dans l'azur.
Du Golgotha Jésus brise la pierre,
Dompte le monde et son rire moqueur
Et conquérant le palais, la chaumière,
Roi légitime, il s'avance en vainqueur.
Sur mon drapeau, qui marche à ta lumière,
O Christ, O Roi, je veux ton Divin Cœur!

L'exemple du Père Lecompte devait être contagieux dans la communauté. Le premier atteint fut le Père Blain, le plus surpris lui-même de se lire en vers, bien cadencés d'ailleurs. Quittant un jour ses instruments de physique, il entreprit de nous donner une version des plus belles parties de l'*Habitant*. A une séance académique où n'avaient été invités que des intimes, il nous récita *Johnny Courteau, le Curé de Calumet, Mon frère Camille, le Docteur Fiset, le Coteau de St-Sébastien*, et quelques autres pièces du recueil de Drummond. Comme peinture de mœurs, le plus caractéristique de ces morceaux est *le Coteau de St-Sébastien*.

On y sent une émotion pénétrante dans ces vers d'un jet facile.

Le Coteau de St-Sébastian.

Je devrais être épouse heureuse,
Toujours joyeuse.
Se trouve-t-il dans le pays
Un meilleur mari que Louis?
Et puis, est-il une autre mère,
Qui puisse me montrer sur terre,
Des garçons
Plus mignons
Et des filles
Plus gentilles
Que j'en ai bercé sur mon cœur?
Je devrais sentir mon bonheur.
Regardez, ma troupe charmante
Autour de moi babille et chante.
Mais, je pense, en voyant leurs jeux,
Au temps où je jouais comme eux.
O mes heureux jours de fillette!
Je vous pleure, je vous regrette.
Hélas! je me souviens trop bien
Du coteau de St-Sébastien.

Gaîment je vins ici, nouvelle mariée;
Et les plus durs travaux étaient pour moi bien doux.
Le désert me parut une plaine égayée,
Le long voyage, court, avec Louis partout;
Mais qu'est-ce qui m'étreint? Qu'est-ce qui me tourmente?
Dans mon cœur un chagrin de jour en jour augmente;
Pour moi, n'est-il plus un moyen
De contempler ce coin de terre,
Où se mire dans la rivière
Le beau coteau St-Sébastien?

Jadis, il m'était doux, me tenant dans ma porte,
De humer les parfums que le printemps apporte,
De contempler ces prés, où scintillent les fleurs,
Etoiles de nos champs de diverses couleurs,
De voir brouter la biche en robe mouchetée;
La pauvrette souvent était inquiétée
Par les bruits de la ferme où l'on fait tant de train.
Lentement nous avons conquis notre terrain,
Par le fusil d'abord, la herse, la charrue.
Sur un sol vierge il faut qu'un colon trime et sue!
Enfin, grâce aux travaux que le bon Dieu bénit,
Dans l'or de ces blés mûrs s'est blotti notre nid.

Bientôt nos huit enfants, dans notre maisonnette,
Gazouillaient tout le jour leur douce chansonnette;
La même que maman chantait sur mon berceau;
Pourquoi leur ai-je donc appris cet air si beau?
C'est lui qui me transporte au bord de ma rivière;
Tiens, j'entends le courant clapoter sur la pierre,
Et là, je vois Trefflé, le passeur toujours gai;
Qui ramène en chantant sa barque vers son quai;
    Comme je me trompe moi-même!
    Car, ici, quel rève est le mien!
    Je suis loin du pays que j'aime,
    Loin du coteau St-Sébastien.

Louis me surprit un soir dans une rêverie;
Je regardais le ciel, le lac et la prairie.
    Il était à deux pas,
    Je ne le voyais pas.
Je me tourne, il m'embrasse et me dit: "Ah, ma belle,
"Tu l'aimes, je le sais, notre terre nouvelle.
"Que j'en suis content! Car, voyage où tu voudras,
"De plus charmant pays au monde on n'en voit pas".
    Mais d'une autre pensée
    Mon âme était bercée.
J'observais un nuage ébauchant tour-à-tour
Un mur, une maison. Tout-à-coup son contour
Dessina ce coteau, séjour de mon enfance. . . . .
    Je pleurais en silence.
Louis n'entendit rien de mon secret sanglot;
J'embrassai le pauvre homme et n'en dis pas un mot.

Avec un tel mari, comment faut-il s'y prendre?
S'il saisit mon chagrin, son bon cœur va se fendre,
Et s'il me disait: "Tiens, Toinette, allons chez toi",
Pour sûr, je dirais "non". Car c'est plus fort que moi;
Si je revois encor cette terre chérie
Je n'en pourrai partir sans m'arracher la vie;
Ainsi donc, c'est fini; que mon cœur en secret
Pleure. . . Jamais Louis ne saura mon regret,
La promesse en est faite, et je l'ai confirmée.
Ma peine est dans mon âme à jamais enfermée,
    Mon Dieu! Mon Dieu! sois mon soutien,
    Loin du coteau St-Sébastien.

La première institution de la langue française de l'Ouest est bien le collège de Saint-Boniface. Il constitue notre véritable forteresse contre l'assimilation des autres races. C'est de ce centre d'enseignement supérieur que se répandent la lumière, l'activité et le mouvement intellectuel. Une étude des séances académiques données dans cette institution m'entrainerait trop loin. Qu'il me suffise d'en signaler quelques-unes des plus brillantes. *Garcia Moreno* (par J. Bernier), *le Kulturkampf, Navigation Aérienne, Télégraphie sans fil* (par le P. Blain S.J.), *Actualités et poésies* du P. Chossegros, à l'occasion des noces d'argent du collège (1910), ont fait le charme de plusieurs soirées littéraires et scientifiques et ont été le thème d'études classiques soigneusement élaborées.

J'aborde maintenant deux pièces de résistance: *Le martyr de Saint-Cyrille* est un drame en trois actes composé par le Père Béliveau et interprété au collège de Saint-Boniface pour la première fois, sous les yeux mêmes de l'auteur.

Voici une courte analyse de cette pièce.

Cyrin, apprenant que son fils Cyrille, âgé de dix ans, est chrétien, entre dans une grande fureur et menace de le chasser du foyer. Cyrille répond qu'il est navré de chagrin, mais qu'il trouvera une demeure dans la maison de son Père Céleste. Le père menace de le tuer. Cyrille reste inébranlable et est dénoncé à Lycarion, gouverneur de Césarée. Devant les flammes du bûcher, Cyrille demeure ferme et meurt en martyr. Sa mort amène la conversion de sa sœur. La scène se passe à Césarée en Cappadoce, 250 ans après Jésus-Christ. Les entretiens de Cyrille avec les esclaves de son père, sont empreints de charité fraternelle et indiquent l'évolution dans les mœurs, apportée par l'Evangile. Un prologue en vers par le Père Lory S.J. accompagne cette tragédie. Le trait dominant de ce drame est la piété profonde des premiers chrétiens et la foi héroïque de ce jeune enfant. Le style nerveux et châtié de l'auteur donne à cette pièce une émotion pénétrante qui persiste longtemps après la chute du rideau au dernier acte.

Robert ou l'hôte de la forêt est un autre drame en cinq actes, écrit par l'honorable Joseph Bernier, député de Saint-Boniface, à sa sortie du collège.

La scène se passe en Bretagne, au 17e siècle. Le marquis Côte-de-Fer est possesseur d'un château-fort dont il a confié l'intendance à Casca. Ce dernier, aidé de Paolo, son serviteur, ourdit un complot contre son maître, le fait disparaître et remplace le seigneur. Le fils du marquis, Robert, agé de sept ans, réussit à s'échapper, grâce à la protection de son précepteur Bernard. Après douze ans d'une vie errante et cachée, l'enfant, devenu homme, se décide à reconquérir ses biens et vient se réfugier dans les forêts avoisinantes du château, d'où il sème la terreur parmi les habitants du château et se voit surnommé "l'Hôte de la Forêt" à cause du mystère qui entoure son existence. Il tombe enfin entre les mains de Casca qui tient déjà sous les verrous le seigneur, qu'on croit mort. Le dialogue entre le père et le fils, dans un des donjons du château, est peut-être la partie la mieux sentie et la plus touchante. Le repentir d'un des vieux serviteurs du comte amène la délivrance du seigneur, qui rentre dans ses domaines.

On comprend aisément que certains actes aient besoin d'un travail de retouche, mais ils sont plus que compensés par des coups de théâtre bien préparés. Le style colorié, brillant et plein de vie du jeune auteur, alors à ses débuts, répand de la chaleur dans l'action de tout le drame. Bref ce drame dénote un talent supérieur.

A cette liste de nos littérateurs que l'Ouest peut réclamer en propre, je pourrais ajouter Pierre Margry qui nous a laissé ses *Découvertes et établissements des Français dans l'Ouest;* l'honorable L.-R. Masson, l'auteur des *Bourgeois de la Compagnie du Nord-Ouest;* Frédéric de Kastner, qui a publié les *Héros de la Nouvelle-France* où se trouve une vie de LaVerendrye; Benjamin Sulte, auquel nous devons également une biographie de LaVerendrye, une autre du chevalier de Niverville et l'histoire des Canadiens-français qui renferme une foule de notes précieuses pour l'histoire de l'Ouest; et enfin Joseph Tassé qui nous a donné les *Canadiens de l'Ouest.*

Je serais tenté de m'approprier ces auteurs au profit de l'Ouest, si je ne me rappelais le commandement qui défend de s'emparer du bien d'autrui. Il est vrai qu'ils n'ont jamais vécu dans l'Ouest; mais vous me permettrez de réclamer comme nôtres les pages si françaises où ils parlent de nous et de nos illustres découvreurs.

Le souvenir de ce que nos aînés ont accompli dans le passé nous anime, nous, leurs successeurs dans l'Ouest, dans les âpres luttes de l'heure présente, pour conserver le dépôt précieux qu'ils nous ont légué. L'un des moyens de nous entraîner dans l'accomplissement de nos devoirs, comme entité française, c'est de ne pas négliger la culture intellectuelle qui nous fera conserver l'idéal propre au génie des races latines. Je ne veux pas dire que nous ne devons pas nous approprier, en les tempérant et en les adoptant à notre mentalité française, quelques-unes des qualités qui s'accentuent davantage chez les Anglo-saxons, comme leur patience, leur sérieux, leur force d'attention et leur sens pratique des affaires commerciales. Ce filon d'emprunt, dans notre âme, ne saurait en altérer la structure primitive, ni les aspirations ancestrales. La tendance naturelle qui nous soutient, nous arrive de parentages trop illustres et à des prises trop fortes dans notre sang pour qu'elle puisse jamais perdre de son empire.

Les anciens du pays étaient des déracinés, transplantés des rives du Saint-Laurent sur les bords de la Rivière-Rouge. Comme jadis les races pélagiques qui, les premières, s'établirent sur les rives du Tibre, ces pionniers de l'Ouest avaient les yeux tournés vers le berceau de leur famille, la patrie des ancêtres. Le plus grand nombre d'entre eux nourrissaient le secret espoir d'aller un jour, là-bas, réchauffer leurs membres vieillis auprès de l'âtre paternel. Hélas! Bien peu virent leur rêve se réaliser. Leur descendance, il faut le dire, ainsi que les fils des colons de sang français nés dans l'Ouest, tout en conservant un souvenir affectueux pour la province mère, ont pris contact avec le sol et se sont attachés sans retour à la patrie d'adoption de leur père. Ce rameau, détaché du tronc principal, a pris racine et nous espérons qu'il ne cessera de se couvrir de fleurs et de fruits dont la richesse et la saveur rappelleront toujours leur provenance et leur rapprochement de la province de Québec.

Nous avons hérité de l'élan naturel du génie français qui cherche avec passion à s'élever dans le monde idéal. Par tradition, par l'épanchement instinctif de sa grande âme, la race française a besoin de faire de grandes choses. Elle aspire à la conquête des âmes. Pour y parvenir, son cœur se dilate et ne recule devant aucun sacrifice. Elle verse le sang de ses missionnaires et de ses religieux dans ces contrées inhospitalières de l'Athabasca-Mackenzie, de la Baie d'Hudson et du Labrador. Attirée par le fond même de ses plus intimes aspirations, elle se donne tout entière, le sourire sur les lèvres, jusqu'à son dernier soupir, pour satisfaire ce passionnant désir de son âme chevaleresque. Ce serait un crime que de déformer un si noble caractère ou d'étouffer des enthousiasmes aussi réconfortants. Or, quand un peuple abandonne sa langue, il est bien près d'abdiquer ses dispositions natives.

En terminant, je crois être l'écho fidèle de mes compatriotes de l'Ouest en assurant que le vent cessera de souffler de la nue, et les eaux du Saint-Laurent de baigner le pied de la citadelle de Québec, avant que vos frères de l'Ouest oublient le doux parler de la France, et les enseignements religieux qu'ils ont reçus de leurs pieux ancêtres.

Saint-Boniface, 15 avril, 1915.

La Langue française hors de France.

PAR A. D. DECELLES, M.S.R.C.

(Lu à la réunion de mai, 1915).

Le 27 septembre, 1066, Guillaume le Conquérant s'embarquait à l'embouchure de la Somme pour l'Angleterre. Quatre cents navires et mille bateaux portaient son armée de soixante mille hommes. Le but de son expédition, vous le connaissez bien; il s'agissait d'enlever la couronne au roi Harold et de s'emparer de son royaume. Quelques jours plus tard, les armées des deux princes se trouvaient en présence à Hastings et se préparaient à livrer bataille.

Robert Wace, un chroniqueur Anglo-Normand de l'époque, nous a laissé un tableau pittoresque de l'état d'âme des Normands et des Anglo-Saxons à la veille du grand jour; ceux-ci atterrés par la perspective de la partie où allait se jouer leur sort, voulurent s'étourdir. La nuit se passa dans leur camp en une beuverie interminable mêlée de chants, curieuse façon de se donner du courage. "Toute la nuit mangèrent et burent. Vous les eussiez vus moult se demener, saillir et chanter." Toute autre fut la préparation des Normands au combat. Pénétrés des dangers qu'ils allaient courir, ils se préparèrent à la mort. On ne voyait partout que groupes de soldats se disposant à une confession générale. Robert Wace, dont il vient d'être question, nous rapporte ces faits dans son style si simple:

Et li Normanz et li Franceiz
Tote nuit firent oreisons,
Et furent en aflicions.
De lor péchiés confèz se firent

Le lendemain, jour de la bataille, la bonne humeur avait changé de camp et passé du côté des Français. Avant de porter le premier coup à l'ennemi, Guillaume permit au jongleur Taillefer de marcher en avant de ses compagnons. Arrivé près des Anglo-Saxons, il lance en l'air son épée et puis sa lance les rattrapant par la poignée. En faisant ces tours d'adresse pour narguer l'ennemi, il ne cessait de chanter les chansons de France:

De Karlemaine et de Roland
Et d'Olivier et de ses vassals
Ki moururent à Roncevals

Après ces préliminaires—pour nous bien bizarres—le choc entre les deux armées se produisit violent, acharné. Harold périt dans la mêlée et la victoire vint couronner la vaillance des Normands qui furent bientôt maîtres de l'Angleterre.

Ils se conduisirent comme en pays conquis, la brutalité marquant tous leurs rapports avec les Anglo-Saxons. Rien n'était trop cruel pour les vaincus réduits souvent au rang d'esclave et vendus comme vil bétail. D'après William de Malmesbury et autres chroniqueurs, tout ce que les Normands voulaient, ils se le croyaient permis. Ils versaient le sang au hasard, arrachaient le pain de la bouche des malheureux et prenaient tout l'argent, les biens, la terre.

L'Angleterre subit une transformation à ce point que l'influence française introduisit à la cour, à l'église, dans les tribunaux, les usages et la langue d'outre-Manche. "Durant deux cents ans, dit Hygden, contre l'usage et l'habitude de toute nation, les enfants à l'école furent obligés de quitter leur propre langue, de traduire en français les leçons latines et de faire leurs exercices en français." Un autre annaliste ajoute: "Les enfants des gentilshommes apprenaient à parler français du moment où on les berçait dans leur berceau et les campagnards s'étudiaient à parler français pour se donner l'air de gentilshommes." De prime abord, on serait porté à croire que la langue anglo-saxonne disparut complètement du pays conquis. Il n'en fut rien; une partie du peuple à la campagne continua à parler comme ses ancêtres. A un certain point de vue, il devint bilingue pour menager ses intérêts dans ses rapports avec les conquérants. Walter Scott note à ce sujet un fait curieux. Il fait remonter à la conquête normande les doubles noms qui désignent certaines choses en Angleterre. Lorsque le paysan apportait au marché des villes la viande de l'animal appelée chez lui *sheep*, il l'offrait sous le nom de mouton au Normand. Par le même procédé, *pig*, *swine*, à la campagne, devenait porc, en ville, et de même *calf*, veau.

Il est bon de rappeler que, bien avant la conquête normande le français avait pénétré en Angleterre. Comme le disait un poète anglais:

> Filii nobilium, dum sunt juniores,
> Mituntur in Franciam, fieri doctores.

La langue française vint se superposer à l'anglais et, chose singulière qui démontre qu'à cette époque la langue n'était pas liée à la nationalité comme elle l'est de nos jours, la bourgeoisie se plia assez docilement aux volontés des Normands et s'empressa d'apprendre la langue romane. Dès lors, elle règne en souveraine à la cour comme dans les châteaux, dans les tribunaux, et à l'église; et cette souveraineté s'étend sur une période de près de deux cents ans. Les Normands—les Northmen qui parlaient les idiomes scandinaves lors de leur établissement en France, ne s'étaient-ils pas hâtés de les délaisser pour parler la langue de leur nouvelle patrie?

La littérature de France—chansons des trouvères et des troubadours—devint celle de l'Angleterre. Les grands—la classe lettrée les lisait dans l'original; le peuple dans des traductions. *La chanson de Roland, le Roman de Renart,* y devinrent lecture courante comme en France.

Ainsi se produisit selon un écrivain français ce phénomène singulier. "A côté d'auteurs, français de race et de langage, sujets des rois d'Angleterre, d'autres employèrent notre idiome qui étaient anglais de race et de langage et qui, imitant de leur mieux le style préféré des maîtres du pays, rédigèrent en français des chroniques comme firent aux douzième et quatorzième siècle, Jordan Fantosme auteur d'une *Chronique de la guerre entre les Anglais et les Ecossais* (1173-74,) et Pierre de Langtaff; des poèmes religieux, comme firent au treizième, Robert de Greteham, Robert Grosseteste, William de Wadington; des romans en vers, comme ceux de Hue de Rotelande; des contes moralisés en prose comme ceux de Nicole Bozon; des poésies lyriques ou des fabliaux comme *Le roman de un chevalier de sa dame et de un clerk,* redigé en français par un Anglais au treizième siècle, comme ceux que composèrent divers anonymes; des ballades comme celles qu'on doit tant à l'extrémité de la période dans la seconde moitié du quatorzième siècle, à l'ami de Chaucer, le poète Gower." ([1])

Comme les rois d'Angleterre l'étaient aussi de Normandie, ils traversaient souvent la Manche pour faire d'assez longs séjours dans cette province. Le Prince Noir, à qui les armes de la Grande-Bretagne doivent la fameuse devise: "Dieu et mon droit" passait la plupart de son temps à Bordeaux. Souvent aussi des princesses françaises devenaient, par mariage, reines d'Angleterre. C'est de cette façon que s'agrandissait le domaine de l'Angleterre, au dépens de la France, que ce pays acquit l'Aquitaine et la Guienne. Tout favorisait la diffusion de la langue française outre-Manche. Elle dominait partout dans les hautes sphères, à la cour, au parlement embryonnaire de l'époque. C'est en français que fut redigée la célèbre *magna charta,* la grande charte des libertés anglaises.

Le fameux Prince Noir dont il vient d'être question avait composé son épitaphe, curieux spécimen de français du temps, qu'on peut encore lire sur son tombeau à Canterbury.

(1) Jusserand.

Voici ce curieux échantillon du français de l'époque.

Tel com tu es, je fus;
Tu seras tel comme je sus,
De la mort ne pensai-je mie
Tant comme je avais la vie.
En terre avais grand richesse
Dont je y fis grande noblesse,
Terre, maisons et grand trésor,
Draps (et), chevaux, argent et or;
Mais or suis-je pauvre et chétis,
Parfond en la terre gis,
Ma grand beauté est tout allée . . .
Et si ore me veissiez,
Je ne cuid pas que vous dissiez
Que je eusse onques homme été.

Aussi bien la langue française rayonnait-elle alors sur l'Europe avec un prestige qui la faisait accueillir et rechercher partout. On lui trouvait un charme incomparable dans la conversation, une précision, une clarté dans l'expression qui facilitaient les relations d'un peuple à l'autre. L'Italie elle-même, en dépit de son langage musical, lui accordait ses suffrages; et l'amie du Dante—Brunetto Lattini—n'hésitait pas à proclamer que "la parlure du français est plus délitable et plus commune à toutes gens."

Comment cette domination française en Angleterre prit-elle fin? Comment ne s'est-elle pas perpétuée jusqu'à nos jours? La conquête de la Normandie par Philippe-Auguste amena un grand écart entre la France et l'Angleterre, et produisit une rivalité qui rangea les deux pays l'un contre l'autre, et créa chez le peuple anglais une antipathie générale pour les choses de France, surtout langue et coutumes. Sous Edouard III, le français cessa d'être la langue courante, hors de la cour. Dès lors les plaidoyers devront se faire devant les tribunaux dans la langue anglaise parce que "la langue Franceys, dit une ordonnance du Roi, est trop desconnue en le dit realme".

Mais la langue française conserva encore sa place dans les *public records*, c'est-à-dire les registres officiels. Longtemps après les lois du royaume s'imprimèrent en français à côté de l'anglais et cette double publicité se prolonge jusque sous le règne de Henri VII.[1] Pour contenter la curiosité des philologues, citons un échantillon d'un de ces statuts publiés dans les deux langues sous ce roi.

[1] La Biblithèque du Parlement fédéral possède ces lois.

THE Kynge our sovereyne lord Henry by the grace of God Kynge of Englande and of Fraunce and Lord of Irlande the vii, at his Parliamente holden at Westminster the ix. day of Novembr in the thirde yere of his noble reigne; to the worship of God and Holy Chirche and for the comen wele of this his reame, by thadvyts and assente of the lordes spirituell and temporell and the comens in the saide Parliamente assembled, and by auctorite of the same Parliamente, hath ordeyned and established certeyn statutes and ordenaunces in maner and fourme as hereafter ensueth.

Nostre Seignior le Roy Henry par la grace de Dieu, Roy Dengliter & de Fraunce & Dirland, le septisme, a son parliament tenuz à Westminster le novesme jour de Novembre lan de son noble reigne tierce, al l'honour de Dieu & de Seint Esglice & pur la commune bien de cest son Realme, de l'advise & assent de lez Seigniors espirituels & temporels & lez communes en le dit parliament assemblez & par auctorité de même parliament, ad ordeigne & establie certeinz statuitz & ordenancez en maner & forme icy après ensuantz.

Ce jargon bizarre ne ressemble en rien à la langue que l'on parlait alors en France (1485-1509). Qu'on se le rappelle, c'est sous Edouard III que le français cesse d'être employé dans les tribunaux, comme nous venons de le dire. Le long travail d'assimilation qui avait commencé peu après la conquête s'était depuis longtemps accompli, c'est-à-dire sous les deux derniers Plantagenets Richard II et Edouard III. Une double fusion s'était opérée: celle des deux races et des deux idiomes. Il n'y avait plus de Saxons ni de Normands, mais des Anglais. Même transformation à l'égard de la langue. Par quel singulier phénomène, ou caprice, le normand a-t-il si longtemps conservé sa place dans les statuts du royaume. N'oublions pas qu'au point de vue des usages et des coutumes, l'Angleterre est un pays de routine, ou si l'on préfère, de tradition. Jusqu'à nos jours, se sont conservées et perpétuées au Parlement de Westminster quelques phrases ou formules françaises dont le souverain se sert en certaines circonstances ou à la fin des sessions.

Henri VIII fut le dernier roi d'Angleterre à noter en langue française (selon l'usage de ses prédécesseurs) son rang dans la suite de la dynastie normande; officiellement il s'appelle "le huitième roi de ce nom depuis la conquête". La littérature anglaise proprement dite, aboutissant à l'ère actuelle remonte à Chaucer qui dédaignant l'anglo-normand publia les premières poésies en anglais, langue nouvelle résultant de la fusion des deux langues en présence en Angleterre. Quelle fut la part afférente à l'une et à l'autre ? Les philologues ont réussi à le déterminer d'une façon assez précise. On estime que le vocabulaire anglais actuel compte deux fois plus de mots d'origine française que d'origine germanique.

Skeat, dans son dictionnaire étymologique, classe les mots d'après leur provenance. Il se trouve d'après ce classement que les mots empruntés aux idiomes germaniques couvrent sept colonnes et demie; et ceux tirés du français et des langues romanes, seize colonnes.

Lorsqu'on examine de près les deux langues, on est surpris de retracer dans l'anglais des vieux mots français et même des expressions entières. Voltairer aillait un jour les habitants d'outre-Manche qui avaient une façon si bizarre de demander des nouvelles de leur santé! Qu'est-ce que cela signifie, disait-il, *How do you do* ? Or, Voltaire ne se doutait pas qu'il se moquait d'une vieille expression française que l'on retrouve dans le Roman de Renart: *Comment vous li faites*, dit un des personnages en abordant le roi ?

A côté de la fusion des deux langues, la conquête normande eut une autre répercussion dont les conséquences se perpétuent. En effet, les soixante mille compagnons de Guillaume se mêlèrent à la population anglo-saxonne et firent souche de familles nombreuses, les meilleures de l'Angleterre au point de vue de la naissance. Le chroniqueur, Robert of Gloucester (1250) caractérise d'une façon bien significative ce mélange: "Les gens de Normandie habitent encore parmi nous et y demeureront à jamais. Les hauts personnages de ce pays descendent des Normands, et les hommes de basses conditions sont fils de Saxons!"

Français et Anglais sont donc bien apparentés, mais les prétentions des rois d'Angleterre au trône de France, les rivalités d'intérêt d'un côté de la Manche à l'autre et aussi la religion ont creusé entre eux un abîme. La guerre actuelle le remplira-t-elle ? Verrons-nous ces ennemis séculaires se reconcilier dans une entente cordiale durable ? Il ne faut pas préjuger la politique à venir; l'amitié n'existe guère entre les peuples.

La langue française a toujours conservé un droit de cité en Angleterre. Presque toute la noblesse et les classes instruites tiennent à honneur de la parler et souvent de l'écrire. Il y a aujourd'hui 10,000 écoles où l'on enseigne le français en Angleterre.[1]

* * *

Nous venons de voir la place que notre langue a tenu en Angleterre, jetons un coup d'œil sur son rôle ailleurs. Les affinités sociales, politiques et commerciales entre l'Espagne et la France font de l'étude du français une nécessité impérieuse dans le pays du Cid. Il y est enseigné presque partout, ce qui ne veut pas dire qu'il est aussi parlé, mais il est souvent compris. Les comités de l'Alliance Française

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[1] Au mois de juin dernier, j'arrivai à la Malbaie. Il y avait alors au quai plusieurs sous-marins anglais qui faisaient des évolutions. Tous les officiers qui les montaient logeaient au Château Murray et tous parlaient notre langue.

d'Espagne font de grands efforts pour propager l'étude de notre langue qui, chose à noter, est plus répandue en Portugal que chez sa voisine.

La Suisse vient en première ligne parmi les pays de langue française. Comme on le sait, plusieurs cantons en ont fait leur langue officielle. La Suisse, au reste, est un pays *trilingue*, pourrait-on dire, car presque tous les habitants de l'Helvétie parlent avec facilité, outre notre langue, l'allemand et l'italien.

Dans les pays scandinaves, le français est en honneur chez les lettrés. Que dire du Levant, de l'Extrême-Orient? Durant de longues années, il a été le seul idiome étranger connu, grâce au dévoûment, à la persévérance des communautés religieuses d'hommes et de femmes qui l'y ont introduit et maintenu.

La langue de Bossuet a aussi traversé les mers pour s'implanter en Amérique. Ne parlons pas de notre partie du continent où nous marcherions sur un terrain trop connu. Allons plutôt au delà de l'équateur. Nos amis d'Ontario trouveraient matière à surprise s'ils visitaient la République Argentine, le Paraguay, l'Uruguay et le Brésil, remplis de journaux français. Cette surprise irait à son comble en y voyant l'enseignement obligatoire de notre langue presque prescrit dans une province. Un voyage de ce côté formerait, ou plutôt réformerait leur mentalité.

Napoléon, au milieu de ses merveilleux exploits et de ses ambitions toujours inassouvies, fit un jour un rêve: Il lui sembla qu'il était possible de rendre universel en Europe, dans les pays conquis par ses armes, l'usage de la langue française. Ce rêve vint se heurter au sentiment national qu'il souleva et qui rebondit contre cette idée chimérique du grand Empereur. On vit presque une insurrection populaire contre le français que les idées de liberté, de fraternité portée sur ses ailes avaient d'abord fait accueillir avec enthousiasme. Napoléon s'aperçut que l'on n'impose pas une langue à un peuple. Lorsque l'on veut s'attaquer aux mots avec lesquels les hommes ont été bercés, c'est comme si l'on tentait de briser le berceau lui-même. Enfin, de cet attentat surgit la colère du peuple qui s'élève en mur infranchissable contre le sacrilège. Voyez la Pologne: depuis au delà de cent ans, elle parle sa langue, en dépit des efforts de trois gouvernements acharnés à sa suppression. La langue c'est l'âme d'une nation et c'est en vain que l'on veut la lui arracher.

Dans presque tous les pays de l'Europe, il est entendu que l'élite de la nation doit parler une autre langue que la sienne. Or, dans le choix que l'on fait à ce sujet, la préférence est presque toujours donnée au français.

Il n'est pas hors de propos de répéter ici ce que nombre de gens semblent ignorer. En dépit de bien des oppositions, le français reste la langue diplomatique de l'Europe. L'Angleterre et les Etats-Unis ont voulu déroger à l'usage établi, mais force leur est bien de s'y conformer parfois lorsqu'il s'agit d'entrer en pourparler avec les puissances continentales. Les délibérations de la Convention de Londres, en 1908, ont été rédigées en français: l'Allemagne, la Russie, l'Autriche, la Grande-Bretagne et les Etats-Unis étaient parties à cet accord (il s'agissait de régler le droit des gens en temps de guerre). Il y a quelques années, il se fondait sur notre continent un Institut pan-américain dans lequel sont entrées toutes les nations de l'Amérique du Sud et les Etats-Unis. Après maintes discussions, il fut arrêté que le français serait la langue officielle de cette importante association.

L'on rencontre quelquefois, dans ce domaine, des faits qui semblent incroyables. N'était-ce pas bizarre, par exemple, de voir l'Italie et l'Allemagne, au temps de Crispi, se servir du français pour négocier un traité contre la France ?

Nulle part en Europe le français n'a joué un rôle aussi considérable qu'en Angleterre. Il est vrai qu'ici il avait été imposé, en quelque sorte, par la conquête, tandis qu'en Allemagne, en Russie aussi bien qu'en Italie et dans la Péninsule ibérique, c'est l'attrait et l'amour du beau qui le firent rechercher et accueillir. Comme le fait remarquer Palsgrave: Le génie français au moyen âge rayonnait sur presque toute l'Europe, depuis les pays scandinaves jusqu'au sud de l'Italie et de l'Espagne.

C'est Catherine II qui l'introduisit en Russie. Elle se plut à remplir sa cour de savants et de littérateurs français et de propager autant que possible l'étude de leur langue. Ses successeurs suivirent son exemple; et il n'y a pas aujourd'hui de pays où le français soit plus cultivé qu'en Russie dans les classes élevées. Journaux, théatres, littérature semblent un reflet du mouvement intellectuel de Paris.

Le français en Allemagne! Ces deux termes semblent une antinomie, tellement sont intenses les antipathies qui se dressent comme un mur infranchissable d'un côté à l'autre de l'Alsace et de la Lorraine. Ce n'est là qu'une apparence qui se dissipe à la lumière de la réalité. C'est sous Frédéric le Grand que notre langue se fit d'abord connaître à Berlin. Qui n'a pas entendu parler du séjour de Voltaire, de Maupertuis, d'Argens et de bien d'autres à la cour de ce fameux roi! Il se piquait non seulement de connaître le français mais aussi de l'écrire. Il existe de lui un poème en six chants: *Paladion.* C'est une suite de mauvais vers, entachés d'impiété et dont l'insipidité en rend la lecture impossible. L'*Anti-Machiavel* est sorti aussi de sa plume et aucun de ses autres ouvrages n'a été écrit en allemand.

Quelle surprise si dans ces derniers temps, une institution allemande s'était intéressée à la langue française au point d'instituer un concours sur "L'universalité de la langue française". C'est cependant ce que l'on vit en 1759. Cette année-là, l'Académie de Berlin appelle les savants, les littérateurs de l'Europe à se prononcer sur ce point, et depuis cette époque notre langue a toujours tenu une place prépondérante à Munich, à Dresde comme à Hambourg et à Francfort. De nos jours, les études dans ce domaine ne se sont point ralenties et la science germanique s'est plongée dans de profondes recherches sur les origines de notre langue. *La Revue de dialectologie romande*, publiée jusqu'au mois d'août 1914, donnait dans chaque livraison des articles de philologie signés plutôt de noms allemands que de noms français.

En Autriche-Hongrie, nous trouvons une culture française poussée plus loin qu'en Allemagne. Des classes élevées de la société, elle est descendue au sein de la bourgeoisie, et les écoles primaires se font un devoir de donner à leurs élèves jusqu'à six heures d'études de français par semaine.

Que dire de l'Italie et de la Grèce! Le génie gréco-latin n'a-t-il point passé dans la langue de Bossuet pour se muer en moyens d'expression de la parole humaine d'une incomparable richesse. Ces deux pays sont fiers de se mettre dans la tradition et de se faire un honneur de connaître une langue si profondément apparentée aux leurs ?

Sait-on qu'au mois de juillet dernier l'ultimatum posé à la Serbie par l'Autriche a été rédigé en français ? Le protocole a imposé le même moyen de communication au Tzar et au Kaiser dans les pourparlers engagés entre ces deux souverains avant la déclaration de guerre. On sera curieux de lire quelques extraits de cette correspondance entre le Kaiser et le Tzar reproduits ici textuellement tels qu'ils se trouvent encadrés dans le Livre bleu anglais.

Citons d'abord le télégramme de l'empereur russe à son *ami* allemand.

L'Empereur Nicolas
à l'Empereur Guillaume.

1er août 1914 (2 heures après-midi).

J'ai reçu ton télégramme, je comprends que tu sois obligé de mobiliser, mais je voudrais avoir de toi la même garantie que je t'ai donnée, à savoir que ces mesures ne signifient pas la guerre et que nous poursuivrons nos négociations pour le bien de nos deux pays et la paix générale si chère à nos cœurs.

Notre longue amitié éprouvée doit, avec l'aide de Dieu, réussir à empêcher ces effusions de sang. J'attends avec confiance une réponse de toi.

NICOLAS.

A cet appel suprême pour prévenir le conflit sans nom auquel nous assistons, l'empereur Guillaume répondit comme suit:

Berlin, 1er août 1914.

Je te remercie de ton télégramme; j'ai indiqué hier à ton Gouvernement le seul moyen par lequel la guerre pouvait encore être évitée.

Bien que j'eusse demandé une réponse pour midi, aucun télégramme de mon Ambassadeur contenant une réponse de ton Gouvernement ne m'est encore parvenue.

J'ai donc été contraint de mobiliser mon armée.

Une réponse immédiate, claire et non équivoque, de ton Gouvernement est le seul moyen de conjurer une calamité incommensurable. Jusqu'à ce que je reçoive cette réponse, il m'est impossible, à mon vif regret, d'aborder le sujet de ton télégramme. Je dois te demander catégoriquement de donner sans retard l'ordre à tes troupes de ne porter en aucun cas la moindre atteinte à nos frontières.

GUILLAUME.

Tout en étant décidé de mobiliser, Guillaume défendait à Nicolas de se mettre en garde. Comme l'Autriche avait déjà attaqué Belgrade, la Russie prenait ses précautions tout en négociant avec cette puissance. C'est alors que Guillaume, craignant de voir le conflit manquer, fit par son ambassadeur à Saint Pétersbourg la déclaration de guerre qui suit, après avoir rappelé certains faits:

"Sa Majesté l'Empereur Mon Auguste Souverain au nom de l'Empire, relevant le défi, se considère en état de guerre avec la Russie."

F. POURTALÈS.

Saint Pétersbourg, 1er août, 1914.

Il est curieux de voir le nom si français de Pourtalès accouplé de cette manière à celui du kaiser.

Citons encore un petit fait qui en dit plus qu'il n'est long sur l'usage si répandu de notre langue en Europe. En 1908, me disait un ministre canadien français, étant à Londres, je fus invité à diner avec un de mes collègues anglais, chez un personnage de haute position. Parmi les convives il y avait des Anglais, des Russes, des Allemands et des Italiens. Par une convention tacite, la conversation entre ces hommes de nationalité différente s'engagea en français. En rentrant à l'hotel, mon collègue me dit en parlant du diner: "je n'ai jamais autant regretté que ce soir de ne pas parler français. J'ai dû rester étranger à tout ce qui s'est dit à table; j'ai été humilié."

Le français, ni aucune autre langue, ne saurait aujourd'hui prétendre à une prépondérance mondiale en face de ce sentiment national qui confond le langage avec l'idée de patrie, mais on voit combien il est encore partout à l'ordre du jour.

D'après le chroniqueur Robert de Gloucester, "les gens de bien en Angleterre parlaient le français". Nous ne saurions pousser notre pensée aussi loin, mais il est bien permis de soutenir qu'il est encore le mode d'expression le plus recherché par l'élite des nations les plus civilisées de l'univers. L'idée qu'on se faisait au moyen âge de sa perfection au point de vue de la clarté, de la précision et de l'harmonie s'est transmise jusqu'à nos jours.

Manié par les écrivains de génie, il a encore le don de sonner avec un rythme sonore à nos oreilles émerveillées. Au temps de Jeanne d'Arc on lisait dans le grimoire des bergers cette phrase hyperbolique, exacte peinture des sentiments de l'époque à l'égard de leur pays: "O Paradis, France du Ciel, O France, Paradis du monde". Il fallait pour correspondre à cette opinion emphatique une langue extraordinaire pour former un ensemble harmonieux. On ne manquait pas de croire à l'existence de cette musique des mots puisqu'on disait vers le même temps: "Doux français peut se comparer au parler des anges dans le Ciel!".

[1] La manière du langage comparée à Bury Saint-Edmond.

Les médailles décernées aux Indiens d'Amérique

ETUDE HISTORIQUE ET NUMISMATIQUE.

PAR VICTOR MORIN, LL.D.

Présentée par M. EDOUARD MONTPETIT, M.S.R.C.

(Lue à la réunion de mai, 1915.)

Les indigènes de l'Amérique, aussi bien que ceux des autres parties du monde, ont toujours été de grands enfants; les couleurs voyantes, les objets brillants, les hochets de toute sorte avaient un grand charme pour eux. Leurs guerriers aimaient à orner leur beauté rustique de rubans et de plumes dans les grandes fêtes, et se couvraient le corps de peintures criardes lorsqu'ils entraient sur le sentier de la guerre.

Différaient-ils sensiblement en cela de leurs cousins des pays civilisés? Je n'oserais l'affirmer, car, de nos jours, les rubans à la boutonnière sont encore de belle mise, les titres et les décorations sont en grande demande, ici comme en Europe, malgré les allures démocratiques de notre génération; seulement les rôles ont un peu changé, car ce sont à présent les "guerrières" qui se mettent de la peinture sur le visage.

Sans faire de recherches d'atavisme entre les anciens habitants du pays et les modernes, contentons-nous donc de noter le fait que les premiers explorateurs n'eurent pas de frais considérables à encourir pour obtenir des naturels les fourrures et autres objets précieux qu'ils convoitaient; quelques grains de verroterie, quelques verges de ruban suffisaient pour faire déposer à leurs pieds des richesses inépuisables.

Mais à mesure que leurs relations avec les Européens devenaient plus fréquentes, les Indiens apprécièrent l'utilité des objets qu'ils voyaient aux mains de ceux-ci, et leurs exigences devinrent plus grandes. Bientôt, ils voulurent posséder des mousquets, ces "petits tonnerres" qui les avaient d'abord tant effrayés, au point de leur faire prendre les hommes blancs pour des "manitous". Et quand ils eurent, pour leur malheur, goûté à "l'eau de feu", ils devinrent insatiables.

Les traiteurs, il est vrai, leur firent payer cher ces appétits nouveaux. Le prix d'un fusil se payait en fourrures empilées les unes sur les autres jusqu'au haut du canon, et l'on en vint à fabriquer, en vue de la traite, des armes qui ne mesuraient pas moins de huit pieds de hauteur.

Il restait aux Indiens la ressource de "faire effacer leurs rêves", superstition dont on trouve encore des traces aujourd'hui. D'après leurs croyances, les songes étaient des manifestations de la visite du Grand Esprit qui leur faisait connaître sa volonté pendant leur sommeil; aussi se hâtaient-ils d'accomplir religieusement au réveil ce qui leur avait été indiqué en songe, afin de ne pas s'exposer à la colère du Grand Esprit en désobéissant à ses injonctions; c'est ce qu'ils appelaient "effacer le rêve" en le réalisant. (Cf. *Relation abrégée de quelques Missions des Pères de la Compagnie de Jésus dans la Nouvelle-France*, par le Père Bressani, en 1653). Lorsqu'ils convoitaient ardemment un fusil ou un collier de verroterie, la hantise de sa possession les poursuivait jusque dans leur sommeil, et ils en "rêvaient" littéralement. Aussi ne manquaient-ils pas, le lendemain, d'aller faire part à leurs frères blancs des ordres reçus de la divinité pendant la nuit, afin de se faire remettre l'objet convoité. Mais ils constatèrent bientôt que les blancs aussi avaient des songes, sauf cette différence qu'ils étaient hors de proportion avec les leurs; pour un fusil rêvé par un Indien, le traiteur rêvait le lendemain qu'on lui avait rempli sa tente des plus précieuses fourrures. Si bien qu'à la fin, les pauvres enfants de la forêt, constatant qu'ils n'étaient pas de taille à lutter avec des Normands dans le domaine du rêve, s'efforcèrent de chasser de leur esprit ces visites nocturnes de leur divinité.

Quelques traiteurs ayant cependant montré des pièces d'argent frappées à l'effigie du roi, les Indiens en devinrent très avides, mais l'usage qu'ils en firent fut des plus imprévus. Au lieu de les mettre en circulation pour se procurer d'autres effets, ils s'en firent des objets d'ornement, et les percèrent pour se les suspendre en collier ou aux oreilles.

Ils voyaient en effet dans ces pièces, non seulement une parure qu'ils étaient glorieux d'étaler, mais encore un talisman du "Grand Ononthio" ce monarque puissant dont ils avaient entendu dire tant de merveilles et dont ils considéraient tenir un gage d'amitié en portant son image.

Ils jugeaient naturellement de la valeur de ces pièces à raison de leurs dimensions, et quand ils virent entre les mains des blancs quelques-unes des nombreuses médailles de grand module frappées à l'effigie royale en commémoration des évènements importants du règne du Roi-Soleil, leurs chefs voulurent en posséder comme marque de distinction spéciale.

Les gouverneurs et les missionnaires mirent à profit ces dispositions, ceux-ci pour induire les Indiens à se faire baptiser, et ceux-là pour assurer l'allégeance des principaux chefs à la couronne de France. A ces fins, les missionnaires leur distribuaient des objets religieux, tandis que les gouverneurs les décoraient de médailles et leur prodiguaient d'autres marques d'attention propres à les détourner des sollicitations de l'Anglais dans les guerres que se faisaient alors ces deux puissances.

Il est vrai qu'un certain nombre d'entre eux acceptaient ces cadeaux sans se faire de grands scrupules des engagements qu'ils comportaient. Le Père Chrestien LeClercq nous dit, dans son livre rarissime "*Premier Etablissement de la Foy dans la Nouvelle-France*" qu'"un Indien se serait volontiers fait baptiser dix fois par jour pour une chopine de whisky ou une livre de tabac," et lorsqu'il leur convenait de changer d'allégéance, ils échangeaient simplement leur médaille pour une autre qu'ils recevaient à l'effigie de leur nouveau souverain.

Mais la plupart d'entre eux, et surtout ceux qui se convertirent, furent d'une fidélité inviolable à la religion qu'ils avaient embrassée et au roi qu'ils avaient reconnu; aussi les persécutions religieuses qui sévissaient alors en Europe eurent-elles une répercussion plus féroce encore au Nouveau-Monde entre ces peuplades qui ajoutaient à leurs haines séculaires cette nouvelle cause de dissension: les croyances religieuses.

1.—Medailles francaises.

Médaille Atouata, 1669.

La première mention de la présentation d'une médaille à un Indien se trouve consignée dans la "*Relation annuelle de la mission du Sault depuis la fondation jusques à l'an 1686*" par le Père Chauchetière S.J., où il est dit dans la relation de l'année 1669: "La première cabane ne demeura pas longtemps seule, en moins d'un an il y en eut quatre; entre autres on y vit celle d'un Onnontagué lequel a esté baptisé en France et à qui le Roy donna son nom et une belle médaille d'argent qu'il a toujours pendue à son col."

Cette relation, qui est déposée aux Archives de la Bibliothèque de la ville de Bordeaux, est restée inédite jusqu'à la publication qu'en a faite le Père de Rochemonteix dans son excellent ouvrage "*Les Jésuites et la Nouvelle-France au XVIIè siècle,*" et la mention que le P. Chauchetière y fait de cette médaille est complétée dans la "*Relation de ce qui s'est passé au Canada du 27 novembre 1670 jusqu'au départ du vaisseau en novembre 1671*" (Archives de la Marine, "*Correspondance générale,*" Vol. IV) où l'on parle d'"un Sauvage du

Sault nommé Louis Atouata, filleul du Roy, qui conserve chèrement la médaille dont Sa Majesté lui a fait présent."

Le "Sault" désignait alors la mission de La Prairie de la Madeleine fondée par les Pères Jésuites en 1667, dans le but d'évangéliser les sauvages et de les soustraire à l'usage des boissons enivrantes et aux influences pernicieuses de la vie nomade; la lettre du Père Enjelran rapportée au Vol. 60 de l'édition Twaithes des "*Relations des Jésuites*" nous dit que: "C'est là où est cet Iroquois qui vint en France et dont le roi est parrain." Le Père Chauchetière (*loc. cit.*) nous dit qu'en 1676, la stérilité du sol contraignit cependant "la mission à quitter la terre de La Prairie pour en aller chercher une à cinq quarts de lieue plus haut, nommée le Sault St-Louis ou de St-Xavier, du tiltre de la mission": cet endroit est aujourd'hui désigné sous le nom de "La Tortue"; on y voit encore le tombeau de la "sainte sauvagesse" Catherine Tekakouita, décédée en odeur de sainteté en 1680. Trente ans plus tard, et pour la même raison, le Père Lafitau obtint la permission de transporter cet établissement au site qu'il occupe actuellement à Caughnawaga, où le sol se prêtait mieux à la culture du maïs; c'est là qu'il avait découvert la précieuse plante de "ginseng" au sujet de laquelle il fit imprimer en 1718 un *Mémoire* adressé à S.A.R. le duc d'Orléans.

Il ressort donc de ces citations qu'Atouata était un des iroquois qui firent la traversée et furent présentés à la cour de Versailles, qu'il fut baptisé pendant son séjour en France, que Louis XIV fut son parrain, qu'il lui donna son nom et lui fit cadeau, probablement à cette occasion, d'une belle médaille d'argent. C'est ce qui explique pourquoi ce sauvage, dont il n'est pas autrement fait mention dans l'histoire de la colonie, eut l'honneur d'être "filleul du roi", alors que des chefs célèbres comme Garakonthié furent grandement honorés d'être conduits aux fonts baptismaux par le gouverneur.

Quant à la médaille qu'il reçut à cette occasion, rien ne nous renseigne sur son identité, mais il est tout probable qu'elle devait être une des nombreuses pièces destinées à commémorer les évènements du règne de Louis-le-Grand. Le Rev. Père Jones, indianologue érudit et archiviste de la Compagnie de Jésus, dont je sollicitais l'opinion au sujet de cette médaille et des documents qui s'y rapportent, exprimait l'avis qu'elle pouvait fort bien être une des croix de Lorraine qu'on a trouvées en grand nombre dans les sépultures indiennes, surtout si elle fut présentée à Atouata comme cadeau de baptême, car, à cette époque, on appliquait indistinctement, dans les missions, le nom de "médaille" aux divers objets de piété ou d'ornement qu'on portait au cou. On peut se faire une idée de la variété de ces objets en consultant le relevé qu'en a fait le Rev. W. M. Beauchamp pour le musée de l'Etat de New York, dans son étude intitulé: "*Metallic Ornaments of the New York Indians.*"

Médaille du Chef des Assiniboines, 1683.

La coutume de distribuer des médailles aux chefs indiens pour gagner leur amitié s'était déjà suffisamment établie dès 1683 pour que nous en trouvions à cette date jusque sur les bords de la Baie d'Hudson.

On lit en effet dans le récit des aventures de Chouart et Radisson qui nous est donné par N. E. Dionne, au Vol. V de sa "*Galerie Historique,*" qu'au printemps de cette année, J. B. Chouart des Groseilliers qui avait hiverné dans cette région pour attendre le retour de son oncle Radisson "reçut la visite de quatre cents Assiniboines, dont le chef portait sur sa poitrine une médaille que le gouverneur de la Nouvelle-France lui avait donnée en gage d'amitié pour lui et sa tribu."

Comme pour la médaille d'Atouata, nous n'avons cependant pas d'indications qui nous permettent d'établir l'identité de cette pièce, et l'original des "*Voyages*" de Radisson publiés par la "Prince Society" de Boston est même muet sur ce détail.

Ces sauvages qui avaient connu Radisson au service de la France l'année précédente ne furent pas peu surpris de le trouver cette fois en charge d'une expédition anglaise. A vrai dire, sa carrière mouvementée lui a bien valu l'épithète de "transfuge"; indigné de voir ses services méconnus par Colbert, il était passé en Angleterre où il avait reçu meilleur accueil; il y avait épousé une descendante de l'amiral Kertk, avait organisé la Compagnie de la Baie d'Hudson, et après divers changements d'allégéance, il revenait faire profiter l'anglais des découvertes et des relations de commerce qu'il avait établies avec les indiens pour le bénéfice de la France.

Médaille de la naissance du duc de Berry, 1686.

En 1686, Louis XIV fit frapper, à l'occasion de la naissance de son petit-fils le duc de Berry, une médaille qui portait d'un côté son buste avec la légende "LUDOVICUS MAGNUS REX CHRISTIANISSIMUS", et au revers les bustes de son fils le Dauphin et des trois enfants de ce dernier, Louis, duc de Bourgogne, Philippe, duc d'Anjou, et Charles, duc de Berry, avec la légende "FELICITAS DOMUS AUGUSTAE", et en exergue l'inscription "CAROLUS DUX BITUR. NAT. XXXI. AUG. MDCLXXXVI."

Des exemplaires de cette médaille apportés au Canada firent fureur parmi les Indiens qui y voyaient non seulement le portrait du roi, mais encore ceux de son fils et de ses petits-fils, en un mot toute la lignée royale; et comme cette pièce était d'assez belle dimension (41 millimètres), elle devint l'objet des plus grandes convoitises.

Felicitas Domus Augustae, 1693.

Si bien que, sur les représentations qui lui furent faites à ce sujet, le roi décida, en 1693, de faire frapper une nouvelle émission de ces médailles, avec quelques modifications, pour en faire la distribution à titre de cadeau aux Indiens du Canada. L'inscription de la date de naissance du duc de Berry n'ayant plus sa raison d'être sur ces nouvelles pièces, on la remplaça à l'exergue par le millésime de l'année (MDCXCIII), et l'on mit sous chaque buste le nom et le titre du prince qu'il représentait (SEREN. DELPH.; LUD. D. BURG.; PHIL. D. AND.; CAR. D. BITUR.); comme cette médaille était destinée à des chefs de différents grades, il en fut frappé de cinq grandeurs différentes, mesurant respectivement 75, 60, 41, 36 et 31 millimètres de diamètre. La gravure des divers modules en fut faite par des artistes différents, Roussel, Molart, Hardy, Mauger, Dollin et Bernard (T.B.), mais les dessins sont presque identiques sur chacune.

(*Voir Figure 1*).

Voici donc la première médaille frappée en France pour les Indiens du Canada. On pourrait croire, en lisant les comptes rendus des nombreuses distributions qui en furent faites, que plusieurs d'entre elles nous sont parvenues, mais tant de causes ont concouru à les faire disparaître (enfouissement dans les sépultures, échange pour des médailles anglaises, conversion en ornements différents, etc.,), qu'il n'en a été retrouvé qu'une seule jusqu'à ce jour; c'est une médaille en argent de 41 millimètres avec bélière, et portant la date de 1693; elle appartenait à une vieille famille de la tribu des Hurons à Lorette, et c'est aujourd'hui l'Université Laval de Québec qui la possède dans sa collection. Les matrices de toutes ces médailles ont heureusement été conservées au Musée Monétaire de la Commission des Monnaies et Médailles à Paris, où l'on peut en obtenir des reproductions en bronze.

Mais quelle preuve avons-nous de la destination de ces médailles aux Indiens d'Amérique, puisqu'elles ne portent à leur face aucune indication à cet effet ? Cette preuve indiscutable se trouve dans une "*Lettre de Madame Duplessis Sainte Hélène, religieuse de l'Hôtel-Dieu de Québec, à Madame Hecquet de la Cloche, à Abbeville*", portant la date du 17 octobre 1723, conservée aux Archives Nationales de France, et reproduite au volume XII de "*La Revue Canadienne*" (1875), où la révérende sœur s'exprime comme suit, en parlant des coutumes des Indiens:

"Le Roi Louis 14 avait envoyé des médailles d'argent assés grandes où son Portrait étoit d'un côté et de l'autre celui du Dauphin son fils et des 3 princes ses enfans, pour donner à ceux qui se distingueroient dans la guerre, on y a ajouté depuis un ruban couleur de feu large de 4 doigts, cela est fort estimé chez eux. . . Quand il y meurt quelque chef,.........., on le fait enterrer honorablement, une partie des troupes est sous les armes, on fait sur sa fosse plusieurs décharges de mousquets, on met sur sa bière une épée croisée de son fourreau et la médaille en question attachée dessus."

Honos et Virtus, Louis XIV.

A l'occasion du traité de paix signé avec l'Angleterre, la Hollande, le Portugal et la Prusse, à Utrecht le 11 avril 1713, et avec l'Allemagne à Rastadt le 6 mars 1714, des médailles furent frappées par les diverses puissances belligérantes. La France, obligée d'accepter des conditions onéreuses, en particulier la perte des territoires de la Baie d'Hudson, de l'Acadie et de Terreneuve qui enserraient pratiquement la Nouvelle-France comme dans un étau, n'avait guère de sujet de glorification à perpétuer sur la sienne; elle ne pouvait que célébrer l'héroisme de ses grands capitaines tombés au champ d'honneur, et Louis XIV, dont l'astre était à son déclin, pouvait dire comme François 1er un siècle auparavant: "Tout est perdu, fors l'honneur"; il était satisfait cependant, car ce traité assurait à son petit-fils Philippe d'Anjou la succession au trône d'Espagne qui avait été la cause première de cette longue guerre.

La médaille qu'il fit frapper porte à l'avers le buste drapé du roi avec la légende "LUDOVICUS XIIII. D. G. FR. ET. NAV. REX," et au revers la personnification de l'Honneur et de la Valeur, le premier sous la figure d'un héros drapé d'une toge et couronné de laurier, et le second sous celle d'un soldat romain vêtu d'une tunique et coiffé d'un casque, les deux personnages se donnant la main droite et tenant chacun une lance dans la main gauche, tandis qu'aux pieds du premier gît une corne d'abondance, et au-dessus d'eux se lit la légende "HONOS ET VIRTUS".

(*Voir Figure 2*).

Ce dessin qui porte comme signature la lettre "W" est attribué par quelques-uns à Warin qui était pourtant mort depuis quarante ans à cette époque, tandis que d'autres l'attribuent sans plus de raison à Winslow qui était à peine né et qui ne commença l'exercice de son art à la Monnaie de Paris qu'en 1737. Il n'y a donc pas plus lieu d'en attribuer la paternité à l'un qu'à l'autre, à moins qu'on ne se soit servi d'une gravure inutilisée de Warin, ce qui est peu probable; peut-être est-il du même graveur, dont il est question dans la *Circulaire Numismatique* de Spink en 1913, qui signait de cette initiale une médaille commémorative de la convalescence de Ferdinand IV de Danemark en 1700, et dont l'identité n'a pas encore été révélée; c'est peut-être aussi Christian Wermuth, graveur de la Monnaie de Gotha, à qui l'empereur d'Allemagne avait accordé, en 1699, le privilège d'exercer son art chez lui, et qui signait souvent ses œuvres de la seule initiale "W", ainsi qu'on peut en voir plusieurs exemples dans l'ouvrage "*Medallic Illustrations of the History of Great Britain and Ireland to the death of George II*" publié par les soins des conservateurs du Musée Britannique, mais la facture, plutôt médiocre de Wermuth me fait hésiter à lui attribuer cette belle œuvre, et les difficultés que j'ai rencontrées à obtenir des renseignements du service de la Monnaie, à l'époque tourmentée que nous traversons, ne m'ont pas permis d'élucider cette question.

Wermuth usa si largement de son privilège de frappe privée que près de treize cents médailles sortirent de son atelier, mais un grand nombre d'entre elles furent supprimées à cause de leur caractère satirique; il ne ménagea pas Louis XIV, il est vrai, dans ses pièces satiriques, surtout pendant la guerre de la succession d'Espagne, mais il produisit aussi plusieurs œuvres à sa louange.

On trouve au sujet de l'allégorie de cette pièce une intéressante dissertation faite en 1899 et publiée dans la revue "*Canadian Antiquarian*" sous le titre "*Medals awarded to the Canadian Indians*", par R. W. McLachlan, une de nos autorités en numismatique, qui en tient cependant pour Winslow, et qui retrace l'idée de cette allégorie à une pièce de monnaie consulaire de Rome; il conclut que l'artiste a voulu représenter, dans les deux personnages romains, le français et l'indien faisant la paix au grand traité de Montréal en 1701.

Il est probable en effet que l'artiste s'est inspiré de la monnaie romaine Fufia pour le dessin de cette médaille, mais il est pour le moins risqué d'en faire l'attribution au traité indien de M. de Callières, car Louis XIV n'aurait jamais songé à mettre les "sauvages" sur le pied d'égalité qu'on voit dans les personnages de cette médaille. Même en supposant qu'il eût agi ainsi en 1701, il n'eût certainement pas voulu servir du réchauffé aux puissances européennes treize ans plus tard en utilisant une allégorie indienne pour commémorer le traité d'Utrecht, et la conclusion logique s'impose que ce dessin a été destiné et utilisé en premier lieu pour la médaille du traité de 1714. D'ailleurs, si Louis XIV eût voulu faire allusion aux Indiens et leur être agréable, pourquoi ne les aurait-il pas fait représenter dans leur costume national, ainsi que fit Georges I pour la médaille offerte aux Indiens des colonies anglaises vers le même temps? Il devait bien penser que ses alliés indigènes connaissaient trop peu l'histoire de Rome pour apprécier l'allégorie de la pièce Fufia. On ne trouve au surplus aucune indication que cette médaille ait été frappée avant la signature du traité d'Utrecht tandis qu'il est très admissible qu'aussitôt la paix faite avec l'Allemagne, Louis XIV en aurait confié l'exécution à un artiste étranger.

On peut donc conclure avec assez de certitude que cette allégorie ne signifie pas autre chose que ce qu'elle représente: "l'Honneur couronné de laurier, et la Valeur revêtue des attributs de la guerre, unis ensemble sous l'égide de Louis-le-Grand". On en trouve une autre preuve dans le fait qu'elle a été employée, à la même époque, mais avec un autre avers, pour être décernée en France comme "Prix Universel des Arts", ainsi que l'indique le "*Catalogue des Poinçons, Coins et Médailles du Musée Monétaire de Paris*", ce qui aurait manqué de sens et n'aurait que médiocrement flatté les lauréats de ce prix, s'il était vrai que l'un des personnages (l'Honneur) représentait les Peaux-Rouges du Canada.

Quoiqu'il en soit, j'hésite fort à croire qu'elle ait été destinée *à cette époque* aux Indiens du Canada, car ce n'est pas à leur intention qu'elle a été gravée, et comme elle n'a été frappée que dans la dernière année du règne de Louis XIV, il est fort douteux qu'elle aît pu être connue au Canada assez tôt pour être décernée, par le gouverneur, sous le règne de ce souverain; d'ailleurs, on n'a trouvé aucune de ces médailles en possession des Indiens; toutes celles qu'on a trouvées entre leurs mains, et qui ne sont pas simplement des reproductions, sont à l'effigie de Louis XV.

Louis XIV mourut l'année suivante; son fils le Dauphin et son petit-fils le duc de Bourgogne l'ayant précédé dans la tombe, ce fut son arrière petit-fils âgé de cinq ans qui lui succéda sous le nom de Louis XV, et sous la régence du duc d'Orléans. Les traités d'amitié, cimentés par la présentation de médailles, étaient alors tellement entrés dans les mœurs de la Nouvelle-France, que nous assistons à une véritable orgie de demandes de ces décorations, au point que les gouverneurs ne pouvaient réussir à les satisfaire. On peut en juger par les extraits suivants de la correspondance officielle.

Le 8 octobre 1721, M. de Vaudreuil écrivait au Conseil:

"J'ai reçu la lettre que le Conseil m'a fait l'honneur de m'écrire le 20 juin dernier, dans laquelle j'ai trouvé les douze médailles ayant le portrait du Roy, soit quatre grosses et huit petites que le Conseil m'a envoyées au lieu de 36 que j'espérois recevoir et qui avoient été destinées pour m'être envoyées l'année dernière, afin de les distribuer aux sauvages Abénakis qui sont le plus affectionnés à la nation....... Mais comme ces douze médailles ne suffisent pas pour en donner à tous les chefs sauvages à qui j'en ai fait espérer, et qu'il est nécessaire qu'il m'en reste afin d'en pouvoir donner dans les occasions qui se présenteront, je supplie le Conseil de vouloir bien m'envoyer l'année prochaine les vingt-quatre qui sont restées en France."

L'année suivante, dans une *Lettre* du 21 octobre 1722, le marquis de Vaudreuil accuse réception de "douze médailles avec le portrait du Roy, sçavoir: quatre grandes et huit petites qui y estoient jointes"; et de son côté, le marquis de Beauharnois écrit au Comte de Maurepas, en date du 15 octobre 1722, "que l'aventure de nos Iroquois et Hurons contre les Renards me met dans l'obligation d'en donner aux principaux chefs de party, je vous supplie, Monseigneur, d'ordonner qu'il m'en soit envoyé l'année prochaine afin que je sois en état de les décorer de cette marque d'honneur qui les rend aussy respectables parmy eux."

Dans un "*Rapport*" adressé par Messieurs de Vaudreuil et Begon au Ministre, le 26 octobre 1723, ils recommandent que "pour donner de l'émulation aux sauvages qui se distingueront, il fût envoyé l'année prochaine 24 médailles d'argent de la même grandeur que les dernières qu'ils ont reçues."

Le 25 septembre 1727, le marquis de Beauharnois écrit au comte de Maurepas que les Révérends Pères Jésuites lui "ont souvent demandé des médailles pour les chefs sauvages domiciliés, auxquels on avait coutume d'en donner; il le prie de lui envoyer une douzaine de petites médailles et six grandes. Si ce nombre ne suffit pas pour cette année, il aura l'honneur de lui en demander encore l'année prochaine". Et comme l'appétit vient en mangeant, il suppliait, dans une autre lettre du 17 octobre 1734, "qu'il lui en soit envoyé l'année prochaine deux douzaines pareilles aux dernières qu'il avait reçues". Et les mêmes demandes se continuent jusqu'à la cession du pays.

Quelles étaient donc ces médailles qui jouissaient d'une si grande popularité au Canada? Etaient-ce encore les médailles FELICITAS DOMUS AUGUSTAE, dont la Mère Duplessis Sainte Hélène nous parle dans sa lettre du 17 octobre 1723, alors que Louis XV régnait déjà depuis huit ans? Evidemment non, et la Mère Duplessis ne pouvait alors parler que de médailles qu'elle avait vues ou qui avaient été décernées plusieurs années auparavant; ce ne pouvait non plus être la médaille de Louis XIV *Honos et Virtus*, car on n'aurait pas présenté sous le règne de Louis XV une médaille à l'effigie de Louis XIV, même si les destinataires étaient des Indiens; et d'ailleurs, les lettres du gouverneur de Vaudreuil en date du 8 octobre 1721 et du 21 octobre 1722, parlant de médailles "ayant le portrait du Roy", il ne pouvait s'agir que du roi alors régnant. Ce ne pouvait non plus être la médaille *Honos et Virtus* de Louis XV car, à cette époque, ce roi n'était encore qu'un enfant, et les médailles portant cette allégorie qu'on a trouvées en possession des sauvages sont gravées par DuVivier, avec un buste de Louis XV présentant une figure beaucoup plus âgée que celle d'un enfant de onze ans, preuve évidente qu'elles sont d'une époque postérieure.

Sacre de Louis XV, 1722.

La réponse à cette question m'a été récemment fournie par la découverte d'une médaille du sacre de Louis XV que j'ai trouvée dans la tribu huronne de Lorette et dont le chef Bastien fait remonter la possession à près de deux siècles. C'est une pièce en argent de 32 millimètres, gravée par Roettier, dont elle porte les initiales I.C.R., ayant à l'avers le buste du roi-enfant, couronné et revêtu du manteau et des ornements royaux, et la légende: "LUD. XV, REX CHRISTIANISSIMUS," et au revers la scène du sacre avec la légende: "REX COELESTI OLEO UNCTUS", et en exergue "REMIS 25 OCT. 1722." Elle porte une bélière dans laquelle est passé un double anneau d'argent reliant une chaînette de même métal, avec laquelle elle a été presentée pour être suspendue au cou.

(*Voir Figure 3*).

On doit donc admettre que les médailles réclamées si instamment par le gouverneur et par l'intendant, de 1721 à 1734, sont des médailles du sacre, et sans doute aussi quelques autres de celles qui furent frappées pour rappeler les évènements des premières années du règne de Louis XV, mais qui se ne rapportaient aucunement aux Indiens tout comme la reine Anne d'Angleterre faisait distribuer en cadeau aux Indiens des colonies anglaises, quelques années auparavant, des médailles de ses dernières victoires et même des pièces de monnaie d'une couronne, ainsi qu'on le verra plus loin.

Honos et Virtus, Louis XV.

Cependant, le problème des relations avec les indiens du Canada prenait chaque jour une importance plus grande, et comme les anglais réussissaient à s'en concilier un grand nombre au moyen de traités accompagnés de distribution de présents, les gouverneurs français se voyaient obligés de lutter avec eux par les mêmes moyens.

DuVivier, qui était alors médailliste attitré du roi, fut chargé de préparer le dessin d'une médaille destinée à produire grand effet chez les Peaux-Rouges, et il crut ne pouvoir mieux faire qu'en rééditant à leur intention l'allégorie *Honos et Virtus* de Louis XIV avec quelques retouches.

L'avers de cette pièce représente le buste lauré et drapé de Louis XV à l'âge viril, avec la signature de l'artiste sous la coupe du buste, et la légende "LUDOVICUS XV, REX CHRISTIANISSIMUS", mais à l'encontre de la médaille de Louis XIV, le personnage Honos se présente ici de face, la poitrine entièrement découverte, tenant sa lance de la main droite, et donnant la gauche au personnage Virtus, le reste du revers étant à peu de chose près semblable à l'autre. Elle n'est pas datée, mais on peut l'attribuer à la décade de 1730, si l'on compare l'effigie du roi avec celle qu'on voit sur certaines pièces de monnaie de cette époque qui portent le même buste de Louis XV, gravé par DuVivier.

(*Voir Figure 4.*)

Cette médaille plut énormément aux sauvages qui croyaient y voir, comme le dit Zay dans une étude sur les "*Medailles d'honneur pour les Indiens*" publiée dans l'"*Annuaire de la Société Française de Numismatique*" de 1889 "l'amitié des Français et des Indiens, ceux-ci représentés par le personnage simplement drapé, ceux-là personnifiés par le guerrier romain." Aussi est-il probable qu'elle leur fut distribuée d'autant plus généreusement que les Anglais courtisaient alors, par les mêmes moyens, l'amitié des tribus; et comme il fallait observer des distinctions entre les chefs de différents grades, on en fit de grandeurs différentes. (Cf. "*Catalogue de la collection Gerald E. Hart,*" vendue aux enchères par Scott, à New York, en 1895).

Si nous ne connaissons qu'un exemplaire de la médaille FELICITAS DOMUS AUGUSTAE, nous avons en revanche plusieurs de celle de Louis XV HONOS ET VIRTUS. La bibliothèque du Parlement, l'Université Laval, MM. R. W. McLachlan et W. H. Hunter, en possèdent des exemplaires, et même la collection Hunter nous offre un curieux exemple de la rivalité qui existait entre les Français et les Anglais pour s'assurer l'amitié des sauvages: c'est une médaille d'argent HONOS ET VIRTUS, sur laquelle on a simplement poinçonné le nom de Georges III (épelé *Gorge*) par-dessus celui de Louis XV, tout en laissant son effigie et le reste de la légende intactes, et qu'on a sans doute remise en distribution comme médaille anglaise.

Certains numismates ont cru devoir mettre en doute la destination de ces médailles aux Indiens du Canada, mais on en trouve une preuve concluante dans une lettre du Père Roubaud, missionnaire jésuite chez les Abenakis, écrite de la mission de Saint-François le 21 octobre 1757, et reproduite au III è volume des "*Lettres édifiantes et curieuses écrites des Missions Etrangères*", où il décrit une grande assemblée de guerriers Indiens et dit: "Les Chefs et Capitaines ne sont distingués, ceux-ci que par le hausse-col, et ceux-là que par un médaillon qui représente d'un côté le portrait du Roi, et au revers Mars et Bellone qui se donnent la main, avec cette devise :"VIRTUS ET HONOR".

Mais on était arrivé à l'époque où les "quelques arpents de neige" du Canada donnaient le cauchemar à Madame de Pompadour; aussi le roi n'hésita-t-il pas, malgré le dévouement de Montcalm et la valeur de Lévis, à biffer d'un trait de plume la possession de ce domaine qui, pour lui, ne valait pas le Parc-aux-Cerfs. Soixante mille Français implantés au prix des plus grands sacrifices sur les bords du Saint-Laurent, et autant d'Indiens disséminés depuis l'Acadie jusqu'au Mississipi, qui avaient uni leur fortune à celle du drapeau fleurdelisé, étaient livrés à la merci du conquérant. Désolés tout d'abord de cet abandon, puis désespérant, après trois années d'attente, de voir reparaître sous les murs de Québec les voiles blanches des bateaux de France, ces Français devinrent avant tout Canadiens, et se groupèrent loyalement autour du nouveau drapeau qui protégeait leurs demeures, prêts à le défendre dès lors au prix de leur sang contre ceux-là mêmes qui l'avaient déployé en Amérique, mais qui le foulaient aux pieds quelques années plus tard, tandis que les sauvages vinrent apporter, tristement d'abord, joyeusement ensuite, leurs belles médailles françaises pour y faire substituer le nom du nouveau souverain.

II.—Médailles anglaises.

Dès la fondation de ses colonies de Virginie et de New York, l'Angleterre avait recherché l'amitié des Indiens, tant pour les prédisposer favorablement envers ses établissements de colonisation, que pour s'en faire des alliés dans ses luttes contre la France au Nouveau-Monde. Aussi ne tarda-t-elle pas à tirer parti de la vanité du sauvage pour lui passer au cou des médailles qui flattaient cette passion en même temps qu'elles captaient son allégeance en faveur du souverain régnant, pour la simple raison qu'on doit servir celui dont on porte la livrée (Zay, *loc. cit.*)

Le port de ces insignes répondait en même temps à un autre dessein: comme ils n'étaient accordés qu'à bon escient aux sauvages titrés et bien méritants, ils leur servaient de plaques d'identité pour pénétrer dans les établissements des colons. On sait en effet que les premières colonisations des anglais en Virginie, dans les Carolines, dans la Pensylvanie et la Nouvelle-Angleterre, avaient rencontré chez les indigènes autant d'hostilité que celles de la Nouvelle-France, et que les colons durent s'entourer de toutes sortes de précautions pour se protéger contre le massacre, l'incendie et le pillage de la part des tribus au milieu desquelles ils vivaient.

Une loi adoptée par la Colonie de Virginie en 1661 décrète en effet: "that badges (viz), silver plates and copper plates, with the names of the towne graven upon them, be given to all adjacent kings within our protection" (*Hennings Statutes-at-large*, II, page 142.), et d'autres lois pourvoient même à l'imposition d'amende et à la peine du fouet contre tout visiteur qui séjourne plus d'un certain temps dans les établissements. (Entick, "*The Present State of the British Empire*," Vol. IV.)

Charles II 1683.

Il semblerait que la première médaille anglaise qui servit à la fois de récompense honorifique et de marque d'identité pour les Indiens fut celle que Charles II fit frapper vers 1683, et qui est décrite au catalogue de Hawkins "*Medallic Illustrations of the History of Great Britain and Ireland to the death of George II*," publié par les Syndics du Musée Britannique, avec la mention: "Il est probable "qu'elle était destinée à être distribuée en cadeau par le roi." Elle porte à l'anvers le buste de Charles II, avec la légende: "CAROL. II. D. G. ANGL. SCOT. FRAN. ET HIB. REX.", et au revers les armes royales, écartelées, au 1er d'Angleterre, au 2nd d'Ecosse, au 3è de France et au 4è d'Irlande, entourées de la jarretière portant la devise: "HONI SOIT QUI MAL Y PENSE", avec le lion couronné et la licorne colletée et enchaînée pour supports, le casque à sept grilles surmonté de la couronne, avec un lion couronné en cimier, et accompagnées de feuilles d'acanthe, et sur une banderolle en exergue la devise "DIEU ET MON DROIT". Elle mesure 53 millimètres et porte un anneau pour être suspendue au cou comme la plupart des anciennes médailles anglaises destinées aux Indiens. Les matrices en furent gravées par Roettier et sont déposées au Musée Britannique.

(*Voir Figure 5*).

Ecussons de Charles II.

Ce qui porte surtout à croire que cette médaille fut frappée pour être distribuée aux Indiens de l'Amérique, outre l'indication un peu vague des conservateurs du Musée Britannique, c'est la découverte de trois écussons gravés, portant la légende: "CHARLES II, KING OF ENGLAND, SCOTLAND, FRANCE, IRELAND AND VIRGINIA", et comme attributs le lion, la fleur de lis, le chardon et la harpe, auxquels on en a ajouté, dans un coin, un autre qui semble être une plante de tabac représentant la Virginie; ils portent respectivement en inscription, le premier "THE QUEEN OF PAMUNKY", le second "YE KING OF PAMUNKEE", et le troisième "YE KING

OF PATOMACK." Il n'y a aucun doute que ces pièces ont été présentées autant comme marque d'honneur que comme talisman pour donner droit de cité, dans les établissements des colons, à leurs destinataires respectifs qui régnaient à cette époque sur les tribus sauvages de la Virginie et des rives du Potomac. Elles sont en argent, de forme oblongue, mesurant 4 × 6 pouces de diamètre, et portent au revers cinq anneaux pour les tenir en place; la première faisait partie de la collection Scott de Baltimore, et les deux autres de celle de la Société Historique de Virginie.

Ces écussons ne portent pas non plus d'indication qui en fixe la date, mais Betts les place entre les années 1670 et 1674 dans son excellent ouvrage "*American Colonial History Illustrated by Contemporary Medals*", et de son côté, le Rev. H. E. Hayden les décrit en détail comme étant les premières médailles relatives aux Indiens de l'Amérique, mais sans leur assigner de date, dans une savante étude présentée à la Société Historique et Géologique du Wyoming en 1885, sous le titre: "*An account of various silver and copper medals presented to the North American Indians by the Sovereigns of England, France and Spain from 1600 to 1800.*"

Notons, en parlant de Charles II, que c'est lui qui, lors de sa restauration en 1660, fonda la Société Royale de Londres; c'est également sous son règne que l'architecte Wren commença la construction de la cathédrale Saint-Paul à Londres, et que la Compagnie de la Baie d'Hudson, organisée par le transfuge français Radisson, obtint une charte qui lui conférait le droit de traite dans tout le bassin de cette baie.

La première mention authentique d'une distribution de médailles anglaises aux Indiens se trouve consignée au Vol. V des "*Documents relatifs à l'Histoire Coloniale de New York,*" où l'on rapporte le discours de Robert Hunter, gouverneur de New York, aux Sachems des Cinq Nations réunis à Albany le 16 août 1710. Parlant de la reine Anne, alors régnante, et de ses victoires sur les armées françaises, il fait allusion à leurs frères qui ont vu la grande reine et sa cour en Angleterre, et il leur dit: "Her Majesty has sent them, as a pledge of *her* protection and as a memorial to them of *their* fidelity, a *medal* for each Nation, with her Royal Effigies on one side, and the last gained battle on the other, which, as such, she desires may be kept in your respective castles for ever. She has also sent her *Picture* in *silver*, twenty to each Nation, to be given to the Chief warriors to be worn about their necks as a token that they should always be in readiness to fight under her Banner against the Common Enemy."

Prise de Tournai, Anne 1709.

Le Rev. Hayden exprime l'avis, dans son étude citée ci-dessus, que cette médaille de la "dernière victoire" de la reine Anne, à laquelle le gouverneur fait allusion, est celle qui fut frappée en 1709 pour célébrer la prise de Tournai, représentant à l'avers le buste de la reine avec la légende: "ANNA. D. G. MAG. BRI. FRA. ET. HIB. REG.", signée des initiales I. C. (John Croker) et au revers Pallas assise, s'appuyant d'une main sur un bouclier et tenant de l'autre une lance sur laquelle est fixée une couronne murale avec la légende "TORNACO EXPUGNATO" et en exergue "MDCCIX". Les "portraits en argent" destinés aux principaux guerriers de chaque nation seraient tout simplement des pièces d'une couronne à l'effigie de la reine. (Cf. Hayden, *loc. cit.*)

(*Voir Figure 6*).

Bataille de Malplaquet, 1709.

Cette opinion est certainement respectable, mais je crois plutôt qu'il s'agit ici de la bataille de Malplaquet, gagnée par Marlborough et le prince Eugène sur Villars et Boufflers huit jours après la prise de Tournai (le 11 septembre 1709). La harangue du gouverneur Hunter dit en effet que la médaille offerte aux sachems indiens porte d'un côté l'effigie royale et de l'autre côté "la dernière bataille gagnée;" or la prise d'une ville n'est pas précisément ce qu'on entend par le mot "bataille," tandis que la représentation de l'attaque victorieuse des retranchements français dans le bois de Taisnières que Croker a gravée sur la médaille destinée à célébrer la victoire anglaise de Malplaquet concorde mieux avec les paroles du gouverneur; l'astucieux officier avait d'ailleurs dû songer qu'une scène de combat dans une forêt plairait infiniment aux indiens.

L'avers de cette pièce représente le buste couronné de la reine Anne avec la légende; "ANNA D. G. MAG. BRI. FR. ET HIB. REG.", et au-dessous les initiales du graveur "I.C."; au revers on voit les bataillons alliés à l'attaque des retranchements français dans un bois et au-dessus d'eux la Victoire avec deux couronnes de laurier; on lit en légende: "CONCORDIA ET VIRTUTE" et en exergue; "GALLIS AD TAISNIÈRES DEVICTIS, AUG. XXXI, MDCCIX." Elle mesure 48 millimètres.

Notons qu'à cette époque l'Angleterre n'avait pas encore adopté la réforme du calendrier grégorien en vigueur chez les nations catholiques depuis 1582; elle ne l'accepta qu'en 1752, et c'est ce qui explique la divergence de dates pour un même événement, suivant qu'il s'agit d'un pays catholique ou protestant. Espérons qu'à la suite de la communion d'idées qui se développe entre les puissances alliées au cours de la présente guerre, les avantages évidents du système métrique décimal s'imposeront au peuple anglais, comme le calendrier grégorien sera accepté par les russes et les grecs.

Les autres médailles de victoires anglaises auxquelles le gouverneur Hunter aurait pu faire allusion sont celle de la reddition de Mons le 21 octobre 1709, celle de la prise de Douai le 27 juin 1710, et celle de la bataille d'Almenara le 27 juillet 1710; mais si l'on tient compte du temps nécessaire à la gravure et à la frappe de ces pièces, ainsi que de la longueur des traversées transatlantiques à cette époque où les bateaux à vapeur étaient inconnus, il faut de suite écarter l'hypothèse des deux dernières médailles, tandis qu'entre les allégories des prises de Tournai et de Mons et la représentation de la victoire de Malplaquet, on ne peut hésiter à croire que c'est cette dernière pièce dont les sachems des Cinq Nations ont été decorés.

Traité d'Utrecht, Anne 1713.

A l'occasion du traité d'Utrecht qui suivit la guerre dont nous venons de relater quelques incidents, la reine Anne fit frapper une médaille portant en avers son buste avec la légende "ANNA D. G. MAG. BRI. FR. ET HIB. REG." et au revers Britannia debout tenant un rameau d'olivier dans la main droite et une lance avec bouclier dans la gauche, entre une scène maritime et une scène agricole, et la légende "COMPOSITIS VENERANTUR ARMIS"; en exergue "MDCCXIII". Cette pièce fut-elle offerte aux Indiens des colonies anglaises? La chose est tout probable bien qu'on n'en trouve aucune mention dans les annales coloniales, et le doute que nous avons signalé au sujet de la médaille HONOS ET VIRTUS de Louis XIV se présente pour celle-ci.

Georges I, 1714.

Georges I monta sur le trône d'Angleterre l'année suivante et fut le premier à faire frapper à l'intention des Indiens des médailles portant un symbole qui leur fût personnel. C'est au sujet de ces pièces que le Rev. H. E. Hayden a publié l'intéressante étude mentionnée plus haut et dans laquelle il les décrit en détail.

Ces médailles portent à l'avers le buste lauré et drapé de Georges I, avec la légende: "GEORGE KING OF GREAT BRITAIN", sauf une variété dont la légende est en latin "GEORGIUS MAG. BR. FRA. ET HIB. REX."; le revers représente un Indien, sous un soleil rayonnant, au pied d'une colline, tirant une flèche sur un daim, et il en existe quatre variétés connues. On n'a trouvé jusqu'à présent aucune de ces pièces en argent, et les exemplaires en bronze et en cuivre qui sont connus sont fort usés et corrodés par leur long séjour dans la terre où ils ont été trouvés, ainsi qu'en fait foi celui que je possède; cependant on en trouve un à la bibliothèque du Parlement qui est en bon état de conservation. Ils mesurent respectivement 50, 48, 46 et 25 millimètres, et presque tous ont une bélière.

(*Voir Figure 7*).

Les pièces ainsi analysées par Hayden ne portent pas de date, mais il réfère à la découverte mentionnée par Charles Miner dans son "*Histoire du Wyoming*", où il est parlé d'une médaille portant d'un côté l'effigie de Georges I, "avec la date 1714", et de l'autre côté un chef indien. Cette pièce aurait été découverte par Miner en 1814 sur l'emplacement d'anciennes fortifications de Wilkes-Barré, et aurait été déposée au Musée de la Société Historique de Philadelphie; mais l'exactitude de sa description est mise en doute par Hayden, et elle ne concorde pas, d'ailleurs, avec la reproduction qui en est donnée par Miner lui-même; comme cette description diffère cependant sur plusieurs points de celle des médailles de Hayden, cette pièce pourrait bien être totalement différente des autres.

Georges II, non datée.

Irwin fait mention dans son ouvrage "*War Medals & Decorations*" d'une médaille semblable à celle-ci, mais émise par Georges II, portant son buste lauré et cuirassé, et la légende: "GEORGIUS II, D. G. MAG. BR. FR. ET. HIB. REX.", le revers représentant aussi un Indien tirant une flèche sur un daim qui s'enfuit. Cette médaille qui ne porte pas non plus de date a été trouvée en 1865 à Lackawanna, Pennsylvanie; elle est en bronze et mesure 25 millimètres de diamètre. On peut voir, dans la collection de la bibliothèque du Parlement, à Ottawa, cette médaille de Georges II, mais elle est d'un diamêtre plus grand que ne l'indique Irwin.

Georges II, 1731.

Le catalogue de Hawkins ("*Medallic Illustrations of the History of Great Britain and Ireland*, &c.,") fait mention d'une pièce frappée en 1731, sous le règne de Georges II, et qui est du même type que celle de Charles II que nous avons décrite ci-dessus comme étant probablement la première médaille anglaise distribuée aux Indiens. Elle porte à l'avers l'effigie du roi, avec la légende: "GEORGIUS II, D. G. MAG. BRI. FRA. ET. H. REX. F. D.", et au revers les armes royales avec leurs divers attributs. Elle est en argent, mesure 47 millimètres et porte un anneau de suspension.

(*Voir Figure 8*).

Presque toutes les médailles anglaises offertes aux Indiens jusqu'au milieu du siècle dernier sont du même type, c'est-à-dire qu'elles portent à l'avers l'effigie du souverain régnant, avec son nom et ses titres en légende, et au revers les armes royales avec la jarretière, les devises, supports, couronne, cimier et autres attributs royaux; et bien que Hawkins n'ose préciser la destination de cette médaille de Georges II plus que celle de Charles II, il devient un peu plus précis, car il ajoute: "Perhaps the badge of a Society, or for distribution amongst the Chiefs of the American Indians."

En 1753, Sir Danvers Osborne qui venait d'être nommé gouverneur de New York, apporta d'Angleterre trente médailles d'argent dans des étuis de chagrin, avec ruban écarlate et agrafes d'argent, pour en faire des cadeaux aux chefs des Six Nations Iroquoises. Betts attribue ces médailles à l'année 1753 et les décrit comme étant coulées et ciselées avec bélière en argent, portant à l'avers le buste lauré de Georges II, et la légende: "GEORGIUS II, D. G. MAG. BRI. FRA. ET. H. REX. F. D.", et au revers les armes royales avec les attributs ordinaires et la devise "DIEU ET MON DROIT".

Hawkins n'en fait cependant pas mention à cette date dans son catalogue, et je suis porté à croire qu'il s'agit ici de la médaille de 1731, dont Sir Danvers Osborne pouvait d'autant plus facilement faire usage qu'elle n'était pas datée, et qu'on n'aurait pas eu le temps de frapper une médaille spéciale à l'intention de ses nouveaux administrés les Iroquois, entre la date de sa nomination et celle de son départ pour l'Amérique. O'Callaghan, l'érudit historien de New York, a publié un article à ce sujet dans le volume IX, première série, de la revue "*Historical Magazine*", en septembre 1865; c'est la source des renseignements donnés ci-dessus, mais Hayden, qui en fait mention dans son étude, confond atrocement cette pièce, par un anachronisme inexcusable, avec les diverses médailles de Georges III, décrites par Sandham dans son ouvrage: *Coins, Tokens and Medals of the Dominion of Canada.*

Un autre fait qui porte à rejeter l'idée d'une frappe spéciale de ces médailles pour Sir Danvers, c'est que le 2 janvier suivant (1754), Robert Dinwiddie, gouverneur de la Virginie, écrivait au Colonel Washington: "I have sent you some medals for y'self, Colo. Fry, the Half King, Monucatoocha, the Chiefs of the Delawares and Shawnesse, to wear as tokens of His Majesty's favour" ("*Dinwiddie Papers*, Vol. I." in the "*Collections of the Virginia Historical Society*"). Les médailles ainsi distribuées par le gouverneur Dinwiddie devaient être de la même provenance et espèce que celles apportées par Sir Danvers Osborne; on ne les trouve, pas plus que celles-ci, mentionnées dans le catalogue du Musée Britannique, et toutes deux devaient être du type qu'on y trouve attribué à l'année 1731. Des exemplaires de cette médaille, bien qu'extrêmement rares, sont parvenus jusqu'à nous et correspondent à la description de Hawkins; on peut en voir un superbe dans la collection de la bibliothèque du Parlement, à Ottawa; M. P. B. Murphy, de Québec, en possède aussi un très beau, bien que percé pour suspension, et le Rev. W. M. Beauchamp, dans son étude sur les "*Ornements Métalliques des Indiens de New York*", nous dit qu'il s'en trouve un, quelque peu maltraité par les enfants, dans la collection de John Jones de Baldwinville.

Puisque nous parlons de Georges II et du Musée Britannique, notons en passant que c'est à ce roi que remonte la fondation de cette grande institution.

La culture des arts avait cependant reçu à cette époque assez d'impulsion en Amérique pour qu'on songeât à y produire des médailles, et comme les Indiens étaient toujours restés le cauchemar des colons, les premières œuvres des artistes coloniaux indiquent cette préoccupation d'une façon bien caractéristique; il fallait en effet se concilier par les bonnes relations, ces voisins redoutés ou s'assurer un repos relatif en leur portant des coups qui répandraient la terreur au milieu d'eux.

Destruction de Kittanning, 1756.

La première médaille frappée aux colonies commémore la destruction, par le colonel Armstrong, du village indien de Kittanning sur la rivière Alleghany, à 45 milles du fort Duquesne, aujourd'hui Pittsburg, le 8 septembre 1756. Elle fut gravée par un orfèvre de Philadelphie, du nom de Edward Duffield, et porte à l'avers les anciennes armes de Philadelphie, et au revers la scène de destruction de Kittanning; bien qu'elle se rapporte aux Indiens, elle ne peut cependant être classée parmi les "Médailles décernées aux Indiens", ce serait une ironie de mauvais aloi.

Georges II, 1757.

Mais l'année suivante, une société philanthropique de Philadelphie, dont le but se trouvait clairement défini dans le nom quelque peu encombrant de : "Friendly Association for Regaining and Preserving Peace with the Indians by Pacific Means", chargea Duffield de graver une véritable médaille d'amitié pour les Indiens, dont la frappe fut confiée à Joseph Richardson, un des membres de la société. Ce ne fut pas à vrai dire un chef-d'œuvre artitisque, mais comme les bonnes relations de l'homme blanc avec l'Indien y étaient mises en scène, elle obtint un grand succès auprès de celui-ci. En voici la description: avers, buste lauré et drapé de Georges II, avec la légende: "GEORGIUS II, DEI GRATIA"; revers, un blanc assis sous un arbre, présentant le calumet de paix, orné de deux ailes d'oiseau, à un Indien assis par terre en face de lui, entre eux brûle un feu de conseil, et au-dessus un soleil rayonnant; la légende "LET US LOOK TO THE MOST HIGH WHO BLESSED OUR FATHERS WITH PEACE" couvre toute la circonférence de la pièce, et le millésime "1757" est en exergue. Diamètre 45 millimètres.

(*Voir Figure 9*).

Les demandes furent nombreuses, et l'on dut frapper cette pièce à diverses reprises, si bien que les dernières impressions accusent une forte brisure de la matrice; tout de même, les exemplaires en sont rares, surtout ceux dont l'impression est intacte. Le gouvernement des Etats-Unis a fait faire une nouvelle matrice de cette pièce dont on peut obtenir des reproductions à la Monnaie de Philadelphie.

Les "*Mémoires Biographiques d'Antoine Bénézet*", publiés par Robert Vaux en 1817, nous donnent une intéressante description et une reproduction de cette médaille. Bénézet était un philanthrope huguenot dont la famille émigra à Philadelphie en 1731, et qui y consacra le reste de sa vie à écrire et à faire de la propagande en faveur des indiens et des esclaves nègres; il contribua dans une grande mesure, à faire naître l'idée de cette médaille.

Montréal en 1760.

L'attribution de la pièce suivante n'a pas encore été clairement définie; elle est désignée par McLachlan sous le nom de "Médaille de la Conquête" dans son étude citée plus haut, et il émet l'opinion qu'elle fut distribuée par Sir William Johnson, major général et surintendant des affaires des Six Nations, aux chefs des troupes indiennes qu'il avait conduites à l'attaque de Montréal sous Amherst en 1760.

Le dessin de cette pièce s'écarte absolument des types conventionnels suivis jusqu'ici, car l'avers représente une ville fortifiée, située sur le bord d'une rivière, et porte en chef l'inscription "MONTRÉAL", tandis qu'en exergue se trouvent dans une ellipse déprimée les initiales "D.C.F."; le revers est uni, mais sur les exemplaires qu'on en a trouvés jusqu'à ce jour, une main malhabile a gravé en légende le nom du chef à qui la médaille était décernée, et en inscription le nom de sa tribu. Cette médaille, qui est en argent, paraît avoir été coulée et ciselée; elle a une bélière rapportée, et son diamètre est de 45 millimètres.

(*Voir Figure 10*).

De prime abord, la représentation qu'elle nous donne de Montréal semble fantaisiste, mais si on la compare avec les vues de la ville qui ont été publiées à cette époque, en particulier celles du "*London Magazine*" et du "*Royal Magazine*" de 1760, et celle de Patten publiée par Jeffreys en 1762, on reconnaîtra facilement la même source d'inspiration; le graveur y représente, en autant qu'on peut le faire dans le champ restreint d'une médaille, le fleuve Saint-Laurent, le mur des fortifications, la colline de la citadelle sur laquelle flotte le drapeau anglais, l'église des Jésuites, la chapelle de la Congrégation, l'église paroissiale de Notre-Dame, l'Hôtel-Dieu, l'église des Récollets, et un sixième clocher, placé cependant trop en arrière, est supposé représenter l'Hôpital Général. On a prétendu à tort que la chapelle de Bonsecours était au nombre des clochers ainsi indiqués, car elle avait été détruite dans l'incendie de 1754, et ce n'est qu'en 1772 qu'elle fut reconstruite.

L'auteur de cette médaille, qui a pourtant pris la peine de se mettre bien en évidence en accaparant l'exergue pour sa signature "D.C.F." est resté pendant longtemps inconnu de nos principaux numismates; la nouveauté du dessin portait McLachlan à conclure, dans les études qu'il a faites sur cette médaille jusqu'en 1908, qu'elle avait été produite en Amérique par un graveur inconnu, de New York, tandis que Betts se contentait de citer cette opinion en observant que les lettres "D.C." peuvent fort bien être les initiales de ce graveur, et la lettre "F" indiquer simplement le mot "*fecit.*" Mais l'opinion de McLachlan a depuis été confirmée, tel qu'il l'établit dans une communication à "*The American Journal of Numismatics*" en 1909, et comme on peut s'en rendre compte en consultant l'ouvrage de Chaffers "*Gilda Aurifabrorum*" ou celui de Howard "*Old London Silver*"; ce mystérieux inconnu est un orfèvre du nom de D. C. Fueter, (que Howard, par erreur typographique sans doute, dénomme Fuetes) de Chelsea, qui fit enregistrer sa marque (les initiales D.C.F. dans un cercle allongé) au Guild des orfèvres à Londres en 1753. On trouve au "*Dictionnaire des Médaillistes*" de Forrer, actuellement en cours de publication, que Fueter émigra effectivement à New York en 1754 qu'il vécut plus tard à Bethléem, en Pensylvanie, puis retourna en Suisse en 1769. Ces détails biographiques font également écarter l'opinion de Beauchamp qui attribue cette pièce (*loc. cit.*) à l'époque de la révolution américaine.

Vingt-trois de ces médailles paraissent avoir été distribuées par Sir William Johnson; de ce nombre, six nous sont connues jusqu'à présent, elles portent les noms des chefs *Caneiya* et *Tekahonwaghse* de la tribu des Onondagos, *Aruntes* de celle des Mohawks, *Tantalkel*, *Songase* et *Madoghk*, de celle des Mohigrans ou Mohichans. La médaille de Tekahonwaghse appartient à R. W. McLachlan, de Montréal, et elle porte la note suivante gravée au bas du revers: "Taken from an Indian Cheif (*sic*) in the American War 1761"; si elle appartenait à un chef tué en 1761, la théorie qu'elle a été décernée en 1760 serait donc plausible. M. W. H. Hunter, de Toronto, s'est porté récemment acquéreur de la médaille de Madoghk, et celle de Tantalkel se trouve à la bibliothèque du Parlement.

Georges III monta sur le trône d'Angleterre le 25 octobre 1760; la capitulation de Montréal venait d'être signée et le drapeau des Bourbons avait été remplacé par l'étendard de St-Georges des rives de l'Atlantique aux sources des grands lacs. Mais la paix n'étant pas encore conclue, l'Angleterre, qui tenait à conserver ses conquêtes en Amérique, voulut se concilier l'amitié des diverses tribus indiennes en récompensant les guerriers qui avaient combattu sous ses drapeaux et en faisant des traités d'amitié avec les autres.

Mariage de Georges III et Charlotte.

Une occasion favorable se présenta bientôt: le jeune roi épousa Charlotte de Mecklembourg-Strelitz le 8 septembre 1761, et les tribus loyales lui adressèrent à cette occasion leurs félicitations auxquelles le roi répondit en faisant frapper à leur intention une médaille d'argent représentant en avers les bustes du roi et de la reine se faisant face et placés sous un rideau noué entre leurs têtes, et au revers les armes royales avec les attributs ordinaires.

(*Voir Figure 11*).

Cette médaille ne porte aucune inscription ni date, mais en tenant compte du temps nécessaire à sa production, après réception de l'adresse des Indiens, on peut, en toute certitude, l'assigner à la fin de 1761 ou au commencement de 1762. Son diamètre n'est que de 38 millimètres, format habituellement destiné aux simples guerriers, ce qui indiquerait qu'elle a été distribuée avec profusion; mais comme c'est presque toujours le cas, les petites médailles étant moins appréciées que les grandes, leurs récipiendaires consentirent plus facilement à s'en défaire, et le nombre d'exemplaires connu en est fort restreint.

Le 10 février 1763, se signait à Versailles le traité de paix entre la France, l'Angleterre, l'Espagne et le Portugal, par lequel les possessions françaises en Amérique passaient définitivement sous la couronne d'Angleterre. La colonie de la Nouvelle-France fondée par Champlain au prix de tant de labeurs, et maintenue pendant un siècle et demi au prix de tant de sang, devenait anglaise; les officiers qui avaient combattu si valeureusement avec Lévis étaient retournés en France après avoir brulé leurs drapeaux, mais les 60,000 colons, qui restaient attachés au sol arrosé du sang de leurs pères, se rallièrent autour de leurs prêtres sous les clochers de leurs églises, et, devenus anglais par allégeance, ils restèrent français de cœur et de langue, gardant, en vertu du traité, la foi que les fils de Saint-Louis leur avaient apportée.

Mais si les Canadiens-Français acceptèrent loyalement le changement de régime qui leur était imposé, il n'en fut pas ainsi des Indiens qui, n'étant pas parties au traité, n'entendirent pas laisser disposer de leur territoire et de leur allégéance sans être consultés. Dès le mois de mars 1763, Pontiac, fameux chef des Ottawas, se mit à la tête d'une confédération de tribus hostiles à la domination anglaise, et réussit, par la ruse et la violence, à s'emparer de la plupart des fortins disséminés sur l'immense étendue de territoire qui s'étendait sur tout le parcours des grands lacs et jusqu'au Mississippi. La conspiration fut découverte dès son origine par Holmes, commandant du Fort de Miami, mais le général Amherst n'en mesura pas d'abord toute la gravité, et il se contenta de faire des remontrances aux tribus. Les forts de l'Ouest tombaient cependant l'un après l'autre aux mains de Pontiac qui vint mettre le siège devant Détroit, et ce n'est que par la délation d'une jeune indienne Chippewa, amoureuse du commandant Gladwin, que le fort fut sauvé. Amherst, ouvrant enfin les yeux à la réalité du danger, chargea le colonel Bouquet d'aller renforcer et ravitailler les postes menacés, et il convoqua à Niagara une grande assemblée des tribus amies, fin de s'assurer de leur loyauté.

Lion et Loup.

C'est vraisemblablement à cette occasion que fut distribuée la curieuse et rarissime médaille "Lion et Loup", dont l'allégorie a provoqué chez les numismates tant d'opinions contradictoires. Elle représente à l'avers le buste cuirassé de Georges III, décoré du ruban de la Jarretière, avec la légende: "GEORGIUS III, DEI GRATIA"; au revers un lion au repos sous un arbre et un loup qui semble vouloir l'attaquer, tout en se tenant à une distance respectueuse et dans une attitude indiquant qu'il va fuir à la moindre riposte; au second plan, on voit derrière le lion une église et deux maisons qu'il protège, et derrière le loup une forêt où il pourra se réfugier en cas de poursuite. Elle est en argent, mesure 58 millimètres, porte un anneau de suspension, et l'on n'en connaît que peu d'exemplaires. L'un d'eux, qui se trouve aujourd'hui dans la collection Hunter, fut trouvé par un cultivateur du nom de Steubing en labourant sur sa ferme près de Berlin, Ontario; croyant que c'était une simple rondelle de ferblanc, il l'y laissa près d'une année, jusqu'à ce que son fils ayant appris que cette ferme occupait l'emplacement d'un ancien cimetière indien, s'avisa d'aller examiner le "vieux morceau de ferblanc" et y découvrit un superbe exemplaire de la médaille "Lion et Loup".

(*Voir Figure 12*).

Les explications qu'on a voulu donner de cette allégorie jusqu'à ce jour sont plus ou moins boîteuses et sont empreintes de partialité de la part de leurs auteurs, car personne ne veut accepter pour sa nation l'emblème du loup que Tancred dans son ouvrage "*Historical Record of Medals*", et McLachlan dans "*Canadian Numismatics*" attribuent à l'Amérique, je ne sais trop pour quel motif, puisque les Etats-Unis n'étaient pas encore en révolte contre l'Angleterre à cette époque, et Betts, de son côté, l'attribue, sans plus de raison, à la France qui venait pourtant de conclure la paix avec l'Angleterre, et qui respectait loyalement ce traité en protégeant même les garnisons des forts anglais contre les attaques des indiens (Cf. Parkman, "*Conspiracy of Pontiac*"; Bancroft, "*History of the United States*", etc.) Non, l'allégorie de cette médaille, la date à laquelle elle a été frappée et les évènements qui se déroulaient à cette époque, justifient plutôt l'attribution que je crois devoir en faire au mouvement qu'on a appelé "La Conspiration de Pontiac".

Il semble avoir été fait deux matrices du revers de cette médaille avec de légères modifications dans les détails, tel que la forme du loup qui est efflanqué sur l'une et corpulent sur l'autre; ce double emploi est dû sans doute au fait qu'il a fallu en distribuer un grand nombre aux diverses tribus à mesure qu'elles proclamaient leur loyauté à l'Angleterre, et que la première matrice a fini par se briser. On aurait trouvé, paraît-il, ces deux variétés en 1889 dans une sépulture indienne à St-Joseph, dans l'Etat du Michigan, et une dans la tombe d'Otussa, fils de Pontiac, à Presque-Isle, à l'embouchure de la rivière Shawnee.

On peut objecter que le fait d'avoir trouvé cette médaille dans la sépulture d'Otussa devrait faire mettre de côté l'attribution que je fais de son allégorie à la Conspiration de Pontiac, mais je crois qu'au contraire, cette circonstance prouve mon avancé, car elle s'explique de deux manières. Il est très possible, en effet, que Pontiac aurait reçu cette médaille comme marque d'allégéance d'un chef qui se serait rallié à lui après avoir assistée à l'assemblée de Niagara; mais il est encore plus probable qu'Otussa ou Pontiac lui-même l'aurait conquise en tuant dans une bataille le chef qui la portait et à qui il l'aurait enlevée en même temps que la chevelure, chose que les Indiens ne manquaient jamais de faire dans leurs combats féroces, pour se parer ensuite de ces trophées, celle-là au cou et celle-ci à la ceinture.

Rappelons à ce sujet le récit, fait par le major général Strange, de la bataille du Lac aux Grenouilles, lors de la seconde insurrection de Riel en 1885; on y verra que les Indiens qui prirent part à ce combat avaient conservé la coutume d'enlever les chevelures et les médailles de leurs ennemis tués à la bataille: "The fallen Indian was the Chief. He wore the Queen's medal, supplied by the Canadian Government, an ornament about the size of an agricultural trophy for a prize pig. These medals are solid silver, and much valued by the chiefs, who hand them down from father to son. Some of them bear the image and superscription of good King George III. The next morning, on passing the spot where he fell, I noticed the tall athletic figure of the dusky warrior as he lay like a bronze statue. He had lost his scalp, and his medal."

Happy while united.

La grande assemblée de Niagara et les traités de paix qui s'en suivirent avec différentes tribus nécessitèrent l'exécution d'une véritable "médaille de paix et d'union" entre les blancs et les Indiens; de là naquit l'idée de la médaille "HAPPY WHILE UNITED", qui semble avoir fait l'objet d'un concours, puisque les quatre variétés qu'on en connaît semblent avoir été produites vers la même époque, tout en présentant des différences de détails assez notables, mais se rapportant toutes à une idée commune.

Elles portent à l'avers l'effigie du roi Georges III, avec la légende "GEORGIUS III, D. G. M. BRI. FRA. ET. HIB. REX. F. D.", avec quelques différences dans le traitement de l'effigie et de la légende; le revers nous montre un chef indien tenant un calumet de paix et un officier anglais assis l'un près de l'autre et se serrant la main, les paysages de l'arrière-plan et les détails du traitement varient suivant les pièces, dont les unes indiquent une ville maritime avec des ballots de tabac sur lesquels les personnages sont assis (Vattemare, "*Collection de Monnaies et Médailles de l'Amérique du Nord*"; Schoolcraft, "*History of the Indian Tribes*"), tandis que d'autres les représentent assis sur un banc rustique à l'embouchure d'un fleuve (Tancred, "*Historical Record of Medals*"; Betts, McLachlan, "*American Journal of Numismatics*," &c.), mais toutes portent la devise: "HAPPY WHILE UNITED"; trois portent en exergue le millésime "1764", et une autre celui de "1766". Il est probable qu'on a voulu représenter sur toutes la ville de New York, métropole des possessions britanniques en Amérique, et l'une d'elles, gravée par Fueter, l'auteur de la médaille de Montréal, porte sa marque "D.C.F." dans un cercle déprimé, et l'inscription "N. YORK" poinçonnée dans le champ du revers.

Toutes ces médailles ont une curieuse bélière formée d'une aile d'oiseau et d'un calumet de paix unis en sautoir; on sait en effet que chez les Indiens, les ailes d'oiseau, et particulièrement celles de l'oie sauvage, étaient au nombre de leurs emblèmes de paix (Cf. Hawkins "*Medallic Illustrations*"); elles sont en argent, les unes frappées et d'autres coulées, et leur module varie de 76 à 50 millimètres; toutes sont extrêmement rares.

(*Voir Figure 13*).

Traité de Pontiac.

Betts assigne à cette même date (1764) et place parmi les médailles "HAPPY WHILE UNITED" une autre pièce du type ordinaire des médailles royales, qui est décrite par Tancred (*loc. cit.*), avec mention qu'il en a été frappé de diverses grandeurs, la plus grande ayant plus de trois pouces de diamètre, et qu'elles ont été parfois offertes avec une chaîne de suspension en argent. Elle porte à l'avers l'effigie du jeune roi Georges III, avec la légende: "GEORGIUS III, DEI GRATIA", et au revers les armes royales telles qu'on les représentait avant 1801, soit: écartelé, au 1er les armes d'Angleterre palées de celles de France, au 2nd celles d'Ecosse, au 3è celles d'Irlande, et au 4è celles de Hanovre.

Mais l'avers de cette pièce représentant la même effigie du roi que sur celle du Lion et Loup, on doit plutôt conclure qu'elle a été frappée avec ce revers pour être distribuée aux chefs des tribus confédérées, après la négociation du traité de paix avec Pontiac en 1765. On lit en effet dans Parkman (*Histoire de la Conspiration de Pontiac*) que "le 23 juillet 1766, Sir William Johnson rencontra Pontiac et un grand nombre de ses chefs à Oswego, et leur fit de nombreux cadeaux", au nombre desquels devaient se trouver plusieurs médailles; Betts est d'avis qu'on aurait alors donné à ces Indiens la médaille Lion et Loup, mais comme cette allégorie aurait été plutôt insultante pour eux, il est raisonnable de croire qu'on l'a remplacée par les armes royales en conservant le même avers que sur la médaille Lion et Loup.

Révolution américaine.

A peine les derniers échos des coups de feu de Pontiac s'étaient-ils tus, qu'un autre nuage beaucoup plus menaçant s'élevait à l'horizon; je veux parler de l'adoption de la loi du Timbre imposée par l'Angleterre à ses Colonies d'Amérique en 1765, pour défrayer les dépenses de la liste civile, et des sentiments d'indignation avec lesquels cette mesure fut reçue dans les Colonies du Sud, au point que Bancroft lui attribue l'origine des sentiments de révolte qui conduisirent à l'Indépendance américaine. Cette loi, dénoncée vigoureusement, même en Angleterre par William Pitt, fut rappelée l'année suivante, il est vrai, mais les germes de révolte étaient déjà semés dans les cœurs des Américains, et l'on sait par quelle suite d'évènements ils en vinrent en peu d'années à la décision de secouer le joug de la mère-patrie.

Assagie par l'expérience de ses relations avec les Colonies du Sud, l'Angleterre chercha, dès les premiers grondements de la tempête, à se concilier les autres éléments qu'elle avait enrôlés récemment sous son drapeau. Elle gagna l'affection des canadiens-français par sa justice en adoptant la mesure parlementaire connue sous le nom d'"Acte de Québec" qui leur garantissait l'exercice de leur religion, l'usage de leur langue et les autres droits qui leur avaient été reconnus par la capitulation, mais qui étaient restés plus ou moins définis jusqu'alors; elle s'en fit par ce moyen des sujets reconnaissants qui en 1775 défendirent son drapeau contre l'armée américaine révoltée contre elle, pendant qu'un certain nombre de marchands anglais, dont les sympathies secrètes étaient pour les révoltés, se tenaient à l'écart sur l'ile d'Orléans pour crier selon les résultats de la guerre "Vive le Roi", ou "Vive la Liberté" (Cf. "Garneau, *Histoire du Canada.*")

Dans cette circonstance critique, il ne fallait pas négliger non plus l'appoint considérable des tribus indiennes dont le concours pouvait influer fortement sur le résultat final. Ces pauvres sauvages ne pouvaient guère parvenir à se comprendre dans le labyrinthe politique de la situation. Tant qu'il s'était agi de lutte entre français et anglais, c'était assez facile à débrouiller, mais aujourd'hui qu'il n'y avait plus que des anglais divisés entre eux sur des questions fiscales et autres casse-têtes diplomatiques, ils ne s'y entendaient plus; leur naturel guerrier prenant le dessus, ils étaient tout de même assez disposés à suivre sur le sentier de la guerre celui qui les convaincrait le premier avec de belles paroles accompagnées de cadeaux attrayants.

Pitt intervint encore ici au nom de la civilisation pour protester contre la participation des Indiens dans cette guerre contre les colonies américaines, et le discours éloquent qu'il fit à la Chambre des Communes en 1777 contre les atrocités indiennes porta à son apogée la popularité que son attitude sur la loi du Timbre lui avait déjà conquise aux Etats-Unis, mais ses paroles n'eurent que l'effet d'une protestation.

Georges III à l'époque de la révolution américaine.

Des médailles furent donc frappées à profusion et confiées à des envoyés chargés d'aller porter la bonne parole aux tribus. Le type ordinaire de l'effigie du roi avec la légende "GEORGIUS III, DEI GRATIA" d'un côté, et les armes royales de l'autre, fut adopté; il y en eut de diverses grandeurs, depuis 78 millimètres jusqu'à 29, mais par esprit d'économie sans doute, un grand nombre furent frappées "en creux", c'est-à-dire qu'elles consistent en deux lamelles d'argent pour l'avers et le revers, réunies ensemble par un cercle de même métal, avec anneau pour suspension. Elles diffèrent entre elles non seulement en diamètre, mais par quelques légers détails d'exécution, tels que le nombre et la grandeur des rivets sur la cuirasse du roi, et la position du lion et de la licorne relativement à la devise sur les armes royales. La distribution s'en fit pendant toute la durée de la guerre de la révolution américaine.

(*Voir Figure 14*).

Betts rattache la plupart de ces médailles à la date de 1762, parce que le revers de l'une d'elles (décrite par lui sous le n° 439) est le même que celui de la médaille du mariage de Georges III avec la reine Charlotte, dont il est question plus haut; mais ceci est loin d'être une preuve concluante, puisque dans les "Corrigenda" de son ouvrage, il déclare que l'effigie du roi sur l'avers de cette médaille est d'une époque postérieure, et l'on sait, en effet, qu'il arrive parfois aux ouvriers de croiser l'avers d'une médaille avec le revers d'une autre en employant les matrices de deux pièces différentes, soit intentionnellement, ou par ignorance ou distraction. De plus, il est facile de constater que sur toutes ces médailles la figure du roi n'est plus celle d'un adolescent de vingt ans mais plutôt celle d'un homme qui a atteint la trentaine, ce qui les placerait à l'époque que nous leur assignons.

Commissions des Chefs.

Il nous arrive ici une innovation importante à noter: c'est l'octroi de commissions reconnaissant l'autorité des chefs à qui les médailles sont décernées, et leur conférant l'investiture officielle de leur titre. On croirait lire des commissions de notaires ou de "commissaires pour la décision sommaire des petites causes", ainsi qu'on peut en juger par le document suivant, dont l'original se touve aux archives de la Société Historique de l'Etat du Wisconsin; je n'en reproduis que le texte anglais mais la pièce est dans les deux langues:

"*Frederick Haldimand, Captain General and Governor in Chief* of the Province of Quebec, Ec. Ec. Ec., *General and Commander in Chief* of His *Majesty's Forces* in said *Province and Frontier* Ec. Ec. Ec.

To CHAWANON, *Grand Chief* of the *Folles-Avoines:* (L.S.)

"In consideration of the fidelity, zeal and attachment testified by CHAWANON, *Grand Chief* of the *Folles-Avoines* to the King's Government, and by virtue of the power in me vested, I do confirm the said CHAWANON, *Grand Chief* of the *Folles-Avoines* aforesaid, having bestowed upon him the *great medal*, willing all and singular the Indian inhabitants thereof to obey him as *Grand Chief* and all Officers and others in His Majesty's service to treat him accordingly."

"Given under my hand and seal, at Montreal, this *seventeenth* day of *August*, one thousand seven hundred and seventy-*eight*, in the *eighteenth* year of the reign of our Sovereign Lord George the Third by the Grace of God, of Great Britain, France and Ireland, King, Defender of the Faith, &c."

"By His Excellency's Command
"Fred. Haldimand,
"E. Joy."

La formule de ces commissions mesure huit pouces par douze, elle est imprimée en anglais et en français, avec des blancs pour les noms, les titres, le module de la médaille et la date de son octroi; si l'on tient compte de ces détails, et surtout du fait que les mots "mil sept cent soixante-dix——" (one thousand seven hundred and seventy ——) sont imprimés, laissant à remplir le chiffre de la décade, de même que le module de la médaille, on admettra que l'opinion émise ci-dessus, quant aux diverses dimensions de cette médaille et quant à l'époque de son émission, est vraisemblable.

La Société Historique du Wisconsin possède une médaille obtenue d'un chef des Folles-Avoines (Menomonees) qui est probablement celle dont il est fait mention dans cette commission; le chef qui la possédait l'a échangée pour une médaille américaine, au temps de la guerre de sécession, à la suite des recherches faites par les ordres du gouvernement dans le but de faire disparaître les médailles étrangères (Cf. J. D. Butler, "*Early Historic Relics of the Northwest*" publié au vol. IX des *Collections* de la Société Historique du Wisconsin).

L'indépendance des Colonies révoltées ayant été reconnue en 1783 par le traité de Versailles, le pays put enfin jouir de quelques années de paix, au cours desquelles la nouvelle république organisa son existence politique, et l'Angleterre s'occupa de son côté de la régie interne des possessions qui lui restaient en Amérique. Environ quarante mille loyalistes, au nombre desquels se trouvaient plusieurs tribus indiennes, refusèrent allégéance au drapeau étoilé, et quittèrent leurs établissements sur le sol des Etats-Unis pour se fixer dans la Nouvelle-Ecosse, dans le Nouveau-Brunswick, ainsi que dans le Haut et le Bas-Canada, afin de rester sujets anglais.

C'est à ce mouvement qu'il semble raisonnable de rattacher la médaille "LOYAL ASSOCIATED REFUGEES", dont l'attribution n'a pas encore été clairement définie jusqu'à ce jour; mais comme cette médaille semble avoir été destinée aux loyalistes de race blanche aussi bien qu'aux Indiens, il n'y a pas lieu de l'inclure dans cette revue des "Médailles décernées aux Indiens"; nous en dirons un mot plus tard en parlant de quelques pièces supplémentaires.

L'histoire numismatique des médailles indiennes est donc presque aussi obscure à la fin du XVIIIè siècle et au commencement du XIXè que cent ans auparavant; les exemples suivants nous en donnent la preuve:

Georges III, 1794.

On trouve dans le "*Médaillier du Canada*" de Leroux, au N° 834, une petite médaille de 32 millimètres, du type ordinaire (avers: buste du roi avec légende; revers: armes royales), signée per Miller et portant la date de 1794, au sujet de laquelle on ne peut trouver de renseignements concluants. Le gouverneur Simcoe écrivait au Colonial Office le 1 avril 1793: "I wish you would send me out as Indian presents a few flags with the arms of Upper Canada. . . . . Remember also the 200 silver medals with the arms of Upper Canada which I requested last year to be sent out to be given as presents to the Chiefs." Comme on n'a trouvé aucune trace de telles médailles, il est fort possible que celle de 1794 lui aît été substituée, de même qu'on pourrait admettre comme motif assez plausible de l'émission de cette pièce le fait que la crainte du contre-coup de la révolution française au Canada qui hantait Lord Dorchester à cette époque, lui eût fait rechercher l'amitié des Indiens par la distribution de cette médaille, et l'inscription poinçonnée sur sa tranche: "MAY HE EVER REIGN IN THE HEARTS of HIS PEOPLE" nous porterait à le croire. Cette préoccupation du gouverneur se retrouve également dans le fait que pour inspirer aux canadiens-français l'aversion des horreurs qui accompagnèrent la révolution française, on fit imprimer en français à Québec, à la même époque, et distribuer à profusion un opuscule écrit par Cléry, valet de chambre de Louis XVI, relatant la captivité et le supplice des membres de la famille royale de France. Cette petite médaille de 1794 est très rare; cependant, la bibliothèque du Parlement et M. Hunter en possèdent chacun un exemplaire. La description que nous en donne Leroux est incomplète car il ne fait pas mention du nom du graveur ni de l'inscription sur la tranche.

(*Voir Figure 15*).

Georges III, post 1801.

On trouve également au N° 836 du "*Médaillier du Canada*" de Leroux la reproduction d'une autre médaille de 57 millimètres, qui porte à l'avers le même buste de Georges III qu'on voit sur la médaille "Lion et Loup", attribuée ci-dessus à l'époque de la guerre de

Pontiac, mais dont le revers nous présente pour la première fois les armes royales *sans les fleurs de lys*, et avec l'écusson de Hanovre *sur le tout*. Or, comme ce n'est qu'en 1801 qu'une proclamation royale a décrété la suppression des fleurs de lys sur les armes anglaises, tandis que le buste de l'avers remonte à 1764, il faut en conclure que cette médaille n'a été frappée qu'après 1801, et c'est par suite d'un ana chronisme dans l'emploi de l'avers que le buste du roi est du même âge que sur la médaille "Lion et Loup". M. McLachlan possède un très bel exemplaire de cette curieuse pièce que j'ai pu comparer soigneusement avec celle du "Lion et Loup", et l'on en trouve un autre à la bibliothèque du Parlement.

(*Voir Figure 16*).

Guerre de 1812.

Mais si le contre-coup de la révolution française se fit peu sentir au Nouveau-Monde, il n'en fut pas ainsi de l'épopée napoléonienne. Dès 1806, l'Angleterre avait mis l'interdit sur les côtes du continent européen depuis Brest jusqu'à l'Elbe; elle saisit plusieurs navires américains qui y faisaient le commerce, en même temps qu'elle décréta le droit de visite des navires neutres et l'exerça sur le "*Chesapeake*", à la grande indignation des Américains. Napoléon sut profiter habilement des sentiments d'hostilité qui se manifestaient aux Etats-Unis comme un écho de la guerre d'Indépendance; il attisa le mécontentement de la jeune république, et, le 18 juin 1812, le Congrès américain déclarait la guerre à l'Angleterre.

Il s'en fallait de beaucoup cependant qu'on fût prêt à cette guerre d'un côté ou de l'autre de la frontière américaine, et les premières escarmouches semblèrent démontrer qu'on s'y engageait à regret. L'alliance des Indiens, toujours prêts à déterrer le tomahawk, fut sollicitée de part et d'autre, mais la plupart des tribus restèrent fidèles au drapeau britannique; on peut juger de la terreur que ces guerriers produisaient sur les troupes américaines en lisant la proclamation du général Hull aux habitants du Canada, dans laquelle il dit: "No white man found fighting by the side of an Indian will be taken prisoner; instant destruction will be his lot" (Cf. Richardson, "*War of 1812*").

On connaît la série des engagements qui eurent lieu sur terre et sur eau pendant les deux années qui suivirent; les Américains ont transmis à la postérité le souvenir de leur succès par l'émission de seize médailles pour leurs victoires navales, et de onze pour celles de leurs armées, tandis que du côté canadien, les victoires de Queenstown Heights, de Lundy's Lane, de Lacolle, mais surtout les glorieux faits d'armes de Châteauguay et de Chrysler's Farm, où les troupes canadiennes, assistées de quelques Indiens, luttèrent victorieusement contre des forces vingt fois supérieures, nous sont trop connus pour qu'il soit nécessaire de les rappeler.

Le traité de Gand, signé le 24 décembre 1814, mettait fin aux hostilités, mais, tout en établissant une paix honorable pour les deux pays, il ne réglait pas la question brûlante de l'inviolabilité des vaisseaux battant pavillon neutre, qui avait été le prétexte avoué de cette guerre, tandis que le but secret des Etats-Unis paraît avoir été la conquête du Canada.

Il est intéressant à ce propos, en face d'évènements provoqués par des causes presque indentiques à cent ans de distance, au cours d'une guerre qui embrase l'Europe presque entière et qui menace de s'étendre aux autres continents, de noter l'opinion de Sir Archibald Alison qui déclare dans son "*Histoire de l'Europe pendant la Révolution française*", publiée de 1833 à 1842, que "le traité de Gand doit être regardé plutôt comme une longue trêve que comme une pacification finale."

Georges III, 1814.

Pour récompsenser la loyauté et le concours des Indiens du Canada dans cette guerre, le gouvernement anglais fit frapper une splendide médaille en trois modules différents (75, 60 et 38 millimètres), destinée aux Chefs de divers grades, dont la gravure fut confié à Thomas Wyon, l'un des membres de cette famille de graveurs fameux qui se sont succédé à la Monnaie Royale pendant plus d'un siècle. C'est une des plus belles médailles de cette série, mais je doute fort qu'à cette époque Georges III eût la belle prestance que l'artiste lui donne, car la formule anglaise "le roi règne mais ne gouverne pas" s'appliquait alors littéralement à son état; elle porte à l'avers le buste lauré du roi, couvert du manteau royal, avec le collier de grand commandeur de l'Ordre de la Jarretière, et la légende "GEORGIUS III, DEI GRATIA BRITANNIARUM REX F.D."; le revers porte les armes royales surmontées du casque et de la couronne avec les devises et supports ordinaires, feuilles d'acanthe, roses, chardons et trèfles, et en exergue la date "1814".

(*Voir Figure 17*).

Sainthill, dans son "*Olla Podrida*", vol. I, nous dit qu'au lieu de ce revers, Wyon avait d'abord représenté "l'Angleterre assise présentant une médaille à un Indien d'une belle prestance athlétique, revêtu du costume de sa tribu", mais que malheureusement, ce dessin fut brisé lors de la trempe, et comme le graveur n'avait pas le temps d'en faire un autre, on lui substitua celui des armes royales.

Potentats africains.

La politique de se concilier les chefs sauvages en leur présentant des médailles d'honneur avait trop bien réussi en Amérique pour que l'Angleterre négligeât de l'employer ailleurs; aussi voit-on au IIè volume du "*Journal de l'Expédition du Niger*", publié par l'explorateur Lander en 1832, que "des médailles de Georges III, frappées à l'intention des chefs indiens de l'Amérique du Nord qui furent favorables à l'Angleterre pendant la guerre de 1812, ont aussi été présentées à des potentats africains pour s'assurer leur amitié."

Georges IV, 1821.

Les auteurs de numismatique ne font aucune mention de médailles indiennes de Georges IV ni de William IV, mais M. Cyrille Tessier, de Québec, possède une belle gravure colorée, dont on trouve aussi un exemplaire au Château de Ramezay, représentant le chef huron Nicolas Vincent Tsawanhoni en costume de gala, tenant à la main un superbe collier de *wampum* (dont M. Tessier est également possesseur), et portant au cou deux médailles, avec la mention que l'une d'elles fut présentée à Tsawanhoni par le roi Georges IV à l'occasion d'une visite qu'il fit, avec trois autres chefs, à la cour de Londres le 7 avril 1825.

Ces quatre chefs avaient été délégués par la tribu des Hurons de Lorette pour revendiquer auprès du roi la possession d'une certaine partie de leur réserve qui se trouvait comprise dans le fief Saint-Gabriel, dont le gouvernement s'était emparé avec les autres biens des Jésuites après la mort du Père Cazot, "le dernier des Jésuites", décédé en 1800. Les délégués arrivèrent en Angleterre le 14 décembre 1824, sous la conduite d'un anglais du nom de W. Cooper qui avait été revêtu du titre de chef sous le nom de *Tourhaunché*, mais il paraîtrait, d'après les renseignements qui m'ont été communiqués par le grand chef de la tribu, que ce *cicerone* leur ayant représenté qu'ils mécontenteraient le roi en lui réclamant un territoire dont la couronne s'était emparé, ils n'ouvrirent pas la bouche sur l'objet de leur visite; ils se contentèrent de parader à la cour et d'accepter les cadeaux et les attentions dont ils furent l'objet, tandis que les membres de la tribu, qui s'étaient cotisés pour défrayer le coût du voyage, en furent pour leurs frais.

Dans une communication de A. E. Bulger à la revue "*Canadian Antiquarian*" (Vol. VII, janvier 1879), et dans une autre de Henry Mott à la publication "*Canadiana*" (Vol. I, 1889), on trouve également le récit de la présentation de ces chefs au roi Georges IV par les généraux Brock et Carpenter, et la mention que le roi ayant remarqué qu'ils portaient au cou des médailles de Georges III, les complimenta, et leur offrit à chacun une médaille d'or à son effigie.

Ces médailles n'étaient cependant pas en or massif, mais plutôt en vermeil, ainsi que j'ai pu le constater par celle de Tsawanhoni qui est en possession du chef Bastien, de Lorette. C'est une belle pièce de 70 millimètres, avec un grand anneau et ruban pour suspension, portant à l'avers le buste lauré et drapé du roi, et la légende GEORGIUS IV, DEI GRATIA BRITANNIARUM REX; le revers se compose d'une couronne de feuilles de laurier et d'épis de blé, réunis à la base par un bouquet de roses, de chardons et de trèfles et fermée au sommet par une couronne royale, entourant l'inscription "CROWNED JULY XIX, MDCCCXXI"; on voit au-dessous un petit cheval courant; les mots GOD SAVE THE KING sont en légende.

(*Voir Figure 18*).

La communication de A. E. Bulger mentionnée ci-dessus constate en plus la présentation d'une médaille de Georges IV par le gouverneur de l'Assiniboine à un chef de la tribu des Chippewas ou Sauteux, de Red Lake, dans le territoire de la Baie d'Hudson, en 1823, et cite à l'appui de cette assertion une aquarelle représentant ce chef en compagnie du gouverneur et des guerriers de sa tribu à Fort Douglas, la même année, et portant cette médaille au cou.

On trouve en outre, au Château de Ramezay, la peinture originale de la réception de Robert Symes, marchand de Québec, élu au grade de chef honoraire de la tribu des Hurons de Lorette, sur laquelle on voit au cou de chacun des chefs la médaille d'or de Georges IV, accompagnée d'une médaille d'argent. Ce souverain était très fastueux; cependant, tout porte à croire qu'il n'a pas fait frapper de médaille spéciale pour les Indiens, mais qu'il leur a plutôt distribué celle de son couronnement.

William IV, 1832.

Tancred (*loc. cit.*, page 83) fait mention d'une médaille frappée sous le règne de William IV en 1832, dans le but de cimenter des alliances avec les roitelets de la Sénégambie et des autres provinces de la Côte Occidentale d'Afrique, au cours des explorations et des établissements de l'Angleterre sur ce continent. Cette médaille porte à l'avers le buste du roi, et au revers les armes royales; elle est en argent avec un anneau de même métal et mesure 76 millimètres; la collection Murdock vendue aux enchères à Londres, en possédait un exemplaire. De même que la médaille de 1814, frappée à l'intention des Indiens d'Amérique, a été donnée à des potentats d'Afrique, comme on l'a vu plus haut, il est probable que cet échange de bons procédés eut lieu pour la médaille de William IV, car ce souverain ne paraît pas non plus en avoir fait frapper spécialement pour les Indiens du Canada, et comme ces pièces sont toutes du même type et ne portent pas d'incription distincte pour un pays ou l'autre, le roi pouvait s'en servir indifféremment pour témoigner son amitié en Afrique ou en Amérique.

Une preuve circonstancielle nous porte d'ailleurs à conclure à l'émission de médailles de William IV aux Indiens du Canada; c'est l'octroi de commissions du même genre que celle du gouverneur Haldimand que nous avons rapportée plus haut, conférant le titre de "Chef" ou de "Grand Chef" à des Indiens sous le règne de ce souverain. L'existence de ces pièces semble peu connue, mais j'ai l'avantage de posséder celles qui furent émises en faveur de "François Papineau Chako-mi-sa-kie, grand chef de la tribu des Nipissingues du Lac des Deux Montagnes", la première signée par le gouverneur Kempt le 1 juin 1830, sous le règne de Georges IV, lui conférant le titre de "Chef" et la seconde signée par Lord Gosford le 1 juin 1837, sous le règne de William IV, le reconnaissant comme "Grand chef"; ces commissions sont imprimées sur parchemin, en anglais et en français, avec des blancs pour inscrire le nom, le titre et la date; et bien que leur texte ne fasse pas mention de "médaille", il est tout probable qu'elles étaient accompagnées de ces décorations, puisque la coutume en avait été établie auparavant.

Victoria, 1840.

L'emploi qu'on semble avoir fait en Amérique de quelques médailles destinées aux potentats d'Afrique, nous conduit à signaler la contestation que certains auteurs ont cru pouvoir faire du classement parmi les médailles canadiennes d'une des plus belles pièces de notre numismatique indienne. Il s'agit de la médaille de Victoria, portant la date de 1840, que McLachlan dit avoir été frappée pour sceller les traités faits avec les Indiens dans les premières années du règne de cette reine, ainsi que pour récompenser la neutralité des tribus lors de l'insurrection de 1837, mais que Tancred (*loc. cit.*) affirme avoir été frappée en 1840 à l'intention des chefs africains de la Sénégambie, en nous donnant même le nombre exact de chacun des trois modules qui en ont été frappés.

Il semblerait singulier, en effet, qu'on eût daté de 1840 une pièce qui aurait été destinée à rappeler des évènements de 1837-38, ou même des traités qui ont été signés *à diverses époques* pendant les premières années du règne de Victoria, d'autant plus que ces traités ne se rapportaient plus qu'à des concessions ou abandons de territoires, et que ceux qui datent de 1840 sont peu importants; mais comme on vient de voir que, d'un autre côté, les souverains anglais n'étaient pas précisément méticuleux sur l'individualité des destinataires de ces pièces, dont on a d'ailleurs trouvé des exemplaires chez les Indiens du Canada aussi bien que chez les potentats africains, on peut accepter sans scrupule la théorie que quand même elles auraient été frappées en premier lieu pour les rois de Sénégambie, ces pièces ont aussi été distribuées au Canada comme médailles indiennes.

Cette opinion est d'ailleurs confirmé par les faits: je suis allé au village indien de Lorette interroger les chefs de cette tribu, et j'ai constaté que le grand chef Bastien, élevé à cette charge en 1883, et décédé en 1896, avait été fait sous-chef en 1843, et qu'il avait reçu à cette occasion la médaille de Victoria, datée de 1840. J'y ai vu, en même temps, deux modules de cette médaille, en argent, mesurant respectivement 75 et 38 millimètres, qu'on m'a déclaré avoir été décernés à Nicolas Vincent Tsawanhoni, le récipiendaire de la médaille de Georges IV, dont il est fait mention plus haut, et dont le fils M. J. G. Vincent se fit prêtre et mourut l'an dernier à l'âge d'environ 70 ans.

M. P. M. Wickham, de Saint-Lambert, possède également une de ces médailles du grand module ainsi qu'une photographie du grand chef Bastien, prise à l'atelier Livernois, de Québec, en habit militaire, avec épaulettes brodées, ceinture fléchée, baudrier de wampum, bracelets en argents, bonnet de plumes et deux médailles au cou, sur l'une desquelles on distingue clairement l'effigie de Victoria.

De son côté, la Société d'Archéologie et de Numismatique de Montréal possède dans sa galerie indienne du Château de Ramezay une peinture originale de "Zacharie Vincent Télariolin", chef Huron et peintre, avec la mention "son portrait peint par lui-même"; nous donnons comme première illustration une reproduction de cette peinture où l'on voit au cou du chef une médaille qui semble être celle qui nous occupe; mais comme le dessin original porte le mot "Canada" sur la médaille, et qu'aucune de ces pièces ne porte en réalité cette désignation, il est permis de croire que Télariolin a quelque peu lâché la bride à son imagination. Ce chef, "le dernier des Hurons authentiques", était bien connu à Québec il y a quarante ans; il possédait un talent naturel extraordinaire pour le dessin, et bien qu'il n'eût jamais pris de leçons, il a produit des pièces vraiment remarquables. C'était aussi un philosophe à la manière de Diogène: dans les dernières années de sa vie, on le voyait souvent parcourir la ville de Québec couvert de haillons, et la Société d'Archéologie possède une de ses photographies prise par Livernois dans cet état de décadence.

On doit donc admettre sans restriction que la médaille "Victoria 1840" est à sa place comme médaille indienne dans la présente étude; elle porte à l'avers le buste de la reine par W. Wyon, avec un diadème de croix de Malte et de roses, et la légende: "VICTORIA DEI GRATIA BRITANNIARUM REGINA, F. D."; au revers les armes royales à peu près semblables à celle qui figurent sur la médaille de Georges III, 1814, sauf l'écusson de Hanovre qui a disparu et la date qui est remplacée par celle de "1840". Elle mesure 75 millimètres, mais il en existe deux autres modules de 60 et 38 millimètres, et sur ce dernier la légende de l'avers est abrégée.

(*Voir Figure 19*).

Cette médaille est très rare en cet état; vingt ans plus tard le prince de Galles l'adapta à sa tournée d'Amérique en y faisant graver sa devise et la date "1860", ainsi qu'on le verra plus tard; les exemplaires de cette adaptation se rencontrent beaucoup plus fréquemment.

Médaille des Micmacs, 1842.

La pièce suivante est désignée à tort par McLachlan sous le nom de "Médaille du Traité d'Ashburton" parce qu'elle aurait été donnée "aux Micmacs et autres Indiens qui assistèrent Lord Ashburton en "qualité de guides ou autrement, dans la délimitation des frontières entre le Canada et les Etats-Unis." Elle est fort différente de celles que nous avons décrites jusqu'ici, puisque l'avers porte simplement le buste en réduction de la reine, sans ornements ni légende, mais entouré d'une large bande destinée sans doute à recevoir la gravure des noms et titres du récipiendaire; le revers est aux armes royales entourées d'un cercle portant la légende: "VICTORIA DEI GRATIA BRITANNIARUM REGINA FID. DEF." qui en couvre toute la circonférence; le seul module connu est d'une épaisseur beaucoup plus grande que dans les médailles indiennes ordinaires, et mesure 65 millimètres de diamètre.

(*Voir Figure 20*).

La bibliothèque du Parlement possède une de ces médailles, qui porte encore son cordon de suspension, et sur laquelle se lit l'inscription suivante, gravée dans l'espace réservé à cet effet sur l'avers: "*Presented to Joseph M. Itkabeitch, chief of the Micmac Indians at Restigouche, by the Minister of War and Colonies, by command of the Queen, 25 Jan. 1842.*" Comme Lord Ashburton ne s'embarqua à destination de sa mission qu'en février 1842, ce n'est donc pas au cours de sa visite que ces médailles furent distribuées; si elles se rapportent à l'établissement des frontières fixées par le traité qui porte son nom, il faudrait en conclure qu'elles ont plutôt été offertes à l'occasion des relevés préliminaires, afin de se concilier les tribus sauvages dont il fallait traverser le territoire, ou récompenser ceux qui y avaient participé.

La conclusion de cette entente ne prêtait pas d'ailleurs à de grandes réjouissances de la part de l'Angleterre, car Lord Ashburton, qui n'était pas de force à lutter avec Daniel Webster sur l'échiquier diplomatique, ainsi que Dent le fait remarquer dans son ouvrage *Canada since the Union of 1841*, nous faisait perdre dans ce règlement une grande partie du territoire auquel nous avions des droits avérés. Il fut complimenté tout de même, et le traité fut ratifié par le parlement anglais qui était heureux de voir se régler enfin une question brûlante que l'arbitrage du roi de Hollande n'avait fait qu'ajourner en 1818; mais Lord Palmerston s'en vengea en stigmatisant cette mission du nom de "Capitulation d'Ashburton."

Or il se trouve que la médaille d'Itkabeitch ne se rapporte ni de près ni de loin à l'établissement des frontières du Nouveau-Brunswick, et voici son histoire:

Les Micmacs de Ristigouche, qui se plaignaient depuis longtemps de l'injustice des lois de pêche à leur égard, avaient décidé d'envoyer auprès de la reine une délégation composée du chef Joseph Malie Itkabeitch, et des capitaines François Le Bobe et Pierre Basquet, dans le but de faire améliorer la législation relative à leurs pêcheries, d'obtenir qu'on leur distribuât sur place les gréements de chasse qu'ils étaient tenus d'aller chercher chaque année à Québec, et aussi pour solliciter les fonds nécessaires à la complétion des travaux de leur chapelle qui étaient suspendus depuis trois ans. Le capitaine O'Halloran, du 69è régiment, qui avait été nommé "grand chef blanc," titre qui équivalait à celui de "surintendant" de cette tribu, donna aux délégués une lettre de recommandation à Lord Stanley, en date du 19 novembre 1841, et les mit à bord d'un vaisseau marchand qui faisait voile pour l'Angleterre.

Le ministre des colonies reçut plutôt froidement cette visite qui lui tombait sur les bras pour solliciter des secours pécuniaires, "sans moyens de subsistance en Angleterre et sans qu'il fût pris de dispositions pour leur rapatriement, &c," ainsi qu'il s'en exprimait amèrement à Sir William Colebrooke, lieutenent-gouverneur du Nouveau-Brunswick, dans une lettre du 13 janvier 1842, et le capitaine O'Halloran, auteur de cette équipée, en fut vertement réprimandé.

Nos délégués ne furent même pas admis à voir la reine, mais ils reçurent chacun une médaille, en fiche de consolation, avec une lettre de Downing Street en date du 2 février 1842, disant, après les compliments d'usage: "*Her Majesty has not been able to grant You an interview, but Her Majesty has signified Her Pleasure that You should each be presented with a Medal in token of the interest which Her Majesty takes in Your Welfare.*" (*Public Archives*, G. 112).

On trouve une mention succincte de cette visite au 3è volume des *Mélanges Religieux* (1901) et la correspondance officielle échangée à son sujet entre le Bureau des Colonies et les gouverneurs du Canada est des plus intéressantes; on y voit que les Micmacs avaient déjà pris la tempérance totale, qu'ils étaient exemplaires, industrieux, et qu'ils réclamaient instamment les bienfaits de l'instruction. Les délégués furent rapatriés tant bien que mal par voie de New-York, et si leur démarche n'eut pas tout le succès immédiat qu'ils en espéraient, elle eut du moins l'effet d'ouvrir les yeux du ministre sur la situation précaire des Micmacs, et finalement d'améliorer leurs conditions d'existence.

Cette médaille, gravée par B. Wyon, ne fut certainement pas frappée à la seule intention des délégués Micmacs; nous poursuivrons plus tard l'étude de son identité.

Châteauguay, Chrysler's Farm et Fort Détroit.

En 1848, la reine Victoria fit frapper des médailles militaires pour les survivants des troupes qui avaient pris part aux campagnes de 1793 à 1814, suivant la coutume inaugurée en Angleterre avec la médaille de la bataille de Waterloo.

Les guerriers indiens qui avaient combattu aux batailles de Châteauguay, de Chrysler's Farm et à la prise du Fort Détroit dans la guerre de 1812-14, eurent droit à ces trophées tout comme les autres survivants des troupes coloniales; mais comme il n'y avait que cent vingt Indiens présents à la bataille de Châteauguay, il va de soi que les survivants de ces guerriers étaient très rares en 1848, et comme il est probable que plusieurs de ceux qui y avaient droit ne les réclamèrent pas, soit par ignorance ou timidité, il n'est pas surprenant que celles de ces médailles qui portent un nom indien soient très rares; de fait Irwin (*loc. cit.*) mentionne que *quelques-unes* seulement furent réclamées par les Indiens. Ces médailles portent à l'avers le buste de la reine Victoria, ceint d'un diadème croisetté et fleurdelisé, avec la légende "VICTORIA REGINA", et en exergue la date "1848"; au revers on voit Britannia debout couronnant Wellington agenouillé devant elle, et le lion britannique couché à ses pieds, la légende "*To the British Army*", et en exergue les dates "1793-1814". Une agrafe d'argent est fixée sur un pivot soudé à cette médaille et porte une barre d'argent sur laquelle est inscrit le mot "CHATEAUGUAY"; elle se porte avec un ruban rouge bordé de bleu, et les combattants de Chrysler's Farm et de Fort Détroit ont reçu, pour agrafer à leurs médailles, des barres d'argent rappelant ces faits d'armes; le nom du récipiendaire et son grade sont poinçonnés sur la tranche de la médaille.

(*Voir Figure 21*).

Prince de Galles, 1860.

La visite du Prince de Galles (plus tard Edouard VII) au Canada en 1860, fournit l'occasion d'une distribution de médailles aux chefs Indiens accourus pour lui présenter leurs hommages, mais il ne fut pas frappé de pièces spéciales pour cet objet. On se servit des médailles de Victoria 1840, sur l'avers desquelles on grava dans la partie inférieure du champ, chaque côté du buste de la reine, les trois plumes d'autruche, emblême du Prince de Galles, et sa devise "ICH DIEN", ainsi que la date "1860".

(*Voir Figure 22*).

Ce voyage du prince héritier en Amérique avait été décidé en réponse à une adresse du parlement provincial du Canada, invitant la reine et la famille royale à visiter le pays à l'occasion du parachèvement du pont Victoria à Montréal; sur l'invitation du président Buchanan, le prince termina sa visite en passant par les Etats-Unis, où il voyagea sous le nom de Lord Renfrew, car le protocole voulait qu'il laissât de côté l'apparat royal en quittant les possessions britanniques.

Les tribus indiennes saisirent avec empressement cette occasion d'exprimer leur loyauté au fils de leur souveraine; ils se rendirent avec des cadeaux de *wampum* et autres objets indiens sur divers points de l'itinéraire suivi par le cortège royal, et ils reçurent des médailles dont les plus grandes, suivant l'expression de Robert Cellem dans son compte rendu "*Visit of His Royal Highness the Prince of Wales to the British North American Provinces*", "étaient destinées aux chefs et couvraient toute la paume de la main, tandis que d'autres plus petites avaient à peu près le diamètre d'une demi-couronne". C'est à cette occasion que le prince, frappé de l'intelligence du jeune délégué chargé de présenter l'adresse des Six Nations à Brantford, l'invita à faire ses études à l'université d'Oxford; c'était un indien Mohawk nommé Oronhyatekha, alors âgé de vingt ans, qui fut plus tard admis à la pratique de la médecine et prit une part très active au mouvement du secours mutuel dans le monde entier; il a été frappé une médaille en son honneur, et il possédait lui-même une intéressante collection indienne, dont la plus grande partie se trouve aujourd'hui à l'Université de Toronto.

Première insurrection des Métis.

Nous voici rendus à l'époque troublante de la première insurrection du Nord-Ouest causée en 1869 par la précipitation du gouvernement canadien à faire acte de possession des immenses territoires s'étendant du 49è degré de latitude à l'océan Arctique, et du lac Supérieur aux Montagnes Rocheuses. Ce domaine royal venait de lui être concédé par la Compagnie de la Baie d'Hudson, et William MacDougall en avait aussitôt été nommé gouverneur; mais en voyant arriver chez eux cet important fonctionnaire, accompagné d'une nuée d'arpenteurs chargés de cadastrer le territoire, les Métis crurent qu'on voulait les déposséder de leurs terres, et secrètement encouragés par quelques employés de la Compagnie de la Baie d'Hudson qui voyaient cette invasion d'un mauvais œil, ils se révoltèrent, s'emparèrent de Fort Garry (aujourd'hui Winnipeg), et proclamèrent leur indépendance avec John Bruce, colon écossais, comme président, et Louis Riel comme Secrétaire d'Etat. On sait de quelle courte durée fut ce soulèvement qui ne se termina cependant pas sans qu'on eut à regretter l'exécution de Thomas Scott après un semblant de procès conduit par Riel qui, entre temps, avait remplacé Bruce à la présidence.

Dans le même temps s'imposait la construction du chemin de fer du Pacifique Canadien mise comme condition de l'entrée de la Colombie Britannique dans la Confédération Canadienne en 1871, et instruit par l'expérience du soulèvement des Métis, le gouvernement ne voulut pas se hasarder à faire des arpentages à travers les territoires des tribus indiennes sans se concilier auparavant leur bon vouloir. Il nomma donc une commission chargée de passer à cet effet des traités avec les Indiens du Nord-Ouest, et comme la vanité des sauvages était toujours restée leur point faible, l'une des conditions de ces traités stipule que "chaque chef recevra un costume, un drapeau, et une médaille comme marque de distinction."

Traités N^{os} 1 et 2, 1871.

Seulement, la préparation d'une médaille appropriée demandant un certain temps, la commission fut assez embarrassée lorsqu'il s'agit de faire la première distribution; elle n'eut d'autre ressource que de faire venir de Londres un certain nombre de médailles d'une matrice qui avait été gravée par Wyon pour distribution de prix, portant à l'avers le buste de la reine orné d'un diadème croisetté et fleurdelisé, avec la légende: "VICTORIA REGINA", et au revers une guirlande de feuilles de chêne. En outre de cette médaille destinée aux chefs, il fut stipulé que chaque Indien, homme, femme ou enfant, recevrait une somme de trois dollars par année, à titre de compensation; ce n'était pas ruineux, mais Esaü avait bien vendu son droit d'aînesse pour un plat de lentilles!

(*Voir Figure 23*).

Cette médaille, mesurant 51 millimètres, fut distribuée aux signataires des traités N^{os} 1 et 2 conclus au cours de la première année des travaux de la commission, en août 1871, mais comme les chefs témoignèrent quelque désappointement de son exiguité, la commission résolut de les satisfaire sous ce rapport en confiant à un orfèvre de Montréal du nom de Hendry l'exécution de celle de l'année suivante, d'après un dessin fourni par le gouvernement d'Ottawa.

Traités projetés pour 1872.

Ce dessin comprenait la médaille de la Confédération frappée en 1867, représentant en avers le buste de la reine portant un voile, un diadème croisetté et fleurdelisé et un collier de perles, avec la légende: "VICTORIA D. G. BRITT. REG. F. D."; au revers Britannia assise avec un lion à ses genoux, recevant les hommages de quatre jeunes femmes représentant les quatre provinces qui étaient entrées dans la Confédération, et la légende: "JUVENTAS ET PATRIUS VIGOR, CANADA INSTAURATA 1867"; à cette pièce qui mesurait déjà 72 millimètres, le dessin ajoutait une bande de 11 millimètres de largeur, dont l'avers portait la légende: "DOMINION OF CANADA CHIEFS' MEDAL 1872", et le revers "INDIANS OF THE NORTH-WEST TERRITORIES".

(*Voir Figure 24*).

Hendry, n'ayant pas l'outillage nécessaire pour frapper des médailles de cette dimension, eut recours à la galvanoplastie, et remit au gouvernement vingt-cinq électrotypes d'un diamètre de 94 millimètres, et d'une épaisseur de 10, ayant toutes les apparences d'une médaille d'argent; mais il fallait jouir de la santé robuste d'un indien pour être en mesure de porter cette meule au cou. Les chefs reçurent cet objet avec une grande joie, mais ils ne tardèrent pas à constater que "tout ce qui brille n'est pas or", et lorsqu'ils s'aperçurent de quelle supercherie ils avaient été victimes, ils ne tardèrent pas à exprimer leur dédain pour ces fausses pièces, et à récriminer si bruyamment qu'on les leur échangea pour les pièces artistiques qui furent frappées l'année suivante.

Quelques chefs de moindre puissance avaient cependant, reçu tout simplement la médaille de la Confédération, plaquée en argent, mais sans encerclement. Telle fut celle donnée à Sitting Bull, fameux chef Sioux, qui était venu s'établir au Canada après ses démêlés avec ses troupes américaines; cette pièce est aujourd'hui dans ma collection, et l'on y voit la tache faite par l'acide nitrique lorsque son récipiendaire a voulu s'assurer si elle était en argent massif.

Traités de 1873 à 1877.

Les négociations n'aboutirent à aucun traité en 1872, de sorte que la médaille de Hendry portant cette date consacre une erreur historique; le traité N° 3 ne fut signé qu'en 1873 et les autres chaque année suivante jusqu'en 1877. Dans l'intervalle, la commission des traités s'était préparée, et le gouvernement canadien avait fait graver par le fameux artiste Wyon, de Londres, une splendide médaille de 76 millimètres, portant le buste de la reine, avec voile, diadème et collier, comme sur celle de la Confédération, et la légende: "VICTORIA REGINA"; le revers représente au premier plan un officier anglais et un chef indien se serrant la main auprès d'un campement indien; à l'arrière-plan la prairie et un soleil rayonnant à l'horizon. La légende est composée des mots "INDIAN TREATY No. ..." et la date "187.." laissant à indiquer, au poinçon, le numéro du traité et l'année de sa date.

(*Voir Figure 25*).

Sept traités ont donc été signés entre le gouvernement canadien et les tribus indiennes du Nord-Ouest au cours des années 1871 à 1877; dans les cinq derniers traités, le gouvernement porta *généreusement* à cinq dollars par tête l'indemnité accordée aux Indiens pour l'abandon de leurs territoires, et si les chefs furent mécontents des médailles des premiers traités, ils parurent entièrement satisfaits, et avec raison, de celles des derniers.

Duc et Duchesse de Cornwall et York, 1901.

Pour clore la série de ces médailles de provenance anglaise, il ne nous reste plus qu'à mentionner celle qui fut présentée par le duc et la duchesse de Cornwall et York (aujourd'hui Georges V et la reine Marie) aux chefs des tribus indiennes à l'occasion de la visite de leurs Altesses Royales au Canada en 1901.

Cette médaille fut faite à Toronto par la maison P. W. Ellis & Co., et mesure 65 millimètres; elle porte à l'avers les bustes accolés du duc en uniforme et de la duchesse avec diadème, en réduction, entourés de rinceaux de feuilles d'érable dans le périmètre de la médaille, et les inscriptions "THEIR ROYAL HIGHNESSES THE DUKE AND DUCHESS OF CORNWALL & YORK" dans le champ; le revers porte les armes royales, également en réduction, et l'inscription: "CALGARY, SEP. 28TH 1901" en exergue, et la légende: "PRESENTED TO HEAD CHIEFS IN COMMEMORATION OF ASSEMBLY OF INDIAN TRIBES", couvrant tout son périmètre. Elle a été frappée en argent et en bronze, et l'on y a soudé un petit anneau pour suspension.

(*Voir Figure 26*).

III.—Médailles espagnoles.

Ayant fait la revue des relations de la France et de l'Angleterre avec les Indiens de l'Amérique, nous allons revenir quelque peu en arrière, afin d'esquisser, à grands traits et dans le même ordre d'idées, l'action de l'Espagne qui fut la première puissance européenne à prendre contact avec les indigènes du Nouveau-Monde.

Les sources de renseignements que nous avons sur la numismatique hispano-indienne sont assez maigres, pour la bonne raison peut-être qu'à l'encontre des Français et des Anglais, les Espagnols ont employé les moyens coercitifs plutôt que la persuasion pour établir leur domination dans les Indes Occidentales; c'est ce qui explique le nombre restreint des médailles espagnoles que l'on a constaté avoir été présentées aux Indiens. Le principal ouvrage que l'on aît sur cette question est celui de Adolfo Herrera, intitulé: "*Médaillas de Proclamaciones y Juras, de los Reyes de Espana.*"

Lorsque Christophe Colomb eut révélé à la catholique Espagne l'existence d'un Nouveau-Monde, la première pensée de Ferdinand et d'Isabelle fut d'y faire pénétrer les lumières de la civilisation et de la foi; Ferdinand, surnommé le Catholique, faisait preuve d'un catholicisme militant qui lui avait fait établir l'Inquisition, et les luttes séculaires des rois d'Espagne contre les Maures l'avaient préparé a christianiser le Nouveau-Monde par la force en y mettant en pratique la maxime mahométane: "Crois ou meurs".

Mais pour convertir les infidèles, la force ne pouvait pas seule produire de bons résultats, et la prédication n'était pas suffisante; il fallait des symboles pour parler à l'imagination des Indiens, et les missionnaires ne tardèrent pas à suivre les premiers explorateurs en distribuant à profusion autour d'eux des objets de piété, médailles, images et même des livres.

Par malheur, les descriptions enthousiastes des richesses du Mexique et du Pérou, qui avaient été faites par les découvreurs de ces pays, allumèrent la cupidité des rois aussi bien que celle des aventuriers; ceux-ci se ruèrent avec une férocité inouie à la conquête de la toison d'or pour leur compte particulier, tandis que les souverains prélevaient la part léonine au profit de leur caisse continuellement mise à sec, comme un tonneau des Danaïdes, dans leurs guerres séculaires.

On ne tarda pas à battre monnaie au Nouveau-Monde; Herrera prétend même que Cortez a fait frapper des pièces à Mexico, sans cependant en établir la description avec certitude, mais on lit dans l'"*American Journal of Numismatics*", Vol. XVI, et dans le "*Catalogue Officiel de la Monnaie de Philadelphie*", que ces pièces auraient été frappées dès 1522, et que des édits pour l'établissement de Monnaies au Mexique et à Hispaniola furent publiés en 1528, 1530 et 1535, et quelques années plus tard à Lima, San-Luis-de-Potosi et à Santa-Fe-de-Bogota. L'imprimerie marchait de pair avec l'établissement de la Monnaie; Juan de Mendoza faisait monter une presse à Mexico en 1522, et Jean Pablos y publiait le premier livre imprimé en Amérique sous le titre de "L'Eschelle Céleste" (voir l'article que j'ai écrit sur les incunables américains dans le "*Canadian Magazine*" en juin 1911).

Si l'on était pressé de battre monnaie, on ne s'empressa pas cependant de consacrer par la frappe de médailles un évènement aussi important que la découverte d'un monde, ni la gloire des hardis navigateurs qui en avaient révélé l'existence; ce n'est qu'au moment de l'abdication de Charles-Quint en 1555, qu'on voit pour la première fois sur les pièces de monnaie des rois d'Espagne le titre "REX INDIARUM", et l'on sait quelle récompense Colomb reçut pour ses découvertes!

On se préoccupait encore moins des Indiens; le monde civilisé rougit encore de honte au souvenir des traitements barbares que Cortez, Pizarre et les autres conquérants espagnols, affolés par l'appât des richesses fabuleuses du Mexique et du Pérou, infligèrent à ces populations qui, cependant, avaient déjà atteint un haut degré de culture intellectuelle, afin de s'emparer de leur trésors. Aussi, les premières médailles frappées par les Espagnols à l'intention des peuples de ces pays paraissent-elles avoir été des médailles religieuses dont la plus ancienne porte la date de 1682.

Notre-Dame de Guadeloupe, 1682.

C'est une pièce en bronze, de forme elliptique, mesurant 45 × 38 millimètres, avec bélière et anneau de suspension, représentant à l'avers la Vierge debout sur un croissant dans les nuages, et entourée d'une gloire, avec la légende: "N. S. D. GVADALVPE DE MEXICO OR. PR. N. ROMA", et dans le champ l'année "16—82"; au revers, le buste auréolé de Saint-François d'Assise, en habit de moine, les mains croisées, levant les yeux au ciel, et la légende: "SAN FRANCESCO. O. P."

Une autre petite médaille de Sainte-Rose de Lima en avers et de Saint-Paul en revers a été trouvée sur le site du village indien de Scipioville, dans le comté de Cayuga, Etat de New York, et comme cette mission indienne, fondée en 1656, n'a duré que jusqu'en 1687, Betts attribue la date de cette pièce au plus tard à cette dernière année; elle pouvait cependant fort bien être de provenance française, car Sainte-Rose de Lima était très vénérée au Canada français, et le

Rev. W. M. Beauchamp a trouvé quantité d'autres médailles religieuses sur les anciens sites des villages indiens de l'Etat de New York où elles avaient dû être distribuées par les missionnaires jésuites.

Charles II d'Espagne étant décédé sans enfants en 1700, avait, par son testament, désigné comme son successeur Philippe d'Anjou, petit-fils de Louis XIV, dont le buste figure sur la médaille "FELICITAS DOMUS AUGUSTAE" que nous avons décrite comme étant la première médaille française distribuée aux Indiens. Cette succession détermina la "Guerre de la Succession d'Espagne" entreprise par Louis XIV pour assurer la possession de cette couronne à son petit-fils contre les autres prétendants, et elle se termina par le traité d'Utrecht qui consacrait, comme nous l'avons vu plus haut, la légitimité des droits de Philippe.

Monté sur le trône en 1701 sous le nom de Philippe V, il abdiqua en 1724 en faveur de son fils aîné Louis I qui mourut la même année, et Philippe reprit les rênes du pouvoir qu'il garda jusqu'à sa mort en 1746; son fils Ferdinand VI surnommé le Sage, lui succéda, mourut sans postérité en 1759, et transmit la couronne à son frère qui régna sous le nom de Charles III.

Médailles de Proclamation, 1701 à 1761.

Des médailles de proclamation furent frappées, tant en Espagne que dans le Nouveau-Monde, lors des avènements de ces divers souverains.

Mexico, Lima et Vera Cruz furent au nombre des villes qui proclamèrent ainsi leur allégéance à Philippe V; Cholula, Mexico, Panama, San-Felipe, Santa-Fe-de-Bogota, Vera-Cruz, le Yucatan et Zacatecas firent de même à l'avènement de Louis I, en 1724; Buenos-Ayres, Chihuahua, le Guatemala, la Havane, Mexico, Panama, Los-Angeles, Porto-Rico, Santa-Fe-de-Bogota, Santiaga-de-Cuba, Saint-Domingue, le Venezuela, Vera-Cruz, Zacatecas et nombre d'autres villes et possessions espagnoles au Nouveau-Monde voulurent manifester de la même manière leur loyauté à Ferdinand VI; et près de cinquante villes de l'Amérique espagnole célèbrent également l'avènement de Charles III qui fut proclamé dans ses possessions américaines en 1760 et 1761.

Nous ne reproduirons qu'une de ces nombreuses médailles à titre d'échantillon; c'est celle de la proclamation de Charles III à Mexico, en 1760, dont l'avers porte le buste drapé et cuirassé du roi décoré de l'Ordre de la Toison d'Or et entouré de la légende "CAROL III, ANTIQ ET NOV. HISPAN. REX MEXI. PROCL.", sous le buste le nom du graveur Madero; le revers représente les armes de la ville de Mexico se composant d'un pont à trois arches défendu par une tour centrale accostée de deux lions et surmontée d'un aigle posé sur un nopal, avec la devise "INSIGN. FIDELIT. ET PUBLIC. LAETITIAE. 1760"; elle est en argent, mesure 35 millimètres et est percée pour recevoir un anneau de suspension.

(*Voir Figure 27*).

Les archives d'Espagne sont assez silencieuses sur la distribution de ces pièces aux Indiens du Nouveau-Monde, mais il est plausible de croire que les caciques des Antilles, du Mexique, de la Floride et des autres possessions espagnoles reçurent quelques-unes de ces médailles de proclamation en marque d'amitié ou en reconnaissance de leur allégeance; celle de Mexico que nous venons de décrire tendrait à confirmer cette assertion par le fait qu'elle a été percée pour être suspendue au cou.

Dans l'intervalle, la puissance de l'Espagne ayant subit des échecs, elle en vint à chercher plus volontiers l'amitié et l'assistance des naturels; les gouverneurs tirèrent profit de la vanité des chefs, ici comme ailleurs, pour les attacher à leur cause en leur distribuant des présents à l'occasion d'alliances contractées avec eux, et l'on voit dans "*The American Numismatic Manual*", publié par M. W. Dickeson en 1859, que le Musée d'Etat de Floride possède une commission espagnole trouvée en la possession d'un chef indien tué sur le champ de bataille, lui donnant le titre de "Chef de la Médaille."

Carlos III, Florida, 1760.

La pièce à laquelle semble se rapporter cette commission faisait partie de la collection de J. J. Mickley, de Philadelphie, qui l'aurait reçue au comptoir pour une pièce de cinquante sous, et elle a fait plus tard partie de la collection de Charles I. Bushnell vendue aux enchères en 1882; elle est décrite comme suit: en avers le buste de Charles III, revêtu du manteau royal, avec la légende: CARLOS III, D. G. HISPAN REX, au revers une rose épanouie avec une feuille et un bouton sur sa tige, et la légende: "JUAN ESTEVAN DE PENA FLORIDA 1760".

(*Voir Figure 28*).

Les commentateurs de Betts prétendent cependant dans leur *Corrigenda* qu'ici le mot "Florida" indique un nom de personne et non pas celui du pays, mais il aurait peut-être été plus vraisemblable de dire qu'il se rapporte à la fleur représentée sur cette médaille; d'autre part Fonrobert exprime l'avis, dans son ouvrage "*Sammlung Uberseeische Munzen Und Medaillen*", que c'est probablement une pièce de proclamation.

La pièce de Mickley est percée dans sa partie supérieure pour être suspendue au cou, mais M. Georges W. Parent, de Montréal, en possède un exemplaire parfait, qui parait être celui provenant de la vente Holland; ce sont les deux seuls qui soient connus, et quelles que soient les opinions des numismates au sujet de cette pièce, les circonstances qui s'y rapportent permettent de la placer parmi les médailles hispano-indiennes.

Carlos de Borbon, Mexico, 1780.

La naissance des princes de la maison royale était aussi, en Espagne comme dans les autres pays d'Europe, (v.g. médaille FELICITAS DOMUS AUGUSTAE), l'occasion de réjouissances publiques qui se traduisaient par la frappe d'une médaille. La Bibliothèque Nationale de Paris a, dans sa collection, et je possède également, une médaille frappée à Mexico en 1780 à l'occasion de la naissance de Charles de Bourbon, fils du prince des Asturies et petit-fils de Charles III, portant en avers le buste du roi faisant face à ceux du prince et de la princesse des Asturies, et la légende: "CARLOS III, REY DE ESPANA Y DE LAS INDIAS; CARLOS Y LUISA DE BORBON PRINCIPES DE ASTURIAS", et au revers une reine indienne couronnée de plumes, avec un arc et un carquois en sautoir, s'agenouillant pour recevoir un enfant des mains de l'Espagne, casquée et revêtue d'une robe ornée de lions et de châteaux crénelés, et la légende: "CARLOS DE BORBON. NACIO EN EL PARDO EN 5 DE MARZO DEL ANO DE 1780"; en exergue les mots: "GRABADA EN MEXICO POR GERON ANTONIO GIL".

(*Voir Figure 29*).

Cette pièce nous fixe donc sur l'endroit et la date de sa production ainsi que sur le nom de son auteur; celle de la Bibliothèque Nationale est en cuivre, et la mienne en bronze argenté, porte une bélière et mesure 52 millimètres. Il est tout probable qu'il en fut frappé des exemplaires en argent pour être offerts aux caciques ainsi qu'aux principaux dignitaires des colonies espagnoles circonvoisines, à moins qu'on ne se soit contenté, par économie, de les leur en offrir en bronze argenté, comme on a vu que Georges IV offrait des médailles "d'or" en argent doré.

Le prince dont la naissance est ainsi célébrée semble n'avoir vécu que peu de temps, puisque son père, fils de Charles III et prince des Asturies, qui régna plus tard sous le nom de Charles IV, eut pour successeur Ferdinand VII, un autre de ses fils né quatre ans après celui qui nous occupe, et proclamé héritier de la couronne en 1790. Comme Ferdinand ne laissa pas d'héritier mâle, le trône échut à sa fille Isabelle qui fut proclamée reine en 1833, mais elle eut à disputer son titre au Prétendant Don Carlos, son oncle, né en 1788, qui n'avait pu recevoir au baptême ce nom de Charles que parce que son frère du même nom, à la naissance de qui cette médaille fut frappée en 1780, était alors décédé. (Cf. Betts, *loc. cit.*)

Carlos III, Por Merito.

Enfin, la *Société Historique du Wisconsin* possède une médaille hispano-indienne découverte à la Prairie du Chien en 1864, et dont voici la description: en avers le buste du roi d'Espagne, avec la légende: "CARLOS III, REY D'ESPANA E DE LAS INDIAS"; au revers une couronne de cactus attachée avec des rubans et entourant l'inscription "POR MERITO". La légende et l'inscription de cette pièce sont très effacées, comme on peut en juger par la photographie que j'en ai obtenue; son attribution est également loin d'être clairement définie, car les mots "POR MERITO" constituent une distinction honorifique tout aussi applicable à des collégiens qu'à des chefs indiens, et vers le même temps, on trouve une médaille gravée par Gil pour l'Académie de Mexico, portant en avers le buste de Charles III, avec une légende analogue, et au revers l'inscription "AL MERITO" dans une couronne de laurier; mais outre l'opinion rapportée ci-dessous, l'apparence seule de la médaille "POR MERITO" justifierait son classement au nombre de celles décernées aux Indiens.

(*Voir Figure 30*).

Le professeur J. D. Butler exprime l'avis, dans une étude sur les "*Souvenirs Historiques du Nord-Ouest*", publiée au Vol. IX des "*Collections*" de la Société Historique du Wisconsin, que cette médaille aurait été présentée par le gouverneur espagnol Francesco Cruzat à Huisconsin, chef de la tribu des Renards, le 20 novembre 1781; son diamètre est de 57 millimètres, elle est en argent, percée pour suspension, et dénote l'usure d'une médaille qui aurait été longtemps portée. Nous n'en connaissons pas d'autre exemplaire que celui de la Société Historique du Wisconsin.

Après cette date, on ne trouve guère de traces de médailles espagnoles pouvant avoir quelque rapport avec les Indiens. En 1808, le Mexique levait l'étendard de la révolte contre l'Espagne, et après de longues années de luttes, il proclamait son indépendance en couronnant Iturbide empereur du Mexique en 1822. Dans l'intervalle, les Etats-Unis avaient acquis la Floride aux termes d'un traité signé avec l'Espagne en 1819, comme ils avaient acheté la Louisiane de Napoléon en 1803.

En dehors du Canada, l'Amérique Septentrionale a donc rompu depuis un siècle presque tous les liens qui la mettaient sous la dépendance des pouvoirs européens, et dès l'année 1823, l'énonciation de la "Doctrine de Monroe", dont le but immédiat était d'empêcher toute tentative de la part de la "Sainte Alliance" d'aider le roi d'Espagne à reconquérir ses anciennes colonies d'Amérique, fermait la porte à toute nouvelle domination étrangère sur ce continent.

Ainsi donc, la jeune République américaine avait à peine coiffé le bonnet phrygien depuis un demi-siècle, qu'elle se sentait déjà assez forte pour lancer à l'Ancien Monde comme un défi la devise chère à son peuple: "L'Amérique aux Américains". Il n'entre pas dans le cadre de cette étude d'examiner les causes qui lui avaient déjà fait prendre autant d'empire dans les affaires du Nouveau-Monde, mais la description des médailles qu'elle a frappées à l'intention des tribus indiennes de son territoire va nous fournir l'occasion de rappeler quelques-uns des évènements qui l'ont conduite à prendre si rapidement sa place au milieu des nations.

IV.—Médailles américaines.

A peine les treize colonies révoltées contre l'autorité de la Grande-Bretagne, à la suite des évènements que nous avons rappelés plus haut, eurent-elles proclamé leur indépendance, qu'elles songèrent à se ménager des alliances pour conduire à bonne fin cette lutte audacieuse.

Déjà, au Congrès de 1774, il avait été décidé d'adresser une lettre en français aux habitants de la Province de Québec, les invitant à faire cause commune avec les révoltés, ainsi qu'à envoyer des délégués au congrès de Philadelphie l'année suivante; cette lettre fut distribuée dans les campagnes du Canada sous forme de pamphlet et le 24 janvier 1776, une proclamation contenant les mêmes appels fut imprimée en français à Philadelphie et affichée aux portes des églises du Bas-Canada. Les Canadiens firent si peu de cas de ces imprimés que très peu d'entre eux sont parvenus jusqu'à nous; quatre ou cinq exemplaires du pamphlet sont connus, et je crois être le seul à posséder un exemplaire de la proclamation affichée aux portes des églises.

L'appel du congrès n'ayant pas été écouté, Franklin, Chase et Carroll vinrent tenter, à la suite de l'invasion de Montgomery, de soulever les Canadiens sur place et ils amenèrent même avec eux un imprimeur français de Philadelphie du nom de Fleury Mesplet qu'ils installèrent dans le soubassement du Château de Ramezay, à Montréal, pour imprimer et répandre leurs proclamations dans tout le pays, mais sans obtenir plus de succès qu'ils n'en avaient obtenu par l'appel du congrès en 1774. Les Canadiens-français se rappelaient en effet que c'étaient les mêmes hommes qui avaient dénoncé si violemment l'"Acte de Québec" aux Etats-Unis l'année précédente, ils se défiaient de cette amitié soudaine à leur égard, accompagnée de paroles si mielleuses, et les quelques Canadiens-français qui se laissèrent séduire par les phrases sonores du Congrès furent désignés malicieusement par leurs compatriotes loyaux sous le nom de "Congréganistes" (Cf. DeCelles, *Histoire des Etats-Unis*).

Les révoltés ne furent guère plus heureux avec les tribus indiennes; depuis que Pontiac avait fait sa paix avec l'Angleterre, la hache de guerre avait été enterrée profondément, les tribus avaient accepté loyalement la souveraineté anglaise, et dans cette révolte dont elles pouvaient difficilement saisir la raison, elles prirent plus volontiers parti pour l'autorité constituée du pays.

Il restait à la jeune république l'espoir d'entraîner les pays européens, ennemis séculaires de l'Angleterre, à prendre fait et cause pour elle, et c'est dans ce but que Franklin se rendit à la cour de Versailles, où sa simplicité de quaker et son habileté de diplomate lui conquirent de nombreuses sympathies; mais, bien qu'à l'origine des hostilités la France eût laissé partir des soldats et des munitions à destination des Etats-Unis, ce ne fut qu'en 1778 qu'elle reconnut ouvertement leur indépendance et qu'elle permit à La Fayette, Rochambeau, D'Estaing, et autres officiers de marque, de mettre leurs épées au service de Washington, en même temps qu'elle s'employait à faire entrer l'Espagne et la Hollande dans le même mouvement. La diplomatie de Franklin avait donc fini par trouver meilleur accueil au milieu des cours d'Europe que dans les campagnes du Canada.

Dès que les chefs des tribus sauvages qui avaient gardé le culte de la France au fond du cœur, apprirent ce retour offensif de leurs anciens frères d'armes sur la terre d'Amérique, ils se rendirent à Philadelphie, puis à bord du vaisseau amiral "pour s'assurer par eux-mêmes", suivant les termes de la *Dépêche* de l'amiral D'Estaing au comte de Vergennes qu'on trouve consignée aux *Archives de la Marine* "si c'était bien réellement des Français, pour demander à voir le pavillon blanc dont l'aspect les fait toujours danser, à entendre la messe dont ils étaient privés depuis dix-sept ans, à recevoir l'accolade du Révérend Père Récollet qui est notre aumônier, sans parler de quelques fusils, de la poudre, des balles, et de l'eau-de-vie dont ils ne se sont occupés qu'avec modération, mais qu'ils ont acceptée avec plaisir". Et Doniol ajoute dans son *Histoire de la Participation de la France à l'Indépendance des Etats-Unis:* "c'étaient d'anciens amis de la France. L'un d'eux en parlait encore la langue, et portait au cou une médaille donnée par M. de Vaudreuil; la sœur de sa mère avait été la femme de Bougainville, et il trouvait un cousin sur l'escadre."

L'échec des négotiations américaines auprès des tribus indiennes n'avait donc pas été général, et si la plus grande partie d'entre elles restèrent fidèles à l'Angleterre, quelques-unes prirent fait et cause pour les Etats-Unis; rendons-leur cette justice que leur participation aux combats ne fut cependant pas souillée des actes de barbarie qui soulevèrent les protestations indignées de Pitt à la Chambre des Communes contre les usages féroces des tribus alliées de l'Angleterre.

On a vu précédemment que les Anglais avaient distribué force médailles pour s'assurer l'alliance des Indiens, mais les Américains ne disposaient pas des mêmes moyens de persuasion, car ils avaient à s'occuper de beaucoup d'autres soins que de faire de la numismatique à l'origine de cette guerre, dans laquelle ils s'étaient engagés un peu en aveugles et sans préparation suffisante.

Happy while United, 1780.

Aussi, la première médaille qui semble avoir été frappée par la nouvelle république à l'intention des Indiens porte-t-elle la date de 1780, et elle indique la préoccupation d'entraîner l'enfant des bois à se joindre aux révoltés, car elle représente à l'avers Bellone armée, foulant aux pieds un tyran dont la couronne est tombée, et la légende: "REBELLION TO TYRANTS IS OBEDIENCE TO GOD", avec l'inscription "VIRGINIA" sur une banderolle dans la partie supérieure du champ; le revers reproduit la scène de l'officier et de l'indien sur la médaille "HAPPY WHILE UNITED", avec la même légende, mais avec ces différences que la situation des personnages et de la mer est à l'inverse de celle-ci, et qu'elle porte la date "1780" en exergue; l'anneau est aussi formé d'un calumet et d'un aile d'oie sauvage, elle mesure 73 millimètres, et les exemplaires connus jusqu'à présent sont en cuivre ou en étain.

Avec l'aide effective de la France et la "neutralité armée" des autres puissances européennes liguées dans un traité signé en 1780, la République américaine ne tarda pas à assurer le succès de ses armes; malgré la trahison d'Arnold et les succès partiels de Clinton et Cornwallis, celui-ci capitule enfin à Yorktown le 19 octobre 1781 devant les forces réunies de Washington, Rochambeau, et de Grasse; l'Angleterre, qui se voyait isolée des autres nations, finit par s'apercevoir qu'elle n'avait rien à gagner et tout à perdre dans cette lutte contre ses propres enfants supportés par toute l'Europe, et elle en vint à la conclusion de mettre à profit la remarque faite par Catherine de Russie à son ambassadeur: "qu'il n'en tenait qu'à elle de rétablir immédiatement la paix en renonçant à ses colonies." Dès 1782, on jeta les bases d'un traité de paix qui fut définitivement signé à Versailles le 4 septembre 1783, reconnaissant l'entrée des Etats-Unis au rang des nations.

A l'exemple de Cincinnatus retournant à sa charrue après avoir sauvé la patrie, Washington se retira paisiblement après la guerre sur ses terres de Mount Vernon, mais on vint bientôt l'arracher à cette solitude pour diriger de ses conseils l'organisation politique du pays, et finalement pour le porter au pinacle de l'honneur en l'élisant premier président de la nouvelle république en 1789.

Parmi les détails de l'organisation du nouvel état de choses, on n'eut garde d'oublier l'élément important des Indiens, et le Congrès nomma une commission chargée de traiter avec eux. Suivant en cela l'exemple de la France et de l'Angleterre qui s'étaient pendant longtemps disputé l'allégéance des tribus en se faisant remettre les médailles ennemies pour les remplacer par les leurs, le député Kean, de la Caroline du Sud, faisait la proposition suivante à la séance du Congrès tenue le 20 avril 1786: "Que le Bureau du Trésor constate le nombre et la valeur des médailles reçues des Indiens par les commissaires nommés pour traiter avec eux, qu'il en fasse frapper un nombre égal en argent, aux armes des Etats-Unis, et qu'il en fasse la remise aux chefs de qui elles ont été reçues."

Cette résolution ne fut cependant mise à exécution que longtemps après, et Washington crut devoir prendre l'initiative en faisant graver, sous sa présidence, de grandes médailles d'argent qu'il fit offrir aux principaux chefs indiens, ainsi qu'on le constate par une lettre du général Knox, Secrétaire de la Guerre, à la tribu des Choctaws, en date du 17 février 1792, dans laquelle il dit: "Frères, votre père, le général Washington vous envoie deux grandes médailles d'argent; vous désignerez les deux Grands Chefs qui devront recevoir ces marques de distinction".

Le dessin de ces pièces est attribué au Dr. Rittenhouse, premier directeur de l'Hôtel de la Monnaie à Philadelphie, de 1792 à 1795; et la gravure en fut confiée à J. Rominic, de Boston, qui y poinçonna ses initiales "J. R."; nous en trouvons la description et la reproduction dans le splendide ouvrage de Loubat: "*The Medallic History of the United States of America 1776-1876*", avec des notes intéressantes relatives à celle qui fut offerte par Washington à Sagoyawatha, mieux connu sous le nom de "*Red Jacket*", célèbre orateur et chef Seneca, à l'occasion de sa visite à Philadelphie en mars et avril 1792.

Washington, 1792.

L'avers représente au premier plan le général Washington, debout, en uniforme, et tête nue, présentant le calumet de la paix à un indien qui le fume après avoir laissé tomber son tomahawk; l'indien a la tête ornée de plumes, porte une médaille au cou, des bracelets, et se tient debout sous un pin; à l'arrière-plan un colon laboure la prairie avec deux bœufs, et l'on voit au loin sa maison et des montagnes; en exergue: "GEORGE WASHINGTON, PRESIDENT, 1792." Le revers représente les armes des Etats-Unis: l'aigle aux ailes déployées tenant dans son bec une banderolle portant la devise "E PLURIBUS UNUM"; dans ses serres une branche d'olivier et un faisceau de treize flèches, et sur la poitrine l'écusson des Etats-Unis, au-dessus de sa tête treize étoiles et une gloire éclatant d'un nuage qui s'étend d'une aile à l'autre. Cette médaille est elliptique, mesure cinq pouces et trois quarts par quatre, outre son anneau de suspension, et porte les initiales du graveur marqués au poinçon.

(*Voir Figure 31*).

On sait que plusieurs médailles semblables ont été présentées à divers chefs de tribus de 1792 à 1795, il paraîtrait même, que leur émission remonte à la première année de la présidence de Washington, en 1789, celle-ci représentant Columbia offrant le calumet à un indien qui laisse tomber sa hache, et comme elles sont gravées, il était facile d'en copier d'autres et de les mettre en circulation comme étant des originaux. En 1866, la médaille originale de Red Jacket appartenait au général Ely S. Parker, l'un des grands sachems de la confédération des Six Nations, et le "*Harper's Magazine*" publiait à son sujet un article où il était dit que le brave Red Jacket, ayant souvent la gorge sèche, allait mettre sa médaille au "clou" pour se procurer de l'eau-de-feu; les graveurs profitaient alors du séjour de ce bijou chez "ma tante" pour en faire des copies qu'ils vendaient ensuite à prix d'or comme originaux.

Médailles des Saisons, 1796.

W. S. Baker, auteur d'une étude très recherchée sur les médailles de Washington, "*Medallic Portraits of Washington*", place au nombre des médailles indiennes les trois pièces connues sous le nom de "Médailles des Saisons" qui auraient été frappées en 1796, pendant le second terme de présidence de Washington, et dont les dessins sont de Kuchler. Les avers représentent des scènes rurales qui les font respectivement désigner sous le nom de "Médaille du Berger," "Médaille du Cultivateur" et "Médaille de la Famille"; la première représente au premier plan un berger et divers animaux de ferme, au second plan des collines, des arbres et une maison dont la porte est ouverte, laissant voir des personnes à l'intérieur; la seconde montre un semeur de grains au premier plan et un laboureur et une maison de ferme au second; la troisième représente au premier plan une fileuse et au second une tisserande, à gauche un enfant surveillant un bébé au berceau, et à droite un foyer de cheminée; chacune de ces médailles porte en exergue les lettres "U.S.A."; le revers est le même pour toutes et porte les mots "SECOND PRESIDENCY OF GEO. WASHINGTON, MDCCXCVI" en cinq lignes parallèles entourées d'une guirlande de feuilles de chêne et d'olivier réunies par un nœud de ruban.

Baker dit, au sujet de ces médailles: "They were unquestionably used as Indian Peace Medals, the designs referring to different phases of civilized life being intended to attract attention to its comforts and advantages and to induce them to make a change in their habits of living". Il est permis cependant de mettre cette destination en doute, car Washington connaissait assez ses alliés indigènes pour savoir qu'ils seraient peu sensibles aux charmes d'une médaille qui ne porterait pas quelque attribut qui leur fût propre, et je ne sache pas qu'aucune de ces médailles ait été effectivement trouvée chez les tribus indiennes.

Deux autres pièces sont indiquées par Baker comme médailles indiennes de Washington. La première n'a que l'avers représentant le buste de Washington sur un piédestal entre Minerve et un Indien, et la légende "GEN. GEO. WASHINGTON, PRESI. OF THE UNIT. STA."; en exergue "BORN FEB^Y 1732 DIED DEC^R 1799." Baker suppose que cet avers était destiné à servir à une autre médaille de paix pour les Indiens, mais que le revers n'en ayant jamais été fait, on y ajouta les dates de la naissance et de la mort du président peu de temps après son décès, et l'on en frappa quelques impressions sur lamelles. L'autre pièce consiste en un petit médaillon du président que possédait l'auteur. La classification de ces deux pièces parmi les médailles indiennes est donc plus qu'arbitraire, et nous ne croyons pas devoir leur donner place ici.

Adams, 1797, à Taylor, 1849.

Washington ayant refusé l'honneur d'un troisième terme à la présidence des Etats-Unis, John Adams lui succéda le 4 mars 1797, et l'on fit frapper pendant son terme d'office une médaille portant à l'avers son buste avec son nom, son titre et l'année de son accession en légende, et au revers deux mains entrelacées, l'une ayant au bras une machette d'uniforme militaire, couverte de trois galons d'or avec boutons, et l'autre ayant le bras nu, sous un tomahawk et un calumet en sautoir, et les mots "PEACE AND FRIENDSHIP", distribués du haut en bas du champ.

(*Voir Figure 32*).

Quelques numismates prétendent que cette médaille d'Adams est posthume, ou que la médaille originaire a été simplement gravée au lieu d'être frappée, comme la grande médaille de Washington, en se basant sur le fait que les "Registres" de la Monnaie mentionnent que les Médailles de Paix du président Jefferson sont les premières du type "PEACE AND FRIENDSHIP", mais Loubat (*loc. cit.*) mentionne la médaille d'Adams comme étant la première de cette série de médailles présidentielles qui ont été distribuées aux chefs indiens, et Satterlee, dans son ouvrage "*An Arrangement of Medals and Tokens struck in honor of the Presidents of the United States*", en fait la même attribution, et ajoute que les matrices n'en ont jamais été trempées, de sorte que cette pièce n'a été frappée qu'en métal mou. "Elle appartient, dit-il, à la série des "Médailles de Paix" autorisées par le Congrès et frappées à la Monnaie des Etats-Unis pour être distribuées aux tribus indiennes. A de rares exceptions, les médailles de chaque administration ont été faites de trois grandeurs différentes, et une partie en a été frappée en argent."

Ce type de médailles destinées aux chefs indiens s'est continué pour les successeurs d'Adams qui ont occupé le siège présidentiel aux époques suivantes: Thomas Jefferson de 1801 à 1809, James Madison 1809 à 1817, James Monroe 1817 à 1825, John Quincy Adams 1825 à 1829, Andrew Jackson 1829 à 1837, Martin Van Buren 1837 à 1841, John Tyler 1841 à 1845, James K. Polk 1845 à 1849, et Zachary Taylor 1849-1850. Il y eut cependant une légère modification pour la médaille de Jefferson (1801-1809), sur laquelle le bras nu, qui représentait l'indien, est revêtu d'une manchette décorée de l'aigle américain entre deux galons d'or, et la série fut interrompue quant au président W. H. Harrison qui mourut un mois après être entré en charge en 1841.

On a cependant reconstitué la série complète des présidents en frappant une médaille du type ci-dessus décrit pour Washington et une autre avec un revers différent pour W. H. Harrison, suivant la suggestion faite par R. M. Patterson, directeur de la Monnaie, dans une lettre au Secrétaire de la Guerre, en date du 2 novembre 1841. Cette lettre nous donne en même temps les noms des graveurs des diverses médailles des présidents, dont les premières sont dues à Reich, et les dernières à Fürst, et elle suggère un procédé mécanique moins dispendieux pour les médailles futures, soit une appropriation de deux mille cinq cents dollars ($2,500.00) pour la production de soixante du grand module, et de deux cents des deux autres, toutes en argent, pour les chefs indiens. Cette médaille posthume de Washington a le revers "PEACE AND FRIENDSHIP", mais celle de Harrison a pour revers les dates de son accession et de sa mort entourées d'une couronne de feuilles de laurier.

Le revers de ces pièces ayant servi indistinctement aux médailles offertes aux Indiens ainsi qu'aux autres médailles présidentielles, le Catalogue Officiel de la Monnaie nous déclare qu'il est impossible d'établir si une médaille présentant ce type est indienne ou non. Mais les directeurs de la Monnaie ayant sagement décidé de ne pas refrapper ces pièces en argent, on a l'assurance que les exemplaires qu'on trouve en ce métal sont des originaux, et ils conservent une bonne valeur numismatique, soit comme médailles indiennes ou comme médailles présidentielles.

Fillmore, 1850, à Buchanan, 1861.

Zachary Taylor étant mort en 1850, Millard Fillmore qui était vice-président remplit la vacance pendant le reste du terme (1850 à 1853), et adopta le dessin d'une nouvelle médaille dont l'avers est du même type que les précédentes, tandis que le revers représente au premier plan un colon et un chef indien debout devant un drapeau américain; le premier, appuyé au manchon d'une charrue, explique à celui-ci les bienfaits de la civilisation, le tomahawk est remplacé par la hache du bûcheron, et l'arrière-plan représente une scène rurale; en chef la légende "LABOR VIRTUS HONOR", en exergue le nom du graveur J. Willson. Ce dessin servit également aux médailles des deux successeurs de Fillmore; Franklin Pearce de 1853 à 1857, et James Buchanan de 1857 à 1861.

(*Voir Figure 33*).

Lincoln, 1861.

La médaille d'Abraham Lincoln qui fut élu président en 1861, met en opposition deux scènes représentant la civilisation et la barbarie indienne. Dans un médaillon central, on voit un indien civilisé qui laboure, tandis que ses enfants jouent à la balle, à l'arrière-plan sa maison sur une colline, et au loin une église, des bateaux sur une rivière et des montagnes; dans un cercle qui entoure ce médaillon, un indien se préparant à scalper un cadavre qu'il a saisi par les cheveux, le buste d'une jeune indienne, un carquois rempli de flèches, un arc et un calumet entrecroisés. Le dessin et l'exécution de cette médaille sont dus à S. Ellis qui l'a fait breveter, ainsi que l'atteste une étampe sous le buste de Lincoln; il aurait pu se dispenser de le faire, car l'impression lugubre qui se dégage de cette scène n'est pas de nature à porter d'autres artistes à l'imiter.

(*Voir Figure 34*).

Johnson, 1865.

A la mort de Lincoln assassiné le 14 avril 1865, Andrew Johnson le remplaça à la présidence pour le reste de son second terme d'office qui venait à peine de commencer. La médaille du nouveau président fut faite par Paquet et s'écarte aussi des types en usage auparavant; elle représente Columbia tenant au bras gauche un drapeau des Etats-Unis, et donnant la main droite à un chef indien en face d'un mausolée, surmonté d'un buste de Washington, et portant l'inscription "PEACE" dans une couronne de laurier; en arrière de Columbia divers attributs de la civilisation, et en arrière de l'indien des attributs de la vie sauvage.

(*Voir Figure 35*).

Grant, 1869.

Toutes les médailles présidentielles-indiennes décrites jusqu'ici portent à l'avers le buste du président, son titre et l'année de la frappe, ainsi qu'on l'a dit ci-dessus; mais avec Ulysses S. Grant qui remplit la charge de 1869 à 1877, une médaille d'un type tout différent fut gravée par Paquet, bien qu'elle ne porte pas sa signature. Elle représente à l'avers le buste de Grant, et au-dessous un calumet renversé et une branche d'olivier, en légende les mots: "UNITED STATES OF AMERICA, LIBERTY, JUSTICE AND EQUALITY", et sur une seconde ligne la devise: "LET US HAVE PEACE", le tout entouré d'une bordure de feuilles de laurier, coupée par quatre écussons des Etats-Unis. Sur le revers un globe terrestre, montrant l'hémisphère occidental, appuyé sur des instruments d'agriculture, surmonté d'une bible ouverte, et entouré de rayons de gloire, avec la légende: "ON EARTH PEACE GOOD WILL TOWARDS MEN", et sur une ligne intérieure "1871"; le tout entouré d'une bordure de trente-six étoiles.

(*Voir Figure 36*).

Hayes, 1877, à Harrison, 1893.

Pour les cinq présidents qui suivent Grant (Rutherford B. Hayes 1877 à 1881, James A. Garfield 1881, Chester A. Arthur qui remplaça Garfield assassiné par Guiteau en 1881 et remplit la charge jusqu'en 1885, Grover Cleveland (1er terme) de 1885 à 1889, et Benjamin Harrison de 1889 à 1893), la forme des médailles n'est plus ronde, mais elliptique; l'avers représente simplement le buste du président avec son nom et son titre, et le revers montre au premier plan un colon debout, une hache à la main, indiquant à un chef indien debout sous un arbre les bienfaits de la civilisation; on voit au second plan la maison du colon, sa femme et ses enfants et un laboureur; en chef, l'année de la présidence dans un rayon de gloire éclatant à travers le mot "PEACE"; en exergue un tomahawk et un calumet en sautoir entrelacés par une couronne de feuilles d'olivier.

(*Voir Figure 37*).

Seconde Médaille de B. Harrison.

Benjamin Harrison ne se contenta pas cependant de cette première pièce; il en fit frapper une autre dont l'avers reproduit son buste avec son nom et son titre, et dont le revers se compose de deux médaillons, l'un représentant un indien debout devant son wigwam et un soleil couchant, et l'autre un colon avec son cheval de travail et divers instruments d'agriculture, sa maisonnette, une école et autres accessoires; au dessus de ces médaillons des branches et une couronne de feuilles d'olivier entrelaçant un calumet et un tomahawk en sautoir, traversés par l'inscription "PEACE"; au-dessous une charrue, des branches d'olivier, et sur une banderolle le mot "PROGRESS".

(*Voir Figure 38*).

Ici s'arrête la série des médailles présidentielles-indiennes. Grover Cleveland qui remplaça Harrison de 1893 à 1897, ne fit pas frapper de médaille indienne pour ce second terme; de même William McKinley (1897-1901), Theodore Roosevelt (1901-1909), William H. Taft (1909-1913), semblent avoir jugé les tribus indiennes quantité trop négligeable pour continuer de leur faire la cour en frappant des médailles spéciales à leur intention, et dès lors, les médailles officielles des présidents ne contiennent plus au revers que la date de leur accession, entourée d'une couronne de feuilles de laurier. Même le président actuel Woodrow Wilson n'a pas encore donné son consentement, après deux ans d'exercice de sa charge, à la frappe d'une médaille présidentielle à son effigie.

La distribution officielle de médailles aux chefs indiens par les présidents des Etats-Unis n'a donc duré qu'un siècle, et la plupart ont été frappées en trois modules: 76, 63 et 51 millimètres. La série en est peut -être monotone, car elle ne rappelle pas d'autres évènements historiques que l'accession des présidents et l'expression des sentiments d'amitié envers les tribus indiennes à l'occasion de ces événements. Aussi, n'éveillent-elles que peu d'intérêt ailleurs que chez les numismates, et à mesure que le nombre et l'importance des Indiens diminuent sous la poussée irrésistible de la civilisation et du progrès, l'attention qu'on leur portait autrefois tourne à l'indifférence; il ne restera bientôt plus que ces pièces de métal pour attester silencieusement le rôle que jouèrent dans les siècles derniers ceux qui ont tenu pendant longtemps entre leurs mains la balance du pouvoir en ce pays.

V.—Médailles semi-indiennes.

Il ne faudrait pas croire que cette étude embrasse toutes les médailles relatives aux Indiens; le cadre en serait trop vaste. Il existe, en effet, diverses pièces qui ont été frappées par des corporations privées pour être présentées aux Indiens, d'autres qui ont été destinées aux blancs aussi bien qu'aux Peaux-Rouges, d'autres qui n'ont qu'un rapport plus ou moins éloigné avec ces indigènes, et d'autres enfin, dont l'intérêt indien se résume à la représentation de cette race comme symbole ou attribut. Bien que plusieurs de ces pièces soient très intéressantes et parfois fort recherchées par les collectionneurs, elles ne peuvent être mises au nombre de celles dont la présente étude a pour objet de faire la revue; nous nous contenterons donc d'en signaler quelques-unes parmi les plus connues.

Compagnie de la Baie d'Hudson.

Comme exemples de médailles offertes par des corporations privées, signalons celles de la Compagnie de la Baie d'Hudson formée sous le règne de Charles II pour la traite des pelleteries dans l'Amérique du Nord, et dont les pièces si recherchées des collectionneurs ont été gravées par le médailliste flamand Kulcher, à la fin du XVIIIè siècle. On pourrait les prendre en effet pour des pièces officielles, car deux de leurs variétés portent à l'avers le buste de Georges III, avec la légende ordinaire, tandis qu'une autre représente Britannia victorieuse, avec la légende: "MARI VICTRIX, TERRAQUE INVICTA", et en exergue: "AVITUM TRANSCENDIT HONOREM, MDCCXCIII"; mais toutes portent au revers les armes bien connues de cette compagnie, et sa devise: "PRO PELLE CUTEM". (*Voir Figure 39*).

Compagnie du Nord-Ouest.

Ces médailles semblent avoir été frappées par la compagnie pour ses membres importants, comme faisait quelques années plus tard sa rivale la Compagnie du Nord-Ouest qui présentait à ses "bourgeois", au moment de leur admission dans la "Coterie du Castor" (nom sous lequel le "Beaver Club" était désigné en français), une médaille d'or gravée au nom du nouveau membre, dont une condition rigoureuse d'admission était d'avoir fait le voyage du Nord-Ouest. Il est fort probable que la Compagnie de la Baie d'Hudson offrait aussi ses médailles en argent aux chefs indiens avec qui elle entrait en relation d'affaires ou dont elle voulait s'assurer le bon vouloir, de même qu'Astor et Choteau faisaient pour leurs compagnies respectives dans les Etats de l'Ouest. (Cf. "*American Journal of Numismatics*", Vol. XXXII). M. Hunter est d'avis qu'il en est ainsi du jeton en cuivre de la Compagnie du Nord-Ouest qu'on trouve presque toujours percé et qui aurait servi d'insigne aux Indiens qui faisaient affaires avec cette compagnie.

Guerre de Sept Ans.

Au nombre des pièces mises de côté parce qu'elles présentent tout simplement des Indiens comme personnages allégoriques sans qu'elles soient frappées à leur intention, signalons en premier lieu la médaille gravée aux Pays-Bas par Holtzhey en 1762, portant la devise "EUROPAE ALMAN NE TARDET PACEM". L'avers représente un indien soutenant un amour qui place une statue de la Paix sur une colonne aux armes de l'Allemagne avec les écussons d'Angleterre et de France à la base; le revers représente Mercure assis sur le lion belge et divers attributs de commerce, avec la légende "DURET USQUE AD EXTREMUM", et en exergue "BELG. FOED." On croit que cette pièce fut frappée en prévision d'un traité de paix qui mettrait bientôt fin à la guerre de Sept Ans, et le supplément de l'ouvrage de Van Loon "*Beschrijving van Nederlandsche Historie-Penningen*" en explique l'allégorie par l'espoir exprimé que les événements d'Amérique ne mettraient pas obstacle à sa conclusion prochaine.

Médaille Diplomatique.

Dans le même ordre d'idées, nous devons une mention toute spéciale à la belle pièce que nos voisins désignent sous le nom de "Médaille Diplomatique", gravée par Dupré en 1790 pour être offerte aux ambassadeurs prenant congé des Etats-Unis; elle représente à l'avers l'Amérique sous les traits d'une reine indienne tenant d'une main une corne d'abondance, et indiquant de l'autre les produits de son sol à Mercure, avec la légende "TO PEACE AND COMMERCE", et en exergue: "IV JUL. MDCCLXXVI". Au revers le grand sceau des Etats-Unis. Ce projet ne fut mis à exécution qu'en faveur de deux ambassadeurs, le marquis de la Luzerne, et le comte de Moustier.

Britannia et America.

Mentionnons aussi la médaille "FELICITAS BRITANNIA ET AMERICA" destinée à célébrer la reconnaissance de l'indépendance des Etats-Unis par l'Angleterre, et qui représente Britannia accueillant une reine indienne à qui une colombe apporte un message de paix en face de la cathédrale de Saint-Paul et du Monument de l'Incendie de Londres, avec la date du traité de Versailles en exergue: "MDCCLXXXIII, SEPT. 4".

Confederatio Americana.

Aussi, la médaille "CONFEDERATIO AMERICANA JUVENUS", dont le revers représente un indien devant un wigwam, accueillant une colombe porteur d'une branche d'olivier.

Le seul caractère indien de ces pièces se réduit à l'allégorie qui fait représenter l'Amérique par un Indien.

Pour l'une ou l'autre des raisons indiquées ci-dessus, nous devons également mettre de côté:

William Penn

La médaille de la colonisation de Pensylvanie par William Penn au milieu des Indiens en 1618, qui paraît cependant n'avoir été gravée qu'environ un siècle plus tard par Pingo sous la direction de Hollis, et qui représente en avers le buste de Penn avec la légende "WILLIAM PENN, B. 1644, D. 1718", et les initiales du graveur L. P.; au revers un quaker appuyé sur une canne et serrant la main d'un indien qui s'appuie sur son arc; autour d'eux la légende "BY DEEDS OF PEACE".

(*Voir Figure 40*).

Loyalistes.

La médaille des Loyalistes représentant à l'avers les bustes accolés de Georges III et de la reine Charlotte, avec la légende: "VIVANT REX ET REGINA", et au revers Britannia assise sur le bord de la mer, où l'on voit la poupe d'un vaisseau de guerre de l'époque, et présentant une branche d'olivier à un indien debout sous un *palmier*, et la légende: "LOYAL ASSOCIATED REFUGEES" sur une banderolle terminée par une chaîne. L'attribution de cette pièce n'a pas encore été clairement définie, mais elle semble avoir été distibuée aux loyalistes de l'Empire-Uni qui n'ont pas voulu demeurer aux Etats-Unis après la signature du traité de Versailles, et partant, elle a dû être également offerte aux blancs comme aux tribus indiennes qui sont venues s'établir sur des réserves au Canada, afin de rester fidèles au drapeau anglais.

(*Voir Figure 41*).

Washington-Eccleston.

La médaille gravée à la mémoire de Washington par Eccleston en 1805, dont le revers représente un indien tenant une flèche et appuyé sur son arc, avec cette légende d'une tristesse infinie: "THE LAND WAS OURS".

Sequoyah.

La médaille d'honneur conférée en 1823 à Sequoyah, l'érudit chef Cherokee, qui a donné son nom aux arbres géants de la Californie, ("Sequoia Gigantea") connu pour ses travaux littéraires publiés sous le nom de George Gist, et pour la création d'un alphabet de la langue Cherokee composé de 85 lettres.

Thayendanegea.

La médaille de Thayendanegea (Joseph Brant, 1742-1807) frappée en 1886 à l'occasion du monument élevé à Brantford à la mémoire de ce fameux capitaine indien.

Oronhyatekha.

La médaille d'Oronhyatekha, Chef Suprême de la société de secours mutuel l'Ordre Indépendant des Forestiers, modelée par Hébert lors de l'exposition de Paris en 1900.

Wahshiwah.

La médaille de Wahshiwah, chef de la tribu des Osages, exécutée sur un dessin fait par un indien de cette tribu en 1911, et portant une légende en langue osage.

En un mot, toutes les pièces de même nature qui n'ont qu'un intérêt privé, ou dont la destination officielle aux indiens de l'Amérique n'est pas suffisamment établie. Il n'entre pas dans le cadre de cette étude de les décrire ici, et nous n'en mentionnons quelques-unes qu'à titre d'exemple.

VI.—Observations générales.

Si les pièces dont nous avons fait la revue au cours de cette étude présentent en elles-mêmes un grand intérêt numismatique, cet intérêt double d'intensité pour l'historien et l'archéologue qui les étudient à la lumière des faits historiques et autres circonstances qui s'y rattachent.

Cérémonies de présentation des médailles.

Rappelons en premier lieu que ces médailles n'étaient décernées qu'à l'occasion d'un événement important, soit pour conclure une alliance, signer un traité de paix ou reconnaître des services signalés; on entourait leur présentation d'un grand apparat destiné à créer une profonde impression sur l'imagination ardente des sauvages, afin d'assurer la stabilité de leurs engagements.

Le Père de Charlevoix décrit en ces termes, dans son "*Histoire et Description Générale de la Nouvelle-France*", les cérémonies qui marquèrent la conclusion du traité de paix signé par M. de Caillières avec les délégués des diverses tribus en 1701: "Il indiqua la dernière Assemblée générale au quatrième d'Août, & il voulut qu'on n'omît rien pour donner à cette action toute la célébrité possible. On choisit pour cela une grande plaine hors de la Ville, on y fit une double enceinte de cent vingt huit pieds de long, sur soixante & douze de large, l'entredeux en ayant six. On ménagea à l'un des bouts une Sale couverte, de vingt neuf pieds de long, & presque quarrée pour les Dames, & pour tout le beau Monde de la Ville. Les Soldats furent placés tout autour, & treize-cent Sauvages furent arrangés dans l'enceinte en très bel ordre."

"M. de Champigny, le Chevalier de Vaudreuil & les principaux Officiers environnoient le Gouverneur Général, qui étoit placé de manière à pouvoir être vû & entendu de tous, & qui parla le premier."

. . . .

"Après qu'il eut cessé de parler, un des deux Pères Bigot repéta aux Abénaquis en leur Langue ce qu'il venoit de dire, Nicolas Perrot fit la même chose aux Miamis, aux Illinois, & aux autres Sauvages Occidentaux; le P. Garnier aux Hurons, le P. Bruyas aux Iroquois, & le P. Anjelran aux Outaouais & aux Algonquins. Tous applaudirent avec de grandes acclamations, dont l'air retentit bien loin, ensuite on distribua des Colliers à tous les Chefs, qui se levèrent les uns après les autres, & marchant gravement, revêtus de longues robes de peaux, allèrent présenter leurs Esclaves au Gouverneur Général avec des Colliers, dont ils lui expliquèrent le sens."

. . . .

"On apporta ensuite le Traité de Paix, qui fut signé de trente huit Députés, puis le grand Calumet de Paix. M. de Callières y fuma le premier, M. de Champigny y fuma après lui, ensuite M. de Vaudreuil, & tous les Chefs & les Députés, chacun à leur tour. Après quoi on chanta le *Te Deum*. Enfin parurent de grandes chaudières, où l'on avoit fait bouillir trois bœufs. On servit chacun à sa place, sans bruit & sans confusion, & tout se passa gayement. Il y eut à la fin plusieurs décharges de boëtes & de canons, & le soir, illumination & feux de joye."

"Le sixième, M. de Callières assembla les Députés des Nations d'en haut, & leur dit qu'encore qu'il n'eût pas tout-à-fait lieu d'être content de quelques-uns d'eux, il vouloit bien, en considération de la Paix, ne plus penser à ce que leur conduite avoit eu d'irrégulier".

. . . .

"Il leur distribua ensuite les présens du Roy. Les Outaouais lui demanderent le P. Anjelran & Nicolas Perrot, & il leur dit qu'il vouloit bien leur faire ce plaisir: que le Missionnaire étoit disposé à les suivre; mais à la condition qu'ils seroient plus dociles à profiter de ses instructions. Leur Député le conjura aussi de ne plus souffrir qu'on portât de l'eau-de-vie nulle part, parce que cette liqueur troubloit l'esprit, & ne pouvoit que porter la Jeunesse à des excès, qui ne manqueroient pas d'avoir des suites funestes; tous ceux qui étoient présens applaudirent à sa demande, à l'exception d'un Chef Huron, qui étoit un grand yvrogne, & qui avoit déjà pris ses mesures pour emporter chez lui de quoi boire."

Colliers de wampum.

Dans ces traités, les discours faits de part et d'autre se ponctuaient par la présentation de "colliers" destinés à rappeler l'idée qui s'en dégageait, et qui étaient ensuite conservés avec soin, nous dit encore le P. de Charlevoix, car "non seulement ils composent le trésor-public, mais ils sont somme les registres et les annales que doivent étudier ceux qui sont chargés des archives, lesquelles sont déposées dans la cabane du chef." Le P. Lafitau ajoute dans son ouvrage *Mœurs des Sauvages Amériquains*, que: "toutes les affaires se traitent par des branches et par des colliers de porcelaine qui leur tiennent lieu de paroles, d'écriture et de contrat.............leur longueur, leur largeur et les grains de couleur se proportionnent à l'importance de l'affaire. Les colliers communs et ordinaires sont de onze rangs de cent quatre-vingts grains chacun.............ils ne croient pas qu'aucune affaire puisse se terminer sans ces sortes de colliers. Quelque proposition qu'on leur fasse ou quelque réponse qu'on leur donne seulement de bouche, l'affaire tombe, disent-ils, et ils la laissent effectivement tomber comme s'il n'en eût jamais été question."

Bacqueville de la Potherie, dans son *Histoire de l'Amérique Septentrionale*, Lahontan, dans ses *Nouveaux Voyages*, et tous les auteurs qui ont écrit leurs relations de voyages dans la Nouvelle-France nous parlent de ces colliers aussi précieux que l'or, aux yeux des sauvages, à cause du travail long et pénible que demandait leur préparation, et de l'épuisement des coquillages dont ils étaient formés; Jacques Cartier les désigne dans son *Brief récit* sous le nom de "Esurgni", Lescarbot, sous celui de "Matachiaz" dans *l'Histoire de la Nouvelle-France*, et Lafitau (*loc. cit.*) sous celui de "Gaionni", mais la désignation la plus répandue est celle de "Wampum", sous laquelle on les connaît aujourd'hui. Les chefs accentuaient leurs protestations de fidélité au gouverneur par la présentation d'un collier ou bande de wampum, dont la largeur était proportionnée à l'importance de la question dont ils traitaient; ils recevaient en échange des médailles d'argent et autres présents qu'ils appréciaient fort, du reste; mais comme leurs colliers de wampum ne leur étaient pas toujours remplacés par d'autres, ainsi que la coutume se pratiquait entre eux, et que leurs sources d'approvisionnement s'épuisaient, ces objets sont devenus d'une rareté extrême. On peut en voir la reproduction sur le portrait de Telariolin que nous donnons comme première illustration, et M. Cyrille Tessier possède la plus belle collection de ces colliers que nous connaissions.

Substitutions de médailles ennemies.

Dans la rivalité constante qui existait entre les colonies limitrophes de la France et de l'Angleterre, l'amitié des tribus sauvages étant également recherchée par l'une et l'autre, il arrivait parfois, qu'après avoir signé un traité d'amitié avec "*Ononthio*" l'enfant des bois se laissait séduire par les éloquentes paroles de "*Corlar*"; il remettait alors à l'Anglais les médailles françaises qu'il possédait, et il en recevait d'autres frappées à l'effigie du souverain de sa nouvelle allégéance, mais il va de soi que cette allégéance ne durait qu'aussi longtemps qu'il en portait les insignes.

C'est pourquoi, ajoute Zay (*loc. cit.*) "les missionnaires s'évertuaient à ramener les transfuges, et pour effacer toute trace de leurs relations avec les Anglais, se faisaient remettre les médailles qu'ils en avaient reçues", et il cite à ce sujet deux documents officiels. Le premier est une lettre du gouverneur Marquis de Duquesne à M. Machaud, Ministre de la Marine, en date du 13 octobre 1754, dans laquelle il dit: "La mission de M. l'abbé Piquet, réputé par nos sauvages domiciliés pour être des espions des Cinq Nations, vient de donner des plus grandes preuves d'attachement et de fidélité en me renvoyant les médailles que les Anglois avoient données à quelques-uns de ce village qui avoient furtivement assisté au conseil d'Orange, et ils ont chassé un de leurs frères qui estait soupçonné avoir le cœur anglois". La seconde citation est celle d'une conférence tenue entre M. de Vaudreuil et les délégués des Six Nations, le 22 décembre 1758, au cours de laquelle Koué, chef de la tribu des Oneidas, remet au gouverneur deux médailles anglaises en disant: "Mon père, nous ne pouvons garder les deux médailles que nous avons eu cy devant la légèreté de recevoir de notre frère l'Anglois pour marque de distinction. Nous reconnaissons que ces médailles ont été la véritable source de notre égarement et qu'elles nous ont employés dans des mauvaises affaires. Nous nous en dépouillons, nous les rejetons pour ne plus penser à l'Anglois."

Les mêmes méthodes étaient en usage dans le camp opposé; on lit dans le *Journal* de Sir William Johnson, à la date du 22 août

1759 (cité dans l'ouvrage de Stone): "Interview with Chippewa Sachem Tequa Kareigh. . . . . . Then took from about his neck a large french medal; gave him an English one and a gorget desiring whenever he looked at them he would remember the engagements he now made."

Les Anglais étant restés maîtres du pays, il va de soi que toutes les médailles françaises qu'ils ont pu trouver ont été retirées par eux pour être remplacées par des pièces anglaises; c'est pourquoi les médailles du régime français sont si rares aujourd'hui. Dans leur empressement de changer l'allégéance des chefs sauvages, ils se contentaient parfois, lorsqu'ils n'avaient pas de pièces de rechange à offrir, de poinçonner simplement le nom de leur souverain après avoir effacé celui du roi de France sur les médailles françaises que possédaient ces chefs; nous en avons indiqué un exemple en parlant de la médaille "HONOS ET VIRTUS" de Louis XV et nous en donnons ici la reproduction.

(*Voir Figure 42*).

Les Etats-Unis ont agi de la même manière, tant au moment de leur constitution en nation indépendante, tel qu'on l'a constaté plus haut par la proposition du député Kean en 1786, qu'aux diverses époques de l'expansion de leur territoire. Ainsi, lors de l'acquisition de la Louisiane en 1803, le lieutenant Pike, délégué par le gouvernement auprès des tribus sauvages du Nord-Ouest, se fit remettre par elles toutes les médailles des puissances étrangères qu'elles avaient en leur possession, et les remplaça par des médailles des Etats-Unis. Même à l'époque de la guerre de Sécession, les Etats du Nord, qui craignaient l'intervention de l'Angleterre en faveur des Etats Confédérés, firent rechercher parmi les tribus indiennes les médailles anglaises qui pouvaient encore s'y trouver, pour les remplacer par des médailles américaines, et c'est à la suite de cette recherche que la collection de l'Hôtel de la Monnaie des Etats-Unis s'est enrichie d'une des médailles présentées par le gouverneur Haldimand, avec collation de diplôme en 1778, comme nous l'avons rappelé plus haut. (Cf. "*Collections of the Wisconsin Historical Society*", Vol. IX.)

Rareté des médailles indiennes.

Toutes ces causes ont contribué à rendre les médailles indiennes, et particulièrement celles du régime français, d'une extrême rareté; mais un fait curieux, c'est que les plus rares sont précisément celles qui ont été distribuées en plus grande quantité, c'est-à-dire celles des petits formats destinées aux sous-chefs ou aux simples guerriers.

La chose s'explique assez facilement par le fait que les grands-chefs appréciaient beaucoup plus leurs médailles qu'ils transmettaient à leurs descendants comme un titre de noblesse; tandis que les porteurs de petites médailles, étant d'un rang inférieur ou simples guerriers, consentaient plus volontiers à s'en départir pour se procurer d'autres fantaisies, et en particulier de "l'eau-de-feu" pour laquelle ils étaient souvent prêts à sacrifier ce qu'ils avaient de plus précieux.

La charge de grand-chef étant héréditaire dans certaines tribus, on donnait l'investiture au fils du grand-chef décédé en lui passant au cou la médaille de son père. Les anciennes distinctions de grands-chefs, de chefs et de sous-chefs sont aujourd'hui remplacées par une organisation communale qui assimile les majestueux conseils de guerriers d'autrefois à des réunions de simples conseils municipaux.

Parfois aussi, une médaille ancestrale devenait la propriété d'un rejeton moderne dont les goûts se portaient vers des bijoux plus en harmonie avec la mode du jour. C'est ainsi que la belle médaille de Pierre Basquet dont nous avons parlé à l'occasion de la visite des délégués micmacs en Angleterre en 1842, fut, au dire du Père Pacifique, missionnaire dans cette tribu, convertie en deux bagues et une épingle d'argent, et M. McLachlan dont les souvenirs remotent à plus d'un demi-siècle, nous dit que les orfèvres de cette époque recevaient souvent la visite d'indiens qui leur apportaient leurs médailles pour s'en faire fabriquer des "gorgettes"(*gorget*) ou des bracelets auxquels ils ajoutaient plus de prix, comme objets d'ornement, qu'à leurs médailles historiques. Ces "gorgettes", portées sur la poitrine par les officiers des régiments d'infanterie dans l'armée anglaise, étaient parfois, chez les Indiens, la propriété de la tribu, qui les désignait sous le nom de "sabot de cheval", dont elles avaient un peu la forme, et lorsqu'elle envoyait un délégué en mission officielle auprès d'une autre tribu, elle lui confiait cet ornement comme lettre de créance. Ailleurs la gorgette était l'insigne conféré aux sous-chefs, tandis que la médaille était donnée aux chefs et aux grands-chefs.

(*Voir Figure 43*).

Souvent aussi, les chefs étaient inhumés avec leurs médailles, de même qu'avec leurs divers ornements et avec les objets qui servaient à leur usage ordinaire, tels que des armes et des vivres pour le grand voyage qu'ils entreprenaient vers le royaume des chasses éternelles. Doit-on voir en cela une communauté d'origine de leurs traditions avec celles des Egyptiens qui plaçaient dans les tombeaux de leurs pharaons toutes sortes d'objets précieux et utiles aux usages ordinaires de la vie, où doit-on n'y voir qu'une simple coïncidence dans une croyance commune à l'immortalité de l'âme? Il n'entre pas dans les limites de cette étude de disserter sur cette question. Bornons-nous donc à constater ce fait pour signaler cette autre cause de la rareté des médailles que nous étudions, car la découverte de sépultures indiennes a souvent fait retrouver des pièces rares qui y étaient enfouies depuis plus d'un siècle, ainsi qu'on l'a vu en parlant de la médaille "Lion et Loup" trouvée dans le tombeau d'Otussa.

Valeur de ces pièces.

La plupart des médailles présentées aux chefs étaient en argent; ils appréciaient beaucoup le brillant éclat de ce métal, et connaissaient d'ailleurs sa valeur intrinsèque. Ils connaissaient aussi l'or, tel qu'en font foi les relations du capitaine John Smith et des premiers explorateurs des colonies du Sud; mais ce métal était jugé trop précieux en Europe pour en faire des largesses aux Indiens.

On trouve cependant des occasions où l'on crut nécessaire d'encourir cette dépense pour atteindre un but spécial, dans certaines circonstances critiques. C'est ainsi qu'au moment où Louis XIV, à la suite de revers inouis en Europe, songeait déjà à la nécessité de la paix, tandis que la reine Anne préparait la capture de Port-Royal et l'expédition de Walker dans le Saint-Laurent, on voit, dans un *Mémoire du Roy aux Sieurs Marquis de Vaudreuil et Rondot*, la préoccupation de s'assurer du concours des indiens par la note suivante: "Sa Majesté a accordé trente médailles d'argent et *dix de vermeil* pour faire des présents aux sauvages. Elle les envoie au dit Sieur de Vaudreuil et Elle désire qu'elles soient distribuées aux chefs des sauvages qui lui sont les plus affectionnés et dont on peut tirer le plus de secours". Plus tard, on trouve la note suivante, en date du 12 novembre 1750, dans un *Mémoire du ministre sur les dépenses:* "Comme les Iroquois ont promis de tout faire pour détacher les Abénaquis du poste des Anglais, il faut leur envoyer *quelques médailles d'or* pour les chefs, et d'argent pour les guerriers".

Nous avons également mentionné les "médailles d'or" distribuées par Georges IV aux quatre chefs indiens envoyés en délégation en Angleterre, mais nous devons noter à cette occasion que l'on désigne souvent sous le nom "d'or" des bijoux ou objets en "vermeil," c'est-à-dire en argent doré.

Des médailles de cuivre ont cependant été distribuées, surtout aux simples guerriers; ce métal, déjà connu des indiens rencontrés par Jacques Cartier à Hochelaga en 1535, était en effet recherché par eux comme objet d'ornement; on trouve dans l'étude du Rev. W. M. Beauchamp sur les *Ornements Métalliques des Indiens de l'Etat de New York*, la description de nombreux objets d'ornement en cuivre, et l'on se rappelle aussi que les premières médailles connues qui portent un symbole relatif aux Indiens sont celles frappées à l'effigie de Georges 1er en 1714, et qu'elles sont en bronze et en cuivre.

La valeur marchande actuelle de ces pièces est toute de convention, car elle dépend entièrement de leur rareté et de leur état de conservation; leur ancienneté, la valeur artistique du travail ou la finesse du métal n'ont qu'une importance secondaire. Les éléments commerciaux ordinaires de l'"offre" et de la "demande" en affectent aussi le prix qu'elles atteignent, surtout dans les ventes aux enchères. Breton dans son *Guide Populaire Illustré des Monnaies et Médailles Canadiennes*, cote les diverses médailles d'argent du régime anglais de dix à quarante dollars, suivant leur rareté, mais en réalité, elles atteignent souvent des prix beaucoup plus élevés.

Quant aux médailles originales du régime français, bien qu'on trouve quelques exemplaires de celle de Louis XV "HONOS ET VIRTUS", la valeur de celles de Louis XIV dites "FELICITAS DOMUS AUGUSTAE" est absolument arbitraire, vu qu'il n'en existe qu'un exemplaire authentique. Rappelons à ce propos l'acte de ce collectionneur anglais qui, après avoir obtenu, à un prix fabuleux, un livre rare dont on ne connaissait que deux exemplaires, détruisit immédiatement son emplette, afin de donner une valeur unique à l'autre exemplaire qu'il possédait.

Répliques et croisements.

Il est bien compris qu'il n'est ici question que de "pièces originales", car, de même qu'on fabrique en notre siècle des "tableaux de vieux maîtres" et des "meubles du moyen âge", on produit aussi des éditions nouvelles de médailles anciennes dont les matrices ont été conservées; mais ces reproductions sont loin d'avoir, aux yeux des connaisseurs, la valeur des pièces originales authentiques.

La Monnaie de Paris a souvent accédé aux demandes des collectionneurs en refrappant pour eux des répliques de médailles rares dont les matrices sont déposées à cette institution; mais outre le fait que ces reproductions ont une apparence qui les fait assez facilement reconnaître, les directeurs de l'institution font poinçonner, depuis 1841, le nom du métal et un signe distinctif sur la tranche de la médaille, de sorte que non seulement l'époque du frappement, mais aussi la nature du métal employé peuvent se constater malgré les supercheries. Il est vrai que des manipulations habiles peuvent parfois rendre ces précautions inutiles, mais, la plupart du temps, les connaisseurs savent, à certains indices, distinguer un original d'une reproduction.

D'un autre côté, les répliques ont parfois donné lieu à de nombreux croisements qui ont fait prendre pour des médailles originales d'un type nouveau des pièces frappées avec la matrice d'avers d'une médaille et celle du revers d'une autre; on en a des exemples dans quelques-unes des pièces du règne de Georges III, mais celles dont on a le plus abusé sous ce rapport sont les jetons franco-américains de Louis XV, dont les collectionneurs ont multiplié les croisements à tel point que, dans son *Histoire Illustrée des Monnaies et Jetons du Canada*, Breton compte *trente-neuf* types différents de ces pièces, et indique jusqu'à *sept* variétés d'une même pièce. Il ne faudrait cependant pas pour cela conclure à la dépréciation absolue des pièces croisées, mais leur valeur est d'un intérèt plutôt numismatique.

Antithèse des attributs.

Si l'ignorance des ouvriers cause parfois des croisements de matrices, l'ignorance des graveurs produit aussi des antithèses dans le sujet même de la médaille; ce genre d'erreur peut se produire d'autant plus facilement qu'il s'agit pour eux de représenter les attributs de divers pays qu'ils ne connaissent qu'imparfaitement par les descriptions des voyageurs ou par des lectures incomplètes, surtout aux époques auxquelles les médailles dont nous parlons ont été produites.

C'est ainsi qu'en 1581 dans une médaille de Philippe II, dénommé "Roi d'Espagne et du Nouveau-Monde Occidental," le graveur introduit un *chameau* qui devait bien certainement être le dernier de sa race en ce pays, car il n'a pas, que je sache, laissé de descendants en Amérique. Même en 1783, dans la médaille des Loyalistes réfugiés en Canada au temps de la Révolution américaine, dont nous avons donné une reproduction ci-dessus, Britannia accueille l'indien *sous un palmier;* de même que le chameau aux Indes Occidentales, cet arbre exotique n'a pu résister aux neiges du Canada, car on n'en a pas vu, ailleurs que dans nos serres, depuis l'exécution de cette médaille.

Ces erreurs sont de nature à dérouter le chercheur, et elles sont souvent la cause de fausses attributions des pièces sur lesquelles elles se rencontrent, car, en science numismatique, il faut souvent procéder par déduction et tabler sur des probabilités.

Conclusion.

En un mot, nous avons cherché, dans ce travail, à faire la revue d'un des plus intéressants chapitres de la numismatique du Nouveau-Monde, en nous attachant au caractère historique de ces pièces plutôt qu'aux détails techniques de leur nomenclature, car, sous ce rapport, nous ne pouvons mieux faire que de référer aux ouvrages de Betts, de McLachlan, de Leroux et de Breton qui font autorité en la matière.

Les médailles sont de petits monuments destinés à consacrer la gloire des grands hommes ou à perpétuer le souvenir des évènements historiques importants; c'est pour cette raison que l'étude des "Médailles décernées aux Indiens d'Amérique" nous porte insensiblement à nous éprendre de l'histoire primitive de notre pays. Et plus on étudie l'histoire de la Nouvelle-France, plus on admire la grandeur d'âme de ces fondateurs d'empire que furent Champlain, Maisonneuve, La Salle, Joliet, Marquette, La Vérandrye et autres hardis explorateurs qui donnèrent des mondes à leur patrie, de même que le zèle et le courage des Le Caron, des Viel, des Brébœuf, des Jogues, des Lallemant, des Bressani, des Ragueneau et de tous ces missionnaires avides de verser leur sang pour le salut des âmes, nous font songer aux apôtres-martyrs des premiers temps de la chrétienté.

Mais pour l'éthnologue qui compare la civilisation apportée sur les bords du Saint-Laurent par les envoyés du Roi-Soleil, à une époque où la France déployait une splendeur inouie, avec les mœurs primitives des aborigènes qu'ils y rencontrèrent, une large part de cette admiration s'adresse aux Garakonthié, aux Teganissorens, aux Kondiaronk, aux Pontiac, aux Tecumseh et aux autres esprits supérieurs qui se sont révélés chez les tribus indigènes et dont la diplomatie consommée, le talent oratoire et le génie militaire étaient dignes des autres héros de cette épopée séculaire connue sous le titre modeste d'"Histoire du Canada."

Au nombre des reliques qui nous restent d'un passé glorieux, les médailles décrites au cours de cette étude comptent parmi les plus intéressantes, car, en même temps qu'elles rappellent les faits mémorables à l'occasion desquels elles étaient décernées, elles attestent la munificence de ceux qui les offraient et la valeur de ceux qui les ont portées. Considérons-donc avec vénération ces témoins muets des relations qui ont existé entre les anciens rois de ce vaste territoire et les pionniers qui leur apportèrent la civilisation et la foi, dons précieux que les uns et les autres n'ont peut-être pas toujours appréciés dans toute leur étendue.

Et lorsque nous rencontrons dans le dédale de nos "gratte-ciel" quelques-uns des rares descendants de ces tribus puissantes qui tenaient autrefois la balance du pouvoir en ce pays, et dont les muscles altiers semblent encore aujourd'hui gênés par la contrainte des habits européens, saluons-les avec respect comme on saluait à Rome les gladiateurs qui allaient mourir, en songeant que leurs aïeux possédaient autrefois la terre où nous vivons, et que dans cent ans peut-être, ils n'existeront plus que par le souvenir.

MÉDAILLES DÉCRITES.

I.—Médailles Françaises.

1.—Atouata, 1669.
2.—Chef des Assiniboines, 1683.
3.—Naissance du duc de Berry, 1686.
4.—Felicitas Domus Augustae, 1693.
5.—Honos et Virtus, Louis XIV.
6.—Sacre de Louis XV, 1722.
7.—Honos et Virtus, Louis XV.

II.—Médailles Anglaises.

8.—Charles II, 1683.
9.—Ecussons de Charles II.
10.—Prise de Tournai, Anne 1709.
11.—Bataille de Malplaquet, 1709.
12.—Traité d'Utrecht, Anne 1713.
13.—Georges I, 1714.
14.— " II, non datée.
15.— " II, 1731.
16.—Destruction de Kittanning, 1756.
17.—Georges II, 1757.
18.—Montréal en 1760.
19.—Mariage de Georges III et Charlotte.
20.—Lion et Loup.
21.—Happy while United, 1764 et 1766.
22.—Traité de Pontiac.
23.—Georges III, à l'époque de la révolution américaine.
24.— " " 1794.
25.— " " *post* 1801.
26.— " " 1814.
27.—Georges IV, 1821.
28.—William IV, 1832.
29.—Victoria, 1840.
30.—Micmacs, 1842.
31.—Châteauguay, Chrysler's Farm, et Fort Détroit.
32.—Prince de Galles, 1860.
33.—Traités indiens de 1871.
34.— " projetés pour 1872.
35.— " de 1873 à 1877.
36.—Duc et Duchesse de Cornwall et York, 1901.

III.—Médailles Espagnoles.

37—Notre-Dame de Guadeloupe, 1682.
38.—Proclamation des rois d'Espagne.
39.—Carlos III, Florida 1760.
40.— " de Borbon, Mexico 1760.
41.— " III, Por Merito.

Portrait de Zacharie Vincent Telari-o-lin "le dernier des Hurons" peint par lui-même. Il est revêtu de tous les ornements d'un chef: diadème, boucles d'oreilles, disque, médaille, bracelets, collier de wampum, ceinture fléchée, et tient d'une main son calumet de paix et de l'autre la hampe d'un drapeau anglais.

Figure 1.—Médaille "Felicitas Domus Agustae," 1693.

Figure 2.—Médaille "Honos et Virtus," de Louis XIV.

Figure 3.—Médaille du sacre de Louis XV, 1722.

Figure 4.—Médaille "Honos et Virtus" de Louis XV.

Figure 5.—Médaille de Charles II, assignée à 1683.

Figure 6.—Médaille de la Prise de Tournai, Anne, 1709.

Figure 7.—Médaille de Georges I, assignée à 1714.

Figure 8.—Médaille de Georges II, assignée à 1731.

Figure 9.—Médaille de Georges II, frappée à Philadelphie en 1757

Figure 10.—Médaille de Montréal, assignée à 1760.

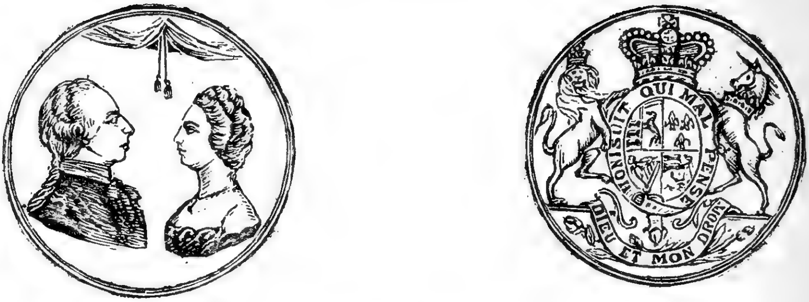

Figure 11.—Médaille du mariage de Georges III et Charlotte.

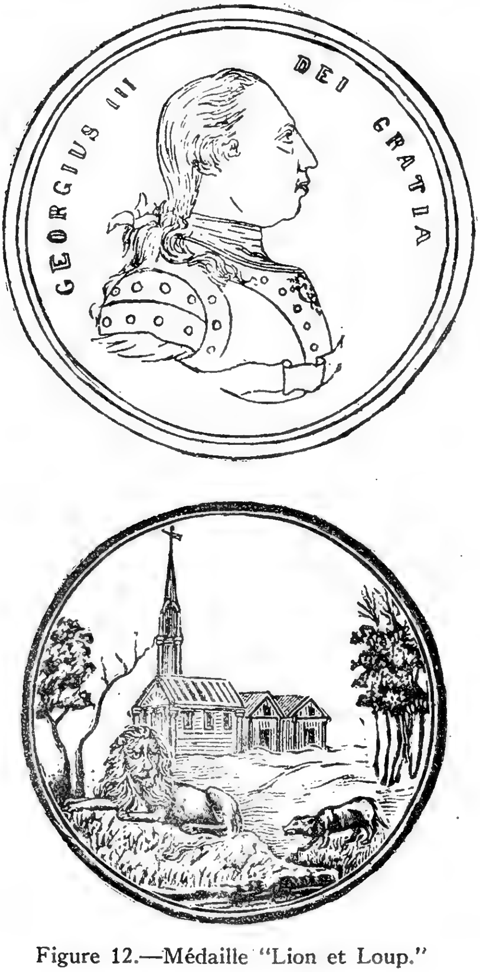

Figure 12.—Médaille "Lion et Loup."

Figure 13.—Médaille "Happy while United," 1766.

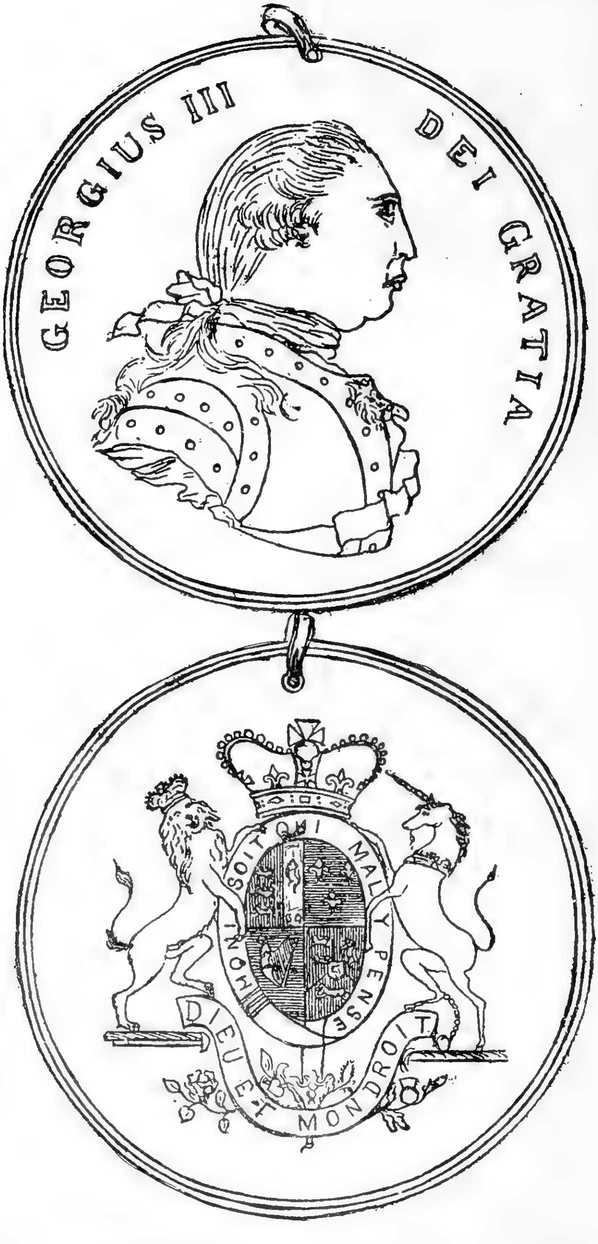

Figure 14.—Médaille de Georges III, à l'époque de la Révolution américaine.

Figure 15.—Médaille de Georges III, 1794.

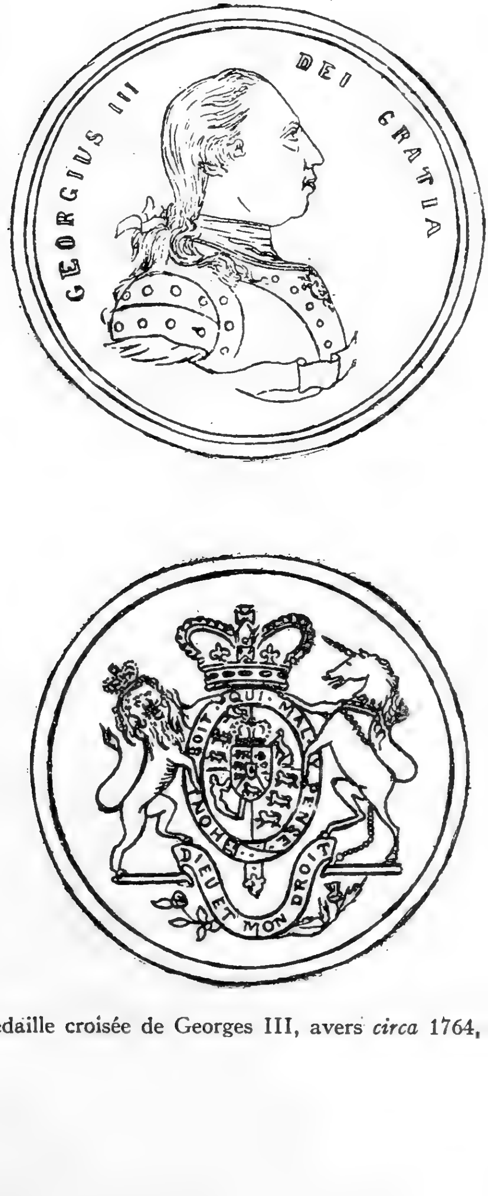

Figure 16.—Médaille croisée de Georges III, avers *circa* 1764, revers *post* 1801.

Figure 17.—Médaille de Georges III, 1814.

Figure 18.—Médaille de Georges IV, 1721.

Figure 19.—Médaille de Victoria, 1840.

Figure 20.—Médaille des Micmacs, 1842.

Figure 21.—Médaille militaire de Châteauguay.

Figure 22.—Médaille de Victoria, gravée pour la visite du prince de Galles, 1860.

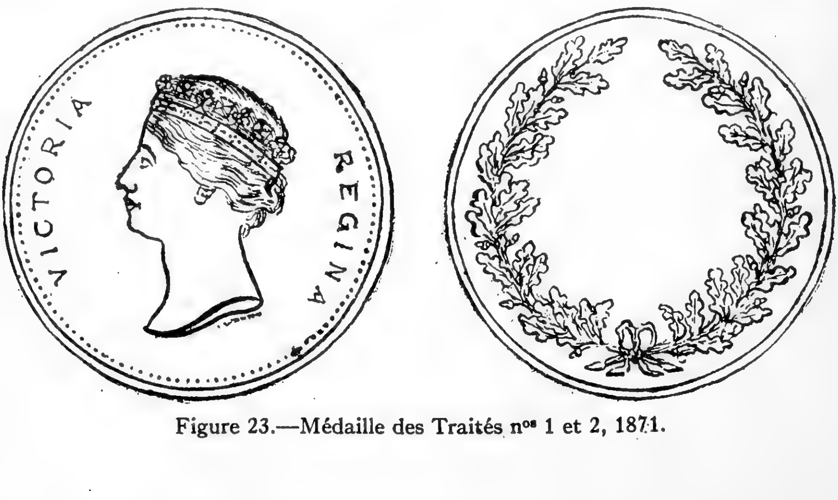

Figure 23.—Médaille des Traités nos 1 et 2, 1871.

Figure 24.—Médaille des Traités projetés, 1872.

Figure 25.—Médaille des Traités de 1873 à 1877.

Figure 26.—Médaille de la visite du duc et de la duchesse de Cornwall et York (plus tard Georges V et Marie) en 1901. Cette reproduction est plus petite que la grandeur naturelle.

Figure 27.—Médaille de proclamation de Carlos III, à Mexico, en 1760.

Figure 28.—Médaille de Carlos III, Florida, 1760.

Figure 29.—Médaille Carlos de Borbon, Mexico, 1780.

Figure 30.—Médaille de Carlos III, "Por Merito."

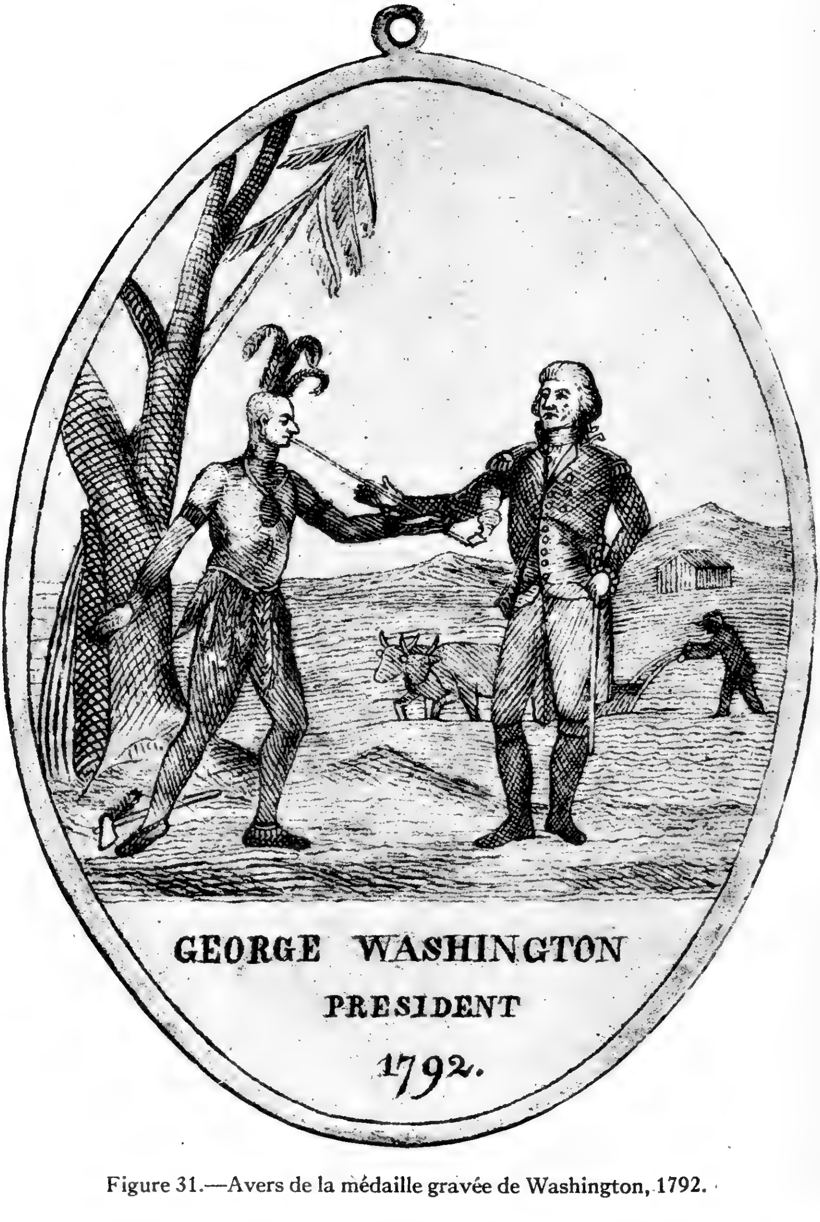

Figure 31.—Avers de la médaille gravée de Washington, 1792.

Figure 32.—Médaille de Adams, 1797.

Figure 33.—Médaille de Fillmore, 1850.

Figure 34.—Médaille de Lincoln, 1862.

Figure 35.—Médaille de Johnson, 1865.

Figure 36.—Médaille de Grant, 1871.

Figure 37.—Médaille de Hayes, 1877.

Figure 38.—Seconde médaille de Benjamin Harrison.

Figure 39.—Médaille de la Compagnie de la Baie d'Hudson.

Figure 40.—Médaille de Penn (Colonisation de la Pennsylvanie).

Figure 41.—Médaille des Loyalistes.

Figure 42.—Médaille "Honus et Virtus" de Louis XV, contremarquée "Gorge III" comme médaille anglaise.

Figure 43.—"Gorgette" (réduite aux deux tiers).

IV.—Médailles Américaines.

42.—Happy while United, 1780.
43.—Washington, 1792.
44.—Médailles des Saisons, 1796.
45.—Présidents Washington, Adams, Madison, Monroe, J. Q. Adams, Jackson, Van Buren, Tyler, Polk et Taylor.
46.—Président Jefferson.
47.— " W. H. Harrison.
48.— " Fillmore, Pierce et Buchanan.
49.— " Lincoln.
50.— " Johnson.
51.— " Grant.
52.— " Hayes, Garfield, Arthur, Cleveland et B. Harrison.
53.— " B. Harrison, 2è médaille.
54.— " McKinley, Roosevelt et Taft.

V.—Médailles Semi-Indiennes.

55.—Compagnie de la Baie d'Hudson.
56.— " du Nord-Ouest.
57.—Guerre de Sept ans.
58.—Médaille Diplomatique.
59.—Britannia et America.
60.—Confederatio Americana.
61.—William Penn.
62.—Loyalistes.
63.—Washington-Eccleston.
64.—Sequoyah.
65.—Thayendanegea.
66.—Oronhyatekha.
67.—Washshiwah.

OUVRAGES CITÉS.

"Acte de Québec, 1774."
Alison.—"Histoire de l'Europe pendant la révolution française."
"American Journal of Numismatics."
"Annuaire de la Société Française de Numismatique."
"Archives de la Marine."—Correspondance générale.
Bacqueville de la Potherie.—"Histoire de l'Amérique Septentrionale."
Baker—"Medallic Portraits of Washington."
Bancroft.—"History of the United States."
Beauchamp.—"Metallic Ornaments of the New York Indians."
Betts.—"American Colonial History Illustrated by Contemporary Medals."
Bressani.—"Relation abrégée de quelques missions des Pères de la Compagnie de Jésus dans la Nouvelle-France."
Breton.—"Guide Populaire illustré des Monnaies et Médailles Canadiennes."
Breton.—"Histoire Illustrée des Monnaies et Jetons du Canada."
Butler.—"Early Historic Relics of the North West."
"Canadian Antiquarian."
"Canadian Magazine."
"Canadiana."
Cartier.—"Brief récit et succincte narration de la navigation faite en 1534 et 1535."
"Catalogue de la Collection Gerald E. Hart."
"Catalogue des Poinçons, Coins et Médailles du Musée Monétaire de Paris."
"Catalogue officiel de la Monnaie de Philadelphie."
Cellem.—"Visit of His Royal Highness, the Prince of Wales."
Chaffers.—"Gilda Aurifabrorum."
Charlevoix.—"Histoire et Description Générale de la Nouvelle-France."
Chauchetière.—"Relation annuelle de la Mission du Sault depuis la fondation jusques à l'an 1686."
"Collections of the Virginia Historical Society."
"Collections of the Wisconsin Historical Society."
De Celles.—"Histoire des Etats-Unis."
Dent.—"Canada since the Union of 1841."
Dickeson.—"American Numismatic Manual."
"Dinwiddie Papers."
Dionne.—"Chouart et Radisson. (Galerie Historique.)"
"Documents relative to the Colonial History of New-York."
Doniol.—"Histoire de la participation de la France à l'indépendance des Etats-Unis."
Entick.—"The Present State of the British Empire."
Fonrobert.—"Sammlung Uberseeische Munzen und Medaillen."
Forrer.—"Dictionnaire des Médaillistes."
Garneau.—"Histoire du Canada."
"Harper's Magazine."
Hawkins.—"Medallic Illustrations of the History of Great Britain."
Hayden.—"An account of various silver and copper Medals."
Hennings.—"Statutes-at-large."
Herrera.—"Medallas de Proclamaciones y Juras de los Reyes de Espana."
"Historical Magazine."
Howard.—"Old London Silver."
Irwin.—"War medals and decorations."

Johnson.—"Journal."
Lafitau.—"Mémoire concernant la découverte au Canada de la précieuse plante de ginseng."
Lafitau.—"Mœurs des Sauvages Amériquains."
Lahontan.—"Nouveaux voyages dans l'Amérique Septentrionale."
Lander.—"Journal of the Niger Expedition."
Le Clercq.—"Premier Etablissement de la Foy dans la Nouvelle-France."
Leroux.—"Médailler du Canada."
Lescarbot.—"Histoire de la Nouvelle-France."
"Lettres édifiantes et curieuses écrites des Missions Etrangères."
"Lettres de Madame Duplessis Sainte-Hélène."
"Lettres des Marquis de Vaudreuil, Beauharnois et Duquesne."
"London Magazine."
Loubat.—"The Medallic History of the United States of America."
McLachlan.—"Canadian Numismatics."
McLachlan.—"Medals awarded to the Canadian Indians."
"Medallic Illustrations of the History of Great Britain and Ireland to the death of George II."
"Mélanges Religieux."
"Mémoires biographiques d'Antoine Bennezet (Vaux)."
Miner.—"Histoire du Wyoming."
Parkman.—"Conspiracy of Pontiac."
"Public Archives."
Radisson.—"Voyages."
"Relations des Jésuites."
"Revue Canadienne."
Richardson.—"War of 1812."
Rochemonteix.—"Les Jésuites et la Nouvelle-France au XVIIè siècle."
"Royal Magazine."
Sainthill.—"Olla Podrida."
Sandham.—"Coins, tokens and medals of the Dominion of Canada."
Satterlee.—"An arrangement of Medals and Tokens struck in honor of the Presidents of the United States."
Schoolcraft.—"History of the Indian Tribes."
"Spink's Numismatic Circular."
Stone.—"Life of Sir William Johnson."
Tancred.—"Historical Record of Medals."
Twaithes.—"Relations des Jésuites."
Vattemare.—"Collection de Monnaies et Médailles de l'Amérique du Nord."
Van Loon.—"Beschrijving van Nederlandsche Historie-Penningen."
Zay.—"Médailles d'honneur pour les Indiens."

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SECTION II

SERIES II DECEMBER 1915 VOL. IX

The Social Organization of the West Coast Tribes.

By E. SAPIR., Ph.D.

Presented by DR. ADAM SHORTT, C.M.G., F.R.S.C.

(Read May Meeting, 1915.)

As is well known, the aborigines of America had developed at the time of the discovery a number of more or less distinct types of social and political organization, ranging from the loosely organized hunting or root-gathering band, with little or no internal complexity and with no definite formal affiliations with other groups, to the complex state found, for instance, in Mexico or Peru, in which a large number of relatively small tribal units were united into a larger body politic, comparable in some measure to the states that we are familiar with in our own history. It is obvious that to a large extent the type of social organization developed by a particular group of people must be due to the economic status attained by it. A roving habit of life will not encourage the formation of social and political solidarity. Conversely, the conditions for social development are more favourable in a community occupying a relatively small territory, to certain parts of which it is bound for at least considerable periods. Typical of the most primitive type of social organization in America are the Eskimo. Among them the unfavourable climatic conditions and the consequent difficulty of maintaining life cause them to form small village groups which change their habitat according to the exigencies of the season, and every individual in which is obliged to procure means of subsistence for himself and his nearest kin. A sea-mammal hunting people like the Eskimo, that cannot find a continuous livelihood in a single spot, cannot be expected to evolve a complex social life, and we are therefore not surprised to find the individual as such more strongly emphasized among them than among most other people. Somewhat analogous, though vastly different in actual detail, is the condition of the roving bands of the Great Basin area of Utah, Nevada, and adjoining states. Here it is the semi-arid character of the soil that makes it impossible for a primitive community to develop a settled mode of life. The necessity of frequently changing camp in order to follow the game or visit the favourite root-gathering spots according to season, again militates against the formation of large and complexly organized social units.

The economic basis of a people is of course not in every case simply determined by the character of the country inhabited, for, with the increase of culture, means are evolved whereby the difficulties of an unfavourable environment are largely conquered. We need only point out that the limitations enforced by the semi-arid country referred to on the present inhabitants of the region are vastly different from those enforced on the Shoshonean tribes who preceded them. There are, indeed, numerous analogous cases among the Indians themselves. Thus, the Pueblo tribes of New Mexico and Arizona, while occupying the same general region as their neighbours the Navaho, differ vastly in social organization from these. While the Navaho are a nomadic sheep-raising people forced by their manner of life to cover a vast territory and to split up into a large number of small groups, which form into larger bodies only at the ritual performances that bring the people together from time to time, the Pueblos are enabled by their intensive system of agriculture to form into perfectly coherent well-knit communities that are housed in permanent villages comparable in many ways to our own towns. Here the conditions are evidently favourable for the development of authority vested in certain individuals and of a number of complex social inter-relations. Similarly, it seems not improbable that the more intensive pursuit of agriculture by the Iroquoian tribes than by their Algonkian neighbours, among whom hunting occupied a relatively more important place economically, was fundamentally responsible for the greater social and political elaboration characteristic of the former.

I do not, of course, mean to urge that a type of social organization is directly dependent on economic factors to the exclusion of everything else. As a matter of fact, it is perfectly clear that many historic causes may bring about social developments in no way connected with the economic status of the community. For one thing, no group of people is ever entirely isolated and free to develop entirely from within and as influenced by purely environmental causes. The influence exerted by neighbouring peoples must always be borne in mind, and frequently enough in America we find that much in the social constitution of certain tribes remains unintelligible until we take into consideration the stimulus of contact with neighbouring tribes. Thus, there is no doubt that the so-called Wabanaki Confederacy of certain Eastern Algonkian tribes was brought into being largely by the suggestive influence of the powerful

Iroquois Confederacy that harassed these tribes. Similarly, there is no doubt that the relatively greater degree of social complexity obtaining among certain Athabaskan hunting tribes of British Columbia, such as the Carrier and Chilcotin, when contrasted with their more simply organized kinsmen to the north and east, was more or less directly due to imitation of social features found among the Coast tribes that neighboured them to the west.

This note of warning is here sounded because it is too often assumed by facile system-makers that the social organization of a people can be more or less directly inferred from its economic conditions. With all reservations, however, I believe it is fairly clear that the peculiar environment of the West Coast tribes of British Columbia had much to do with the development of their rather complex social life. Not so much that these conditions explain in every case the actual forms of organization that we find to prevail among these tribes, as that they seem to furnish a general stimulus for the growth of relatively settled communities with intricate social ramifications. In the first place, the Indians of the West Coast had abundant means for subsistence at their disposal. The streams teemed with various kinds of salmon throughout the year, and the sea offered a great variety of edible sea-mammals and invertebrates. It was thus possible for a rather large group of people to make a comfortable living in a quite restricted bit of coast territory. Access to the sea at a few points and the control of a few streams up which the community could follow the salmon at their spawning periods were all that was needed to insure ample means of subsistence for all. Furthermore, the unusually great rainfall of the coast country made it necessary for the Indians to house themselves in substantial shelters, and at the same time gave them the ready means wherewith to fill this want. I refer to the heavily wooded character of the coast. The inexhaustible supply of readily worked wood, particularly the red cedar, gave the Indians all that was necessary for the building of large houses. In a word, the West Coast Indians were fishermen and sea-mammal hunters who, unlike the Eskimo, were able to thrive within relatively restricted territories, and who dwelt for the greater part of the year in permanent villages consisting of a long row of large wooden houses strung along the beach. Most of these houses were large enough to provide not merely for a family in the narrower sense of the word, but for a large house group forming a family in a larger sense and dominated by one man who, on grounds of descent, took precedence of all others in the house group. The village community with its definite number of house groups may, then, be expected to be the most fundamental social unit in this area and, indeed, in spite of all complications that have been brought about among some of the tribes, the legends of the Indians themselves and the study of the facts involved seem, in practically every case, to argue back to the village community as the primary social unit.

The social groupings that prevail among the West Coast Indians may be classified under four heads: groupings according to rank, groupings based on kinship, local groupings, and ceremonial or ritualistic groupings. The last of these may hardly be considered as coming within the scope of social organization; but among certain of the West Coast tribes, more particularly the Kwakiutl, they have become so intimately connected with the social structure that it is difficult to exclude entirely a reference to ceremonial groups. These four types of social units naturally intercross in a great many different ways, so much so that it becomes no easy matter to present a thoroughly intelligible picture of the social structure of a typical West Coast tribe.

Before examining each of these types of organization somewhat more closely, it will be well to acquaint ourselves briefly with the distribution of the tribes we are considering. The northernmost of the tribes generally included under the term of West Coast Indians, are the Tlingit, who occupy the long strip of coast forming the panhandle of southern Alaska. They are subdivided into a large number of distinct tribes, among the better known of which are the Yakutat, Chilcat, and Sitka Indians. These speak a number of mutually intelligible dialects forming a linguistic unit that is only very remotely related to certain other American languages. The Haida Indians occupy the Queen Charlotte Islands and part of the Prince of Wales archipelago north of these. These Indians formerly inhabited a large number of villages distributed along the coasts of the Islands; but are now almost entirely reduced to the two villages of Skidegate and Massett in the Queen Charlottes, and a number of villages in the Prince of Wales archipelago, occupied by the Kaigani. South of the Tlingit, on the mainland, are the Tsimshian, who inhabit the region of Nass and Skeena rivers. They are divided into three closely connected dialectic groups which form one of the isolated linguistic stocks of America, at least so far as is at present known. The Haida and Tlingit languages, on the other hand, can be shown to be distantly related. South of the Tsimshian are the Bella Coola, in many respects a peculiar tribe, that form an isolated offshoot of the great Salish family which has representatives as far south as Columbia river. The northwestern, northern, and northeastern shores of Vancouver Island and the mainland opposite are occupied by a large number of tribes that are closely connected linguistically and may be embraced under the general term of Kwakiutl, which term, however, applies strictly speaking only to the Indians of Fort Rupert in northern Vancouver Island. The more northern of the Kwakiutl tribes, such as the Bella Bella and Kitamat, offer a contrast in social organization to their southern neighbours, being more closely allied in several important respects to the linguistically unrelated Tsimshian. The western coast of Vancouver Island is inhabited by a number of tribes grouped together under the term Nootka. The Nootka language is genetically related to Kwakiutl, though only fairly distantly so. Finally, in the southeastern part of Vancouver Island and on the mainland opposite, there are a considerable number of linguistically quite divergent but related tribes making up the bulk of the Coast Salish, as far as they are represented in Canada. From our present point of view the Tlingit, Haida, Tsimshian, Bella Coola, and northern Kwakiutl, are to be grouped together in contrast to the southern Kwakiutl, Nootka, and Coast Salish. The former of these may be considered as the more typical in regard to social organization. It is interesting to observe that the broad line of division runs through a linguistic group, an example of the failure of linguistic and cultural classifications to coincide such as we have numerous parallels of in America, and indeed all over the world.

All these tribes are characterized by a clear development of the idea of rank; indeed, it may be said that nowhere north of Mexico is the distinction between those of high and those of low birth so sharply drawn as in the West Coast tribes. Three classes of society may be recognized—the nobility, the commoners, and the slaves. It is not practicable to distinguish between chiefs and nobles, as has been done for instance by Hill-Tout for the Coast Salish, as the lesser chiefs or nobles grade right in continuously with the head chiefs. Intermarriages between nobles and commoners or slaves, and between commoners and slaves, were in theory quite impossible, and in earlier days could at best have been but rare. We learn here and there from their legends that individuals of low rank were sometimes raised to a higher rank by marriage into a chief's family; but the very point made in such cases serves to emphasize the essential differences of rank. High rank is determined primarily by descent—whether in the male or female line depends on the tribe. A very important factor, furthermore, in determining rank is wealth, as illustrated more particularly by the distribution of great quantities of property at ceremonial feasts generally known as potlatches. It is not enough for one of high birth to rest in his hereditary glory. If he wishes to preserve the respect of his fellow tribesmen, he must at frequent intervals reassert his rank by displays of wealth, otherwise he incurs the risk of gradually losing the place that properly belongs to him on the score of inheritance. We read, indeed, of cases in which men of lower rank have by dint of reckless potlatching gained the ascendency over their betters, gradually displacing them in one or more of the privileges belonging to their rank. Among the West Coast Indians, as in Europe, there is, then, opportunity for the unsettling activities of the parvenu.

A necessary consequence of the division of the village community into a number of large house-groups is that, associated with each chief, there is, besides the immediate members of his own family, a group of commoners and slaves, who form his retainers. The slaves are immediately subject to his authority and may be disposed of in any manner that he sees fit. The commoners also, however, while possessing a much greater measure of independence, cannot be considered as unattached. Everything clustered about a number of house-groups headed by titled individuals, and in West Coast society, as in that of mediæval feudalism, there was no place for the social free-lance. If the number of commoners and slaves connected with a chief's family grew too large for adequate housing under a single roof, one or more supplementary houses could be added on to the first; but they always remained under its sphere of influence. In this way we can understand how even a group of houses forming an outlying village might be inhabited entirely by people of low birth, who were directly subject to one or more chiefs occupying houses in the mother village. From this point of view the whole tribe divides into as many social groups as there are independent chiefs.

The rank of chief or noble is connected in most cases with a certain degree of personal power, but real communal authority is naturally vested in only the highest chief or chiefs of the village, and then not always as absolutely as we might be inclined to imagine. Even the highest chief is primarily always associated with a particular family and house, and if he exercises general authority, it is not so much because of his individual rank as such, as because the house group that he represents is, for one reason or another, the highest in rank in the community. In legendary terms this might be expressed by saying that the other groups branched off from or attached themselves to that of the head chief.

Fully as characteristic of high rank as the exercise of authority is the use of a large variety of privileges. The subject of privileges among the West Coast Indians is an exceedingly complex one and cannot be adequately disposed of here. Privileges include not only practical rights of economic value, such as the exclusive or main right to a particular fishing ground or the right to receive a certain part of a whale which has drifted on to the tribal shore; but also, and indeed more characteristically, many purely ceremonial or other non-material rights. It is these which form the most important outward expression of high rank, and their unlawful use by those not entitled to them was certain in every case to bring about violent friction and not infrequently actual bloodshed. One of the most important of these privileges is the right to use certain carvings or paintings, nearly always connected with the legendary history of the family which the chief represents. We shall have somewhat more to say of these crests later; here I wish to point out that from our present point of view the crests are but one of the many privileges that are associated with high rank. A further indication of such rank is the right to use certain names. The right to the use of any name is, properly speaking, determined by descent, and the names which have come to be looked upon as higher in rank than others naturally descend only to those that are of high birth. These names comprise not only such as are applied to individuals and of which a large number, some of higher, others of lower rank, are at the disposal of the nobleman; but also names that he has the exclusive right to apply to his slaves, to his house, very often to particular features of his house, such as carved posts and beams, and in some cases even names applied to movable objects such as canoes or particularly prized harpoon-heads or other implements. Further indicative of rank is the right to perform particular dances both in secular feasts or potlatches and, though perhaps to a somewhat less extent, also at ritualistic performances.

Perhaps the clearest outward manifestation of rank is in the place given a chief whenever it is necessary to arrange in some order the various participants in a public function. Thus, in a public feast or potlatch, those of high rank are seated in certain parts of the house that are preserved exclusively for the nobility. These are the rear of the house and the halves of the sides which are nearest the rear. These seats are graded as to rank, and it is perhaps not too much to surmise that the obvious grading made visible to the eye by a definite manner of seating at feasts was in a large measure responsible for the extension of the idea of grading of ranks and privileges generally. The exact seat of honor differed somewhat with the different tribes. In some it was the centre of the rear; in others that seat on the right side of the house, as one faces the door, which was nearest the corner. Other arrangements into series which could give a concrete idea of the ranking enjoyed by an individual are the order in which gifts are distributed to the chiefs at a potlatch; furthermore, the order in which they are called out when invited by a representative of another tribe to attend a feast which is to be given some time in the near future by the latter. The ranking orders thus arrived at by seating, distribution of gifts, invitations to feasts, and in various other ways that it is not necessary to enter upon here, might be expected to coincide. To a certain extent they do tend to approximate, and the highest in rank in a community will nearly always be found to head any such list that might be constructed. In practice, however, one finds that the various orders do not necessarily strictly correspond, in other words, that a person might individually be of lesser rank than another from the point of view of seating, but would have a prior claim to be invited, say. This curious state of affairs shows clearly enough that at last analysis rank is not a permanent status which is expressed in a number of absolutely fixed ways, but is rather the resultant standing attained by the inheritance of a considerable number of theoretically independent privileges which do, indeed, tend in most cases to be associated in certain ways, but may nevertheless be independently transmitted from generation to generation.

Nowhere in America is the idea of the grading of individuals carried to such an extent as among the West Coast Indians. It applies however, only to the nobility, the commoners and the slaves not being differentiated among themselves with regard to rank. It has already been indicated how the ceremonial seating, for instance, of the nobility is expressive of their higher or lower status relatively to each other. In those tribes, like the Haida and Tlingit, that are subdivided into phratries and clans, a matter that we shall take up presently, this grading of chiefs represents something of a political or administrative basis, inasmuch as subsidiary to the town chief we have a number of clan heads. Subordinate to these, in turn, are the heads of the various house groups. Here again, however, it is important to notice that the town chief is always at the same time the chief of the particular clan that is dominant in that village and that the clan chief is at the same time the head of the particular house group that forms the nucleus of, or is the highest in rank in, the clan. In other words, ranking is not so much of a political or administrative character as it is determined by the handing down of status and privilege from holder to heir. It follows that the political organization, such as it is, impresses one as superimposed on the house group or family organization by inner growth of the latter. So strong a hold has the idea of ranking taken upon the Indians that we find it operative even in cases where it would naturally not be expected to find application. Thus, it is often customary for a number of invited tribes as such, as represented of course by certain chiefs, to be assigned definite ceremonial seats and thereby by implication to be ranked relatively to each other—at times a somewhat risky proceeding. Furthermore, in some tribes it is even customary for medicine men to be organized on the basis of rank, such ranking not necessarily depending entirely on the individual supernatural powers displayed by the medicine men as on the fact that they are entitled by inheritance of medical lore to such and such honours.

As already indicated, the subject of privileges is a vast one, and a complete enumeration of all the economic, ceremonial, and other privileges of one high in rank would take a long time. To a certain extent a man has the right to split his inheritance, in other words, to hand down to one of his sons or nephews, as the case might be, certain privileges, to another certain others. Very often such a division is reducible to the association of privileges with definite localities, a point which is of primary importance in connection with the village community as the fundamental unit in West Coast organization. Thus, if one by the accidents of descent has inherited according to one line of descent a number of privileges associated with village A, in which he is no longer resident, and a number of other privileges according to another line of descent originally associated with village B, in which he is resident, it would be a quite typical proceeding for him to bring up one of his heirs, say the one naturally highest in rank, to assume control of one set of privileges, a younger heir of the other. If the privileges originally connected with village B, let us say, tend to give one a higher place in the tribe than those connected with village A, the chances are that the first heir will be induced to take up his permanent residence in that village, while the transmitter may take the younger heir down to the more distant village and take up residence for a period in order to introduce his heir, as it were, to the privileges designed for him. In other words, there is a more or less definite tendency to connect honours with definite villages and, indeed, no matter how much rights of various sorts may become scattered by the division of inheritances, by the changes of residence due to inter-marriage, and by other factors which tend to complicate their proper assignment, a West Coast Indian never forgets, at least in theory, where a particular privilege originated or with what tribe or clan a particular right, be it name, dance, carving, song, or what not, was in the first instance associated. In short, privileges are bound to the soil.

This brings us to what I believe to be one of the most fundamental ideas in the social structure of these Indians, that is, the idea of a definite patrimony of standing and associated rights which, if possible, should be kept intact or nearly so. Despite the emphasis placed on rank, I think it is clear that the individual as such is of very much less importance than the tradition that for the time being he happens to represent. The very fact that a man often bears the name of a remote ancestor, real or legendary, implies that the honours that he makes use of belong not so much to him individually as to his glorious ancestry, and there is no doubt that the shame of falling behind, in splendour and liberality, the standard set by a predecessor, does much to spur him on to ever greater efforts to increase his prestige and gain for himself new privileges. There is one interesting fact which clearly shows the importance of the family patrimony or of the standing of a particular line of descent as such, as distinct from the individual who happens to be its most honoured representative. This is the merging of various persons belonging to three or four generations into a single unit that need not be further differentiated. Among the Nootka Indians, for instance, an old man, his oldest son say, the oldest son of the son, and, finally, the infant child of the latter, say a daughter, form, to all intents and purposes, a single sociological personality. Titularly the highest rank is accorded, among the Nootka, to the little child, for it is always the last generation that in theory bears the highest honours. In practice, of course, the oldest members of the group get the real credit and do the business, as it were, of the inherited patrimony; but it would be difficult in such a case to say where the great-grandfather's privileges and standing are marked off against those of his son, or grandson, or great-granddaughter. In some cases even a younger son, who would ordinarily be considered as definitely lower in rank than his elder brother, might represent the standing of his father by the exercise of a privilege, say the singing of a particular song in a feast, that belongs to the patrimony of the family. "For men may come and men may go," says the line of descent with its distinctive privileges, "but I go on for ever." This is the Indian theory as implied in their general attitude, though there is no doubt that tremendous changes have in many instances gradually evolved by the dying out of particular lines of descent and the taking over of their privileges by other groups only remotely perhaps connected with them by kin, by the introduction of a new privilege gained say as a dowry, and by numerous other factors. The best way to gain a concrete idea of such a structure of society is to think of the titled portion of the tribe as holding up a definite number, say 15 or more, honoured names, or occupying that number of seats, that have descended from the remote past. The classification of the tribe according to kin intercrosses with that based on rank, as by it individuals are brought together who, from the latter point of view, would have to be kept apart. It is clear that not all the members of a large family group can inherit the standing and all the privileges that belong to it. There must be a large number, particularly the younger sons and daughters and those descended from them, who are less favoured than their elders and who will inherit only some, probably the lesser, privileges. In the course of time, as their relationship to the heads of the family or clan becomes more and more remote, they must be expected to sink lower and lower in the general social scale, and there is no doubt that a large proportion of the commoners are to be considered as the unprivileged kinsmen of the nobles. This is no doubt the attitude of at least some of the Indian tribes, such as the Nootka, among whom such a notion of the relation between the classes of society as we find among the castes of India, say, is certainly not found. There is no doubt, however, that with the growth of power attained by the chiefs and with the increasing remoteness of the ties of kinship binding them with most of the commoners, the chasm between the two would gradually widen. The slaves must be left out of account in this connection. They do not enter into the genealogical framework of the tribe, but seem to a large extent to have been recruited from captives of war.

Indian legend, at least among the Nootka and Kwakiutl, generally conceives of the village community as having grown up out of the small family immediately connected in the remote past with a legendary ancestor. All the members of the village community are therefore looked upon as direct descendants of a common ancestor and must therefore, at least in theory, bear definite degrees of relationship to one another. Whether or not the members of a village are actually so connected is immaterial, the essential point being that even in those tribes where there is no clan organization properly so-called, there is, nevertheless, a distinct feeling of kinship among all or most of the members of each of its village communities. This is borne out by the fact that individuals are taught to address each other by certain terms of relationship, even where the appropriateness of such terms is not obvious to them. Thus, a man well advanced in years might call a little child his older brother, for the reason that they are respectively descended from ancestors who stood to each other in that relation. Naturally intermarriages would bring about intercrossings of all sorts, and in course of time the more remote degrees of relationship would be forgotten and new ones, brought nearer home by more recent marriages, take their place.

Let us suppose that a village community is strictly homogeneous in structure, that is, contains no members that cannot count their descent in either the male or female line from the common ancestor. It is obvious that this state of affairs cannot last indefinitely. The accidents of war will doubtless bring it about that sooner or later some neighbouring village community, that has suffered considerably at the hands of an enemy and that finds itself subject to extermination at their hands, will seek protection from the first village community and, in order to gain this end, will receive permission to take up residence with it. It is immediately apparent that the new enlarged village community, provided it is permanent, will have increased in complexity of structure. Their adherence to their respective traditions will be such that neither of the former village communities will give up its peculiar set of privileges, so that a twofold division of the community, as accentuated by these privileges, will persist. If we imagine this process to have occurred several times, we will gradually arrive at a community which is subdivided into several smaller units which we may call septs or bands, or perhaps even clans, each of which has its distinct stock of legendary traditions and privileges exercised by its titled representatives and whose former connection with a definite locality is still remembered. The growth of the village community does not need, of course, to have taken place only in this fashion. Many other factors may be at work. The group added to the original community may be the survivors of a conquered village who are given a subordinate place. Furthermore, a member of another tribe or community that has married into the community may, if he (or she) has sufficient prestige, be able to assert the higher rank that he (she) brings with him (her) and found a new line of descent which will take its place side by side with those already represented. We see, then, a number of ways in which the typical division of a tribe into clans, such as we find among the Haida, may be expected to originate. Such a clan, from the point of view of West Coast conditions, may be defined as a group of kinsmen, real or supposed, who form one of the subdivisions of a village community and who inherit a common stock of traditions associated with a definite locality, the original home of the group.

Clans in this sense we have among the southern tribes that we have enumerated; but it is not until we reach the more northern tribes, such as the Tlingit, Haida, and Tsimshian, that the clan becomes a clearly defined and perfectly solidified unit. This is brought about primarily by the restriction of inheritance. Among the Nootka Indians, for instance, it is possible to inherit privileges in both the male and female lines, preference, where possible, being given to the former. This being the case, it is often hard to see exactly to which sept or clan a person properly belongs, and the decision is generally based on the character of the privileges that are transmitted to him, for, as we have seen, a privilege is always connected with a definite locality, sept, or original village community. In other words, a person steps into certain rights to which he has a claim by descent, and in the exercise of these becomes identified with the particular sept or clan with which they are associated. As the septs have their definite seating at feasts, it is easy to see how the identification of an individual with one sept rather than with another can be made visible. This will indicate also that there are certain natural limitations to the inheritance of all privileges that one has a theoretical claim to. This sort of clan division, however, for the reason that it is too ill-defined and vacillating, can hardly be considered as typical of what we ordinarily understand by clan organization. If, however, we once limit the inheritance of status and privileges to either the male or female line, to the absolute exclusion of the other, we obtain a series of septs or clans that are once and for all rigidly set off against each other. Among the more northern tribes, then, who inherit through the female line alone, there can never be the slightest doubt as to what clan a person is to be identified with.

Furthermore, among the more southern tribes intermarriage is prohibited only between such as are demonstrably related by blood, even if fairly remotely so. Owing to the structure of the village community, this would in many cases mean that there are few persons in a village that one is legally entitled to marry; but it is important to note that the village community as such need not be exogamous, that is, does not specifically prohibit intermarriage among its members. The clan of the northern tribes, which is more rigidly defined by descent and which therefore gains in solidarity, is further accentuated by strict exogamy. Whether such exogamy is a primary feature of the clan itself or is only a necessary consequence of the exogamy of certain larger groups known as phratries, which we shall take up in a moment, is a question which I would not venture to decide and which need not occupy us here. We spoke before of the fact that the original village communities, before amalgamating, each had its peculiar privileges. Certain of these privileges, particularly the crest paintings and carvings, are emblematic of the communities and may be said to give the septs or clans a totemic character. Among the southern tribes, however, it would seem that the crests, which are generally animals or supernatural beings, are employed exclusively by the nobles and that a commoner, even though identified with a particular sept, cannot be said to be in any sense associated with the crest. To what extent the crests are characteristic of the clan generally in the north and to what extent they are more especially in the nature of privileges enjoyed by the nobles, has not been made perfectly clear. It would seem that certain crests, whose origin is particularly remote, have lost such individual value as they may have had and have become clan emblems properly speaking, whereas others are more restricted in their use and would seem to be the peculiar privilege of certain titled individuals or families.

We shall now briefly review the main facts of clan organization among the Tlingit, Haida, Tsimshian, and Kwakiutl, concerning whom our published information is fullest. The Tlingit are divided into two main divisions, known respectively as Ravens and Wolves, the latter being in some of the villages referred to also as Eagles. In at least one of the southern Tlingit tribes, the Sanya, there is a division which stands outside of the grouping into two phratries, and the members of which may intermarry with either the Ravens or the Wolves. The Ravens and Wolves are respectively debarred from intermarriage within their own ranks. A Raven man must marry a Wolf woman, a Wolf man a Raven woman, while the children of the pair belong to the phratry of the mother. It is important to bear in mind that this dual division of the Tlingit Indians is not associated with particular villages or even tribes, but applies to all the Tlingit tribes. A Raven, for instance, from Tongas, the southernmost Tlingit village, is as strictly debarred from marrying a Raven woman of Yakutat, in the extreme north, as a Raven woman of his own village. When we remember that he may never have been within miles of Yakutat and may know few or no Indians from that region, we see clearly that whether or not phratric exogamy is in origin an outgrowth of an interdict against marriage of those of close kin, an interdict which we find to be practically universal, it is certainly rather different from it psychologically. The leading crest or emblem of the Raven people is the raven, who is at the same time the most important mythological being in the beliefs of the Tlingit Indians. The main crest of the Wolf people is the wolf. The phratries stand to each other as opposites that do each other mutual services. Thus, the Wolves conduct the funeral ceremonies of the Ravens and, when they give a feast, distribute the property to the Ravens.

Each phratry is subdivided into a considerable number of clans, each with its own distinctive crest or crests, generally in addition to the general crest of the phratry to which it belongs. Unlike the two main phratries, the clans are not found in all the villages of the Tlingit, though many of them are found represented in more than one village. If we assume, as I believe to be the case, that the clans were originally nothing but village communities, it follows that the present distribution of clans is secondary and due to migrations or movements of part of the clansmen away from the main body of their kinsmen. Should a number of clansmen of the original clan village be induced for one reason or another to take up residence in another village, the home primarily of another clan, it is clear that they would, to begin with, be an intrusive element in their new home; but would in course of time be looked upon as forming an integral part of the village community, though of lesser importance than the dominant clan. The legends of the Indians themselves clearly indicate that such whole or partial clan movements have frequently taken place. Many of the names of the clans themselves plainly indicate their local origin. Thus, the Kiksadi are a Raven clan that are found represented in several Tlingit tribes, such as the Sanya, the Stikine people, and the Sitka Indians. The name means nothing more than People-of-the-Island-Kiks and clearly implies that the clan was, to begin with, at home in a particular locality and gradually became distributed over a large area by various movements of population. The force of tradition would always be strong enough to keep up the old clan crests and other clan privileges, wherever the clansmen moved. In course of time the appearance is attained of a clan distribution which has nothing to do with local communities as such.

Very similar conditions prevail among the Haida Indians. Here again we have two main phratries, subdivided into a large number of clans. As among the Tlingit, the Haida phratries are exogamous and descent in them is reckoned through the female line. One of them is termed Raven, though, curiously enough, the main crest of this phratry is not the raven but the killer-whale. The opposite phratry is termed Eagle, this animal being the chief crest of the phratry. Among the Haida, as among the Tlingit, the native legends indicate that the clans were originally confined to certain definite localities, but that in course of time the clansmen moved about in various ways until now, when they are represented in a number of villages. One concrete instance will serve to illustrate the actual state of affairs. In the town of Skidegate there were represented in earlier times three distinct Eagle clans, and three distinct Raven clans, each of these six clans occupying its own houses. Of the six clans the dominant one was an Eagle clan known as People-of-the-great-house, claiming as their crests the Raven (this in spite of the fact that they do not belong to the Raven phratry), a supernatural being known as *wāsg̣o*, the dog-fish, the weasel, the eagle, the sculpin, and the halibut. Presumably this clan formed the original nucleus of the present town of Skidegate about which the other clans in course of time clustered. The Haida clan names are generally either local in character, like most of the Tlingit names, or of an honorific character, like the one that we have just quoted.

The Tsimshian are organized similarly to the Tlingit and Haida, except that their clans are grouped into four phratries: the Raven, Eagle, Wolf, and Grizzly Bear.

Among the southern Kwakiutl also the single tribes are subdivided into a number of clans, each of which, there is reason to believe on legendary and other evidence, originally formed a separate village community. These have chiefly honorific titles, such as "The-chiefs," "Those-who-receive-first," and "Having-a-great-name." Some of these names occur in more than one of the Kwakiutl tribes; but it seems more likely that these correspondences in name are due to imitations rather than to a genealogical connection between the clans of like name. The social structure of the Kwakiutl Indians differs from that of the Tlingit and Haida in that the clans are not grouped into phratries, and that they do not seem to be exogamous. As to descent, it seems that at least the most important privileges are regularly transmitted as a dowry to the son-in-law, who holds them in trust for his son. This method of inheritance has been explained as a peculiar Kwakiutl adaptation of an originally paternal system of inheritance to the maternal system in vogue among the more northern tribes, by whom the Kwakiutl were presumably influenced. There are, however, some difficulties in the way of this explanation, one of which is the fact that the Nootka Indians to the south are not organized on a purely paternal basis, but allow many privileges to descend through the female line. Among them also such privileges may be handed over as a dowry, though this system has not been standardized among them to the same extent as among the Kwakiutl.

There are two important peculiarities of the West Coast crests which make them contrast with the totems of such typical totemic communities as the Iroquois Indians of the east or the Pueblos of the southwest. Among these latter, who, like the Haida and Tlingit, are organized into exogamous clans of maternal descent, a clan has a single crest or totem after which it is named. Moreover, no other clan can use this totem. The West Coast clans differ in both these respects. As we have already shown in the case of one of the Haida Eagle clans, a group of clansmen generally lay claim to more than one crest; further, only certain crests are confined to single clans, the more important ones being generally represented in several. Thus, the grizzly-bear is claimed as a crest by no less than twelve distinct Haida clans of the Raven phratry, the rainbow by eight, the sea-lion by five, the beaver by twelve Eagle clans, the whale by seven, the humming-bird by three, and so on. In some cases a clan even makes use of a crest which primarily belongs to the opposite phratry. Evidently there is not the same intimate and clear-cut association between totem and clan, as such, that is typical of the Iroquois and Pueblo Indians.

It is probable that the duplication of crests is to be explained chiefly on the theory that many clans arose as subdivisions of other clans. Such a clan offshoot would keep the old crest or crests, but might in time add one or more to its stock, without sharing them with the mother clan. The clan can, indeed, be arranged in the form of a genealogical tree and the crests stratified. The older the crest, the greater number of times is it found in the various clans; on the other hand, a crest found in only one clan may be suspected to be of recent origin, as it probably does not antedate the severance of its clan from the older group originally including it.

Whatever may have been its origin, the crest seems to have become, to a large extent, a symbol of greatness, and it became the desire of the chiefs to add to their prestige by the acquisition of new crests. They were not only obtained by inheritance, but could be secured as gifts, or even by forcible means in war. The fact that the name of the clan does not as a rule refer to a totem also seems to indicate that the clan may not, to begin with, be organically connected with a particular crest. That the clansmen are not conceived of as descended from one of their crest animals, and that there seem to be no taboos in force against the eating or killing of the crest animals, need not matter, for these are by no means constant features of even typical totemic societies.

There is another feature of the crests of the West Coast Indians which accentuates their difference from typical clan totems. This is the tendency they have to be thought of in very concrete terms, as carvings or paintings. It would in many cases, for instance, be more correct to say that a certain chief uses a ceremonial hat representing the Beaver, or that he has the right to paint the Thunder-bird on the outside of his house, than that he possesses the Beaver or Thunder-bird crest or totem. His justification for the use of these would be a legend, telling of how one of his ancestors gained the privilege by contact with the crest animals—a type of legend which is told to account for the use of nearly all crests. We see more clearly now why earlier in this paper I referred to crests as a particular type of an inheritable privilege. Incidentally, it is interesting to note that the Kwakiutl term for crest seems to denote primarily a carving.

Crests are shown or utilized in different ways. They may be painted on movable boards used as screens or otherwise, painted on the outside of the house or along the bed platform, carved on the house-posts or beams, or on memorial columns, or on the outside house-posts popularly known as totem poles, tattooed on the body, painted on the face during feasts, represented in dance-hats, masks, staffs, or other ceremonial paraphernalia, woven in ceremonial robes, referred to in clan legends, dramatically represented at potlatches in performances based on such legends, referred to in songs owned by the clan or clan-chiefs, and in individual or house names. Not all house names, however, refer to a crest. The village and clan names are also, as a rule, unconnected with crests. So accustomed have the West Coast Indians, particularly those of the north, become to the representation of crest animals in carving and painting, that they introduce them even in objects that are not as a rule connected with the exercise of privileges. Among such objects are the beautifully ornamented dishes, boxes, batons, spoons, rattles, clubbers, and gambling-sticks that are so often admired in ethnological museums. We see here how the elaboration of the crest system has fostered among these Indians the development of plastic art. It has also been suggested, and I believe with justice, that the tendency to artistic and dramatic representation in turn reacted upon the development of the crest system, a development that was strengthened by the ever-present desire for new privileges and for novel ways of exhibiting the old ones.

The origin of the crests need not have been the same in all cases. In some cases, for instance, it can be shown that they were obtained by marriage or as gifts in return for a service. These new crests would of course be handed down along with the old inherited ones. Such methods of obtaining crests, however, must be considered as purely secondary, and the real problem of accounting for their origin still remains. The most plausible explanation that has been offered is, on the whole, that which considers the clan crest as an extension of the personal manitou or tutelary being. Among practically all Indians we find the practice of seeking supernatural protection or power by fasting and dreaming of certain animals or objects that are believed to be endowed with such power. If we suppose that a personal guardian thus obtained is handed down by inheritance, we can readily understand how the manitou of an ancestor may gradually become transformed into a clan totem or crest. The main difficulty with this theory is that personal guardians or medicines do not normally seem to be inheritable. On the other hand, the legends related by the West Coast Indians to account for the origin of crests do bear an unmistaken resemblance to tales of the acquisition of supernatural guardians. It is not difficult to understand how the religious element, which must have been strongly emphasized in the manitou, gradually faded away as the manitou developed (or degenerated) into a crest. At any rate, the problem is far from being satisfactorily solved.

Even more fundamental than the clans are, among the northern tribes, the phratries which include them. Their origin also is far from clear. Whether they resulted from the amalgamation of a number of clans into larger units, or whether, on the contrary, the clans within the phratry are to be considered as local off-shoots from it, is often difficult to decide. On the whole, however, the latter alternative seems the more typical one. This is indicated, first of all, by the fact that each of the two main phratries is represented in every village, though, on the other hand, the necessary intermarriages between the phratries might soon bring about this state of affairs under any circumstances. More important is the fact that the phratric crest is shared by all or practically all the clans of the phratry; this seems to imply that the phratry with its crest is a fundamental unit antedating the rise of the separate clans. The fundamental importance of the two phratric divisions of the Haida is beautifully illustrated by their belief in the validity of this social arrangement in the supernatural world. Thus, every being of the sea was conceived of as belonging from the beginning of time to either the Raven or Eagle phratry. It is conceivable that the phratries are sociologically reinterpreted forms of originally distinct tribal units. Apropos of this possibility, it may be noted that in many tribal organizations certain clans, gentes, camp-circle units, or other social units are, either in fact or origin, a group of aliens incorporated into the main tribe. According to Tlingit legend, indeed, the Ravens were originally Coast people, the Wolves inland people. This may, however, be a mere rationalization of an obvious fact of zoological distribution, the raven being common on the coast while the wolf is chiefly confined to the woods.

So much for social organization according to rank and kinship. The third type of organization, the local, we have had to take up in connection with the other two. Local classifications as distinct from kin classifications arise only when the clan ceases to be confined to a single locality. When this happens, the kin and local groupings necessarily intercross and town administration arises, which provides for more than the needs of a clan or group of kinsmen.

The ritual organization which we have listed as a fourth type of social organization is best developed among the Kwakiutl Indians. Among these Indians the clan system which is operative during the greater part of the year, the so called profane season, gives place during the winter to a ritualistic organization based on the right to the performance of religious dances. The dancers impersonate various supernatural beings from whom they are supposed to have received manitou power. In actual practice the performance of the dance is conditioned by the inherited right to them. Such rights are justified in legends accounting for the introduction of the dance by an ancestor, supposed to have come in contact with the supernatural being himself and to have been instructed by him. In a sense all those who perform the same dance form a secret society, though this term, which has been often used, does not seem particularly appropriate to me. The dances are graded into two series—a lower and a higher one. The dancers of the lower series are collectively known as Sparrows[1], those

[1]Or some other small bird.

of the higher as Seals. One may pass in successive seasons from one so-called society to another, up to the point allowed by his or her particular inheritance. The most important of the dance-societies are the Ghosts, the Fool-dancers, the Grizzly-bears, and the Cannibals. While there are certain external resemblances between the ritual and clan organizations of the Kwakiutl, I believe it would be erroneous to consider the former as specialized forms of the latter. I consider it far more likely that the ritualistic activities were simply patterned on the normal clan organization, the ever-present tendency to ranking finding expression in both. The other tribes of this region have borrowed much of the Kwakiutl rituals, but do not seem to share their elaborate ritual organization.

The space at our disposal will not permit us to go more deeply into the intricacies of West Coast social organization. It is difficult to render clear in a few strokes what seems an essentially involved set of social phenomena and I am not at all certain that I have succeeded in my object. The main points that I have tried to bring out are the fundamental importance of inherited privileges as such, the growth of the village community into a clan, the peculiar character of the crest system of these Indians when compared with typical totemism elsewhere, and the almost exaggerated development of the idea of grading of individuals and privileges.

An Organization of the Scientific Investigation of the Indian Place-nomenclature of the Maritime Provinces of Canada.

(Fifth Paper).

By W. F. GANONG, M.A., Ph.D.

(Read by Title, May Meeting, 1915.)

This paper continues the aim and general method of its four predecessors, which have appeared in successive volumes of these Transactions. In all I am trying to apply the methods of exact scientific analysis to a very interesting subject which is more entangled with error than any other I can think of. The method may be described as that of collection-authentication-localization-comparison-classification-inference-testing-conclusion. It is solving the problems of the difficult subject with unexpected success.

For convenience of reference I may state that the previous papers treated in this way the names Oromocto, Magaguadavic, Upsalquitch, Manan, Nepisiguit, Kouchibouguac, Anagance, Wagan, Pokiok, Penniac, Bocabec, Pentagoet-Penobscot, Pohenegamook, Cobscook, Canso, Sevogle, Petitcodiac, Bedeque, Baddeck, Pokwagamoos, Pugwash, Pocologan, and used the roots thus made available in the analysis of a good many others of lesser importance. In the present paper I have adopted a somewhat different plan, for I have taken a single prominent root, viz., the suffix —*acadie* and its variants, and have tried to treat systematically all of the names I can find that involve this root.

A great many of the names contained in these papers are extinct, but they offer a perfect treasury of pleasing and appropriate place-names for use in the future, as names are required for new post offices, settlements, and the like. For this purpose they need often to be simplified, to which end, I have given much effort; and I have tried to suggest simple and pleasing forms, not on the basis of any arbitrary choice of my own, but in accordance with the principles which have guided the simplification of such aboriginal names as have remained in actual use.

As to pronunciation, I have myself used, as a rule, only the ordinary English sounds of the letters in order that the reader may be able to understand the words without constant recourse to special keys. For a similar reason, viz., in order that the conclusions as to the origin of the respective names may be readily copied in print by any who are interested to do so, I have avoided the use of all special signs that are difficult to reproduce typographically, although in reproducing the words given by others I have kept rigidly to their exact forms. All of the pronunciation signs from Rand's works are identical with those used in the English Dictionaries, the only peculiarity occurring in his *Micmac-English Dictionary*, where his editor has adopted the letters *tc* to express the soft *ch* as in church. Gatschet and M. Chamberlain both use the standard alphabet of philologists, in which the vowels are sounded in the continental fashion. Father Rasle's words are of course to be read as French.

CONTENTS.

A. The application and significance of the aboriginal place-name suffix which survives as —ACADIE, —AQUODDY, or —KONTE.

In listing, for purposes of comparative study, the Indian place-names, both extant and extinct, in the eastern provinces of Canada, one is struck by the abundance of certain terminations, the most frequent of which is —ACADIE, or some form obviously identical therewith. Not many of these names have survived, only Shubenacadie and Passamaquoddy, with the less-known Newdy Quoddy, Benacadie, Shenacadie, and Amaguadus in the Maritime Provinces, (Tracadie having another origin), the allied Megantic in Quebec, with Matamiscontis, Nahmakanta, Cobbosseecontee, and probably Mooselookmeguntic in Maine; but a great many others have been used by the Indians, as recorded in the following pages. The particular termination —ACADIE has also another interest, in that the very abundance of its use is popularly supposed to have originated the historic name ACADIE, of pathetic memory. In this paper I give all of the names ending in —ACADIE that I can find (through there must be more), and incidentally I take advantage of the opportunity to present anew the evidence which bears upon the origin of ACADIE, and which seems to show that the popular belief is not correct, the word having a very different origin.

First we consider the forms of the termination —ACADIE, which is not the aboriginal but the familiarized, French and English, spelling. Our best authority, Dr. S. T. Rand, in his works on the Micmac language, uses most frequently, as witness the many examples in the following pages, the form –ĀKĂDE, sometimes –ĀĀKĂDE or WĀKĂDE; and this is the form which has been familiarized to –ACADIE, as in Shubenacadie. Less frequently he writes -OOKWÂDIK, -ĀĀKWODE, -OGWŎDE, -OOKWŎDE; and this is the form which has become familiarized to –AQUODDY, as in Passamaquoddy. One's first natural thought must be that the difference between these forms is dialectical, and this view appears in some publications; but it is completely disproved by the fact shown in the following pages, that the two terminations are intermingled throughout the provinces, and not seggregated geographically as the dialectical theory would require. The real explanation of the matter has been given me by Father Pacifique, who himself uses generally –EGATIG, but sometimes –AGOATIG. It is a euphonic matter, depending upon the preceding vowels; if these give an OO sound, or in other words if the preceding root ends in an OO sound, then the –A-KADI–becomes –A-KWADI, or rather, since in this case the OO sound extinguishes the following Ā, it becomes OO-KWADI. As to the form of the root among the Indians of Maine, there seems to be no equivalent for the OO-KWADI form, while as to the ordinary form –KANTI, the possessive Ā seems always to be subordinated if not wanting, and there is inserted the characteristic nasal N, which, though half silent, is yet usually recognized, making the form KANTI, familiarized to –CONTE or equivalent, as in COBBESEECONTEE. As to a form –UKOTIK, which the late A. S. Gatschet gave to Mr. James Vroom (so Mr. Vroom tells me), as a Penobscot form of AKADI, with the meaning CATCHING PLACE, I have not been able to find any trace thereof in Penobscot Place-names.

In some cases, recorded in the following pages, the termination has the form ĀGĂDIK,–ĀGĂDICH, or the like, with an equivalent –KONTIS in the Maine names. But the matter is perfectly clear, for the final –K represents obviously the common locative, giving the word the significance of a place-name. The forms –CH and –S, represent, I believe, not a condensation of the terminations –CHEECH and –SIS, the diminutives meaning LITTLE, as one's first thought naturally has it, and as even Rand has sometimes assumed, but a softened form of the locative K, a matter which has been explained in the preceding paper (page 264), and is mentioned again on later pages of the present one (pages 390, 400). The locative –K or –CH or –S, of course is understood in all place-names where not expressed, and hence I introduce it in parentheses in writing the aboriginal forms of the termination where it seems to be wanting, thus producing the spelling–ĀKĂDI(K), or equivalent.

The pronunciation of this root by the Indians, (except where influenced, in surviving names, by the whites), has always the accent on the syllable before the last, making it–ĀKĂ'DIK. Rand thus marks it, for actual place-names, throughout his works, and I have myself always caught it in this form from the Indians. We have preserved this stress correctly in Passamaquoddy, but have thrown the accent back to the preceding syllable in Shubenacadie; and our familiarity with that word, and its apparent homologue Tracadie, and especially with their supposed homologue Acadie, leads us involuntarily to throw the stress too far back in pronouncing the Indian termination. It should be –ACA'DIE, and the reader of the following pages should thus sound it in the aboriginal forms of the names. The Anglicized pronunciation –A'CADIE, however, has become so completely fixed in our minds that it would be quite useless, in adopting any of the Indian words into English as future place-names, to attempt to keep the Indian stress; and it will be practically better to sound all such words in the Anglicized manner.

In view of the many variant forms of the root, we must needs adopt some standard form thereof. Naturally we take that which comes the nearest our orthography permits to the most typical Indian form of the word, and that, all things considered, seems to me–ĀKA'DI, which in the locative would be –ĀKA'DIK, or, in case the locative is only understood, –ĀKA'DI(K). The corresponding Maine form would be –KANTI and –KANTIK or –KANTI(K).

The termination –ĀKA'DI has this constant feature of use, that it is always preceded by the name of some object, usually animal or plant, which is specially prominent at the place to which the name applies. Thus, to take the oftenest quoted example, in SHUBENACADIE, which in full Indian form is SEGUBUN-ĀKA'DI(K), the SEGUBUN is the Indian name for the Ground Nut, or Indian Potato, an important food plant of the Indians, while in PASSAMAQUODDY, in Indian PESTUMOO–KWA'DI(K), PESTUM or PESTUMOO is the Indian name for the POLLOCK, an important food fish of the Indians. These two appear to be typical of all.

Turning, now, to a more exact analysis of the termination –ĀKA'DIK, we find it to consist of three parts. The termination –K is obviously the locative suffix just described. The –Ā, written also ĀĀ (the same sound lengthened) and WĀ, is as clearly the familiar Indian possessive, found in a great many words, where it signifies ITS or THEIR, though it is extinguished from the combination if the preceding word ends in O or OO. The remainder of the combination, the –KA′DI–, is the most important part, and it has been differently interpreted in the various writings upon the subject. It is most commonly stated to mean PLENTY or ABUNDANCE, of the object described by the prefix, so that SHUBENACADIE, for instance, would mean PLENTY OF GROUND NUTS, and PASSAMAQUODDY would mean PLENTY OF POLLOCK. This idea seems to have originated with Dawson, or at least was given its wide currency by him through his influential work *Acadian Geology*, often mentioned in the following pages, and it has the benefit of the advocacy of no less an authority than J. Hammond Trumbull, in his foundational work cited often in the following pages, (e.g. page 391). Nevertheless, the evidence seems to me to show that this idea is not quite correct. In the first place, many of the names with the –ĀCA′DIE or –ĀKA′DIK termination have a significance not so much of PLENTY as of OCCURRENCE, such as in AGLASEAWACADIE, meaning AN ENGLISH SETTLEMENT, where the idea obviously is not the plentifulness of the Englishmen, but their occurrence or presence at a certain place. Furthermore, a comparison of the meanings of the entire series of names will show that uniformly this idea of PRESENCE or OCCURRENCE is in them all, while the idea of PLENTY is secondary if present at all. In the second place, Rand, our best authority, in his interpretations of the word, never has prominent the idea of PLENTY, but always of PRESENCE or OCCURRENCE. Furthermore, Father Pacifique, the leading scholar in Micmac of the present day, in his *Micmac Almanac* of 1902, has used this same termination, which he writes –EGATIG, in many cases where only the idea of PRESENCE, not of PLENTY is involved, and most strikingly of all in places named for the Saints of the Church, e.g., PELNALEGATIG, meaning St. Bernard's (the Indian L replacing, as usual, the English R). In the third place, the Indians themselves then interpreting these words, so not make prominent the idea of plenty, but only that of the occurrence there of something. It means "where you get them," my note-book records that a Maliseet Indian once told me; it "Means—where you find 'em," said Captain Campbell Hardy's Micmac, as noted in a work in connection with Shubenacadie following. This point as to the exact significance of the root was argued very clearly and conclusively by James Vroom, with an illustrative list of twenty-two names, in one of his all too rare writings, in the *Educational Review* (St. John), VI, 1892, 9. Gathering all of the evidence together, it seems to me quite clear that the primary significance of the root –KA′DI– is that of PRESENCE or OCCUR-

RENCE of something which is designated by the prefix, whether Ground Nuts, Pollock, Englishmen, or what not. The same idea inheres in the Maine words ending in –KANTI–, all of Trumbull's own illustrations seeming to me to fit better this idea of OCCURRENCE than that of the PLENTY which he tried to draw from them. The reason for the prominence of this idea of PLENTY is obvious enough, for it is of course true that the PRESENCE or OCCURRENCE of any object to a degree sufficient to attract comment and originate a place-name does *imply* a considerable ABUNDANCE, which may therefore be taken as a prominent secondary implication of the word, even though the idea of OCCURRENCE is the primary significance.

While it is not needful for our present purposes to analyse further this root–KA'DI–, we should note that it seems clearly connected with the second part of the Micmac verb ETLŬGADŬM, meaning DWELL or RĖSIDE, as fully considered later under TRACADIE (page 436), which is directly derived therefrom. Trumbull, in his work earlier cited, has attempted a still farther analysis of the root into two components, which, however, seem to me not well applicable to our Micmac forms.

Since for descriptive purposes we need a standard meaning as well as form for this prominent and important root, I have adopted OCCURRENCE, in conformity to the foregoing argument, throughout this paper. Thus the standard form in full would be –Ā-KA'DI–(K), meaning THEIR (or ITS) –OCCURRENCE–(PLACE).

In Father Pacifique's valuable Micmac Almanac of 1902, are contained many place-names ending in –EGATIG, which is his equivalent for Rand's –ĀKĂDE, and our –ĀKA'DI–(K). In some cases these names are exactly equivalent to Rand's except for the spelling; in other cases, they represent, as Father Pacifique has himself informed me, adapted or made-up names, introduced for purposes of convenience in his enumeration of Indian settlements; and in many cases they embody the name of the titular Saint of the church of the place, with this termination, such names being further distinguishable, as a rule, by a prefatory S. All of Father Pacifique's names that I could be sure are aboriginal have been mentioned in the foregoing pages.

Aside from the case of TRACADIE above mentioned, there appears to be no root in our Acadian place-names which can be confused with –Ā–KA'DI–(K), while the same seems true of the -KONTE of the Indians of Maine, for the possible cases cited by Trumbull appear not to occur in reality. There is, however, a certain relation between this root and the termination –Ā–WIK, or –Ā–VIK, (as for example in Magaguadavic), already explained in the first paper of this series (page 187), and later to be discussed by itself. In primary signification the two roots seem practically identical, the –Ā–KA′DI–K signifying THEIR-OCCURRENCE-PLACE, and the –Ā–WIK signifying THEIR-PLACE. To us there is no perceptible difference in significance, but perhaps to the Indian there was. The thought naturally occurs that perhaps the latter form is simply an abbreviation of the former, by omission of a superfluous syllable; and this is possibly the case, though it seems unlikelv.

As with a good many other Indian words, the termination –ĀKA′DI united with a preceding noun, forms primarily a topographical term which only secondarily becomes fixed as a place-name. Thus Shubenacadie, in its Indian form, was probably a term applicable to any place where ground nuts occur, and later by reiterated application to a particular place became recognized as the name of that place. In the same way Meskeguacadie, in its Indian form, was the term by which the Indians designated a meadow, any meadow; but in a special case it became attached to a particular meadow, viz. Grand Pré in Nova Scotia. Rand gives several such names, collected into a single list later in this paper (page 432), in which no use of the terms as true place-names is known. Others, however, occur which are used both as topographical terms and place-names, and there would naturally be every gradation between the two. Undoubtedly all of the –ACADIE names originated in this way. The visible differences between the two would consist only in this, that when the word became a place-name it would take the final locative –K or equivalent, which it would lack if only a topographical term. In addition there seems to be another difference embodied in the forms given by Rand and followed in the following pages, that the topographical terms appear often to be pronounced with the accent on the –Ā syllable instead of the KA; but this may be simply a reflex effect, upon Rand, or his Indian informants, of our popular pronunciation of all –ACADIE names.

While many of the aboriginal –ACADIE names are simple in form and comparatively easy of pronunciation, others are neither. Accordingly in the following list I have endeavoured to suggest simplified forms for future restoration as place-names, giving always this simplified form as the heading. This simplification is by no means an arbitrary process, but is based on the methods by which such words as Shubenacadie, Passamaquoddy, etc., have been brought to their present forms.

B. Analytical list of aboriginal place-names involving the suffix root –ACADIE, –QUODDY, –KONTE, meaning OCCURRENCE.

ADOGWASACADIE. The Micmac name for Trout Brook, according to Rand, who gives it as ATOGASWEGATIK (*Micmac-English Dictionary*, 180). The construction of the name is perfectly clear for the termination is obviously our familiar combination –Ā–KA'DI–K, earlier explained (page 380), while the first part is clearly ADOGWAASOO, meaning TROUT (Rand, *First Reading Book*, 52), making the name mean TROUT-THEIR-OCCURRENCE-PLACE. But we have no hint as to which of the innumerable places called Trout Brook the name belongs, and possibly the word is only a translation of an English name into Micmac. The name *Adagwaasook Fishing Club*, an organization with headquarters on the Little Black River in Kent County, New Brunswick, evidently involves the same root.

AGLASACADIE. The Micmac name, in simplified form, of three widely-separated places in the Eastern Provinces.

(1). The name for Tusket, near the western extremity of Nova Scotia, according to Rand, who gives the word as AGLASEĀWĀ'KĂDE, meaning AN ENGLISH SETTLEMENT (*First Reading Book*, 101). The construction of the word, upon this explanation, seems clear. The latter part must represent our familiar roots –WĀ–KA'DI–(K), already explained (page 380), while the first part would be AGLASEĀ, meaning ENGLISH (Rand, *English-Micmac Dictionary*, 99). The actual use of this name seems fully confirmed by an independent statement in Campbell's *History of Yarmouth County*, 20, which reads "Tusket Village, Anglaseawagatty. Place where the English live. This is late Indian." Campbell's spelling of the name by the way, shows that Rand's accent, as one would expect, is displaced, by a typographical error. Gesner uses the word, apparently in a topographical sense, as noted on a later page (page 439).

(2). Further, this same name, with identical meaning, is given by Rand, in the form AGLĂSĒAWÂKADE, as also the Micmac name for East Bay, Cape Breton (*Micmac-English Dictionary*, 179). This Bay, however, a branch of Bras d'Or, has also another Indian name, for on Bellin's Map of the Island of 1744, it is PISCABOUECH, which clearly represents PESKAPAC, meaning BRANCH LAKE, a very appropriate name, as will later be shown.

(3). The same name has been given me by Father Pacifique, in the form AGLASIEOEGATIG, with the meaning ENGLISH SETTLEMENT, for Point Fleurant, at the mouth of the Restigouche River, directly across from Dalhousie, in Quebec. Close alongside is a little brook called Englishman's Brook, evidently connected with this name. Father Pacifique relates that the Indians early complained of encroachments upon their rights by the English settlers in 1786.

It is quite obvious that Campbell must be correct in saying that this word is late Indian, for of course it could not be aboriginal, that is to say, with this meaning and origin. As to this, I think there may be doubt, since the word may represent a Micmac familiarization of some animal or plant name which happened to resemble rather closely their lately-acquired AGLASEĀ, and which became gradually identified with that increasingly-familiar word. I speak in this way of the word AGLASEĀ because there seems no doubt that it is simply an adoption from the French *Anglaise* (Rand, *Micmac-English Dictionary* 8). There seems no historical reason for the application of the name to Tusket, for while a certain early connection with the English is implied in Denys' mention of early expeditions by the New Englanders to the Tusket Islands for seals (*Description*, II, 236; Champlain Society's edition, 342), and possibly in the fact that some Englishmen were early set on shore by La Tour somewhere near Cape Sable (Murdoch, *History of Nova Scotia*, I, 111), there is apparently no record of a genuine early English settlement at Tusket, which was indeed settled by New Englanders after the neighbouring Yarmouth and Chebogue. Furthermore, the case seems even clearer for East Bay, Cape Breton, (if Rand is correct as to this locality), for no English settlement is associated with that place, so far as I can find. Thus the idea that our name is a familiarization of an earlier slightly different aboriginal name seems markedly probable. Seeking, however, for an animal or other natural object having a Micmac name closely like AGLASEĀ I can find nothing better than SAKSKALĀĀS, which is the Scallop, an excellent food mollusc, which the Indians might secure at the very lowest tides (Rand, *First Reading Book*, 54). The latter part of this word represents somewhat closely the GLAS of AGLASEĀ, especially in the form AGLĀSEĀ which Rand sometimes uses, and which is nearer the French original. The full names of natural objects were often abbreviated when used in combination with the root –ĀKA'DI, as examples later in this paper will show. But as to whether the Scallop is especially prominent and obtainable in those places, I have no information, and must leave for decision to the future student of local natural history.

AJOLECHACADIE. The name, in simplified form, of Todd Brook, a small stream near the mouth of the Jemseg on the lower St. John in New Brunswick, as given me by one of the best informed of the Maliseet Indians, in the form WĔLAJAWĂLLŎŎSQUADIC (in the spelling of my notes), with the meaning PERCH BROOK. The construction of the word seems clear, for the latter part, –QUADIC must represent our familiar combination –KA'DI–K, earlier explained (page 380); and it is interesting in connection with the primary signification of this root, to note that my Maliseet explained it as meaning WHERE YOU GET THEM, as stated in my notes taken long before my attention was directed to these matters. As to the first part of the word, the Maliseet name for PERCH is AHTSAB-QUAH LUSK (Barratt, *The Indian of New England*, 14), or AT'–SAK–WA'–LUS (Chamberlain, *Maliseet Vocabulary*, 38) while in Micmac it is AH-CHOKOLLO–WETZ (Barratt *op. cit.*) or AJOGOOLOOĔCH' (Rand, *First Reading Book*, 52). As between the two there can be no question that the word I wrote WĔLAJĂWALLŎŎS is the Micmac form, though I do not understand my prefixed syllable WĔL; and my informant evidently elided the K or hard G sound, as the Indians frequently do. Gathering together all of the facts it seems clear that the full form of this word would be AJOGOOLOOECH–(Ā)–KA'DI–K, meaning literally PERCH-THEIR-OCCURRENCE-PLACE.

ALOSOLACADIE. The Micmac name, in much simplified form, of Sackville, in Halifax County, Nova Scotia, according to Rand, who gives the name as ALOO-SOOLAWĀKADE (*Micmac-English Dictionary*, 14). He then adds the explanation "So named because an epidemic of measles carried off a large number of the people there." The origin of the name is thus plain, for he gives *ALOOSOOL* as meaning THE MEASELS, while the latter part of the word is our familiar combination –Ā–KA'DI–(K), earlier explained (page 380), making the name in full ALOOSOOL-Ā–KA'DI–(K) meaning literally MEASLES-THEIR-OCCURRENCE-(PLACE). The word is of interest as showing the use of the termination –ACADIE in a sense not of ABUNDANCE, or PLENTY, as so many have claimed, but simply of distinctive OCCURRENCE.

In one of his works, Rand, after describing this case in which many Indians died of the measles, always very deadly to them, quotes this name in illustration of the fact that new Indian names may arise from some striking incident, very likely displacing an older one.

Amaguadus.

The name of a Pond, (a lagoon enclosed by a long beach), just within the northern entrance of East Bay, a branch of Bras d'Or Lake, in Cape Breton; also applied to the neighbouring settlement, and its Post Office. It is AMAGUADEES on the large-scale map of the Geological Survey, AMAGUADEEZ on the older Mackinlay maps, while the Post Office name is AMAGUADUS. Rand uses AMAQUADEES, and gives its Micmac name, without meaning, as AMOKATIK (*Micmac-English Dictionary*, 180). Seeking further light upon the word, I have asked the aid of Rev. Father MacPherson, of Glendale, Cape Breton, priest to the Micmacs of the region, who has been so kind as to interview a number of them for me. He learned from Chief Denys of Eskasoni settlement, the oldest resident there, that the Micmacs apply the name AMAGUADEES to that pond, and know also the name AMAGUADI for another pond near by, apparently that next to the eastward of AMAGUADEES. Chief Denys says also that the latter name is the diminutive of the former, thus involving the termination CHEECH, meaning LITTLE. Obviously Rand gave the form without the diminutive, but the latter has come into prominence owing to the fact that settlement has grown up around the AMAGUADEES and not the AMAGUADI pond.

It seems very clear that the word AMAGUADI involves our familiar termination –Ā–KWA'DI–(K) earlier explained (page 377) and this is confirmed by the Indian testimony given below. As to its meaning, however, there is much conflict of opinion among the Indians, for while Chief Denys told Father MacPherson that the word signifies "some kind of fish there," though he was not sure of the kind, Gabriel Sillibos, Captain at Wycocomagh, gave him "Grove of Spear Pole Trees," while Jim Joe, Captain at Malagawatch, gave him "Missing fish there," with an explanation in the failure of fish to be caught on the hook. Obviously the prefix has become so greatly abbreviated as to be unrecognizable by the Indians themselves, Seeking the Micmac name of some lagoon-dwelling animal or plant, of which the name could be abbreviated to AM–, the most probable by far seems to me NŬMDŬMOO, the Oyster (Rand, *First Reading Book*, 54), an animal which is abundant in the Bras d'Or Lakes, and of which the prominence in Indian economy needs no emphasis. In this case the word in full aboriginal form would be NUMDUMOO–Ā–KWA'DI–(K), meaning literally OYSTERS-THEIR-OCCURRENCE-(PLACE) gradually abbreviated by the Indians to UM–A–KWA'DI–(K), which is practically Rand's and Chief Denys' forms. Then for the smaller pond, the diminutive CHEECH, abbreviated to –ES, was added, giving us our present word. This, however, is but a theory, and awaits further evidence.

AMJELAGWECHACADIE. The Micmac name, in simplified form, of Officers or Mission Brook, just above Mission Point at the mouth of the Restigouche, in Quebec. It was given me by Father Pacifique as AMITLAGOETJAOEGATIG, with the meaning PIN FISH PLACE. The construction of the word is clear, for the termination –OEGATIG is the precise equivalent of our –Ā–KA'DI–K, earlier explained (page 379), while the first part of the name is as clearly the equivalent of AMJĔLAGWĔCH, which Rand gives as the Micmac name of the MINNOW (*First Reading Book*, 52). If there were any doubt as to the identity of the PIN FISH and the MINNOW, it would seem to be removed by Rand himself, who gives in his *Micmac-English Dictionary*, 81, the word KUMJILAGWĒTC as meaning PIN FISH, while on page 20 he gives AMJELAGWETC, evidently the same word with some prefatory sound, as meaning MINNOW. Hence the word in full would be AMJĔLAGWĔCH–Ā–KA'DI–K, meaning literally MINNOW-THEIR-OCCURRENCE-PLACE, which is presumably descriptive.

ANAGWACADIE. The Micmac name for Country Harbour, a very prominent inlet on the southeastern coast of Nova Scotia towards Canso. It is given by Rand as ANŬKWĀKĂDE, with the meaning FLOUNDER-GROUND (*First Reading Book*, 85). The construction of the word is perfectly clear, for the latter part is evidently our familiar –Ā-KA'DI-(K), already explained (page 380), while the first part is as certainly the stem of ANAGWĀĀCH, the Micmac name for the FLOUNDER, an important food fish of the Indians (*op. cit.* 52). Thus the name in full would be ANAGW-Ā-KA'DI-(K), meaning literally, FLOUNDER-THEIR-OCCURRENCE-(PLACE).

I have tried, by inquiry of the Keeper of the Light House on Green Island, near by, to find whether the Flounder is particularly distinctive of this Harbour, but have been told that it is so common a fish in all the harbours of that region as to make it impossible to designate this place as especially distinguished by its presence. Further, the generally deep and rocky character of the Harbour does not offer those extensive sand flats to which the Flounder particularly resorts. Finally, the Harbour as a whole has a Micmac name of its own, far more appropriate to its characteristics, viz.: MOOLABOOGWEK, meaning DEEP VALLEY TIDEWAY, as shown earlier in this series (*these Transactions*, VI, 1912, ii, 191). Taking all of the facts together, accordingly, it seems most likely that the name ANAGWACADIE does not designate Country Harbour as a whole, but some particular locality therein, presumably some sandy cove and possibly its branch Isaac Harbour, which seems to have that character,—a matter to be settled by local studies. Rand himself gives the two words as designating two places (*English-Micmac Dictionary*, 71).

Further, Rand gives precisely the same name, in the form ANAGWĀĀKĂDE, meaning FLOUNDER-GROUND, for White Point (*First Reading Book*, 103). The name White Point occurs several times on the coast of Nova Scotia, and without further data it is not possible to say to which thereof this name belonged, though it must have been one distinguished by the presence of sand flats and not ledges. This would fit best, perhaps, with the prominent White Point at Port Mouton.

It is also possible that the word ANAGWĀĀCH, meaning FLOUNDER, is the stem of NEGOUAC, a prominent place at the mouth of the Miramichi River in New Brunswick, though probably the origin of that name is different, as will later be shown.

ANKWISACADICH. The Micmac name, in simplified and tentative form, of a small brook between Eel River and Bonamis Rocks, at the western end of Bay Chaleur in New Brunswick. Father Pacifique gives me the word as ANGOISGE-GATITJK, with the query PLACE OF JOINTS? The latter part of the name is plain, for it is the precise equivalent of our –Ā–KA'DI–K in the diminutive form –Ā–KA'DI–JEECH–K (page 377). As to the former part, that is somewhat obscure, for Father Pacifique's suggestion, which would connect it with Rand's ANKWISKĪ, meaning IT IS A JOINT (*Micmac-English Dictionary*, 23), does not fit well with the termination, which means OCCURRENCE-PLACE of some natural objects. In this connection one thinks of ANAGWĀĀCH–K meaning FLOUNDER(S), Rand's spelling of which (*First Reading Book*, 52) comes reasonably near to Father Pacifique's form. It is possible, I think, that the word is thus really ANAGWĀĀCHK-Ā-KA'DI-JEECH-K, meaning literally FLOUNDERS-THEIR-OCCURRENCE-LITTLE-PLACE, in description of the occurrence of that fish on the sandy flats at the brook, and implying a greater ANAGWĀĀCHK-Ā-KA'DI-K, not far away (compare the preceding words). One thinks also of the abundant fossils in the vicinity to which the name might possibly apply. Local study will settle the question.

APCHEKUMOOSACADIE. The aboriginal Micmac name, in simplified form, of Canard River, Nova Scotia, given by Rand as APCHECHKŬMOOCH-

WĀKĂDE, meaning RESORT OF THE BLACK DUCK (*First Reading Book*, 86). He gives the name of the Black Duck, one of the most important game birds of Nova Scotia, as APCHECHKŬMOOCH, (*op. cit.* 46; *English-Micmac Dictionary*, 93), while the remainder of the word is also clear, involving our familiar Ā-KA'DI(K). Thus the word would be APCHECHKŬMOOCH-WĀ-KA'DI-K, meaning literally BLACK DUCK-THEIR-OCCURRENCE-PLACE. Rand seems to trip when he makes the same word mean "place abounding in little ducks" (*Micmac-English Dictionary*, 180). The appropriateness of the name to the place is attested by its present name, which of course is merely the French word for Duck, though it is not clear whether Canard was a translation into French of the Indian name, or given independently for the abundance of those birds there. This River is distinguished by the great marshes that border it, precisely such places as the Black Duck most prefers.

Exactly the same name, in the form APCHECHKUMOOCH-WAAKADE, with the meaning DUCKLAND, is given as the Micmac name of East River (Pictou) by G. Patterson, evidently on Rand's authority, in his *History of the County of Pictou*, 1877, 32.

The same word exactly is given also by Rand as a topographical term (*English-Micmac Dictionary*, 93), and therefore may have become a place-name in other instances also.

ASUGADICH. The Micmac name for Clam Harbour, according to Rand, who gives the name in the form ĀĀSŬGÂDĬCH or ASUKADITC (the TC=CH), with the meaning CLAM GROUND or PLACE OF CLAMS (*First Reading Book*, 85; *Micmac-English Dictionary*, 180). The construction of the word is perfectly clear, since the latter part is evidently our familiar combination Ā-KA'DI-(K), already explained (page 380), while the final –TC (or CH) must represent a form of the softened locative K, and not a diminutive CHICH, as might at first be inferred. Rand gives ĀĀS as the Micmac word for CLAM (*First Reading Book*, 53). Thus the full form of the word would be ĀĀS-Ā-KA'DI-CH, meaning literally CLAMS-THEIR-OCCURRENCE-PLACE.

It is also possible that the name ĀSEEDĬK, which Rand gives as the name of Lunenburg, Nova Scotia, with the meaning CLAM LAND, is simply a shortened form of this same name, (*First Reading Book*, 91).

Rand does not definitely locate this Clam Harbour, but no doubt he referred to the well-known place of that name on Clam Bay, between Jeddore and Ship Harbour, east of Halifax in Nova Scotia. Presumably the name is accurately descriptive.

In his *Micmac-English Dictionary*, 180, Rand gives the evidently identical name ASUKADITC as applying to St. Esprit, Cape Breton, a salt-water Lake and an Island on the south coast.

BASELACADIE. The Micmac name, in simplified form, of two places in Prince Edward Island.

(1). Cape Traverse, on the southwest coast, is given by Rand as BŬSLOOĀ-KĂDE or BOOSLOOĀĀKĂDE, meaning SEA-COWGROUND (*First Reading Book*, 85; *English-Micmac Dictionary*, 51). The construction of the word seems clear, for the latter part is obviously our familiar combination –WĀ-KA'DI(K), earlier explained (page 380), while the former part would seem to involve a word meaning SEA-COW. The ordinary Micmac word for the sea-cow, which is of course the Walrus, is BÂSTOOGOBĂJIT (see the next following word), but I cannot find BUSLOO or anything near it applied to that animal. The obvious suggestion that the BUSLOO is a misprint in Rand's works for BUSTOO is negatived by the repeated occurrence of both words in his various works; and I can only conclude that BUSLOO was another name, perhaps used only in combination or as a nick-name, for the Walrus. A hint upon this point is given by Bourinot in his list of place-names ending in ACADIE, where, after citing this name upon Rand's authority, he adds, no doubt from some note by Rand himself, "bouselooa meaning to travel by water" (*these Transactions*, IX, 1891, ii, 327). The Walrus does (or did, for it is now extinct in all this region), migrate or travel extensively by water, and hence very likely was known to the Micmacs both as BÂSTOOGOBĂJIT, "the thick-skinned one," and as BUSLOO, "the water-traveller," the one being his regular name and the other a nick-name. At all events the significance of the place-name seems perfectly clear, as BUSLOO-WĀ-KA'DI-(K), meaning literally SEA COW-THEIR-OCCURRENCE (PLACE), or more generally HAUNT OF THE SEA COW. As the Walrus is known to have frequented all this region, and were accustomed to land and bask upon prominent sandy points, I have no doubt that this name is accurately descriptive of their former haunts.

(2). St. Peters Island, at the western entrance to Hillsborough Bay, near Charlottetown, is given by Rand, as BÂSLOOĀĀKÂDE, meaning SEA-COW-HAUNT (*First Reading Book*, 98), while he has BASLOOĀKADE and PASU-LOOĀKADE in his *Micmac-English Dictionary*, 180, 187. Thus in both form and meaning this word seems identical with that just given for Cape Traverse, the difference between BUSLOO and BASLOO being obviously without significance, and representing simply the ways Rand represented on different occasions a sound that is really intermediate. This spelling BASLOO, however, especially as rendered more easy of pronunciation by the introduction of another syllable on the analogy of Rand's PASULOO, gives the best basis for the simplified form BASELACADIE. Taking all the facts together, accordingly, it seems clear that the Micmac name for St. Peters Island is identical with that for Cape Traverse, the two places being sufficiently distant to prevent any confusion between them in the speech of the Indians, and St. Peters Island, like Cape Traverse being thus indicated as one of the favourite former haunts of the Walrus.

A point that at first sight is very puzzling in connection with this name is this, that Rand, in his *Micmac-English Dictionary* above cited, gives as the meaning of the word for both places, not SEA-COW HAUNT, but LANDING PLACE. The word, however, cannot mean LANDING PLACE in the ordinary sense, partly because no roots corresponding thereto appear in the word, and partly because the termination –Ā-KA'DI-(K) implies so positively the name of some animal or other natural object. Accordingly I think either that Rand meant to write LANDING PLACE FOR SEA-COW, their HAUNTS being all LANDING PLACES, or else that in his earlier studies he confused the name of St. Peters Island with that of Governors Island, the only other in Hillsborough Bay, for the name of the latter means WHERE GOODS ARE LANDED (*First Reading Book*, 88). In this case he would naturally extend his error to the identical name of Cape Traverse. Then in his *First Reading Book* he corrected the error, for the latter work, though published much earlier than his *Micmac-English Dictionary*, was worked over by him for publication as his MS. *Dictionary* was not.

BASTOGOBAJITWACADIE. The Micmac name for Graham Head, on the western coast of Prince Edward Island at Bedeque Bay, according to Rand's special list of names mentioned on page 390, which has BĂSTOGOBĂJĬT-WĀĀKĂDE, meaning SEACOW POINT. The word very obviously involves our familiar combination WĀ-KA'DI-(K), already discussed (page 380), together with the BÂSTOGOBĂJIT, meaning the SEACOW (Rand, *English-Micmac Dictionary*, 228), which animal was of course the Walrus, formerly abundant in this region. Thus the word would be BĂSTOGOBĂJĬT-WĀ-KA'DI-(K), meaning literally SEACOW-THEIR-OCCURRENCE-(PLACE). Our modern maps call the place Graham

Point, though it is Graham Head on all those of earlier date, while Seacow Head is a name now given to the point south of Graham Point, thus indicating that to it especially the Indian name applies. This coincidence of English and Indian names, together with the full form of the name in comparison with the other form of name with the same meaning (BUSLOOACADIE, page 386), indicates that the present name is rather a translation of the English name into Micmac than a genuine aboriginal Micmac name.

This word BÂSTOGOBĂJIT bears a close resemblance to MĔSTŬGEPEGĂJIT, the word for Buffalo, especially when the interchangeability of M and B or P is remembered. They seem not, however, to be the same word, since, according to Rand, the former means "thick skinned" (*Micmac-English Dictionary*, 31) and the latter "thick ribbed" (*English-Micmac Dictionary*, 46). Certainly this designation for the Walrus is accurately descriptive.

The occurrence of the Seacow or Walrus in this region is attested by ample historical evidence, which is summarized for Prince Edward Island in *Acadiensis*, III, 1903, 116, and for New Brunswick and the neighbouring part of Nova Scotia in the *Bulletin of the Natural History Society of New Brunswick*, V, 1903, 240; 1905, 462.

Benacadie.

The name of a Pond, Brook, and Point on the north side of Bras d'Or Lake, between East Bay and Grand Narrows, in Cape Breton. The word occurs in Haliburton's *History of Nova Scotia*, II, 1829, 241, as BENAAKADY (BENAKADY on his map), but earlier than that I have not as yet been able to trace it. The word seems clearly Indian, and Rand gives it as the Micmac BENĀKADĒ or BENĀKADE meaning THE HUMBLE PLACE (*Micmac-English Dictionary*, 32, 180).

Further, Rand gives also the name BŬNĀĀKĂDE as the Micmac name for West River Lake, with the meaning REGION OF DARKNESS (*First Reading Book*, 103). There are several West Rivers in Nova Scotia, with Lakes, but there is no question that Rand here refers to Sheet Harbour Lake on the West River of Sheet Harbour, because in his *Micmac-English Dictionary*, 188, he gives the same name PUNĀKADE with the meaning THE PLACE OF BRINGING FORTH, as applying to West River and also to Sheet Harbour Lake, these two, however, being clearly identical. Now this BŬNĀĀKĂDE of Sheet Harbour Lake and BENĀKADĒ in Cape Breton seem clearly identified by Rand as one and the same name by his list of Micmac names in Dawson's *Acadian Geology*, second edition, which reads,—"Buna-Kaddy (Bunacadie or Benacadie)—is the place of bringing forth; a place resorted to by moose in the calving-time."

Yet further, Rand gives another form and meaning for a name which is apparently identical with the PUNĀKADE above-mentioned,—viz., PUNACADIE, in Micmac UPKUNĀKADE, meaning WHERE CANOES ARE BUILT (*Micmac-English Dictionary*, 191). It is quite possible, by the way, that this PUNACADIE is meant by Rand as the equivalent of PANACADIE, later mentioned (page 409), in New Brunswick, which name, as there stated, is presumably identical with BENACADIE.

Thus Rand gives no less than four entirely different meanings for names which seem clearly identical. It is quite possible to discover in his *Dictionaries*, roots which match up with any of these meanings, but the very multiplicity of explanations shows Rand's uncertainty as to the real construction of the word. Moreover, none of these explanations, excepting possibly the third, are consistent with the presence of the obvious combination –A-KA'DI-(K), which, as already explained (page 378), takes with it the name of some common natural object important to the Indians. Accordingly we would expect to find that the prefix BUN, BEN, PUN, PAN, would represent the name of some such object, evidently in abbreviated form, since it does not occur as such in the *Dictionaries*. In this connection one thinks at once of the important name SHUBENACADIE later considered (page 422) the omission of the first syllable of which would give our name BENACADIE. We have indeed an abbreviation of SHUBENACADIE, by a different omission, in SEGUNAKADEECH, also, later considered (page 421). Considering these facts, in conjunction with the wide distribution and large economic importance of the Ground-nut or Indian Potato which SEGUBUN describes, it would seem extremely probable that in BENACADIE we have an abbreviation of SHUBENACADIE, that is SEGUBUN-Ā-KA'DI-(K), with the same meaning of GROUND NUTS-THEIR-OCCURRENCE-(PLACE). But certainty in the matter must await local study of the records and natural history.

Or possibly the root BEN may represent an abbreviation of MULEBUN, given by Rand as another ground nut, related to SEGUBUN, though its identity is not clear from his brief characterization (*Micmac-English Dictionary*, 103).

The Micmacs of Cape Breton, interviewed for me by Father MacPherson, recognize the word as theirs, but cannot give its meaning. Chief Denys, however, says that while BENEGA'TI is their name for Benacadie, they apply also the name BENAGATEES to Pipers Cove, a place a little to the westward.

BOOKSETACADIE. The Micmac name, in simplified form, of an Island near Sydney in Cape Breton, given by Rand in the form BOOKSETOWĀKADE, meaning THE PLACE OF COAL (*Micmac-English Dictionary*, 180). The construction of the name is clear, for the latter part is clearly our familiar combination –Ā-KA'-DI-(K) already explained (page 380), while the former part is as evidently the Micmac word BOOKSĔTOW', one of two common words meaning COAL (Rand, *English-Micmac Dictionary*, 61). Thus the word in full would be BOOKSĔTOW-Ā-KA'DI-(K), meaning literally COAL-ITS-OCCURRENCE-(PLACE), which no doubt is exactly descriptive. With this word may be compared the KULUMVECH-WOPSKWACADIE of page 432. As to the identity of this island, I have no knowledge, for the best maps and charts mark no island near Sydney on which coal can occur. Seemingly Rand has some error of detail.

CHACODI. A former name for Barnaby River, a branch, on the south side, of the lower Miramichi River in New Brunswick. It first appeared in 1685 on the important map of Jumeau as CHICODI (Photographic copy in the Champlain Society's edition of Father le Clercq's *New Relation of Gaspesia*, 10), which was adopted on the great Franquelin-deMeulles map of 1686 as CHICODY (*these Transactions*, III, 1897, ii, 364). It appears as CHACODI in 1744, on Bellin's very influential *Carte de la Partie Orientale de la Nouvelle-France*, and from that map was copied upon a great number, both French and English, sometimes in the form CHACODY. On the maps of that period the River to which it was applied became gradually enlarged and moved westward to fill a large space that would otherwise have been blank, thus causing some confusion with the Main Southwest Miramichi, while later, as a consequence of some confusion connected with similarity in the Indian names of the Miramichi and Restigouche, it became removed, on some maps, to the Restigouche itself of which it appears as a branch (*these Transactions*, III, 1897, ii 372; this feature is also on Rhode's *Theatrum Belli in America septentrionale;* belonging much before 1800).

The name, pleasing and simple of pronunciation in its form Chacodi or Chacody (best pronounced with the accent on the first syllable and all the vowels short), could well be revived for some place connected with this river. It is clearly Indian in origin. Thus I have myself obtained it from Tom Barnaby, a prominent Micmac, for one of whose ancestors its English name was given, as SEE-QUĂ-DIK' (as in my notes), while another Micmac gave it to me as SEE-WA-DEE′, which latter form illustrates the Micmac tendency, of which I shall later give several cases, to omit the K or hard G sounds in pronunciation. Again, the late Michael Flinne, to whose competent aid I owe so much in these studies, obtained it as SE-GWÂD-DĬK. I have not, however, been able to obtain any meaning for the word; but I think it is identical with the ESKWADĒTC given by Rand as the Micmac name of a "place near Miramichi," with the meaning THE LITTLE FISHING PLACE (*Micmac-English Dictionary*, 181). In this word the final TC is the same as CH, which I take to be a softened form of the locative K, and not a diminutive as Rand evidently thought (page 377 earlier); the KWADĒ would be clearly equivalent to our familiar root –KA′DI–(K), in its frequent form –KWA′DI-(K), already explained (page 377). The possessive Ā is here condensed out, but is present as EE in the other forms cited. The prefix ES– or S–, can be only, if Rand is right, the abbreviated NUMĀĀCH, the Micmac word for FISH, a root which seems to be abbreviated to ′MCH in ′MCH-AGADICHK, the Micmac name for Sainte Anns in Cape Breton, (page 400, later). Thus the full word would be NUMĀĀCH-(Ā)-KA′DI-CH, meaning literally FISH-(THEIR)-OCCURRENCE-PLACE, presumably in description of good fishing there. In this case the word would be exactly the same, though in greater degree of condensation, as ′MCHAGADICHK, already mentioned.

While this seems the most likely derivation of the name, in view of the available data, it is not wholly satisfactory, especially as to the generalized idea of FISH instead of some particular kinds; and I think it likely the prefix S or CH really stands for the termination of the name of some particular fish. Most probable of these would be CHEGAOO, the Micmac name for BASS, (Rand, *First Reading Book*, 53), which does occur in this region, in which case the word would be equivalent in condensed form to the CHEGAOO-WĀĀKĂDE, or BASS-GROUND of Elliott River in Prince Edward Island (below). It may possibly, however, contain the stem for words meaning SHAD or YOUNG ALEWIVES. The subject must have further study, but there seems no doubt that CHACODI belongs in the series of –ACADIE names.

CHEGOLJACADIE. The Micmac name, in much simplified form, of Toad Brook, a very small branch of the Restigouche River on the Quebec side above the Metapedia. It was given me by Father Pacifique in the form TJGŎLTJOEGATIG, with the meaning TOAD'S PLACE. The latter part of the word –OEGATIG is the precise equivalent of our –Ā–KA′DI-K, earlier explained (page 380), while the former evidently involves an abbreviated form of EMKOKCHĂJĬT, the Micmac name for TOAD (Rand, *First Reading Book*, 43), the hard K sound being omitted, as so often is the case in Micmac place-names. Thus the word in full would be EMKOKCHĂ-JĬT-Ā-KA′DI-K, meaning literally TOAD-THEIR-OCCURRENCE-PLACE. Father Pacifique tells me the name is descriptive for "there are many in summer."

CHEGWACADIE. The Micmac name, in simplified form, of some place up Elliott River, one of the three Rivers meeting at Charlottetown, in Prince Edward Island, according to Rand's special list of Micmac names in the Library of Wellesley College. It is there given as CHEGOWWĀĀKĂDE, with the meaning BASS GROUND. The construction of the word seems perfectly clear, for the latter part is evidently our familiar combination –Ā-KA′DI-(K), earlier considered (page 380), while the former is as certainly the word CHEGAOO meaning BASS (Rand, *First Reading Book*, 53). Thus the word in full would be CHEGAOO-Ā-KA′DI-(K), meaning literally BASS-THEIR-OCCURRENCE-(PLACE). The Bass in an important food fish formerly common in all this region. In response to my inquiries, Mr. Thomas W. May, of the Land Office at Charlottetown, tells me that the Bass is occasionally caught in the smelt nets at the Clyde, or Dog, River, a branch of Elliott River; and it is wholly probable that this River is the CHEGWACADIE.

It is quite probable that the name which figures so prominently on the early French maps as CHACODI, a branch of the Miramichi River in New Brunswick, has an identical origin, as has been noted above (page 390).

CHIKSOGUNSACADIE. The Micmac name, in much simplified form, of Busteed's Brook, a well-known place on the Quebec side of the Restigouche below Campbellton, according to Father Pacifique, who gives me the name as TJIGTJAOIGENETJOEGATIG, with the meaning PLACE OF ROSE BERRIES. The construction of the name is clear, for the latter part is Father Pacifique's equivalent of our familiar combination –Ā-KA'DI-K, earlier explained (page 379), while the former part is as clearly identical with CHĬKCHOWĔGŬNĔCH, meaning ROSE BERRY (Rand, *First Reading Book*, 70). Thus the word in full would be CHĬKCHOWĔGŬNĔCH-Ā-KA'DI-K, meaning literally ROSE BERRY-THEIR-OCCURRENCE-PLACE, which is presumably descriptive of a feature of the locality.

Cobbosseecontee.

The name of a Stream in Maine, entering the Kennebec from the west at Gardiner, seven miles below the head of tide at Augusta; also a Pond through which it flows. The surprisingly cumbersome spelling is that of the standard large-scale map of the United States Geological Survey.

It appears first as COBESTCONT in 1630 in the Plymouth Patent (Burrage's *Beginnings of Colonial Maine*, 187); it is COBBISECONTE on an important map of about 1754 (*op. cit.*, opposite page 187); and in a deposition of 1767 by William Lithgow, a resident of the Kennebec who knew the place and Indians well, it occurs as CAW-BIS-SE-CON-TEAGUE (*New England Historical and Genealogical Register*, XXIV, 1870, 23; and, in somewhat different form, in *Collections of the Maine Historical Society*, IV, 1856, 112). In this important document, furthermore, we find the origin of the name very clearly given, for it reads, in connection with the Point on the south side of the stream where it joins the Kennebec, "a small point of Land called by the Natives Caw-bis-se-conteague," and adds that the Indians, being asked why they called the Point by that name, answered, "because the Sturgeon Fish jumped in the River Kennebeck opposite that Point in great plenty." This name "being englished signifies Sturgeon Land." With this very definite information to aid, the construction of the word COBBOSSEECONTEE becomes abundantly clear. The Abenaki word for Sturgeon, according to Rasle's great *Dictionary*, 510, is KEBASSÉ; the latter part of the word seems as clearly the Abenaki suffix KANTI-(K), the exact equivalent of the Micmac KA'DI-(K), meaning OCCURRENCE-(PLACE), as already explained (page 377); while the usual intermediate possessive WE, meaning ITS or THEIR, seems obviously condensed with the similar termination of KEBASSÉ. Lithgow's elaborate termination GUE is obviously equivalent to our locative –K. Thus the word in full would be KEBASSÉ-(WE)-KANTI-(K), meaning literally STURGEON-(THEIR)-OCCURRENCE-(PLACE). This explanation is given in brief by Trumbull, in his very authoritative work on Algonkin place-names (*Collections of the Connecticut Historical Society*, II, 1870, 26, 42), although his suggestion that KEBASSÉ is perhaps also involved in COBSCOOK, has been shown earlier in this series to be groundless (*these Transactions*, VII, 1913, ii, 105). The explanation involving STURGEON has also been given, apparently independently, by Sullivan and by Williamson, in their Histories of Maine, and by many other writers.

The very interesting point in local natural history as to the former special resort of Sturgeon at this place, and the reason therefor, I must leave for others to elucidate, since the locality is far outside the region of my personal knowledge. It seems plain, however, that the name belonged par excellence to the place in the river where the Sturgeon played, but was extended, in accordance with the usual Indian custom, to the contiguous point, where, as Lithgow's deposition shows, was the starting point of an Indian portage trail, and presumably also a camp-ground. The extension of the name to the Stream was a later white man's usage, as indeed is made perfectly clear by Lithgow, who testifies to this effect, and says that the Indian name for the Stream was CAW-BIS-SE-CON-TAETUCK, this termination TUCK, which thus replaces the locative-GUE, i.e. –K, being a very common suffix meaning River, as will later be shown with abundant examples.

CONCHEACADIE. The name applied to Flat Island, the northwesternmost of the Seal Island group on the south coast of Nova Scotia, on a chart in Chabert's *Voyage fait par Ordre du Roi,* of 1753. The word, spelled precisely as above, evidently represents its Micmac name, further evidence for which is the fact that other Indian names appear on the same chart. The termination is evidently a typical case of our familiar combination –A-KA'DI-(K), already explained (page 380); and therefore the prefix CONCHE– must represent some prominent animal or plant that occurred there, as to the identity of which, however, I am still in doubt. This seems clearly to be the island on which Champlain, as recorded in his *Voyages,* found the Tangueux, the bird which has been taken for the Great Auk (*Laverdière's edition,* 158; *these Transactions,* III, 1909, ii, 239), whence his name *Isle aux Tangueux* applied to Flat Island on his maps, a name which possibly persists, much altered in our Tusket. It is not, however, certain that his Tangueu was the Great Auk, because elsewhere in his works, he describes the Tangueu very elaborately in connection with the Bird Islands in the Gulf of Saint Lawrence, and his description applies without the least question to the Gannet (*Laverdière,* 1084). Neither the Micmac name for Great Auk (ABAKTOOË, Rand, *English-Micmac Dictionary,* 26), nor that for the Gannet (TĔDĂGOO, or ŬKWTĂDĂGOO, *op. cit.* 119), can form the stem of CONCHE–. There are names of several birds in which one can fancy to find, in abbreviation, this root, but it is all very uncertain, and the word remains as yet an attractive puzzle.

COMKUDAMACADIE. The Micmac name, in simplified form, of some place near Princetown Royalty in Prince Edward Island, according to Rand's special MS. list of Prince Edward Island names (page 390), which gives it as COMCŬDÂM-WĀĀKĂDE or COMCŬDÂM-WĀĀGAKŬN, without meaning. The construction of the word seems very clear, for the latter part, of the first of Rand's forms, is clearly our familiar combination Ā–KA'DI-(K), already explained (page 380), while the former part seems as certainly the Micmac word COMKŬDĂMOO, meaning STURGEON (Rand, *First Reading Book,* 53), the OO merged into W. Thus the word in full would be COMKŬDĂM-WĀ-KA'DI-(K), meaning literally STURGEON-THEIR-OCCURRENCE-(PLACE). The location given by Rand is far too indefinite to enable us to identify the place exactly. Princeton Royalty lies on the east side of Malpeque Bay on the north side of the Island, and perhaps the special prominence of the Sturgeon in some locality thereabouts will aid to place the name. This is the only case that is known to me in which the Sturgeon figures in the place-nomenclature of the Micmacs, which is surprising in view of the fact that this fish was prominent and important throughout their territory. As to the termination of Rand's second form above given, that is plain, being evidently the frequent root GAKUN or GOKUN or GOGUN, meaning a fishing place, as will be shown later in this series.

EMKOKCHAJITWACADIE. The Micmac name for Bulls Gut, a place near Halifax, according to Rand, who gives the name as EMKOKETCAJITWĀKADE (*Micmac-English Dictionary*, 181), with the meaning ABODE OF TOADS, although in the *First Reading Book*, 84, he gives the word without the termination WAKADE. The construction of the name is clear, for the latter part is obviously our familiar root WĀ-KA'DI-(K), already explained (page 380), while the former part is as clearly ĔMKŎKCHĂJIT, meaning A TOAD (Rand, *English-Micmac Dictionary*, 266). But I have not as yet been able to identify the place, despite much local inquiry, and hence know nothing as to the appropriateness of the name. Possibly this Bull may be short for Bull Bird, and refer to some place near Sambro (compare page 429, later.)

ESKUDUQUADIK. The Micmac name for Canadian Point, a prominent wide marsh point on the south side of the Miramichi River above Chatham, in eastern New Brunswick. The name was given me by the late Michael Flinne, teacher of the Micmac school at Eelground (above Newcastle), as ĔS-KOO-DOO-GŬAD'-IK, meaning PLACE WHERE THEY DUG WILD POTATOES. Obviously the latter part of the word represents our familiar combination Ā-KÁDI-K, in the KWADI form, as earlier explained (page 377), but the former part of the word is not so clear. It seems most likely that it represents a form of MASKOOSĬT, which Rand gives as meaning GROUND NUTS (another name for the Wild Potatoes), and which is the stem of the Micmac name for Isle Haute (*First Reading Book*, 57, and 90). Curiously enough the letters S and D seem to some extent interchangeable in Micmac, as I shall show in other instances later, in which case our ES-KOO-D. would come very close to (M)AS-KO-S of MASKOSIT. As to the identity of the MASKOSIT in relation to SEGEBUN, the more common name for the Ground Nut or Indian Potato, I have no knowledge, nor has Father Pacifique been able to clear up the matter by aid of his Micmacs of Restigouche. Our ESKOODOO would seem to be connected with ESKUDUM, meaning I EAT IT RAW, a cucumber being called ESKUDUMUGĀWĀ, meaning that vegetable which is eaten raw (Rand, *Micmac-English Dictionary*, 53); and this suggestion may later lead to its identification.

Other names for edible roots, liable to be confused more or less in identity with SEGEBUN AND MASKOSIT are MULEBUN (*op cit.* 103) and KAJOO (*op. cit.* 60), both of which are known to the Micmacs of Restigouche, along with SEGEBUN, and another, GAGTJIGOETG, though they do not know MASKOSIT, as Father Pacifique tells me. These words ought to appear in some Micmac names of the –ACADIE type, though I have not yet found them.

GALPEAKADICH. The Micmac name, in simplified and tentative form, of Grog Islands, on the Restigouche below the Upsalquitch River in New Brunswick. The name was given me by Father Pacifique in the form GALPIEGATITJG, with the explanation that the plant called GALPIG (GALPIG ETLIGOTITJIG) grows there, this plant (unidentified by him), being "used as thread." The construction of the word is clear, for Father Pacifique's –EGATITJG is the precise equivalent of our –Ā-KA'DI-K in the diminutive form –A'-KA'DI-JEECH-K (page 377); but the plant called GALPIG I have not yet been able to identify, though possibly it is the Maidenhair Fern, which occurs in that vicinity. The presence of the diminutive termination seems also to imply the presence of another locality for the same plant not far away. Thus the name in full would be GALPIG-Ā-KA'DI-JEECH-K, meaning literally (PLANT)-THEIR-OCCURRENCE-LITTLE-PLACE. A visit to the Grog Islands, (where I once was before I knew this name) would settle the point.

GASPALACADIE. The Micmac name somewhat simplified, for Portage Brook, a branch of the Tabusintac leading down towards Burnt Church in eastern New Brunswick, as shown on a map in *Acadiensis*, VII, 1907, 326; given me by Charles Bernard, Micmac teacher of the Micmac school at Burnt Church in the form GÂSPALAOOACADIE. The word involves a typical use of our familiar combination –Ā-KA'DI-(K), earlier explained (page 380), while GASPALOO is the Micmac pronunciation of our word gaspereau, the name of a common fish. This word, however, appears not to be aboriginal, the Micmac name for that fish being quite different, and as Portage Brook is confused locally with Gaspereau Brook, I think the name GASPALAOOACADIE is simply a translation of the English name Gaspereau Brook into Micmac. We have an exactly homologous usage in the case of the Micmac name for Gaspereau River in Westmorland County, i.e. GAS-PAL-A-WIK'-TOOK, (*these Transactions*, II, 1896, ii, 235). which seems clearly only a translation of our name, perhaps originally French, into Micmac.

GATWEGATIK. See KATACADIE (page 395).

KAKPESACADIE. The Micmac name, in simplified form, of St. Omer, between Carleton and Nouvelle on the north side of western Bay Chaleur in Quebec. Father Pacifique gives me for the place "at the flour mill," the form GAGPESAOE-GATIG, with the meaning PLACE OF SMELTS. Thus the construction is clear, for –OEGATIG is Father Pacifique's form of our –Ā-KA'DI-K earlier explained (page, 377), while KÂKPĔSOW' is the Micmac name for THE SMELT, a very common fish of this region, according to Rand (*First Reading Book*, 53). Thus the word would be in full KÂKPĔSOW-Ā-KA'DI-K, meaning literally SMELT-THEIR-OCCURRENCE-PLACE, which presumably is accurately descriptive.

KALEBOACADIE. The Micmac name for Caribou Marsh, a place shown on the maps between East Bay and Little Bras d'Or in Cape Breton, according to Rand, who gives it in the form KALEBOOĀKADE (*Micmac-English Dictionary*, 183). KALEBOO is the Micmac name for the Caribou (and indeed the original of the latter), while the termination is clearly our familiar combination –Ā-KA'DI-(K), meaning OCCURRENCE–(PLACE). It is possible that the combination is not an aboriginal name but a translation of an English name into Indian.

KALEBOCHACADIE. The Micmac name for some brook near Liverpool, Nova Scotia, according to Rand, who gives it as KALEBOOTCHWĀKADE, meaning LITTLE CARIBOU PLACE (*Micmac-English Dictionary*, 183). The word seems clearly identical with the preceding, except for the interpolation of the TC or CH, which is apparently the Micmac diminutive CHEECH, making the word LITTLE CARIBOU. But I have no further information about the place.

KATACADIE. The Indian name, in simplified form, of several places in the Maritime Provinces as follows.

(1). *KATEKADIK.* The Passamaquoddy Indian name for the little stream now called Eel Brook near the northern end of Grand Manan Island in New Brunswick. It is thus given by Gatschet in his fine article on Indian names in this region in the *National Geographic Magazine*, VIII, 1897, 21. He derives it from KÂT meaning EELS, with –AKÂDI meaning ARE PLENTIFUL, and –K the locative ending meaning WHERE (better, PLACE), thus making the word KAT-Ā-KA'DI-K, meaning literally EELS-THEIR-OCCURRENCE-PLACE. This interpretation I believe to be perfectly correct. The English name of the place, EEL BROOK, shows that the Indian name is accurately descriptive.

I have myself been given for the same place by a Passamaquoddy Indian, QUAT-A-GUA-DICK (in the form of my notes), evidently the same word but in less perfect form than Gatschet's.

While the roots occur in the Passamaquoddy tongue, they belong also to the Micmac, and in view of the occurrence of the same word, at least twice in Micmac territory, as noted in the two following words it seems likely that this is another of several names of this region having a Micmac origin (compare page 412 later.)

(2). *KADAGADIK.* The Micmac name for the Long Marsh Creek just west of Cape Enrage in the southern part of New Brunswick. It was given me by Mark Paul, Micmac chief at Folly Point, in the form KA DĀ GA DIK′ (of my notes), and although I have no meaning it seems evident that the word is identical with the preceding.

(3). *KATAKADDY.* The Micmac name for some place, not specified, in Nova Scotia, as given in the form KATA-KADDY, meaning EEL-GROUND on the authority of Rand by Dawson in his *Acadian Geology*, 2nd edition, 1868, 3. It seems perfectly identical with the two preceding. No doubt the name occurred frequently throughout these Provinces, where the Indians have always used the eels as a favourite food.

(4). *GATWEGATIK.* The Micmac name for Eel Cove, according to Rand (*Micmac-English Dictionary*, 182). This place I have not identified, the possibilities being apparently many; but the word seems identical, though another mode of spelling, with the three preceding.

KITPOOACADIE. The Micmac name for Cape Shubenacadie, called Eagles Nest Point on our modern maps, a prominent headland on the east side of the lower course of the Shubenacadie River. Rand gives it as KĬTPOOĀKĂDE, with the meaning EAGLE HAUNT, or KITPOĀKADE (*First Reading Book*, 85; *Micmac-English Dictionary*, 183). It occurs also in Gesner's list as KITPOO-AYKADDY, meaning A PLACE OF EAGLES (Murdoch, *History of Nova Scotia*, I, 534,) this spelling showing the location of the accent, which Rand omits. The construction of the name seems perfectly clear, for the latter part is evidently and typically our familiar combination –KA′DI-(K) earlier explained (page 380), while the first part is equally plain, for the Micmac KĬTPOO means EAGLE (Rand, *First Reading Book*, 47). Thus the word in full would be KĬTPOO-Ā-KA′DI-(K), meaning literally EAGLE-THEIR-OCCURRENCE-(PLACE). As to the appropriateness of the name, I have been told by Mr. J. H. Waddell, of South Maitland, near the Point, that eagles formerly nested upon the elevated wooded summit, and occasionally do so to this day.

Practically the same word, in the form GTPOTJOEGATIG, with the meaning YOUNG EAGLES PLACE has been given me by Father Pacifique as the name of a mountain between Indian House Brook and the Patapedia, on the Restigouche River.

KLOOPSKEACADIE. The Micmac name for Bird Island, given by Rand in the form CLOOPSKE-ĀKĂDE, meaning MURRE-LAND (*First Reading Book*, 83), and also as KLOOPSKEĀĀKĀDE (*English-Micmac Dictionary*, 37). He gives no further location, but presumably refers to Bird Islands, a small group lying off Beaver Harbour on the southeastern coast of Nova Scotia; for this is the only place of the name that I can find in Rand's territory, while, moreover, he gives a good many names of places in that vicinity. The termination is typically our familiar –Ā-KA′DI-(K), earlier explained (page 380); and Rand gives the Micmac name KLOOPSKE, for the MURRE, (*op. cit.* 47), a very prominent sea-bird of this coast. Thus the name in full would be KLOOPSKE-Ā-KA′DI-(K), meaning literally MURRES-THEIR-OCCURRENCE-(PLACE).

Precisely the same word, in the form KLOOPSKEĀKADE. with the meaning AWK-LAND, is given by Rand in his *Micmac-English Dictionary*, 183, for a place named Cloopsky Point. I am unable to find any such place, and I think it likely that

Rand here really refers to Bird Islands, some Point of which, it is possible, was formerly locally known as Cloopsky Point. He certainly slips a little in his identification of the bird, for the Awk is very different from the Murre, which seems clearly the bird described by the root KLOOPSKE.

I am told by the Postmistress at West Quoddy that the Bird Islands are a locally famous hunting ground for sea-ducks, and other ducks, and that sea-birds breed there.

KLUNQUADIK. (1) The Maliseet Indian name for Hardwood Creek, a small branch of the Saint John River from the east below Grand Falls in New Brunswick. Some years ago the late Edward Jack, who knew these Indians so well, wrote me that the name of the Creek is KLUN-QUA-DIC. Later I obtained the same word from them in the form KLUN-QUA-DIC (as in my notes), with the meaning WHERE THEY MADE A TREATY, which was explained as the place "where their last fight with the Mohawks took place and where a lasting peace was made with them" (*these Transactions*, II, 1896, ii, 196). The correctness of the application of this name to the place is attested by the fine map of the Saint John made by a skilled surveyor specially interested in Indian nomenclature, Dugald Campbell, where the name reads TRANQUADY (copy in *New Brunswick Magazine*, II, 1899, 233, corrected by comparison with the original), while a plan that I have seen of 1817 by Johnson, one of the Boundary surveyors, has CLONKUHOT, evidently an abbreviated form, the locative termination being lacking.

(2). Further, the same word is given by the Passamaquoddies for Musquash, a Harbour on the coast west of the Saint John in New Brunswick. I have myself been given TLAN-QUAH-DIK, with the meaning TREATY PLACE, a form and meaning substantially identical with the above (*these Transactions*, II, 1896, ii, 255). A few years ago, Lewy Mitchell, one of the chief of the Passamaquoddies and long-time their representative in the Maine Legislature, wrote me that the Passamaquoddy name for Musquash Harbour is TLANGOWATIK, meaning "a place of trade, where the treaty of Peace was made between the Passamaquoddy Indians and Micmacs. Tradition is very interesting." This tradition is given in full, upon Lewy Mitchell's authority, in Leland and Prince, *Kulôscap the Master*, 26.

Thus there seems no doubt as to the identity of these two words, and the question now arises whether in reality the traditions have some historical basis, or, as is so often the case, the tradition has arisen to explain a word which has in reality another origin. As to this, while I have no proof through intermediate forms and the like, it seems to me possible that this word TLUNQUADIK or KLUNQUADIK is fundamentally identical with the Micmac TLAKADIK, now TRACADIE, discussed later in this paper (page 436), the N representing a trace of the nasal sound so common with the Indians just to the westward. In this case, these two places would indicate just such common assembly places as the Tracadies appear to have been for the Micmacs, and therefore trading places and treaty places. Musquash would be a natural meeting place for the Passamaquoddies with the Indians of the River Saint John, while Hardwood Creek would have formed the assembly place for those of the lower with those of the upper Saint John, the latter centering at Madawaska. This at least is the hypothesis which I advance as a guide to further investigation.

KOOKWEJAQUODDY. The Micmac name for Jareds Point, according to Rand, who gives the word as COOKWĔJOOGWŎDĬK, meaning A HAUNTED PLACE: SPECTRE-LAND (*First Reading Book*, 90). The construction of the word is clear, for the latter part is evidently our familiar combination –(Ā)-KA'DI-(K), in the AQUODDY form, as earlier explained (page 377) while the former part is as obviously KOOKWĔJOO, meaning SPECTRE (Rand, *English-Micmac Dictionary*, 247), making the word in full KOOKWĔJOO-(Ā)-KA'DI-(K), meaning literally

SPECTRE-(THEIR)-OCCURRENCE-(PLACE), or more generally THE SPECTRE PLACE. No place called Jareds Point occurs in the Maritime Provinces so far as I can find, but there is a Gerards Head on Gerards Island on the eastern side of Pope Harbour on the Nova Scotia coast east of Halifax; and as Rand gives an unusually large proportion of Micmac place-names in that vicinity, I think it most probable that he refers really to Gerards Head.

Further, in his *Micmac-English Dictionary*, 183, Rand gives the name KOOK-WEJOKWÂDĒ, meaning HAUNT OF THE GIANTS, as the name for Middle River of Sheet Harbour, not far from Gerards Head. Evidently this Micmac word is identical in every particular with that above given, though the meaning is somewhat different. Since, however, Rand does not repeat this locality in his other works, both of which assign the name to Jareds Point, and since the two places are too near to bear the same Indian name, and since the Middle River of Sheet Harbour has a very different Indian name of its own (Rand, *First Reading Book*, 99), one would infer that Rand has here a slip in locality, and that the latter name is identical in locality as well as etymology with the former. But Rev. Father Sweet, of Sheet Harbour, tells me the Indians apply the name COOKWEJOOK-WODIK to the East River of Sheet Harbour. Evidently the matter needs further study. Furthermore the name must be identical with that given as KOOKEJOO-KWODDY, meaning GIANTLAND, or LAND OF GIANTS, by Dawson, upon Rand's authority, in his *Acadian Geology*, 2nd edition, 3.

As to the apparent discrepancy of meaning here involved, one giving SPECTRE and the other GIANT, that is easily explained, for there is a word KOOKWES evidently substantially equivalent to KOOKWĔJOO, and meaning "a giant, mythical race of cannibals of enormous size and strength," (Rand, *Micmac-English Dictionary*, 80), to which obviously the word SPECTRE can apply as well as GIANT. As to the appropriateness of the name to Gerards Head, two or three possibilities occur,—one that some natural appearance, great stones or the like, suggests giants etc.; another that this is a place fixed upon by some legend of the cannibal giants as their home, something in the form of the place giving the suggestion; and third, that the word, is a familiarization of the name of some animal that occurred there. As to the possible identity thereof, however, I have no better suggestion than that it may be KAKA-WEGĔCH, given by Rand as the name of the "pigeon duck," (*First Reading Book*, 47), meaning evidently the Old Squaw Duck, still abundant in Nova Scotia, the Micmac name of which survives in the name Cockawee applied to this bird by the white hunters.

This name is evidently allied to the COOKWĔJOOK, Micmac name for the Blue Mountains in Yarmouth County, Nova Scotia, given by Rand as meaning THE SPECTRES (*op. cit.* 83).

KOONDAWACADIE. The Micmac name for Sutherlands Island, near Pictou, Nova Scotia (probably Quarry Island in Merigomish Harbour), according to Patterson's *History of the County of Pictou*, 32, which gives the word as COONDA-WAAKADE meaning A STONE QUARRY. The roots of the word are clear, for the latter part is evidently our familiar combination -Ā-KA'DI-(K) already explained (page 380), while the former part is as certainly the Micmac word KOONDĀOO, meaning STONE (Rand, *English-Micmac Dictionary*, 253). This combination, indeed, is given by Rand in the form KOONDĀWĀĀKĂDE, meaning A STONE QUARRY (*op. cit.*) the word in this case representing a topographical term readily transformable into a place-name. The combination is obviously not aboriginal but recent, and perhaps represents simply another case in which an English name has been translated into Indian.

KOPSKWEDUMOOACADIE. The Micmac name for Geddes Lake, some place in Nova Scotia which I have not as yet, despite much search and inquiry, been able to identify. The name is given by Rand in the form KOPSKWĔDŬM-OOĀKĂDE, meaning LAMPER-EEL-GROUND (*First Reading Book*, 89). The construction of the word is perfectly clear, for the latter part represents our familiar roots Ā-KA'DI-(K), earlier explained (page 380), while KOPSKWĔDŬM plural OOK, is the Micmac name for the LAMPER-EEL, a well-known fish of this region (*op. cit.* 53), the plural form expressed by OO, being used. Thus the name in full would be KOPSKWĔDŬMOO-Ā-KA'DI-(K), meaning literally LAMPER EELS-THEIR-OCCURRENCE-(PLACE).

KWEEMOACADIE. The Micmac name for a small lake near Canso, in eastern Nova Scotia, according to Rand, who gives the word as KWĒMOOĀKADE, meaning LOON-LAND (*Micmac-English Dictionary*, 184). The identity of the Lake is not evident, especially as the lakes that are favourites with the loons are innumerable in Nova Scotia; but the construction of the name is perfectly obvious. The termination is clearly our familiar combination –Ā-KA'DI-(K), already explained (page 380), while the first part involves the Micmac name for LOON, viz., KWEMOO (*op. cit.* 84), making the word in full KWEMOO-Ā-KA'DI-(K), meaning LOON-THEIR-OCCURRENCE-(PLACE).

Apparently an alternative for this name is ANESKAWĀ-KUSPEM, for thus Rand gives it elsewhere in his *Dictionary*, 180. The part KUSPEM is the Micmac word for LAKE, and I believe the ANESKAWĀ involves a root meaning NESTING-PLACE, as will be shown later in this series. Also, the word KWEMOO occurs with a different termination in the names for Spry Harbour and Popes Harbour, both places on the southeast coast of Nova Scotia (*Dictionary* cited, 184), though the name for the latter is differently explained in Rand's *First Reading Book*, 96.

KWESOGWADIK. The Maliseet Indian name for Lower Musquash Island on the Saint John River at the mouth of the Washademoak in New Brunswick. It was given me by one of my best Maliseet informants in the form QUES-O-GWA'-DIK (as written in my notes). The construction of the word seems clear, for the latter part represents evidently our familiar combination,– KWA'DI-K, meaning OCCURRENCE-PLACE (page 377), while the first part contains, I believe, the Indian name for MUSKRAT or MUSQUASH, which is KEW-US (Barratt, *The Indian of New England*, 12) or KAI-U'-HŬS (Chamberlain, *Maliseet Vocabulary*, 33) in Maliseet, and KEEWĔSOO in Micmac (Rand, *First Reading Book*, 43). That it is the Micmac rather than the Maliseet form which is involved in the word seems implied by the presence of the OO sound (which has displaced the possessive Ā), before the –GWADIK. Thus the word in full would be KEEWĔSOO-(Ā)-KWA'DI-K, meaning literally MUSKRAT-(THEIR)-OCCURRENCE-PLACE. Such an interpretation fits perfectly with the same prominent feature of the place that is expressed in its English name, though whether this has been given independently, or is a translation of the Indian name is not clear. Further, the Island consists of a border of intervale almost surrounding a marsh-bordered lagoon, which is just such a place as the Muskrat likes best.

Were it not for the strong confirmatory evidence supplied by the use of the name Musquash Island for the place, we might be doubtful whether the word should not be connected with KŬ-WĔS', meaning the MALLARD DUCK (Chamberlain, *op. cit.* 35), especially as the place is as favourable to Ducks as to Muskrats. But the probabilities are all in favour of the interpretation above given.

MAKWANKADIK. The Passamaquoddy name for Rocky Point, in the northwestern angle of Lake Utopia in southwestern New Brunswick, as given me by Louis Francis, an Indian resident near the lake, in the form MOQUANKA'DIK, with the meaning GROVE OF ROCK MAPLE. The construction of the word is plain, for the latter part is clearly our familiar –KA'DIK, earlier explained (page 380), the possessive Ā being elided, while the former part is as obviously MAKWAN, meaning literally SWEET, but used in place names for the places where maple sugar was made and therefore for groves of the rock, or sugar, maple (compare Gatschet, *National Geographic Magazine*, VIII, 1897, 23). Thus the name in full would be MAKWAN–(A)–KA'DIK, meaning literally SUGAR MAPLE–(ITS)–OCCURRENCE PLACE, which is no doubt descriptive.

Matamiscontis.

The name of a Stream, with its source Lakes, entering the main Penobscot from the northwest below Mattawamkeag, in Maine.

The earliest use of the word I have been able to find is in Greenleaf's list of Indian names of 1823, where it has the form MAD-A-MIS-KON-TIS, with the meaning YOUNG ALEWIVE STREAM (*Moses Greenleaf, Maine's First Mapmaker*, 122). Williamson's *History of Maine* of 1839, I, 67, has MADAMISCONDUS, without explanation. It is MADAMISCONTIS on Greenleaf's later maps, from which the MADAMISCOUTIS of Wilkinson's fine map of 1859 is evidently misprinted. In later times the form MATAMISCONTIS has come into use. An old local pronunciation, as Mrs. Eckstorm tells me, was Methymiscontee or Medamisconty.

Turning to the analysis of the word, we have Greenleaf's meaning, YOUNG ALEWIVE STREAM, as a guide. The Penobscot name for the Alewive I have not been able as yet to find, but in the closely allied Abnaki the word is AÑMS8 (Rasle, *Abnaki Dictionary*, 510; the Ñ being a partly silent nasal, and the 8 representing the sound OUI), while the latter part of the word clearly involves the important root –KANTI, the Abnaki equivalent for our familiar Micmac –KA'DI, meaning OCCURRENCE (page 377). Thus the MISCONTI part of the word would represent an abbreviated ANMESUAKANTI, exactly identical with AÑMES8KKAÑTTI, meaning HERRING (ALEWIVE) PLACE considered later under MESACONTE (page 402). This leaves for explanation two features of the word,—the preliminary MET or MED, and the final S. As to the MAD or MET, that presents no difficulty if the statement of Ballard is correct, that the "Indian" word for Alewive is MAHDĀMĀS (*Report of the United States Coast Survey for* 1868, 249), but Ballard's statements are all too often unreliable. A very different explanation of MET is given by Trumbull in his work earlier cited (page 391), for he makes the word MET-A^{n}MS8AKKA^{n}TTI, mean "a place where there *has been* (but is not now) plenty of alewives, or to which they no longer resort," and to explain the source of the idea "has been, but is not now," he cites Father Rasle's MÈTAÑM8AK, meaning where fish have been to deposit their eggs, but no longer are (*Abnaki Dictionary*, 510). This explanation, however, seems to me most laboured, and the idea itself quite unnatural in connection with a place-name involving a phenomenon, the presence of a certain kind of fish, which must recur year after year. But this matter need not concern us farther, since there is a perfectly simple and natural explanation of this root MET (MED MAD or MAT), for, as will be shown in detail in a later number of this series, it is a somewhat common prefix in the names of steams, where it has the significance of "ending," in the sense of joining with the main stream, and always introduces in the remainder of the word some feature which distinguishes the mouth of the stream. Thus Meduxnakeag (on the Saint John), signifies ending (or joining the Saint John) over falls, and Matawamkeag signifies, I believe, ending or joining the Penobscot over gravel beds. Other examples are Madawaska, Matanacook, Matagoodus, Madunkeunk, and others later to be considered. Thus the word MATAMISCONTI would signify a stream that ends or joins with the main river at an alewive place, and I venture to predict that in early times if now now, as detailed local knowledge will test, this stream has an exceptionally good alewife fishery at its mouth or on its lowermost course. Mrs. Eckstorm has sent me evidence that in early times, alewives ran far higher up the Penobscot than this place.

This leaves the termination S yet unexplained. Such a termination is unusual, for most place-names of the Abenakis-Penobscots-Maliseets-Passamaquoddies and Micmacs end, in their aboriginal forms, with the locative –K. But on the lower Penobscot, and thereabouts, occurs a curious assemblage, a kind of island, of place-names having the termination S, e.g., Matamiscontis, Patagumkis, Matagoodus Quakis, Umbazookskus, Molunkus, Piscataquis, with some thirty others. In several of these cases it is possible that the S represents an abbreviated SIS, meaning LITTLE, as it certainly does in Seebois, which means "little river," but this cannot be true of them all. We have an exactly analogous phenomenon in the Micmac place-nomenclature of the North Coast of New Brunswick where many of the names end in CH instead of the typical K found in the Southern Micmac territory, e.g., Pokemouche, Tatamagouche, Restigouche, and many others where the termination cannot possibly represent a diminutive. In the latter cases, as I have pointed out in the previous paper of this series (*Transactions*, ii, 263-4), the CH seems clearly to represent a softened K, and is therefore the terminal locative, quite equivalent to the usual K. It seems to me pretty clear that in the Penobscot names above cited we have the same phenomenon, and that the final S, probably a relic of an aboriginal SH, represents a softened form of the locative, a suggestion already made in connection with the name Patagumkis in the preceding paper. But what a problem in the Ethnology-Etymology of the earlier Indian immigrants do these islands of the softened locatives represent!

Thus, on the data here presented, the name MATAMISCONTIS would seem to be a simplification of a Penobscot name MAT-AMESU-KANTI-SH, meaning literally ENDS-ALEWIVES-OCCURRENCE-PLACE, or, more generally THE STREAM THAT EMPTIES AT THE ALEWIVES PLACE.

MECHAGADICH. The Micmac name for St. Anns, Cape Breton, according to Rand, who gives the word as 'MCHĀGADĬCHK (*First Reading Book*, 99; *English-Micmac Dictionary*, 250; *Micmac-English Dictionary*, 186, where it is misprinted M'TCEGALITCK). Rand gives no meaning, but it is not difficult to find the one which is most probable. The latter part of the name seems clearly to represent our familiar combination –Ā-KA'DI-, earlier considered (page 380), with the terminal CHK standing for a softened form of the locative K, and not involving abbreviated CHEECH, meaning LITTLE, as might at first seem probable. As to the former part 'MCH, that may represent the condensed or abbreviated form of NUMĀĀCH, meaning FISH, but in accord with the ordinary usage of the termination Ā-KA'DI-K, it more probably represents the abbreviation for some particular kind of fish. As to the most probable kind, in view of the reputation of St. Anns, we think of the COD, of which the Micmac name is PĔJOO, (Rand, *First Reading Book*, 54). Now the letters P and M are easily interchangeable in Micmac words, so that this word could be sounded MEJ which is very close to the MCH of our name. Accordingly I think it possible that this is the real origin of the name, which would be in full PĔJ-Ā-KA'DI-CHK, meaning literally COD-THEIR-OCCURRENCE-PLACE. Possibly the name has connection with the Tuna, for which great fish St. Anns is noted.

This name is maybe related to the original form of CHACODI earlier considered (page 389), and possibly is identical therewith.

Megantic.

The name of a large Lake near the source of the Chaudiere River in southern Quebec; extended also to a Settlement, which is a Station on the Canadian Pacific Railway.

The earliest use of the name that I can find occurs in 1686 in the form MAMIS-COUCANTE, applied to a stream and lake forming one of the sources of the Chaudiere River, on the great map of Acadia by Franquelin and De Meulles, still unpublished as a whole (in the Paris Archives), but reproduced in part and described in *these Transactions*, III, 1897, ii, 364. I find it next on the epochal *Carte de la Partie Oriental de la Nouvelle-France*, of 1744, by Bellin, in Father Charlevoix's *Histoire*, where it is applied distinctly to the lake in the form NANSAKANTI. On the historic Mitchell map of 1755 it is AMAGUNTIC Pond, while it is AMMEGUNTIC in 1775, in the account of Arnold's expedition against Quebec (*Collections of the Maine Historical Society*, I, 508). The earliest use I have found of the present spelling is upon Greenleaf's map of Maine, of 1815, though MEGANTICK is on the Montresor map of about 1768 in the Library of Congress, from which form I suspect the MEGANTIC of his published journal is misprinted (*Collections of the Maine Historical Society, I* 1865, 448.)

While the prefixes, or first parts, of the three forms above cited appear to have little in common, the latter parts are evidently identical, and seem clearly to involve our familiar combination –KANTI, –CONTE, including in the third instance the locative suffix –K. Thus part of the name would be –KANTIK, the precise equivalent of the Micmac -KA'DI-K, earlier explained (page 377), meaning OCCURRENCE-PLACE, with the secondary meaning of ABUNDANCE. This much seems quite clear. As to the first part of the word, all analogy of other uses of –KANTIK would lead us to expect that it involves the name, or an abbreviation thereof, applied to some natural object, animal or plant, prominent at that place. Fully conformable to this idea is the explanation of the word published by Laurent, himself an Abenaki, in his valuable little book, *New Familiar Abenakis and English Dialogues*, 215, where it is made equivalent to NAMAKÔTTIK or NAMAGWÔT-TIK, which word, since Laurent's Ô represents a nasal sound, we would write NAMA-KONTIK or NAMAGWONTIK. He makes it mean LAKE TROUT PLACE, and elsewhere in his book (page 39) he gives NAMAGW as meaning SALMON TROUT, a name often used for the LAKE TROUT. It is evidently the same word which Father Rasle writes NAMÉG8 (*Abnaki Dictionary*, 510), the 8 representing the sound OO or OUI. The present Passamaquoddy Indians call the Lake Trout, or Togue, NEMEK, as I am told by Mr. Chas. J. Rolfe of Princeton, Maine; and of course the word is identical in roots with NAMAYCUSH, the well-known Canadian Indian name for the same fish. Thus it seems very plain that the word is in reality NAMAGW-KONTI-K, meaning literally LAKE TROUT-OCCURRENCE-PLACE. This word, with the usual condensation of the two successive similar syllables GW-KO into one, becomes NAMAGONTIK, which with the loss of the preliminary N becomes AMAGONTIC, identical with AMAGUNTIC the predecessor of our MEGANTIC.

As to the appropriateness of the name to the place, viz., as to the occurrence and prominence of the Lake Trout at Lake Megantic, I have not yet been able to obtain satisfactory information, for no mention of the Lake seems to occur in works descriptive of the Lake Trout, and my repeated inquiries made locally by letter remain unanswered.

But what as to the earlier forms MAMISCOUCANTE and NANSAKANTI, the most notable feature of which is the presence of the S? This I take for a persistence of a letter which was, I think, originally in the word NAMAGW, making it NAMASGW, because it seems perfectly clear that NAMAGW involves the very common root NAMES meaning FISH, with some qualifying addition expressed by the GW. Hubbard, in his *Woods and Lakes of Maine*, 204, states that the Penobscot Indians use NAMÉS for the Lake Trout, though probably he failed to catch an additional syllable. Upon the supposition that the S was originally in the word, though dropped by the modern Indians, then some error of transcription of M and N, common in old records, with the retention of both the GW and KO sounds in the first form, makes both MAMISCOUCANTE AND NANSAKANTI equivalent to NAMAKONTI, the form of Laurent, from which runs as unbroken sequence to our MEGANTIC.

Two other explanations of the word have been published. Father Maurault, in his well-known work *Histoire des Abenakis*, 1866, vi, derives it from NAMESOKÂNJIK, which word (as his usage in the case of Passamaquoddy shows, as later noted, page 418), is equivalent ot NAMESOKANTIK, and he makes it mean FISHING PLACE ("lieu ou se tiennent les poissons"), evidently taking it to involve NAMES, the word for FISH above mentioned. Laurent's authority, however, and other attendant circumstances, would seem to make it plain that the name of the particular fish, NAMEGW (or NAMESGW?) is contained in the word as noted. Again Father Lacombe in his list of Place-names in his *Dictionnaire des Cris*, 708, derives the word from MISÂTTIK, meaning THICK WOODS ("gros bois"); but like most other names in that list, this interpretation represents merely a guess at the Cree roots which happen to come nearest to the modern printed form of the word MEGANTIC, of a very different dialect, and is quite without value.

MENAQUADIK. The Maliseet name for Reardons Island, on the River Saint John in New Brunswick, at the mouth of Bulls Creek a little below Woodstock. It was thus given me by Newell Paul, one of the most reliable of the Maliseets, in the form MEN-HOC-QUA'-DIK, with the meaning PLACE FOR WIGWAM POLES (*these Transactions*, II, 1896, ii, 265). The latter part of the word is clearly our familiar combination –Ā-KA'DI-K, already explained (page 380). The former, however, I have not been able to identify with certainty; possibly it is connected with some word of which the Micmac MĔNĂPSEĀ', meaning TO HUNT FOR WIGWAM POLES, is the Micmac representative (Rand, *English-Micmac Dictionary*, 199). The word must have further study, but its membership in our –ACADIE series is clear.

MESAKANTE. The former Abenaki name (in simplified form) of Farmington Falls, on the Sandy River, a branch of the Kennebec from the west, in Maine. It is spelled MEESEE CONTEE, and given the meaning HERRING PLACE, as local tradition, in an account of the Sandy River settlements by Wm. Allen, in the *Collections of the Maine Historical Society*, IV, 1856, 31, although Willis, in the same volume, 105, has MEESUCONTU. There would seem to be no doubt that this is the AÑMES8KKAÑTTI (the Ñ a partly silent nasal and the 8 standing for OUI) of Father Rasle's *Abnaki Dictionary*, 493, for the name occurs as ANMISS8KANTI in an Indian treaty of 1721 (in Shea's translation of Charlevoix's *Histoire*, V, 273), and is given as AMASAGUANTEG in John Gyles' list of Indian settlements of 1726 (*Collections*, above cited, III, 1853, 327). The word has attracted the attention of Trumbull, who, in his well-known work on Algonkin names, has explained it in a way that leaves little to be said, deriving it from Abnaki ANMES8AK– meaning "literally 'small fishes,' but appropriated to fish of the herring tribe, including alewives," together with the familiar –KANTTI, (the Abnaki equivalent of our Micmac –KA'DI, as explained on page 377), meaning PLENTY, thus making the word mean WHERE THERE IS PLENTY OF ALEWIVES OR HERRINGS

(*Collections of the Connecticut Historical Society*, II, 1870, 25). This name could be written in our modern alphabet as ANMSUAK-KANTI, or, more simply and pronounceably, ANMESUAKANTI, or, better yet, in a simple form available for future local use, MESAKANTE, to which can be assigned the meaning ALEWIVES-PLACE. The appropriateness of the name to the place seems attested by the description given, as above noted, by Wm. Allen who says that the falls continued to be a noted fishing place for several years after the settlers took possession.

The name recalls a puzzle in the aboriginal place-nomenclature of the region. Father Rasle, in his *Abnaki Dictionary*, 493, gives under *Noms*,—AGHENIBÉKKI, la rivière d'AÑMES8KKAÑTTI, seeming to show that the Sandy River was called AGHENIBÉKKI; and as Father Rasle's mission, where his *Dictionary* was written, was for many years at Norrigewock close to the mouth of Sandy River, he could hardly have been mistaken in regard to the names of these places. Yet AGHENIBEKKI and KENNEBEQUI, which Father Rasle himself applies to the main Kennebec, can hardly be wholly different words. Therefore we must conclude that either (1), the preliminary A of the former word involves some root that differentiates the name from Kennebec through some qualification, such as meaning in reverse direction to the Kennebec (which course it has in part) or something of that sort, or else (2), the name Kennebec was used aboriginally for the main Kennebec up to Sandy River and for the latter River to its head, the main stream to Moosehead Lake bearing a different name. For such a usage we have excellent analogy elsewhere, for the Indians applied the name Scoodic to the main Saint Croix up to the Great Forks, and thence up the West Branch, although the eastern branch is in every way the main stream, while precisely the same usage prevailed, I believe, in regard to the main Saint John River, called Woolastook, and its western branch in which the name survives as Aroostook. An explanation for these three apparent anomalies would easily be found if we could suppose that the names were in all cases given to the western branches by the first Indian immigrants who reached them in their migration from the southwest, after which the extension of the name to the main river below would be perfectly natural; and the usage thus established would naturally persist indefinitely. In the case of the Kennebec, however, this possibility seems excluded by the fact that the name Kennebec almost certainly describes the tidal part of the river, as will be shown in the next number of this series. I have no doubt that future intensive comparative study will solve this problem with others. Meantime, it is well to have the problem and its data on record and in mind.

MESKEGUACADIE. (1). The Micmac name for Grand Pré, near Wolfville, in Nova Scotia, given as UMSKEGU-ACÁDI meaning GREAT MEADOW, in a note in *Collections of the Maine Historical Society*, I, 1865, 27, which, however, clearly rests upon information supplied by Rand. The derivation of the name seems clear, for the latter part is evidently our familiar combination -Ā-KA'DI-(K), already explained (page 380), while the former part is as clearly the Micmac 'MSKEGOOL, meaning GRASS (Rand, *English-Micmac Dictionary*, 123), making the word in full 'MSKEGOO-Ā-KA'DI-(K), meaning literally, GRASS-ITS-OCCURRENCE-(PLACE), which is obviously descriptive of the same feature which has given the place the French name of Grand Pré, or Great Meadow. There is not, however, in the word, any root for GREAT, though this is simulated by the 'MSKE, which suggests MĔSKEEK (*op. cit.* 124), meaning GREAT; but the 'MSKE is an essential part of the word for GRASS.

This name is clearly a case of the elevation of a topographical term into a place-name (consult pages 381 and 432), for Rand gives the combination also as a topographical term (*op. cit.* 123,167). Chamberlain gives a Maliseet equivalent as UM-SKIK'-WE-KAT', meaning HAY FIELD (*Maliseet Vocabulary*, 49).

(2). The Micmac name for Medisco Point, on the Bay Chaleur Coast of New Brunswick, according to the late Michael Flinne, who sent me the word in the form 'M-SKĒĒK-GOO-WÂ-GĂD'-Ē, meaning WHERE WILD HAY GROWS. I am not certain that Mr. Flinne had the locality correct, but the word itself is evidently identical in every respect with the preceding.

METABESWACADIE. The Micmac name for the Seventh Lake, that called on recent maps Three-cornered Lake, at the source of Salmon River in eastern Nova Scotia. It is given by Rand as 'MTĂBĔSWĀĀKĂDE, meaning WHERE MUD-CAT-FISH ABOUND (*First Reading Book,* 100). The Mud-cat-fish, more commonly called the Hornpout, widely distributed in Nova Scotia, is 'MTĂBĔS' in Micmac, as Rand states (*op. cit.* 53), while the remainder of the word is obviously our familiar combination –WĀ-KA'DI-(K), earlier described (page 380), making the word in full 'MTĂBĔS'-WĀ-KA'DI-(K), meaning literally HORNPOUT-THEIR-OCCURRENCE-(PLACE).

In response to my question whether the Hornpout is known to occur in this Lake, Dr. A. C. Jost, of Guysboro, a deeply interested student of all such matters in that region, tells me its presence there seems unknown to the men who are acquainted with the River. But I have such confidence in the foundations of Indian place-nomenclature as to predict that it will yet be found there, and in rather special abundance as compared with other lakes in the vicinity.

This name, for the Hornpout, occurs in Passamaquoddy Indian as MĔDEB-ÉSS'M, which gave origin to the modern MEDDYBEMPS, name of a lake in eastern Maine, as Gatschet has pointed out (*National Geographic Magazine,* VIII, 1897, 22), and as I have found independently from local sources.

A similar name occurs also in Northern Maine for Portage Lake, one of the chain of large lakes on Fish River, which is called MEDESBISSOQUOT, from the Hornpout, according to Indian information sent me by the late P. L. Mercure, of Madawaska. The latter part of the ward, however, I do not yet understand.

METASKUMACADIE. The Micmac name, in simplified form, of Snake Brook a very small branch of the Restigouche River, above the Patapedia, as given me by Father Pacifique, in the form MTESGEMOEGATIG, with the meaning SNAKE PLACE. The termination –OEGATIG is the precise equivalent of our –Ā-KA'DI-K, as earlier explained (page 377), while the first part of the name is as clearly 'MTĀĀSKŬM, meaning SNAKE, as Rand gives it (*First Reading Book,* 44). Thus the word in full would be, on Rand's spelling, 'MTĀĀSKŬM-Ā-KA'DI-K, meaning literally SNAKE-THEIR-OCCURRENCE-PLACE, which is presumably descriptive of a feature of local natural history. The English name is probably a translation of the Micmac, though possibly the reverse is true.

MIKCHICHACADIE. The Micmac name, in simplified form, for Boisdale, Cape Breton, a place on the southeast side of St. Andrews Channel, according to Rand, who gives the word as MIGTCĒTCWEGATIG, but without meaning (*Micmac-English Dictionary,* 185). The termination very clearly represents our familiar combination –WĀ-KA'DI-K, already explained (page 380), while the first part of the word would on all analogy involve the name of some animal or plant. Its identity is very perfectly settled by Chief Denys of Eskasoni, interviewed for me by Rev. Father MacPherson who says that the name MIGTJITJOEGATITJG means "where tortoise was getting," that is, where they used to get Tortoises. For the Tortoise, Rand gives MĬKCHĬKCH (*First Reading Book,* 44), the TC of his former-cited work answering always to the CH of the latter work. Thus the subject is perfectly clear, the name in full being MĬKCHĬKCH-WĀ-KA'DI-K, meaning literally TORTOISE-THEIR-OCCURRENCE-PLACE.

Chief Deny's form of the name, unlike Rand's, is obviously in the diminutive form, for the TJ is the same as CHEECH, meaning LITTLE. He says, moreover, that the name belongs to the pond near the church at Boisdale, and that the name MIGTJITJOEGATI (obviously the exact equivalent of Rand's form), is a word but they do not use it. Since these names with their diminutives go in pairs, I have no doubt that the Indians formerly applied the name MĬKCHĬKCH-WĀ-KA'DI-K, to some larger pond on the coast, perhaps one of those towards Boisdale Barachois, or this Barchois itself, though now the name has gone out of use among them. Father MacPherson, in his letter, expresses the name as MĪGJEEJAWĀYGŎDEEJK.

Mira.

The name of a well-known River, Lake, Bay, and Village in eastern Cape Breton.

It appears first in 1685 as Miray, applied to the Bay and a Cape on its south side, on the Jumeau map of 1685 (photographic copy in the Champlain Society's edition of Father le Clercq's *New Relation of Gapesia*, 10). On Bellin's fine map of the Islands, of 1744 it appears as MIRAY, for the Lake, and MIRÉ, for the Bay, whence it was adopted naturally on the English maps as MIRAY, from which the transition to MIRA was easy, though this form is comparatively recent. Meantime, however, an important document of 1713, an application for land, used a form of the name which seems to suggest its own origin, viz., MOULACADIE, which is described as, "the first river in entering the lake Choulacadie on the right hand" (Murdoch, *History of Nova Scotia*, I, 338). Now the lake called Choulacadie, as shown elsewhere in this paper (page 426), can be no other than that now called Mira, and therefore the first river on the right in entering it would be the large stream now called Salmon River. Considering, now, the close association of these names, and remembering that the French always adopted as R the sound which the Indians pronounce L, there would seem no reasonable doubt that MIRA is simply the altered MOOLA of an abbreviated MOOLACADIE. An identical transformation, as will later be shown in detail, occurred in the name of the Northwest Miramichi, which the Indians call MOOLMUNOKUN, but which occurs in French documents as MIRMENAGAN. I take it that the Indians really applied the name CHOULACADIE only to the present Mira River, the French extending it to the Lake, while the Indian name MOULACADIE belonged originally to Salmon River only, but later, in its simplified form MIRA, became extended to the Lake and the River thence to the sea, displacing the older CHOULACADIE.

We seek now the origin of MOULACADIE. This is made quite clear by Chief Denys of Eskasoni, who, interviewed for me by Father MacPherson, gives the Micmac name for Salmon River, the one emptying into Mira Lake, as POLAMOEIGATIG, with the meaning SALMON'S RIVER. Since POLAMEOIGATIG is perfect aboriginal Indian, I suppose there is no doubt it is the true Indian name of Salmon River, not a translation of the English name into Indian; while the English name is either a translation of the Indian, or given independently in description of the same feature. The latter part of this word is the obvious equivalent of our –Ā-KA'DI-K or –ACADIE. The former part is the Micmac word for SALMON, which Rand gives in the form PŬLĂMOO (*First Reading Book*, 54). Now P and M are sounds often interchanged in Micmac, so that PŪLĂMOO can as well be written MŬLĂMOO, and our word would become MOOLAMOO-ACADIE. But, as so many words in the present paper will illustrate, there is a constant tendency to abbreviation in these compounds through omission of some syllables; wherefore, in view of the collective evidence, it seems quite clear that MOOL-ACADIE is simply the condensed form of MOOLAMOO-ACADIE.

Hence we may summarize the entire matter thus,—that MIRA is a contraction and corruption through the French from the Micmac MOOLACADIE, which is a condensation of the roots PŬLĂMOO-Ā-KA'DI-(K), meaning literally SALMON-THEIR-OCCURRENCE-(PLACE), or more generally THE PLACE WHERE SALMON OCCUR, a distinctively descriptive name for Salmon River, an affluent of Mira Lake, the name being extended from Salmon River to the sea by the French.

A very different origin has been assigned to the name MIRA by Bourinot, who derives it from that of a French officer named Miré (*these Transactions*, V, 1899, ii, 3-4). No evidence for his existence is cited, and I think he is an invention of tradition to explain the name. It is quite unlikely that any such person was associated with this place prior to the year 1685, when the name appears in its present form upon the Jumeau map above cited.

MOGULAWESACADIE. The Micmac name, in simplified form, of the large Island now called Portage Island, at the mouth of the Miramichi River in eastern New Brunswick. It was given me by the late Michael Flinne, teacher of the Indian school at Eelground, as MŌ-KŬL-LĂ-WEEJ-WĀ-GA'-DIK, meaning THE PLACE WHERE THEY SHOOT BRANT; while Charles Bernard, Micmac teacher of the Micmac school at Burnt Church, gave me MOGŬLĀWEECHOOACADIE, with the meaning,—"a place where the Brant Geese are plenty and they are generally shot as it were." Rand gives the word MOGŬLAWEECH as meaning the BRANT GOOSE (*First Reading Book*, 48), and Portage Island is a famous hunting ground for that fine waterfowl, always important to the Indians. Accordingly, I believe the construction of the word is perfectly clear; MOGŬLAWEECH means BRANT, while the remainder of the word is our familiar combination –WĀ-KA'DI-K, earlier explained (page 380), thus making the word in full MOGŬLAWEECH-WĀ-KA'DI-K, meaning literally BRANT-THEIR-OCCURRENCE-PLACE, in distinctive description of the locality.

Mr. Flinne thus gave me the full form of the name. I have myself been given by Micmac Indians, with the same meaning, the form MOL-A-WES-WAY-A-DIC (in the exact form of my notes), which is obviously simply a condensed form, with a usual omission of the G sounds, of the full word.

MOGLACADIE. The Micmac name for the Big Bras d'Or Lake in Cape Breton, according to Rand, who gives it as MOGLĀKADIK, meaning PLACE OF BRANT (*Micmac-English Dictionary*, 185). The word seems very clearly a condensation of the MOGŬLAWEECH-WĀ-KA'DI-K given above, and in every way etymologically identical therewith. Presumably it is accurately descriptive, since the Brant is a prominent and important game bird in all that region.

Rand, however, gives also another and quite different word for Bras d'Or Lake, viz., PETOOBŌK (*English-Micmac Dictionary*, 42; *First Reading Book*, 83), and it is wholly improbable that the Micmacs had two different names for the same place. That the name PETOOBŌK belonged really to the Big Bras d'Or, and not to the Little Bras d'Or, is shown conclusively by Bellin's map of the Island in Father Charlevoix's *Histoire* of 1744, which has the legend "appellé par les Sauvages BIDEAUBOCH" on the Big Lake. The same map, however, appears to solve our problem, for it applies the name PAGUELOUACADI, which with the replacement, quite usual, of the P by M, would be MAGUELOUACADI, and therefore quite clearly our word, to West Bay; and this usage is no doubt correct. Rand, by the way, gives another name for West Bay, viz., WŎLNĂMKEÂK' (*First Reading Book*, 103), meaning SANDY COVE; but as this word is always applied to a real cove and not a great inlet like West Bay I have no doubt that Rand's WŎLNĂMKEÂK belongs to some particular cove in West Bay, and that MOGLACADIE is the real Micmac name of West Bay.

MOGLAKATCK. The Micmac name of L'Ardoise, on the south coast of Cape Breton, according to Rand, who gives it, along with the preceding, as MOGLĀK-ĀTCK, without meaning (*Micmac-English Dictionary*, 185). Its form, and the association with the preceding word, makes it seem most probable that it is an abbreviated diminutive of the latter, the TC, equivalent in the *Dictionary* to CH, representing an abbreviated CHEECH, meaning LITTLE. Thus the word would mean LITTLE MOGLACADIE, in distinction from the main MOGLACADIE, which is West Bay, not far distant.

The full form of MOGŬLAWEECH occurs in another Acadian place-name, but with a different termination, viz. MOGULAWIJIK, meaning MULTITUDES OF BRANT, the Micmac name for Port Hill, an arm of Cascumpec Harbour in Prince Edward Island (Rand, *Micmac-English Dictionary*, 185). The termination here is WE-IK, the possessive and locative, precisely as in case of Magaguadavic earlier considered (*these Transactions*, V, 1911, ii, 187).

Mooselookmeguntic.

The name of a Lake of the Rangely group near the head of the Androscoggin River in western Maine. The first occurrence that I have found of the word is upon Purdy's *Map of Cabotia*, of 1814, which has MOOSETUCMAGINTIC, while Greenleaf the next year, on his *Map of Maine*, has MOOSETOCMAGUNTIC. The earliest use of the L instead of the first T that I have found is on Greenleaf's Map of 1842, though undoubtedly it occurs much earlier; and since that time the L has prevailed down to the present. The spelling at the head of this note is that adopted by the United States Geographic Board.

Two explanations of the word have been published. One, cited in Douglas-Lithgow's *Dictionary of American Indian Names*, is without authority or analysis, "where the hunters watch the moose by night." The second is contained in Farrar's *Illustrated Guide Book to the Androscoggin Lakes*, 1892, 161, and represents one of those impossible local interpretations supposed to arise from the expression of a hunter who saw a "moose, took my gun, tick," he was dead etc., one of the same freak type of which many examples have been cited in *these Transactions*, XII, 1906, ii, 6, but which are really no worse than some of the explanations which have been published pretentiously as etymologically authoritative.

The latter part of the word seems to ally it with MEGANTIC, earlier discussed (page 401), but I am informed by a local guide that no Lake Trout (Togue) occur there. The former part also, is still obscure. The modern spelling would seem to ally it with MOOSELEUK, a branch of the Aroostook, which Hubbard defines as MOOSE PLACE (*Woods and Lakes of Maine*, 203), or with MOOSILAUKE, name of a mountain and river in New Hampshire; but, as above noted, the present form of the word appears not to be aboriginal. Thorough search of the early records should give forms to settle its origin, which, it seems reasonably sure, will be found to involve the root –KONTE.

Nahmakanta.

The name of a Lake, and its outlet Stream, flowing into Pemadumcook Lake, on the West Branch of Penobscot River, in Maine. The present pronunciation seems to conform to the spelling, but the older local pronunciation is said to have been NAHMAYKANTEE.

The earliest use of the word I have found is on Greenleaf's *Map of Maine* of 1815, which has the present form. It is NAH-ME-CAN-TE in Jackson's *Second Report on the Public Lands of Maine*, 1838,20. Wilkinson's fine *Map of New Brunswick* of

1859, evidently following some Maine authority, has NAHUMAKANTA. The name is explained by Hubbard, in his excellent work, *The Woods and Lakes of Maine*, 204, as probably composed of NAMÉS, meaning FISH, and KANTI, meaning THERE ARE PLENTY, adding that NAMÉS to the Penobscot hunters means LAKE TROUT. As to the latter part of this word, Hubbard is undoubtedly correct, this being the exact equivalent of our familiar –(Ā)-KA'DI-(K), earlier discussed (page 380); but I think he errs as to the former part, which would seem more probably NAMEGW, the name of the LAKE TROUT, as already discussed under Megantic (page 401), thus explaining the absence of the S in NAHMAKANTA. On this basis the word would be in full NAMEGW-KANTI, meaning literally LAKE TROUT-(THEIR)- OCCURRENCE-(PLACE). As to the appropriateness of the name to this Lake, I am told by Mrs. Eckstorm, my authority for so much of my information about Maine, that the Lake Trout, locally called also Togue, occurs both abundantly and of large size in Nahmakanta Lake, seeming to leave no reasonable doubt as to the correctness of this interpretation.

Two other possible explanations of the word may, however, be mentioned, if only to forestall their later appearance. Thus NAHAM8 is the Abnaki name for EEL (Rasle, *Abnaki Dictionary* 510), which fits well the form of the word above given from Wilkinson's map. Also, Father Rasle shows that NAHAME was the Abnaki word for the WILD TURKEY (*op. cit.* 383), which formerly occurred in New England. Theories upon either of these bases could easily be constructed, but the evidence seems to favor very strongly the derivation from NAMEGW, the LAKE TROUT.

NESOGWACADIE. The Micmac name for Paradise, a Village at about the head of the tide on Annapolis River in western Nova Scotia. Rand makes the name NESOGWĀĀKĂDE, meaning PLACE OF EEL WEIRS (*First Reading Book*, 97), while elsewhere he gives the same place as NESOGWĀKADE, meaning THE PLACE OF EEL-TRAPS ("a place below Lawrencetown," the latter being the next settlement above Paradise on the Annapolis River; *Micmac-English Dictionary*, 117; 186). Father Pacifique in his *Micmac Almanac* of 1902, 23, gives the same word as NISOGOEGATIG. The construction of the word is perfectly clear. Its latter part evidently contains our familiar combination –WĀ-KA'DI-(K), earlier explained (page 380), while the preceding part NESOG, meaning EEL-WEIRS, occurs in many Micmac place-names, as will later be noted (compare also NESOGWĀ "I catch eels in an eel-weir trap," in Rand, *Dictionary* last cited, 117). Thus the word in full would be NESOG-WĀ-KA'DI-(K), meaning literally EEL WEIRS-THEIR-OCCURRENCE-(PLACE), in description no doubt of the distinctive excellence of this place, at the head of tide, for trapping eels in aboriginal times.

NESOGWADIE. The Micmac name of a place near Liverpool in Nova Scotia (not further identified), according to Rand, who gives the word as NESOG-WÂDE or NESOGWŌDE, with the meaning PLACE OF EELPOTS (*Micmac-English Dictionary*, 117,187). In view of the form of the word and its meaning, there would seem no room for doubt that it represents simply an abbreviation of the preceding, though identical in every other respect. The abbreviation seems to follow this plan, NESOGWĀ(KĂ)DE, thus avoiding the repetition of two somewhat similar sounds.

Newdy Quoddy.

The name of a village (on modern maps in the form West Newdy Quoddy called locally West Quoddy), and formerly of the Inlet, or Harbour, beside which it stands, on the southeastern coast of Nova Scotia, about midway between Halifax and Canso. Contracted to Quoddy, it is applied also now to the Inlet; also to a small River emptying into the Inlet and a small Lake emptying into the River; also to a Hill at the west entrance to the Inlet, and to off-lying Shoals.

The earliest use I have found of the name, though it must occur very much earlier, is in 1818, in Lockwood's *Brief Description of Nova Scotia*, 34, where it is NEWTONQUADDY. This is apparently the form used by the sailors, for the *Sailing Directions* have it NEWTONQUODDY as the usual sailors' name. It is NEWCOMQUODDY, in Haliburton's *History of Nova Scotia*, of 1829, (II, 34), which perhaps is misprinted. On maps of Nova Scotia of about the middle of the last century it is NEWDIQUODDY, applied to the Inlet, while the form NEWDY QUODDY seems comparatively recent, curiously reversing the usual tendency of place-names to condense.

The name is derived by Rand from the Micmac NOODAAKWŎDE, meaning SEALING GROUND (*First Reading Book*, 95), while Rand is also quoted by Dawson as giving NOODA-KWODDY, meaning PLACE OF SEALS, or, more literally, PLACE OF SEAL HUNTING (*Acadian Geology*, 2nd edition, 3). Thus the word becomes perfectly clear, for the latter part evidently consists of our familiar combination, –Ā-KWA'DI-(K), already explained (page 377), while the first part is as clearly the stem of NĔDOOAAGWĀ, meaning TO HUNT SEALS (Rand, *English-Micmac Dictionary*, 138, 228). Thus the word in full would be NEDOO-Ā-KWA'DI-(K), meaning literally SEAL HUNTS-THEIR-OCCURRENCE-(PLACE). The form of the name used by the sailors, NEWTONQUADY, I take to be a familiarization of the Indian word, NEWTON being more familiar to English ears than NEWDI. As to the appropriateness of the name to the place, I am told by the Postmistress of West Quoddy that seals still come into the Harbour occasionally, and are rather abundant around Harbour Island just outside; and she adds that the name is known locally to mean RIVER OF SEALS. No doubt the place was originally one of the principal seal-hunting grounds of the Micmacs.

Rand gives also NOODAKWŎDE or NOODAKWÂDE, meaning SEAL-HAUNT, or THE SEAL-HUNTING PLACE, which is evidently identical with the name just considered, as the Micmac name for Winchelsea Harbour (*First Reading Book*, 102; *Micmac-English Dictionary*, 187). The name Winchelsea Harbour does not appear upon the modern maps and appears to be unknown locally, but upon those of a half century or more ago it is used as an alternative name for Mushaboon Harbour, which lies a little westward of Sheet Harbour, Newdy Quoddy lying a few miles to the eastward. Thus Newdy Quoddy and Winchelsea Harbour are only a few miles apart, and it is wholly out of conformity with the principles of Indian nomenclature that two places so near together should have an identical Indian name. It seems probable, accordingly, that Rand in some way confused the two places; and this receives the strongest confirmation from the fact that Dawson, in the place above cited, listing names upon Rand's authority, gives NOODA-KWOODY as the Indian name for "Noodiquoddy or Winchelsea Harbour." And if yet further evidence were needed it might be found in the fact that Winchelsea Harbour has a quite different Indian name, viz., Mushaboon.

PANACADIE. The Indian name for Halls Creek, which empties into the Petitcodiac River at Moncton, New Brunswick, (*these Transactions*, II, 1896, ii, 239). Local writings on the history of the region mention the name, which is used also on a plan of 1809 in the Crown Land Office at Fredericton. The name is known locally, and pronounced Penacadie, as I have been told.

I have no clue to its construction and meaning other than such as is offered by its resemblance to Benacadie in Cape Breton, with which it is presumably identical. It is interesting to note, in connection with the suggestion that the latter may represent a shortened form of Shubenacadie, that this Creek flows through marshes, and presumably some former intervales, making its banks a suitable place for the occurrence of the Ground-nut. Compare BENACADIE.

Passamaquoddy.

LOCATION AND APPLICATION. The name of a large land-locked Bay in the southwestern angle of New Brunswick, but formerly used for an indefinite district thereabouts. It is also the name of the Indian tribe which still exists in that region. Abbreviated to Quoddy, it is applied, as Quoddy Head, Roads and River to various features in the vicinity, as will later be noted. The spelling expresses exactly the local pronunciation, all of the vowels being sounded short, and the accent placed on the syllable before the last.

HISTORY OF THE NAME. It makes its earliest known appearance in 1677 in the forms PERTEMAG8ATE and PESSEMOUQUOTE, in the *Relation* of Father Morain, who speaks of the place as one of the three rivers on which the Indians were settled (Thwaites' *Jesuit Relations*, LX, 262-3). The former of the two spellings, by the way, in view of the latter, and of the construction of the word as noted below, would seem clearly a misprint for PESTEMAG8ATE, the 8 in both words being renderable, as usual, most nearly by OU (or OUI). I find the word next in 1684 as PASCOMADY in an official seigniorial grant (*these Transactions*, V, 1899, ii, 307), which form I take for some careless clerical transposition for the letters in PASMOCADY, since it is PESMOUCADY in the same series of grants in 1691 (*op. cit.* 308), and in many other uses of the name. The word should be pronounced, by the way, with the accent on the syllable before the last, as shown earlier on page 378. The great map by Franquelin and De Meulles of 1686 has PESMONQUADY (*op. cit.* III, 1897, ii, 364), as has the French Census of the same year (Rameau de Saint-Pere, *Une Colonie Féodale*, II, 402); but I think it most probable that both words are from the same source, in which the N was really written U. From this time onward we find a certain dimorphism in the word as used respectively by French and English, of which we shall first trace the French. Thus in 1696 the Sieur de Villebon, then Governor of Acadia, uses PESMOKADIS, in his *journals*, still unpublished, in the Boston Public Library, though according to Murdoch (*Nova Scotia*, I, 214), he had used PESMONQUADIS (PESMOUQUADIS?) in 1694. Later we find PESMOCADY, PESMOCADÉ, PESMONCADY, PESMOCANTI in various documents down to 1744, in which year Bellin, in his great type map, *Carte de la Partie Orientale de la Nouvelle France*, used PESMOCADIÉ, to which he adheres consistently in all others of his maps. Then as the influence of the French waned and finally vanished in that region, their form of the name, which clearly approximated to PESMOCADIE (accented, it is to be remembered, on the syllable before the last) gradually became obsolete. Meantime, however, two variants had appeared. One of them is the form PAS-CAMADI on the great *Carte du Canada* of d'Anville of 1755; and this, like a case earlier mentioned, I take to be an accidental clerical transposition for PAS-MACADI, since nothing in the known history of the word Passamaquoddy explains d'Anville's form, while the transposition is an easily natural one. The other variant is far more important, for around it center some of the later explanations of the name. It is the form PESKADAMIOUKKANTI, given by Father Charlevoix in 1744 in his *Histoire de la Nouvelle France* (Shea's *Translation*, I, 275). He makes, however, the slip of saying that it is the Indian name of the Pentagoët (Penobscot), an error that is patent; moreover, it is corrected by Bellin in 1755, in his printed Explanation of his map, where he says (p. 42) that it was the Indian name for Pescomadié, though apparently he did not connect the two. Meantime, however, a somewhat different form was arising among the New Englanders, who were already resorting to the region for fish and the Indian trade. The earliest English use of the name that I have found is in 1690, in a journal of the Phipps Expedition, which reads PASSEMEQUADIE (*Report on Canadian Archives for 1912*, 55). In the same year, however, in a cotemporary newspaper item, occurs the very interesting form PESCADAMOQUADY (Avery's *History of the United States*, III, fac-simile opposite page 281). Colonel Church in 1696 uses PASSAMEQUADY (Drake's *History of Philip's War*, 1827, 236) and in 1704 PASSAMEQUADO (*op. cit.* 261). It is PASAMIQUADI on the Blackmore map of the region, of 1713, and on the Moll map of 1715 (*these Transactions*, III, 1897, ii, 366, 368), while PASSAMAQUODDA, PESSEMEQUODDY and other forms, often obviously misprinted, occur in later English records. Then, in 1733, on an important map, Southack introduced the present form PASSAMAQUODDY (*these Transactions*, VII, 1901, ii, 268), which form, though naturally with a good many variants and mis-spellings, has prevailed down to the present. Of these aberrant forms, one occurs in the mysterious Visscher map, of uncertain date, which has PERSTMEQUADE, evidently from English sources with the other English words in the vicinity (*these Transactions*, III, ii, 358). More interesting, however, is the form adopted by Mitchell in his famous map of 1755, which has PASSAMACADIE. This spelling is English in its first syllables, but seemingly French in its latter part, and was no doubt chosen by Mitchell through deference to its French associations and presumable (to him) French origin. This form had no influence upon cotemporary maps, his rival Jeffreys having on his *Map of Nova Scotia* of the same year PESSEMIQUADI and PASSAMAQUIDDI (*op. cit.* 379). Thus it is clear that while the French form of the name approximated towards PESMOCADIE the English form approximated towards PASSAMAQUODDY, which naturally has survived. The English form thus differs from the French, *first*, in the possession of an extra syllable introduced into the first part of the word, no doubt for greater ease of pronunciation by the English tongue,as paralelled in the case of Petitcodiac considered in the preceding paper, and *second*, in retention of the QU or KW sound, which disappears from the later French.

ANALYSIS OF THE WORD. Every consideration points to an Indian origin of the word, and this is completely confirmed by the testimony of the modern Indians, who know and use it in their own tongue. Thus, I have been given PES-KUT-UM-O-QUAH-TIK (in the form of my notes) by Gabe Acquin, one of the most reliable of Maliseets, and M. Chamberlain in his *Maliseet Vocabulary* 60, has PĔS′-TE-MO-KA′-TĔK, while Gatschet, who knew the place and Indians personally, has PESKĔDĔMAKÂDI (*National Geographic Magazine*, VIII, 1897, 23). Rand has PESTUMOOKWÂDIK (*Micmac-English Dictionary*, 188), and is quoted for the form PESTUMOO-KWODDY by Dawson in his *Acadian Geology* 2nd edition, 3, and for PESTUMACADIE (Rand was "the missionary at Hantsport, Nova Scotia"), by Ballard in his paper on Maine place-names in the *Report of the United States Coast Survey* for 1868, 255. As to the meaning of the word there is perfect agreement among the authorities. Thus Gabe told me it means WHERE POLLOCK ARE, while Gatschet has WHERE POLLOCK IS NUMEROUS OR PLENTIFUL, from PESKĔDEM, meaning THE POLLOCK FISH, and –KADI, or –AKADI, meaning PLENTY OR ABUNDANCE, "of the object in question." Rand, in the places above cited, derives it from PESTUMOO—,meaning POLLOCK, and –KWODDY, meaning GROUND, (that is, POLLOCK-GROUND), or PLACE OF PLENTY. Furthermore, this modern evidence is supported by many earlier records. Thus (and this is the earliest attempt that I have found at the solution of the word), the Passamaquoddy Indians in the year 1796 told Ward Chipman, one of the British Boundary Commissioners that "Passamaquoddy was so called from the great quantity of Pollock taken there" (Kilby, *Eastport and Passamaquoddy*, 115). Later, in 1828, the missionary to the Passamaquoddies, Rev. Elijah Kellogg, gave the meaning as POLLOCK FISH (*Collections of the Massachusetts Historical Society*, III, 1833, 181), and this statement has been repeated by many others. More specific is the analysis given in 1839 by Williamson in his *History of Maine* (I, 512) for he derives it from PASCODUM, meaning POLLOCK, OQUON, meaning CATCH 'EM GREAT MANY, and KEAG meaning LAND,—in which he is almost correct as we shall soon demonstrate; and this explanation is repeated by other writers later. Ballard gave a correct analysis of the word, based on Williamson and Rand, making the Micmac form, upon Rand's authority as above cited, PESTUMACADIE, and the Etchemin PASCATUMACADIE, with meanings POLLOCK-PLENTY-PLACE, or, on authority of an Indian chief, POLLOCK-CATCH-'EM-GOOD-MANY (*Report of the United States Coast Survey for 1868*, 255). In this paper Ballard cites Barratt in support of PASCATUM meaning POLLOCK; the same excellent work likewise gives PESTUM as the Micmac word for that fish (*The Indian of New England*, 1851, 14). Later Trumbull, in his invaluable work on Algonkin Place-Names in the *Collections of the Connecticut Historical Society*, II, 1870, 26, uses Charlevoix's form PESKADAMIOUKKANTI as a basis, and cites Kellogg and Rand, to a conclusion identical with theirs. Incidentally he raises the question whether the PESKATUM might not have applied to more than one kind of fish, but in this he is wrong, since it is perfectly clear that the Indians gave the name to a single prominent species, as will later more fully appear. Later came Gatschet's analysis, above mentioned, and my own similar explanation in *these Transactions*, II, 1896, ii, 260.

Marshalling these data they point all to one conclusion, viz., that the first part of the word means POLLOCK. In Micmac this word is PĔSTŬM, in the plural PESTUMOO'K (Rand, *First Reading Book*, 54), while the second part represents our familiar combination –Ā-KA'DI-(K), already discussed (page 380), The combination here appears, however, in the form –Ā-KWA'DI-(K), which always follows an OO sound, showing that it is PESTUMOO, the stem of the plural form, which appears in the word; and, as in all such cases, the Ā is extinguished by the OO sound. Thus in full the word would be PĔSTŬMOO-(Ā)-KWA'DI-(K), meaning literally POLLOCK-(THEIR)-OCCURRENCE-(PLACE). Two matters, however, need special elucidation. The various forms of the word all fall into two sharply marked groups,—a first including PESSEMOUQUOTE, PERSTMEQUADE, PESTUMACADIE, PĔS'-TE-MO-KA'-TĔK and the abbreviations which led to the French PESMOCADIE and the English PASSAMAQUODDY, in which the first part of the word is PESTEM–or PESSEM–, and a second group including PES-KUT-UM-O-QUAH-TIK, PESKADAMIOUKKANTI, PESCADAMOQUADY, in which the first part of the word is PESKATUM–. The difference between the two groups is perfectly plain, for PESTUM is the Micmac, and PESKATUM is the Maliseet-Passamaquoddy-Penobscot, name for the POLLOCK, as has already been indicated, and as all vocabularies confirm. The difference in these words caught the critical eye of Trumbull, by the way, though he interpreted PESTUM wrongly as Etchemin, i. e. Maliseet (*Collections* cited earlier, 26). The clearness of the distinction between the two groups raises in turn the question as to which of the two forms is the original, and therefore the actual ancestor, of the word Passamaquoddy. Returning to the records, it seems quite clear that the form involving PESTUM which is the oldest, must be also the one which was abbreviated into the later PESMOCADIE and PASSAMAQUODDY, for the other form, involving PESKATUM, appears not only later but also sporadically. If, now, it seems highly improbable that a name in a territory of the Passamaquoddies would be Micmac, then the answer is also clear and has been given already in this series—viz., several of the most prominent names in this region, including Magaguadavic, Bocabec and Cobscook already considered, with several others later to be noted, are unquestionably Micmac, as are several in the Maliseet territory along the Saint John (*these Transactions*, VII, 1913, ii, 90, 105), in light of which fact Passamaquoddy is not only possibly, but even probably, Micmac. The situation, I think, is clear as a whole. The original word, in actual use by the Indians at first contact with the whites, was PESTUMAKWADI, of Micmac origin, which was adopted and corrupted by the whites to PESMOCADIE-PASSAMAQUODDY; but the Maliseets-Passamaquoddies-Penobscots, knowing that the word meant POLLOCK, used their own equivalent of the word, viz., PESKADUMAKWADI, especially when giving the name with care to the whites. We have actual proof of this double usage in one case, for, as recorded above, one Maliseet Indian gave to me the Maliseet form, and another gave to M. Chamberlain the Micmac form. On this hypothesis the whole subject becomes clear and consistent.

Another point of interest concerns the use, in the PESKADAMIOUKKANTI of Charlevoix, and in the form PESMOCANTI, of an N sound in the second part of the work. The significance is plain—it is simply the nasal N which occurs in the root when pronounced by the Abenakis as explained earlier in this paper (page 377).

We consider now the appropriateness of the name to the place,—which in turn involves the inquiry as to its precise topographical application by the Indians. In all of the earlier records the name is applied to a general district, and we do not find it attached to any recognizable topographical feature until Blackmore's chart of 1713, already mentioned, a chart based upon new surveys, applies PASAMIQUADI to an inlet which is clearly intended for the West Passage, i.e., that between Campobello and the mainland of the United States. On Southack's chart of 1733, also earlier mentioned, and also made from new surveys by Southack himself, the word is applied four times, as WEST PASSAGE OF PASSAMAQUODDY to the West Passage, as PASSAMAQUODDY HEAD to the neighbouring headland on Campobello, as GREAT ISLAND OF PASSAMAQUODDY to Campobello itself, and as PASSAMAQUODDY RIVER to the passage between Deer Island and Maine, the identity of all these places being made plain in *these Transactions*, VII, 1901, ii, 267 seq.

It was this map of Southack's which was used by Mitchell in his map of 1755, likewise already mentioned, and famous in the boundary controversies; and on that map Mitchell adds PASSAMACADIE B., that is Bay, to waters which are clearly the outer Bay, viz., the waters between Campobello Deer Island and Moose Island, as comparison with Southack's map will show. In this usage, the source of which I do not know and which may represent only a happy guess, Mitchell first connects the name with a Bay, and moreover does it correctly, as we shall presently learn. Neither of these maps, nor any other printed map down to 1764, however, shows any trace of the great inner Bay which now bears the name. But, in 1764 John Mitchel surveyed the Passamaquoddy region, and placed the inner Bay on his map, which, unknown in the original, is preserved in a cotemporary compilation and printed in *these Transactions*, VII, 1901, ii, 229, while his full journal of his survey has been published in the *Collections of the New Brunswick Historical Society*, II, 1904, 175. On his map, he applies PASSIMAQUODDY to Campobello, and also to the present Saint Croix,—doing the last, quite obviously, because, like so many others, he misinterpreted Southack's map, which he is known to have had with him, mistaking Southack's outer for the inner Bay. On this map he gives no name to the inner Bay, though the entire map is entitled A PLAN OF PASSIMAQUODDY BAY OR THE BAY OF ST. CROIX, the word Bay being used in this place, quite evidently, in the general sense of the waters of the region, as it is used for example in a document of 1762 which makes Passamaquoddy Bay extend all the way to Point Lepreau (*Report on Canadian Archives, for 1904*, 297). In his field book Mitchel speaks of his survey along the shores of the "Bay of passimaquody" and "passimaquody Bay" (*Collections*, 181), though here again the context shows that he is using the word in the descriptive and not specific sense. Meantime, however, the inner Bay certainly did possess a local name of its own, for, on a large MS. map of 1764, still unpublished, made by Charles Morris, it is called THE GRAND BAY (compare also a Map in *Report on Canadian Archives for 1904*, opposite page 300), while the Journal of Captain William Owen, kept during his residence at Campobello in 1770-1, uses GREAT BAY and GRAND BAY for the inner Bay, not using Passamaquoddy at all except for Campobello (*Collections* cited, I, 1894, 202, 204). This form GRAND BAY persisted into much later records, (compare a document of 1795 in Kilby's work, 116), and I have no doubt it goes back to the time of the Acadians who called it, presumably, LA GRANDE BAIE. The name was known, I think, to Mitchel, and used on his original map even though not on the copy, for Pownall's map of 1776, which in this region depends wholly upon Mitchel, has GT. BAY for the inner Bay, (*these Transactions*, VII, 1901, ii, 230). Thus it seems clear that up to this time the name Passamaquoddy was not used specifically for the inner Bay, but only in a general way as part of the use of the name for the entire region—it was "the Great Bay of the Passamaquoddy Region." In 1772, however, was made the detailed and accurate survey of this region by Thomas Wright, resulting in a beautiful great map, still unpublished but incorporated into the widely used charts of DesBarres. On this map the inner Bay is named GRAND BAY OF PASSIMAQUADI (*photo from original in British Museum*), this name, I take it, being still a descriptive phrase, equivalent to "the grand bay of the Passamaquoddy region". This finds good confirmation in a document of 1784 given by Kilby (*op. cit.* 97) which mentions,—"the bays of Schoodick St. Andrews, Cobbscook &c. &c. formerly comprehended under the general name of Passamaquoddy." Then on Sproule's fine map of the Southwestern part of New Brunswick of 1786 (*these Transactions*, VII, 1901, ii, 412), which follows Wright closely, Wright's form is changed into BAY OF PASSAMAQUODDY; and this form Sproule, on the very important map of 1798 illustrating the decisions of the Boundary commissioners, altered still farther to PASSAMAQUODDY BAY, (*op. cit.* 254). Thus was completed the transformation of the descriptive phrase into the specific place-name, which has persisted in exactly this form on all maps right down to our own day. On the same map Wright had dropped the name Passamaquoddy from all other features in the vicinity, and in this was followed by Sproule and others. The collective effect was this,—that the name Passamaquoddy became thus gradually transferred on the maps from the outer waters, where, as I shall soon show, it belonged, to the inner where it did not.

But while the maps were thus transferring the name to their own satisfaction, from the outer to the inner Bay, and by the weight of their authority have been able to carry with them a certain literary use and the adherence of those who are influenced by books and polite usage, the local usage of the residents has ever refused to conform. Thus, even now the fishermen and sailors who navigate those waters never speak of the inner Bay as Passamaquoddy, but call it universally St. Andrews Bay. This usage is at least as old as 1784, as shown by a document in Kilby's *Eastport and Passamaquoddy*, 97. John Allan, who knew the region well, uses this name, and this only, for the inner Bay on his independent map of 1786 (*these Transactions*, VII, 1901, ii, 264). Furthermore, in local usage, the name Passamaquoddy has always clung around the outer waters, and still does. Thus, the Allan map above mentioned, calls the waters northeast of Campobello PASSAMAQUODDY ENTRANCE. A very interesting map of 1796 by David Owen who knew the region intimately, applies PASSAMAQUODDY BAY to the waters from Cobscook Bay out between Campobello and Deer Island without naming the inner Bay at all, while this same map has the abbreviation Quoddy, in the form QUADY, applied to Campobello and to the West Passage (*op. cit.* V, 1899, ii, 267). A very detailed map of the vicinity of Campobello in a pamplet entitled *The Campobello Mill and Manufacturing Company*, of 1839, applies PASSAMAQUODDY GREAT HARBOUR to the present Eastport Harbour, while the pamphlet uses PASSAMAQUODDY BAY for the outer Bay. Finally this part of the subject is illustrated very beautifully by the usage in Lorimer's *History of the Islands and Islets of the Bay of Fundy*, of 1876, in which the author, out of a close personal knowledge of the region, uses PASSAMAQUODDY BAY for the waters around Indian Island, i.e., the outer Bay, and PASSAMAQUODDY RIVER for the passage between Deer Island and Maine. This is precisely the usage of Southack's map, and it persists even to our own day, for I find Passamaquoddy Bay thus applied in the paper of 1910 by S. Chalmers mentioned below, while I have heard QUODDY RIVER used by fishermen. We still speak of the many islands of Passamaquoddy Bay, embracing those which are not in the inner Bay at all. In the speech of sailors and fishermen, however, the use of Passamaquoddy for the outer waters seems to be dying out, being replaced by more modern and shorter names; while such survival as Passamaquoddy enjoys locally rests upon the historic and poetic appeal which the name makes to those susceptible to such influence. There is accordingly some danger that, as it has never been taken up in purely local nomenclature for the inner Bay, it will die out altogether in the ordinary speech of the residents, and have only a literary existence and that chiefly in application to the inner Bay. That is, the danger applies to the full form of the name; in its abbreviated form QUODDY it has a perfectly fixed and permanent use:—as QUODDY HEAD for the prominent cape which forms the extreme easternmost point of the United States: a certain usage as WEST QUODDY for the West Passage (between Campobello and Maine): and the American charts give also QUODDY ROADS to the West Passage, and EAST QUODDY HEAD to the extreme easternmost point of Campobello, though this latter seems to lack local sanction.

The original application of the name to the outer Bay thus indicated, is confirmed most satisfactorily by independent evidence from another source. In 1796-7 a Commission was taking local evidence in connection with the International Boundary, then in dispute; and the resultant documents, including much testimony from the earliest residents, are printed in part in Kirby's *Eastport and Passamaquoddy*, and in part are still in MS. among the voluminous records of the Commission, of which copies are preserved in the Canadian Archives, in the State Library of Maine, and elsewhere. The local testimony shows some confusion through the fact that the Commissioners, who are known to have used Sproule's map, persistently apply the name Passamaquoddy to the inner Bay, despite which it is clear that the residents, while not agreeing as to the application of the name in detail, did all connect it especially with the outer waters, while two of them attached it expressly to the waters running from Head Harbour, Campobello, westward to the end of Deer Island, and around to Pleasant Point (*op. cit.* 103, 105). Again, in the testimony of Alex. Hodges, which Kilby does not print, the statement is specific, that the waters between Head Harbour and Harbour LaTete as far as, and above, Moose Island, are called Passamaquoddy or Pollock River (*MS. in Maine State Library*). Finally and most conclusively of all, one of the Passamaquoddy Indians interviewed by Ward Chipman, stated that the name Passamaquoddy belonged only to the outer waters, the pollock being not found within the inner Bay (page 411 earlier).

This localization of the aboriginal name Passamaquoddy upon the waters of the outer Bay, raises the question as to whether pollock especially abound there. In fact as I know well from my own personal knowledge of the place, they do; and not only do they abound, as the saltwater fishermen all know, but they are conspicuously prominent on account of a curious feature of their habits, a feature unique among the saltwater fish of this region at least—that of schooling as they feed upon shrimp, when they skip and break at the surface in a striking and characteristic manner. The Indian word PESKÂTUM, indeed, describes this habit, for it means JUMPER or SKIPPER, as various authors have pointed out (Prince, in work cited below, and A. F. Chamberlain in *American Anthropologist*, III, 1901, 678). It is indeed, one of the sights of that beautiful region in its charming early summer to see the pollock schooling; and the place where the sight is especially characteristic, indicating their favourite haunt, is in the waters between Campobello and Deer Island, leading west towards Eastport Harbour. This habit is all the more remarkable since the Pollock is a large fish, much like the Cod in general aspect. While thus schooling they can be speared, and still often are by both Indians and whites, while they may also be taken with rod and fly, a thing unique among saltwater fish in this region. An interesting description of this form of sport has been given by Stephen Chalmers in *Outing*, for June 1910. Here, accordingly, all lines of evidence concur in locating the aboriginal PESTUMOKWADI, the original Passamaquoddy.

Thus we can trace very fully the history of this name. Used by the Indians for the waters of the outer Bay, it was spread by the whites as a district name over all the surrounding region, over which it rolled across islands, bays and headlands like one of its own healthful fogs. Then, in time and with settlement, new names became applied to particular features in the district, there rifting the cloud so to speak. Yet it lingered in some places, clinging closest, of course, around the place of its real origin, but elsewhere remaining only upon the inner Bay where the cartographers had placed it and upon certain headlands and passages where the speech of the sailors and fishermen have preserved it.

Since the evidence seems conclusive that the name Passamaquoddy belonged not at all to the inner Bay, we naturally ask with interest what name the Indians used for this extensive and beautiful sheet of water. No name therefor has apparently been anywhere recorded, nor is any such known to the present Passamaquoddy Indians. I believe, however, that it occurs in a chance record given in *these Transactions*, II, 1896, ii, 245, as obtained by me from John Lola, one of my Passamaquoddy informants. Lola gave me SQUĂ-SO′-DIK-SEE-BAH-HA′-MOOK as the name for Letite Passage. Now SQUA-SO-DIK means a LOOKOUT PLACE, interpreted also as LANDING PLACE, understood to be one of the mythical alighting places of Glooscap, and is the undoubted name for McMasters Island (*op. cit.* 247) a striking Island with abrupt red bluffs, the highest around Passamaquoddy. Now SEE-BAH-HA-MOOK does not mean a passage, but is a Maine Indian name meaning a great lake. Thus Hubbard, in his *Woods and Lakes of Maine*, 20, 211, shows that SEBAMOOK was an Abenaki name for Moosehead Lake, the largest lake of Maine; and this word I take to be identical with Lola's. Hence the name SEBAHAMOOK would apply to the inner Bay, which is completely land-locked and thus in reality a great lake, though of salt water. The name LOOKOUT OVER THE LAKE would be wholly appropriate to the hill on McMasters Island. To this subject, however, I hope later to return with further evidence and more exact analysis.

OTHER EXPLANATIONS OF THE NAME. So conclusive seems the evidence for the interpretation of Passamaquoddy given in the preceding pages, and so consistent are all of the data concerned, that it may seem needless to have argued the subject at such length as I have done. Yet I think it worth while in view of the fact that no less than some seven other explanations of the name have been given, while still others are likely in the future to be mined out and displayed by amateur investigators of these matters in the first flush of pleasure that is yielded by the discovery of roots which happen to match up into pleasing combinations. Thus it has ever been, and I suppose will be always.

The first of the other explanations is correct in substance but erroneous in its interpretation of the roots. It seems to have originated in 1840 with a Report made by Mudge and Featherstonhaugh, two Commissioners sent out by the British Government to examine the matter of the International Boundary. In an official British *Bluebook* of that year they wrote, page 12, "the bay into which the St. Croix empties itself, was known by the Indians of the Morriseet tribe, which still inhabits New Brunswick, by the name of Peskadumquodiah, from *Peskadum*, Fish, and *Quodiah*, the name of a fish resembling the cod. The French, according to their usual custon, abbreviated the Indian name, which we sometimes, in the old records, read *Quadiac* and "Cadie," and at length we find it taking the general designation of 'Acadie'". And the information is added that the fish resembling the cod is the Pollock, which still continues to frequent that bay. Presumably the Commissioners obtained their information about the origin of Passamaquoddy from the Indians with whom they explored the rivers of Maine and New Brunswick, and probably it was given to them correctly; and their strange error in making the second part of the word, viz., Quodiah, mean Pollock, seems best explainable as some freak of memory, intruded when the matter was written down long after it was learned from the Indians. The error was exposed, very fully, and with the help of Rand the Micmac scholar, by Dawson in 1868, in the second edition of his *Acadian Geology*, 2, 3, and it would have had little importance were it not that it influenced others. Thus, this seems clearly the foundation of the explanation given in the *Collections of the Maine Historical Society*, IV, 1856, 191, by C. E. Potter, who derives Passamaquoddy from POS meaning GREAT, ASQUAM meaning WATER, and AQUODDIE meaning POLLOCK or HADDOCK, adding that AQUODDIE "has been *frenchified* or corrupted into *Acadia, Cadia, & Cadie.*" He expresses the belief that the word applied both to the pollock and the haddock, and remarks that he could not find that the Indians distinguished one from the other. This latter remark could not have been based upon any investigation of the matter, for the least knowledge of the vocabularies, the fish, or the Indians would have shown its error, while so far as I can find, his roots Pos and Asquam have no better basis. This paper of Potter's is typical of the copious superficial literature which seems especially to accompany this subject, and is all the worse from its tone of positivism and prominence of its place of publication, which has caused it to be far more widely quoted and copied than would otherwise have been the case. Thus it was cited by Hind, in his *Report on the Geology of New Brunswick*, of 1865, 260, who quotes also the earlier Report of 1840 (*op. cit.* 20), and is the origin of the similar error in John Reade's paper in *these Transactions*, V, 1887, ii, 3. Finally, in no less a work than the *Handbook of American Indians* (II, 347), the word QUODDY is defined as "A Variety of large herring found in Passamaquoddy bay, ME.!

A second explanation is correct as to the first part of the word but erroneous as to the latter part and is promulgated by no less distinguished an authority than J. Dyneley Prince, whose writings upon the Indians of this region are both many and valuable. In 1899, he wrote,—"The word Passamaquoddy is a corruption of the

Indian *Pĕstŭmwŏkā'dyĭk*, the plural of the participial formation Pĕstŭmwŏk-ād 'he who catches the pollock-fish' from Pĕskŭtŭm-wŭk 'pollock-fish,' +-ād, participial ending." (*Proceedings of the American Philosophical Society*, XXXVIII, 1899, 181), and he repeats the statement in his introduction to Leland and Prince's *Kulóskap the Master*, 1902, 23, in the form,—"The name Passamaquoddy is a purely local term, meaning 'spearers of pollock fish' (*peskátum*). The correct form is *Peskumokádyik*." Professor Prince thus makes the place-name a secondary derivative from that of the Indian tribe, in exact reverse of the usual conception. As a mere amateur in these studies I am not prepared to debate Prince's ideas from the philological side, though his explanation seems to be forced, and his failure to recognize the root -AKADI remarkable; but I am quite content to rest the case upon the accumulation of evidence given in this paper, which does not seem to me at all weakened by anything in his interpretation. Possibly he was influenced by the well-known fact that the totem of the Passamaquoddy tribe is a canoe containing two Indians in pursuit of a pollock (*these Transactions*, V, 1887, ii, 3).

The third of the other explanations, however, involved error throughout. It was introduced by Father Vetromile, who, in his book *The Abnakis and their History*, 1866, 54, writes, in connection with the St. Croix,—"Its real Indian name is *Peskadamiukkanti* (which word he credits to Charlevoix), *it goes up into the open fields*...... hence *Scoodic-lakes, open-field-lakes,* explained as open by fire, *schootè* meaning *fire*." In order thus to connect Peskadamiukkanti with Scoodic, the old name of the Saint Croix, Father Vetromile apparently considered that the *eskada* of this word is equivalent to *scoodic*, for which there is no evidence whatsoever. Besides, no roots in the former word can possibly be made to mean either OPEN or FIELDS. In fact, however, the origin of Father Vetromile's meaning for Peskadamiukkanti is easy to find, for more than one earlier writer had assigned to the word Scoodic the meaning OPEN FIELDS, the opening being done by FIRE, a matter that will later be discussed. Accordingly it seems clear that Father Vetromile's memory played him a trick, affixing the meaning to the wrong word. This is all confirmed by the fact that he then goes on to say that the Passamaquoddies derive their name from this word "and not from the word *Quoddy, haddock,* as it is erroneously believed." What authority can we grant to a person, who, a supposed student of the Indians, and author of a book and paper on the Indian language, can accept Quoddy as the Indian name of the haddock? After this it is not surprising to find him saying, "We know from ancient writers that the Micmacs did not know the cod-fish, and this was probably the case with the Etchimins." Against this statement we need only set the testimony of the most ancient of all the writers who came into direct contact with the Micmacs, Lescarbot, who gives in his works a Micmac name for the cod (*Histoire de la Nouvelle France*, Liv. 3, ch. 7). And besides the bones of the cod are found abundantly in the ancient Indian shellheaps (*Bulletin of the Natural History Society of New Brunswick*, No. III, 1884, 24, and other publications). Yet such is the foundation of the greater part of the material in Father Vetromile's book, the prominence of which has given it an influence far beyond its worth. Its explanation of the word is repeated in Knowlton's *Annals of Calais, Maine*, etc., 1875, 12, and I think I have seen it in other publications as well.

Quite different is the fourth explanation, that which Father Maurault adduces in his *Histoire des Abenakis* of 1866, where, on page 6, he says (translated),—"The Abenakis call the River Saint Croix '*paskatami8kanji*,' river which is difficult to perceive, and which is seen as if through the dusk" (rivière qu'il est difficile d'apercevoir et que l'on vit voit comme à travers les ténèbres) and makes this the origin of the name Passamaquoddy. The Indian form suggests the influence of Charlevoix's word, but may possibly have been taken independently from the Abenakis among whom Father Maurault lived. I do not, however, perceive the roots which can give the meaning he assigns; but the matter is hardly important in view of the weight of the evidence which assigns so different a meaning to the word.

A fifth explanation is contained in the *Collections of the Maine Historical Society*, IV, 1856, 116, where Joseph Howard gives, upon the authority of Dr. J. A. Shute an origin from the Delaware tongue, (the Maine Indians being supposed to represent an offshoot thereof), making Passamaquoddy mean "Too many bears." I have not tried to find the Delaware roots that explain this interpretation, for obviously it is too far fetched for consideration in conjunction with the foregoing evidence.

A sixth explanation was given me some years ago by John Lola, a bright Passamaquoddy, who said the word meant, "narrow and wide and comes in narrow again." I do not know the roots he had in mind, but have not troubled to find them, in light of the other evidence. I have since found that Lola, while extremely accurate as to the Indian forms of place-names, had apparently some very original theory as to their meanings, which are often erroneous, as now I know. The fact that his father was a Mohawk, and perhaps taught him that tongue, may explain the matter. I give this meaning only because it may step forth again and I wish to forestall its spread.

The seventh, and last, of the other meanings that I have found is contained in the papers of David Owen, who lived long at Campobello and took a considerable, albeit somewhat superficial and pedantic, interest in local affairs. He made the map mentioned on an earlier page (414). The place-names in his MS (*these Transactions*, V, 1912, ii, 193) show that he was possessed by the obsession that the names of the region used by the Indians had been adopted by them from the French; and upon this view he interpreted Passamaquoddy (doubtless having in mind the French form PASSAMACADIE given the word upon Mitchell's well-known map) as PASSE-EN-ACADIE, meaning apparently, the PASSAGE TO ACADIA. It has not, so far as I have found, yet passed beyond his MS, but may yet appear.

SUMMARY. The name Passamaquoddy is a corruption of an Indian name PESTUMOKWADI, which is condensed from PĔSTŬMOO-(Ā)-KWA'DI-(K), meaning literally POLLOCK (THEIR)-OCCURRENCE-(PLACE), or, more generally THE PLACE WHERE POLLOCK OCCUR, applied originally to the waters between Campobello, Deer, and Moose Islands, in description of the conspicuous and distinctive resort there of the Pollock, but later transferred cartographically to the inner Bay.

POOKUDAPSKWODE. The Micmac name for Porcupine Head, as given by Rand in the forms POOKŬDĂPSKWŌDE, POOGUDOOPSKWODIK and POOKUDÂPSKWÂDE, but without meaning (*First Reading Book*, 96; *Micmac-English Dictionary*, 188, twice). At first sight one is inclined to connect the name with some such root as POOGWEDOOĪ, meaning "I have a thick beard," and other words with the root POOGW, having the meaning of bristly or shaggy (*Dictionary* cited, 142), thus making the word describe the same appearance which apparently has given origin to the English name Cape Porcupine. But this places in an unnatural combination the –KWODE, which seems a typical example of one form of our familiar root –KA'DI-(K), already considered (page 380), on which account we look naturally for some animal having a name like the first part of the word. This we can find in 'MKŬDŌPSKOON, the Micmac name for a large black-backed Gull (Rand, *First Reading Book*, 48), the M being replaceable by P through the usual easy interchangeability of these two sounds in Micmac, and the last syllable being omitted. This, however, raises the question of the identity of the place. Rand, in one of his uses of the word, gives its location as in Cape Breton, which seems clearly an error, nor can I find any Porcupine Head elsewhere in these provinces, though there are two places called Cape Porcupine. I think it altogether probable, however, that Rand here refers to Porcupine Point, which lies on an island near the entrance of Tangier Harbour on the southeast coast. That this latter point might well be called a Head is shown by the fact, plain on the large-scale geological map, that it is immediately backed by a hill, called Porcupine Hill, which is 120 feet in height. Some incidental confirmation of this identification is contributed by the fact that Rand gives an unusually large proportion of names from this vicinity, showing that one of his Indian informants knew that region intimately. This island would offer a far more probable resort for a gull than either of the places called Cape Porcupine. But the point of local natural history has still to be elucidated.

POONAMOQUODY. (1) The Micmac name, in somewhat simplified form, of Salmon River, a branch of Tusket River in western Nova Scotia. Rand gives the name as BOONĂMOOKWŎDE, or BOONAMOOGWÂDE, meaning TOMCOD-GROUND (*First Reading Book*, 98; *Micmac-English Dictionary*, 180). The construction of the word is perfectly clear. The latter part is of course our familiar combination (Ā)-KWA'DI-(K), already explained (page 377); the usual possessive Ā being here extinguished by the OO sound preceding; while the former part is as clearly the Micmac name POONĂMOO, meaning the TOMCOD (Rand, *First Reading Book*, 54), a fish very abundant in this region and important among the food resources of the Indians. Thus the word in full would be BOONĂMOO-(Ā)-KWA'DI-(K), meaning literally TOMCOD-(THEIR)-OCCURRENCE-(PLACE).

Both the location and the construction of the name are confirmed very fully from an independent source, for in Campbell's *History of the County of Yarmouth*, 1876, 3, 20, among Indian place-names showing no trace of the influence of Rand, occurs, "Salmon River—the Indian PONAMAGOTTY, or PLACE OF FROST FISH." The Frost Fish is the common local name for the Tomcod.

(2). The Micmac name for Salmon River, which empties into the head of Chedabucto Bay in Eastern Nova Scotia, according to Rand, who gives it as BOONĂMOOKWŎDE, meaning TOMCOD-GROUND (*First Reading Book*, 100). Thus the word would be identical in every particular with the preceding. Of course one's natural thought must be that Rand has made some slip, and has repeated for this Salmon River, the Indian name which belongs to that at the other extremity of Nova Scotia. This possibly seems excluded, however, by the fact that with this word, Rand gives the Micmac names of seven lakes along it, nearly all of which can be identified exactly as lakes on the Chedabucto Salmon River.

Still another curious use of this name occurs in Father Pacifique's *Micmac Almanac*, of 1902, 25, for he gives, in Cape Breton, Chapel Island, or Salmon River, with the name PONAMOGOATIG, evidently the same word as the preceding. But herein, as Father Pacifique informs me, is an error due to confusion of places on his part in preparing his work. The Micmac name of Chapel Island, as Father MacPherson tells me on authority of Chief Denys, is *Botaloteg.*

PUGUMEJWACADIE. The Micmac name for the White Islands, a small off-lying group on the southeast coast of Nova Scotia about midway from Halifax to Canso. Rand gives the name as PŬGŬMĔJOOĀĀKÂDE, or POOGUMEJOOĀKADE, meaning LAND-LIZARD PLACE, or ABOUNDING IN LAND-LIZARDS (*First Reading Book*, 102; *Micmac-English Dictionary*, 188). On this interpretation the construction of the word is perfectly clear, involving our familiar roots –WĀ-KA'DI-(K), already explained (page 390) together with PŬGŬMŬCH, the Micmac name for LAND LIZARD, by which I presume the little Salamander, often locally though incorrectly called a Lizard, is meant (*op. cit* .44). In response to my inquires, Mr. E. W. Moser, of Mosers River, near by, tells me that "land lizards," a spotted kind, as well as small snakes, are abundant on those islands, seeming to confirm fully the Indian name.

It is of interest to note that Rand gives another and different name for the White Islands, viz., WŌBĀGUL (MINEGOOL), meaning literally THE WHITE ISLANDS, (*Micmac-English Dictionary*, 192), which may be simply a translation of the English name into Indian, or may itself be descriptive of the same feature ("derive their name from cliffs of slate or highly inclined strata showing white to seaward," *Sailing Directions*), which gave origin to the English name.

PULOWECHACADIE. The Micmac name in simplified form, of the land opposite the Town of Chatham, at the mouth of the Miramichi in New Brunswick, according to Mr. Michael Flinne, who gave me the word as PUL-OW′-ETCH-WĀ-GĂD′-IK, meaning THE PLACE WHERE PARTRIDGES WERE PLENTIFUL. This word has every appearance of a genuine aboriginal place-name, for PŬLO-WĔCH′ is the familiar Micmac name for PARTRIDGE (Rand, *First Reading Book*, 49), while the remainder includes the familiar combination –WĀ-KA′DI-K, earlier explained (page 380), making the name in full PŬLOWĔCH-WĀ-KA′DI-K, meaning literally PARTRIDGE-THEIR-OCCURRENCE-PLACE. I suspect somewhat the genuineness of the application of the name, however, since the partridge is so abundant a bird everywhere in New Brunswick as to make its presence but little of a distinguishing mark for any particular place. Mr. Flinne adds that the name is supposed to have been applied by the Indians formerly to the site of Chatham itself.

QUODDY. See NEWDY QUODDY (page 408), and PASSAMAQUODDY (page 410).

SEGUNAKADEECH. The Micmac name for Rice Point, which forms the western entrance to Hillsborough Bay in the southern part of Prince Edward Island. It is given, as SĔGŬNĀKĂDEECH, with the meaning LITTLE GROUND NUT PLACE, in Rand's special list of the names of this Island, earlier mentioned (page 390). The resemblance of the name to SEGUBUNACADIE, the original of SHUBENA-CADIE, in conjunction with the meaning, makes the construction of the word perfectly clear. The termination EECH may perhaps represent the diminutive CHEECH, as Rand supposed, in which case a SEGUNAKADIK must exist not very far away; but I think it more likely that we have simply another case of the softened locative –K (page 377). Of course the –Ā-KĂDE– is our familiar combination earlier explained (page 380), while SEGUN would represent an abbreviation of SEGUBUN, the Micmac word for GROUND-NUT, later given (page 423). Thus the word in full would be SEGUN-Ā-KA′DI-CH meaning literally GROUND NUT-THEIR-OCCURRENCE-PLACE, in description, I have no doubt, of the former occurrence of that plant there.

Curiously enough Rand gives also this same name, in the form SEGUNAKA-DĒTC for the same place, with the meaning SMALL REMNANTS (*Micmac-English Dictionary*, 189); but this latter work was written much earlier than his special list, which therefore is much more correct.

Were not the meaning so positively given by Rand, we might think to find possibly in the SEGUN the name of some animal involving the root SĒGOON, meaning The Spring (just as SĒGOONUMEKW, the name of the Gaspereau, means SPRING FISH, as Rand shows in his *Micmac-English Dictionary*, 148). Also the root SĒKWON meaning RED PAINT, or OCHRE, (*op. cit.* 149) could well form the stem of such a word.

SESMOGUNACADIL. The Micmac name, in simplified form, of the islands in the main River Restigouche near its mouth. Father Pacifique gives me the word in the form SISMŎGŎNEGATIGEL, with the meaning SUGAR PLACE. The construction of the word is clear. The termination—EGATIGEL is the precise equivalent of our -Ā-KA'DI-K, (page 380), here, I believe, placed in the plural, expressed by EL, from the fact that the name applies to several islands collectively. The first part of the word is the Micmac word for SUGAR, given by Rand as SES-MOGŬN (*English-Micmac Dictionary*, 258). Thus the word in full would be SESMOGŬN-Ā-KA'DI-K-EL, meaning literally SUGAR-ITS-OCCURRENCE-PLACE-S, in description no doubt of the former making of maple sugar by the Indians on those Islands.

Shenacadie.

Name of a Village, including a railway station, on the southeast side of Little Bras d'Or Lake in Cape Breton. It is called SUNAKADY on the map in Haliburton's History of Nova Scotia of 1829, where it is applied to the Cove. Rand spells it SUNACADIE, and derives it from the Micmac SOŌNAKADĒ, meaning THE CRANBERRY PATCH (*Micmac-English Dictionary*, 189). The construction of the word would thus seem to be perfectly clear. The latter part would be our familiar combination -Ā-KA'DI-(K), already fully explained (page 380 earlier), while the first part would be SOON one form of the Micmac name for CRANBERRY (Rand, *English-Micmac Dictionary*, 71), making the word in full SOON-A-KA'DI-(K), meaning literally CRANBERRY-THEIR-OCCURRENCE-PLACE. Father MacPherson, of Glendale, near by, tells me that the present Micmacs agree upon CRANBERRY PLACE as the meaning, while old residents say that cranberries formerly occurred there. Thus this name seems completely explained.

Rand also makes the suggestion that SOOLĀ'KĂDE, the Micmac name for Mira in Cape Breton, may represent SOONĀ'KĂDE, meaning CRANBERRY-FIELD (*First Reading Book*, 93); but, as shown elsewhere in this paper (page 426), the origin of that name is quite different. Other uses of this root SOON meaning CRANBERRY in our place-names are mentioned in the preceding paper of this series, page 278.

Further, a place called SHUNACADIE, northeast of Tusket Forks, is mentioned in Brown's *History of Yarmouth*, 32, with the suggestion that it is probably identical with the SOONECATY of Campbell's *History*, considered later, on page 427.

Shubenacadie.

LOCATION AND APPLICATION. The name of an important River of Nova Scotia, rising near Halifax and flowing northward into Cobequid Bay, the head of Minas Basin; also extended to a Township on its west side, and to the principal settlement therein, which is also a railroad station. It is pronounced locally like Shoo-ben-ac'-ad-ee, the vowels all short except the u and the diphthong ie, and the accent on the third syllable.

HISTORY OF THE NAME. The earliest recorded use of the name that I have been able to find occurs in 1686 in the form CHECABNACABIC (which, in view of the later history of the word, I take to be some transcriber's error for CHECABNA-CADIC), upon the great Franquelin-deMeulles map of Acadia (*photograph from the original in Paris*). In an official French grant of 1689 it appears as CHICABEN-ACADI (Murdoch, *History of Nova Scotia*, I, 182.) It is CHICHIMISKADY, presumably an error for CHICHIMIEKADY, in a French petition of 1701, (*op. cit.* 252). On the great *Carte de la Partie orientale de la Nouvelle France*, of 1744, by Bellin, it is CHEBENACARDIE, which is corrected in his later maps to read CHEBENACADIE, this being the earliest case in which the second syllable, CA, is dropped. Such are the principal French forms of the name. The earliest English usage that I have found, (though there must be earlier), is in a document of 1737, which reads CHICOBENAKEDY (*Nova Scotia Archives*, II, 216) while another of 1754 has CHIGABENACADY, and one of 1759 has CHIBENACCADIE (Murdoch, *op. cit.* II, 236, 374), all three of the forms being evidently strongly influenced by the French forms if not directly derived from French sources. Meantime, however, in 1749, an aberrant form had appeared, destined to become very important, and that was the SHUBEN ACCADA on the fine large Map of Nova Scotia and New England made by Charles Morris, afterwards Surveyor General of Nova Scotia (the map published recently with the *Journal of Captain William Pote*, New York, 1896). Morris' form looks like a phonetic spelling of the French CHEBENACADIE which was presumably then coming into use in the official speech of the English rulers of Nova Scotia. Whatever its origin, Morris retained it upon his later maps, in the form SHUBENACCADA, as witness the two maps of 1761 published in the *Report on Canadian Archives*, for 1904, opposite page 300. It was of course from Morris that Morse took his form SHUBENACCADY in his well-known Report of 1783 (*Report on Canadian Archives*, for 1884, xxx). Morse's form must soon have become altered to SHUBENACADIE, which I find first in 1825, in a place mentioned below; and since that time it has become the invariable and standard form of the name. Thus our modern spelling of the word has been derived from the French CHIBENACADIE, itself an abbreviation of CHIGABENACADIE, through the apparently phonetic form SHUBEN ACCADA of Morris. Somewhere in the transferences it has experienced also a change of pronunciation, for all analogy with other words involving the same roots would make its aboriginal, and French, pronunciation CHIBENACA'DIE, while in our day it is invariably SHUBENA'CADIE. A precisely similar phenomenon is found in other names as earlier noted (page 378). To one familiar with these words, the correct pronunciation of all the series of aboriginal –AKA'DIK names becomes very difficult, for one's invariable habit is to accent the wrong syllable.

Analysis of the Word. All considerations point to an Indian origin of the name. The earliest explanation I have found is given by Gesner, in 1849, in his *Industrial Resources of Nova Scotia*, 2, 31, where he says,—"In the Micmac Indian dialect ākăde signifies a place.... The Shubenacadie is called by the natives Saagaabenācăde, a place where their favourite root, the Sagaaban, grows; thus the origin of the term Shubenacadie now applied to the river, where those roots were formerly very abundant." Again, Dawson relates that in his own boyhood a Micmac patriarch explained to him that the word was derived from SGABUN meaning GROUND-NUTS, and ACADIE meaning PLENTY HERE; and he says that later this explanation was fully confirmed by Rand, who gave him the name as SEGUBBUNAKADDY, composed of SEGUBBUN meaning A GROUND-NUT, with A or WA, an adjectival ending, and KADY or CADIE, meaning REGION, FIELD, GROUND, LAND, or PLACE, making the entire word mean "the place or region of groundnuts, or the place in which these are to be found in abundance" (*Acadian Geology*, 2nd edition, 1868 1-3). Again, the same explanation, in substance, was cited quite independently in 1869, by Campbell Hardy whose Indian told him the name was SEEGÉEBENACADIE, because "plent ywild potatoes —segéeben —once grew here," while ACADIE means "where you find 'em" (*Forest Life in Acadie*, 1, 2). Later Rand himself gave the name as SĔGŬBŬNĀĀKĂDE or SĔGŬBŬNĀKĂDE, meaning WHERE-GROUND-NUTS ABOUND, or INDIAN-POTATO FIELD (*First Reading Book*, 101; *English-Micmac Dictionary*, 235). Father Pacifique writes the word SEGEPENEGATIG, in his *Micmac Almanac* of 1902, 22. With such full data the analysis of the word becomes easy. Rand gives, as the name of the Ground-Nut or Indian Potato, the form SĔGŬBŬN (*Dictionary* cited, 125), while the remainder of the word is obviously our familiar combination –Ā-KA'DI-(K), already fully explained (page 380). Thus the full form of the name would be SĔGŬBŬN-WĀ-KA'DI-K, meaning literally GROUND NUTS-THEIR-OCCURRENCE-PLACE. Such an origin, it will be noticed, is in perfect accord with the early recorded forms of the name, as given above; and I think there is no question whatsoever as to the correctness of this interpretation.

The forms of the name as given by Gesner, Dawson, Hardy, and Rand all involve one anomaly, that the root SĔGŬBŬN contains no trace of that preliminary CH sound of the early French forms, which persists in our modern spelling and pronunciation of the name. That the preliminary sound was originally CH and not simply S is well attested by early forms of the Micmac word for Ground-Nuts. Thus, Father Biard, in his *Relation* of 1613, describes them with their Micmac name, which he gives as CHIQUEBI (Thwaites' *Jesuit Relations*, III, 259), while Denys, in 1672, gave their name as CHICAMINS (*Description*, II, 354). Thus it seems clear that the sound in question (i.e. CH), was originally in the word; but whether the Micmacs themselves have dropped it with time in favour of the S, or whether our English authorities have a less acute ear for the presumably very slight influence of the H in the word, I cannot at present tell. I find the same phenomenon in a good many other Indian words,—that the sound which the earlier French caught and recorded as SH we catch and record as S. Probably the Indian pronunciation, as well as our own sound-values for the letters, is slowly changing.

We consider now the appropriateness of the name to the place. The Ground-Nut or Indian Potato, a twining plant of the Pea Family, called by Botanists *Apios tuberosa*, had high importance to the Indians because it produces strings of underground edible tubers much resembling small potatoes, these forming a palatable and nutritious food. As to their particular abundance along the Shubenacadie River, however, I have no information, aside from the statements of Gesner and of Hardy's Indian above cited, though such statements are too general and too much in evident support of an explanation, to have much value. It is, however, a fact that the plant is specially partial to intervales, of which a great many, I believe, occur along this river, especially its lower course. But herein a problem in etymological-botanical correlation still awaits a local student.

Other Explanations of the Name. Of these I have found three. In *A General Description of Nova Scotia*, published anonymously at Halifax in 1825, 86, we read,—"the Shubenacadie....called by way of pre-minence [sic] Shubenacadie, or the River of Acadia, (Shuben being the Indian name for a river)...." It is possible that this statement rests upon a supposition that SHUBEN is identical with the Micmac SEBO, which does mean RIVER; but aside from the remoteness of the resemblance, the word SEBO is never used by the Micmacs in combination in this way.

Again, Father Vetromile, in his work *The Abnakis and their History*, 45 (quoted more fully on pages 418 and 443 of this paper), connects the termination –ACADIE with a Micmac root ACADEM supposed to mean DWELL, or VILLAGE; and he makes the prefix SHUBEN mean RIVER, thus finding in SHUBEN-ACADIE the meaning RIVER WHERE WE DWELL, or VILLAGE-RIVER. Herein, however, we have obviously only a melange of guess and imperfect recollection of earlier writings, without any such foundation as the other evidence bearing upon the word possesses.

Again, I have been told by Mr. J. H. Waddell of South Maitland, a place near the mouth of the River, that Shubenacadie is locally believed to mean ABUNDANCE OF FISH, in description of one of its prominent features. Herein we have evidently an example of familiarization of ideas in place-nomenclature, analogous to the frequent familiarization of sounds, for, keeping the approximately correct conception of abundance of something, local tradition has transferred that something from the unfamiliar, little-known ground-nut to the familiar and prominent fish.

SUMMARY. The name SHUBENACADIE is of Micmac Indian origin, a corruption of SEGUBUN-Ā-KA'DI-K, meaning literally GROUND NUTS-THEIR-OCCURRENCE-PLACE, or more generally THE PLACE WHERE GROUND NUTS OCCUR, presumably in description of the abundance of those important vegetables along the bordering intervales of the River in pre-historic times.

Apparently a much-abbreviated form of the name is in use among the Indians, for Rand gives the name AGEKADE apparently as exactly equivalent to Shubenacadie (*Micmac-English Dictionary*, 179). Further, it seems to me altogether probable that the names BENACADIE and its variants, earlier discussed (page 389), represent an abbreviated form of the same name.

SKUDAKUMOOCHWACADIE. (1). The Micmac name for a large Island in the Bras d'Or Lake, Cape Breton, once used as a burial ground, as Dawson states on Rand's authority in his *Acadian Geology*, 2nd edition, 3, where the word is given as SKUDAKUMOOCHWA-KADDY, meaning GHOST OR SPIRIT LAND. The construction of the word is clear, for its latter part is evidently our familiar combination –WĀ-KA'DI-(K), already explained (page 380), while the former part, is as surely the Micmac SKŬDĀKŬMOOCH', meaning GHOST or SPIRIT (Rand *English-Micmac Dictionary*, 120, 247), making the word in full SKŬDĀKŬMOOCH-WĀ-KA'DI-(K), meaning literally SPIRIT-THEIR-OCCURRENCE-(PLACE). As to the location of this place Father MacPherson has found that it is well known to the present Micmacs of Cape Breton, who call it SGATEGAMOTJEOAGI, and say that it is the small island, apparently Wilsons Island, just off Hay Cove or Johnsons Harbour, near the southwestern extremity of Bras d'Or. They explain the name as GHOST'S PLACE, with an elaborate story of a Frenchman who was seen there after he had been supposed to have been shot at Louisburg, etc. Then Chief Denys adds that they see a light there yet, and this—"In old times before we civilize we have big camp where all dry up bodies, but since civilize we have different places for bury." In this chance expression of Chief Denys we have I think a reference to an ancient custom mentioned by early writers, and the confirmation of Rand's explanation. The main root of the word, by the way, is evidently connected with OOT-KOODÂKŬN, meaning A GRAVE (see page 433).

(2). It is evidently exactly this same word which the late Michael Flinne, gave me, (at different times), in the forms HĒS-KĂ-DĀ'-GUM-MOOK-WĀ-GAD'-IK and ES-KŬT-DĀ'-GŬM-MOOCH-WĀ-GĂ-DIK, with the meaning GHOST, for Portage River, a branch of the Northwest Miramichi leading over towards Nepisiguit. In light of the analogy of the preceding word, this name would seem to indicate an important burial place upon that River, which also bears the name OWOKUN, meaning PORTAGE, in description of its important Portage to Nepisiguit, as already noted in this series (*these Transactions*, VI, 1912, ii, 198).

SOOGUNACADIE. The Micmac name for Indian Cross Point, on the eastern side of the entrance to East River, Pictou, Nova Scotia, according to Patterson's *History of the County of Pictou*, 28, 32, where the word is given as SOOGUNAGADE and stated to mean ROTTING PLACE in description of the Indian burial ground there. The latter part of the word seems to involve our familiar root –Ā-KA'DI-(K), already explained, (page 380) but I have not been able to identify with certainty the first part SOOGUN, for the root meaning ROT is SOOGŬLŬGĂK', and L and N appear not to be interchangeable in Micmac (Rand, *English-Micmac Dictionary*, 222). Thus the matter needs further investigation. The root is no doubt related to OOTKOODÂKŬNĀ'KĂDE, meaning A GRAVE YARD (page 433).

SOOLACADIE. The Micmac name for Mira, in the eastern part of Cape Breton, according to Rand, who gives the word as SOOLĀ'KĂDE, with the suggestion that it may be SOONĀ'KĂDE, meaning CRANBERRY-FIELD (*First Reading Book*, 93). In another place, however, he gives it as SOOLĀKADE, with the meaning THE SILVER PLACE (*Micmac-English Dictionary*, 189.) Chief Denys, of Eskasoni, interviewed for me by Father MacPherson, reports that he knows the name well, in the form SOOLAGATIG, applied to the Lake, but he has no knowledge of its meaning. The name goes far back in the records, for it occurs in a document of 1713 as CHOULACADIE, applied to a lake, evidently that now called Lake Mira (Murdoch, *History of Nova Scotia*, I, 338). The latter part of the name is perfectly clear, for evidently it is our familiar combination –A-KA'DI-(K) already explained (page 380), which implies that SOOL or CHOUL is the name, or its abbreviation, for some common object that occurs there. Seeking such, we find at once the word SOOLĀS the name of a large MUSSEL (Rand, *Micmac-English Dictionary*, 152); and seeking further for information as to the occurrence thereof at Mira, I find the following passage in Vernon's *Cape Breton* (Toronto, 1903, 285),speaking of Mira River,—"The water of the river is beautifully clear, and the bottom of the channel is definable for a long distance. As the steamer leaves the Gut, great mussel beds will be seen in the river bottom. Their growth is so rapid that it is sometimes necessary to drag them out with an improvised harrow in order to clear the channel." The Gut is the very narrow rocky channel connecting the Bay and River, and therefore a prominent place. Accordingly it seems to me, probable almost to certainty that this name SOOLACADIE describe the prominence in the River of the Mussel, a conspicuous mollusc of the coast even though one the Indians seem to have used but little; and this name for the River was naturally extended by the French to include the Lake. Thus the word would be SOOL-Ā-KA'DI-(K), meaning literally MUSSEL-THEIR-OCCURRENCE-(PLACE).

There is possibly some connection (though probably not) between this name and the SOOLEĀWĀGITK, name of a Lake on Lahave River, meaning FLOATING SILVER, given by Rand (*Micmac-English Dictionary*, 189); but I have as yet no further data on this matter.

There is also possibly a connection between this name and that for Cocagne; see page 430. Upon the origin of Mira see earlier, page 405.

SOOLEAWACADIE. The Micmac name, in somewhat simplified form, of Sellarsville, on the north, or Quebec, side of the Restigouche River, about eight miles above Campbellton. Father Pacifique, of the Indian Mission at Restigouche, whose kind aid in these studies has been invaluable, gives me the word as SOLIEO-EIEGATIG, with the meaning MONEY SETTLEMENT or SILVER LAND which he takes for a modern name, and thinks derived from the current belief that large sums of money, for which much digging has been done, were buried by the French on an Island near by. Mrs. W. D. Duncan, of Campbellton and Flatlands, who is deeply interested in local matters, writes me a somewhat different interpretation, saying that just at Sellarsville is a creek which runs west about a mile, the water of which is of a peculiar and very beautiful green color, such as is said by miners to indicate silver ore. She adds that "some of the silver was taken out of the creek years ago, about 1840, but not in any quantity"; while lately some ore has been dug from the Sellarsville Hill. The details need further local investigation, but there seems no doubt as to the general form and meaning of the name, which would involve our familiar combination –WĀ-KA'DI-K, earlier considered (page 380), with a prefix SOOLEĀWĀ', meaning SILVER, and also MONEY (Rand, *English-Micmac Dictionary*, 236,172), thus making the name in full SOOLEĀ-WĀ-KA'DI-K, meaning literally SILVER (or MONEY)-ITS-OCCURRENCE-PLACE. This agrees precisely with Father Pacifique's form, with his different spelling.

Some years ago I was given, by a chief at Mission Point, the name SOO-LE-A-WAY-GA'-DICH (as in my notes) as that of a place on the Restigouche, with the meaning ROCK HEAD TIDEWAY, (i.e., a rock at the head of the tideway ?). As Sellarsville is two or three miles above Tide head, it is possible that this is a different place from SOOLEĀ-WĀ-KA'DI-K, the name being the diminutive of the latter, in which case it is likely that both names are aboriginal. But I think it more likely we have only two forms of the same word, my form involving the softened form of the locative, –CH instead of – K (page 377 and compare WOBIMS-KWACADIE later).

Possibly this name has connection with the SOOLACADIE of Cape Breton (page 426), or with the SOOLEĀWĀGITG mentioned on the same page.

SOONACADIE. The Micmac name for Cranberry Head, a place in Yarmouth County, Nova Scotia, according to Campbell's *History of Yarmouth County*, 20, which gives the form SOONECATY, with the meaning PLACE FOR CRANBERRIES. Thus the construction of the word is clear, for the latter part is evidently our familiar combination –Ā-KA'DI-(K), earlier explained (page 380), while the earlier part is SOON, the Micmac name for CRANBERRY (Rand, *English-Micmac Dictionary*, 71), making the word in full SOON-Ā-KA'DI-(K), meaning literally CRANBERRY-THEIR-OCCURRENCE-(PLACE). Thus the English name is either a translation of the Indian, or else a coincidence showing the prominence of the cranberries at the place.

Brown's *History of Yarmouth*, 32, speaks of SHUNACADIE, a place northeast of Tusket Forks, probably identical with this (page 422). My efforts to identify the exact place by local inquiry (written) have failed. It is not on the maps.

SOONACADIEJEECH. The Micmac name for Nashs Creek, a small stream on the south side of Bay Chaleur in New Brunswick, a little west of Jacquet River. The word was given me some years ago by Micmacs as SOON-A-GE-DE-JEECH, (*these Transactions*, II, 1896, ii, 255), or SOON-AG-A-DE-JEECH (from my notes); and Father Pacifique gives me the word quite independently as SONĔGATIT-JITJG, with the meaning CRANBERRY GROUND. The construction of the word would seem to be quite clear. The latter represents part our familiar combination –Ā-KA'DI-K, earlier explained (page 380), with the diminutive termination –JEECH or –CHEECH, meaning LITTLE, here apparently actually present, and implying the presence of a SOONACADIE somewhere within moderate distance. In words having the diminutive termination the accent is thrown to the last syllable. The former part of the word would be SOON, meaning CRANBERRY, as in case of SOONACADIE just given. Thus the name in full would be SOON-Ā-KA'DI-JEECH'-K meaning literally CRANBERRY-THEIR-OCCURRENCE-LITTLE-PLACE. I have confidence that the designation will be found accurate.

TABULCHACADIE. The Micmac name for Connolly (or Bird) Island, a small Island near Lenox Island, in Malpeque Bay, Prince Edward Island, according to Rand's special MS. list of the names of Prince Edward Island (page 390), which gives the word as TĀBŬLCHWĀĀKĂDE, meaning GOAT ISLAND. The construction of the name is perfectly clear, since the latter part is evidently our familiar combination –WĀ-KA'DI-(K), already considered (page 380), while the former part is as evidently the Micmac word TĀĀBŬLCH meaning GOAT (Rand, *First Reading Book*, 44). Now TĀĀBŬLCH is not an aboriginal word (the goat of course being unknown to the Micmacs prior to the coming of the whites), but is clearly derived from the French DES BOUCS. Therefore the name must be recent and is probably simply a translation of an older English name into Indian or French.

TESOQUODDY. The Micmac name for Pirates Cove, on the west side of the Gut of Canso in eastern Nova Scotia, according to Rand, who gives the word as TĔSOGWŎDE, meaning PLACE OF FLAKES (*First Reading Book*, 96), though elsewhere he gives the meaning PLACE WHERE GOODS WERE SORTED (*Micmac-English Dictionary*, 156). The latter part of the word seems clearly a form of our familiar roots –Ā-KA'DI-(K), already fully explained (page 380), but the former part is not so clear. FLAKES are of course the stages on which the fishermen dry their fish, but I cannot find the root TES in any word for flakes or stages in Rand's *Dictionaries*, although in his *Legends of the Micmacs*, 248, he uses the word TĔSOKTĀGŬNS as meaning the cribs on which dried meat was packed to keep it from the weather and the moisture of the ground. As to Rand's second meaning, it sounds a little like an echo of the English name of the place, and I have not been able to find any satisfactory basis for the meaning in the roots of the name. It is of course possible that the place was one where the Indians had stages for drying some particular kind of meat they took there, or it may refer to an important resort of the early codfishermen with their permanent flakes, in which case the name would be not aboriginal but recent. But it would seem more in conformity with the form and usage of –QUODDY names (page 379), that the TESO– would represent an abbreviation of the name of some animal there prominent, though I have not been able to identify it, and the matter must have further investigation.

TOQUADIK. The Micmac name for the southeast Branch of the Upsalquitch River in northern New Brunswick, as given me by a Micmac chief, in the form TO-QUA'-DIK (*these Transactions*, II, 1896, ii, 277). The latter part of the word is clearly our familiar combination –KA'DI-K, meaning OCCURRENCE-PLACE, as already explained (page 380); but the first part, the TO, I cannot interpret, although all analogy would indicate that it represents the greatly abbreviated name of some animal or plant that is prominent on that stream.

Father Pacifique, however, has suggested another origin, viz., TOGOATIG or TOOKWADIK, with the meaning DOUBLE or GO TOGETHER. A root TOGWOKAAD does occur in words meaning DOUBLE as given by Rand (*English-Micmac Dictionary*, 90), but the resemblance here does not seem to me to amount to identity, nor is any appropriateness evident in the meaning. Accordingly I think this interpretation less probable than the one above given.

TUMAKUNACADIE. The Micmac name for Morrisons (?) Island, apparently some place near Pictou, Nova Scotia, according to Patterson, who, in his *History of the County of Pictou*, 32, gives it as TUMAKUNAWAAKADE, with the meaning PIPE STONE PLACE. The construction of the word is clear, for the latter part is evidently our familiar combination –WĀ-KA'DI-(K), earlier explained (page 380), while the former part would seem to be the Micmac TŬMÂKŬN, meaning PIPE (Rand, *English-Micmac Dictionary*, 196), which word, as the Indian pipes were usually of stone, would be in this case equivalent to PIPESTONE. Thus the entire word would be TŬMÂKŬN-WĀ-KA'DI-(K), meaning literally PIPE-(STONE)-ITS-OCCURRENCE-(PLACE), presumably in accurate description of a feature of the place, as to which, however, I have no further information.

This root TŬMÂKŬN is present in the form TOMOGONOPS, meaning PIPE-STONE, the name of a River in New Brunswick, a branch of the Northwest Miramichi, later to be considered (also *these Transactions*, II, 1896, ii, 276).

There is, however, another possibility as to this word, viz., that it is really TUMAGUNAWAAKADE, meaning HAUNT OF THE SHELL DUCK. This bird, which is that commonly called Shelldrake or Meganser, very common in these Provinces, is called in Micmac TŬMAAGŬNE (Rand, *First Reading Book*, 49), which, with the familiar termination WĀ-KA'DI-(K), would give our word very perfectly. In this way would be explained the otherwise somewhat puzzling absence of the root WAPSK meaning STONE from the combination as given by Patterson. Moreover, this very name does occur somewhere in these Provinces, for in Vroom's list of –ACADIE names (*Educational Review*, St. John, VI, 1892, 9) occurs TUMAGUNEAWAACADE, meaning SHELL-DUCK HAUNT, taken from a copy of Rand's *First Reading Book* annotated by Rand himself, as Mr. Vroom tells me. Local studies will ultimately decide between these two interpretations.

TUMGWOLIGUNECHWACADIE. The Micmac name for Crane Island, a place apparently in Nova Scotia, though I have been unable to determine its identity. It is given by Rand as TŬMGWŎLĬGŬNĔCH′-WĀĀKĂDE, or TUMGWALIGUNĒTCWĀKADE with the meaning HAUNT OF THE CRANE (HERON), or HOME OF THE CRANES (*First Reading Book*, 86; *Micmac-English Dictionary*, 190). The construction of the word is perfectly clear, since the latter part is evidently our familiar combination WĀ-KA′DI-(K) already explained (page 380), while the former part is as plainly TŬMGWŎLĬGŬNĔCH, the Micmac word for CRANE (HERON), as given by Rand, (*First Reading Book*, 50), making the name in full TŬMGWŎLĬGŬNĔCH-WĀ-KA′DI-(K), meaning literally CRANE-THEIR-OCCURRENCE-(PLACE).

The very full form of this name, the length of which especially tempts to abbreviation, in conjunction with the coincidence of meaning of the English name, implies that this is not an aboriginal name, but a translation of the English name into Indian.

UPKOACADIE. The Micmac name for Tar Bay, now called Tor Bay, a prominent place in the eastern part of Nova Scotia, according to Rand (*First Reading Book*, 101), who gives it as UPKOOĀĀKĂDE, meaning TAR, *or* TURPENTINE REGION. The latter part of the word is clearly our familiar –Ā-KA′DI-(K), meaning –ITS-OCCURRENCE-(PLACE) (page 380), while ŬPKOO as clearly means RESIN, PITCH, etc., and hence TAR (Rand, *English-Micmac Dictionary*, 262). Since, however, TAR could hardly have played any greater part here than elsewhere in the economy of the aboriginal Micmacs, it seems pretty certain that the name is not aboriginal, but merely a translation of the English name into Micmac.

UTKOGUNACADIE. The Micmac name for Indian Harbour, Nova Scotia, according to Rand, who gives it as UTKOGŬNĀĀKĂDE, or UTKOGUNĀKADE with the meaning AUTUMN FISHERY (*First Reading Book*, 90; *Micmac-English Dictionary*, 165). There are three places of this name in Nova Scotia, one between St. Marys River and Country Harbour, one on the east side of St. Margarets Bay, and one near the head of Sambro Harbour, just west of Halifax; and I take it the latter is the one meant, because the charts mark just at its entrance a GONIE REEF, which word seems an abbreviation of our name. The latter part of the name is certainly our familiar combination –Ā-KA′DI-(K), already explained (page 380), implying that the first part is the name of some prominent natural object. Rand's explanation AUTUMN FISHERY by no means accords with this construction for the word, and moreover, must be erroneous, because, according to his own works, the root ŬTKOK′ does not mean AUTUMN, but LAST AUTUMN, (*English-Micmac Dictionary*, 27). Moreover the same root, apparently, occurs with a very different meaning in UTKOGŬNCHEECH the name for Blomidon, which Rand interprets, but again I think not correctly, as BARK DOUBLED AND SEWED TOGETHER (*First Reading Book*, 84; also *Legends of the Micmacs*, 291). connecting this name, evidently, with ŬTKOGŬN, meaning "the bark of ordinary soft wood" *English-Micmac Dictionary*, 30). As to some animal or plant having UTKOGUN in its name, I can find nothing nearer than OOTKĬGŬNŬSEES, the name for the Bull Bird, according to Rand, by which undoubtedly he means the Black-bellied Plover, a common bird of this region (*First Reading Book*, 49). Further than this I have not yet been able to go, despite careful inquiry; but local knowledge should solve the question.

WAPMESACADIE. The Micmac name, in simplified form, of Marshals Gulch, a small stream on the Quebec side of the Restigouche River, below the Patapedia. The word was given me by Father Pacifique, in the form OAPMESGOEGATIG, with the meaning WHITE OTTER PLACE. His –OEGATIG is the precise equivalent of our –Ā-KA′DI-K, earlier explained (page 380), and he gives OAMES as meaning WHITE OTTER, the G between the two roots representing no doubt the plural, expressed by Rand as K. The word OAMES seems not to occur in Rand's works, although the root WAP, WAB, or WOB, meaning WHITE, occurs in the names of a number of white animals. Thus the word in full would be WAPMESK-Ā-KA′DI-K, meaning literally WHITE OTTERS-THEIR-OCCURRENCE-PLACE, presumably in perpetuation of some early observation of the occurrence of a white form of the Otter there.

WENJOOTEAMACADIE. The Micmac name for Cape John, presumably the prominent Cape of that name on the north coast of Nova Scotia near Tatamagouche, according to Rand, who gives the word as WENJOOTĒAMWĀKADE, meaning THE COW PASTURE (*Micmac-English Dictionary*, 192). The construction of the word seems clear, for the latter part evidently contains the familiar combination –WĀ-KA′DI-(K), already explained (page 380), while the former part is as certainly WĔNJOODEAAM, the Micmac word for COW (Rand, *English-Micmac Dictionary*, 71). The name, however, cannot be aboriginal, since the word WĔNJOODEAAM is modern, being simply a compound meaning "French Moose" (WENJOO = FRENCH, TEAM = MOOSE). Accordingly the Micmac name appears to be nothing other than a translation of the modern English name into Micmac. Local knowledge would no doubt interpret the details.

WIJULMACADIE. The Micmac name, in simplified and tentative form, of Cocagne, a prominent place on the eastern coast of New Brunswick. The word was given me some years ago by Mark Paul, chiefly at Folly Point, as WIJ-OU-MĀ-GA-DIK (in the form of my notes) but without meaning, while Rand gives it as ĔJAKŬLMĀ′KĂDIK and EAKULMĀKADIK (*English-Micmac Dictionary*, 61, and *Micmac-English Dictionary*, 181), also without hint of meaning. Though at first sight somewhat unlike, these words are undoubtedly one, differing chiefly in the omission of the K sound in the first case,—a feature very common in the abbreviation of words by the Micmacs, of which I have a number of instances. The latter part of the word seems very clearly to involve our familiar combination –Ā-KA′DI-K, already explained (page 380), implying that the first part represents the name of some prominent animal or other natural object. All of my efforts, however, even though aided by the great knowledge, and direct inquiry made of his Micmacs by Father Pacifique, have failed to elucidate either the exact form or meaning of this part of the word. The nearest apparent equivalent I can find is the OOCHŬKŬLMASKWE meaning "inner bark of the white birch" (Rand, *English-Micmac Dictionary*, 30), but it is difficult to suppose that this is the root meant. AJOGOOLOOĔCH means PERCH, (Rand, *First Reading Book*, 52), but this root would not explain the M so plain in the word. Probably it refers to the occurrence of some of the less usual animals or plants.

WOBEACADIE. The Micmac name for Broad River Lake, at the head of Broad River, which empties into Port Mouton in southern Nova Scotia. Rand gives the name as WOBEĀKĂDE, with the meaning RESORT OF SWANS or SWAN LAND (*First Reading Book*, 84). The construction of the word, upon this explanation, is perfectly clear, for the latter part represents obviously our familiar roots –Ā-KA'DI-(K), already fully explained (page 380), while WŎBE is the Micmac name for the SWAN (*op. cit.* 50). Thus the name in full would be WŎBE-Ā-KA'DI-(K), meaning literally SWAN-THEIR-OCCURRENCE-(PLACE). As to the appropriateness of the name, all of my local inquiry has failed to yield any hint. The swan has long been extinct in Nova Scotia, though it formerly occurred there, and presumably this lake was one of their special resorts.

In another place Rand himself gives a different meaning to the name viz., THE WHITE PLACE (*Micmac-English Dictionary*, 173), but this leaves wholly unexplained the termination of the word, and I have no doubt that his *First Reading Book*, in reality though not chronologically the later work, is more correct. Possibly the WŎBE– may represent the abbreviated name of some bird or other natural object other than the SWAN.

WOBIMSKWACADIE. The Micmac name, in simplified form, of the region about the head of Lefurgeys Brook and Glenlivet, on the south, or New Brunswick, side of the Restigouche River ten miles above Campbellton. Rand gives for Glenivit the Micmac name WŎBŬMĬMSKWAGADĬCH with the meaning WHERE THEY GATHER WHITE CRANBERRIES, adding that it may also mean WHERE THEY KILL WHITE PORPOISES (*First Reading Book*, 88; *English-Micmac Dictionary*, 121). Again, he gives WŎBIMSKWĀGA'DICH as the Micmac name for Lafroys or Labrays Brook, with the meaning WHERE THEY GATHER WHITE CRANBERRIES, (*English-Micmac Dictionary*, 153, *First Reading Book*, 91). Neither Glenivit nor Lafroys (or Labrays) Brook appear on any maps or in any other records, and I was long in discovering their identity. The coincidence of Indian names led to the supposition that Glenivit and Lafroys Brook were the same place, or at least contiguous, and at length suggested that probably Rand referred really to Glenlivit, a Scotch-French settlement on the lower Restigouche, with Lefurgeys Brook, a small stream which heads near Glenlivit and flows into the Restigouche a mile above Christopher Brook. With this in mind, I wrote to Mrs. W. D. Duncan whose knowledge of these matters I have earlier had occasion to mention (page 426), and asked her whether there was any association of these places with white cranberries and Indians. She replied as follows:—"Up Christopher Brook, which runs through Glenlivet [and is very close to Lefurgeys Brook], there used to grow great quantities of high bush cranberries. Before the frost colors them red, they are of a light yellow colour, not white but they might be called white by the Indians. I know the squaws had a bad habit of picking them in that unripe condition and selling them to the housewives." The evidence, accordingly, is all perfectly consistent, and points clearly to the application of this Indian name to the place where the Indians formerly gathered the High Bush Cranberries on the upper courses of Christopher and Lefurgeys Brooks near Glenlivet. It is known, by the way, that they gathered other berries also in the green or half ripe condition, of course for convenience in preserving them for winter. As to the Micmac name that seems clear, for the latter part is clearly our familiar combination –Ā-KA'DI- with the softened form of the locative, i.e., CH instead of –K, as earlier explained (page 377). As to the former part of the word, that evidently involves WOBĀE, meaning WHITE (Rand, *Dictionary* cited, 280), with a great condensation of NĬBŬMANŎKSE, meaning BUSH– CRANBERRY TREE (Rand, *First Reading Book*, 69). Thus the word in full would be WOBĀE-NĬBŬMANŎKSE-Ā-KA'DI-CH, meaning literally WHITE-BUSH CRANBERRY TREES-THEIR-OCCURRENCE-PLACE, in description of the place above mentioned. I think there is no doubt as to the essential correctness of this interpretation.

WOSOGWESOQUODDY. The Micmac name for Petite, a place in Hants County, Nova Scotia, according to Rand, who gives it, without meaning, in the form WŎSOGWĔSOOGWŎDE (*English-Micmac Dictionary*, 195). This Petite must of course represent Petite Riviere, now called on our maps Walton River, emptying into Minas Basin about one-third of the way from the Avon to the Shubenacadie, and is not to be confused with Petite Riviere in Lunenburg County west of La Have, a place having a very different Indian name. The latter part of the word clearly involves our familiar combination –(A)-KWA'DI, already fully explained (page 377), but the first part, WŎSOGWĔSOO, which is presumably the name of some prominent kind of animal or plant, I have not yet been able to interpret, excepting that it bears a certain resemblance to WĬSKŬMAGWĀĀSOO, meaning FISH-HAWK (Rand, *First Reading Book*, 50. WŎSOGOWEECH, meaning THE LIGHTNING-BUG (*op. cit. 71*), must be excluded because not ending in OO as this form of termination requires. The obliging Postmaster at Walton River has endeavoured, but thus far in vain, to ascertain whether any special animal or plant was considered characteristic of the place in early times; but I have no doubt that local studies will settle this question.

C. A list of words containing the termination –ACADIE, which are topographical terms, and accordingly may have been elevated to place-names, though nowhere thus used, so far as known.

ALMAWACADIE. ĀLMAWĀKADE, an obvious misprint for ALMAWĀKADE meaning A GERMAN SETTLEMENT (Rand, *Micmac-English Dictionary*, 13), a combination of ALMA, A GERMAN (*op. cit.*) adopted from the French ALLEMAND, with –Ā-KA'DI- meaning THEIR-OCCURRENCE (page 380).

KULUMUECHWOPSKWACADIE. KŬLŬMOOĔCHWŎPSKWĀĀKĂDE, meaning a COAL MINE (Rand, *op. cit.* 170), a combination of KŬLŬMOOĔCHWŎ'PSKW meaning COAL (*op. cit.* 61) with –Ā-KA'DI, meaning ITS-OCCURRENCE, (page 380). This is obviously the GALAMOETJOAPSOEGATIG, meaning COAL MINES IN COUNTY of Father Pacifique's *Micmac Almanac*, 25.

KUSAWOGWACADIE. KŬSAWOGWĀĀKĂDE, meaning MINE OF IRON (Rand, *op. cit.* 170), a combination of KŬSAWŎK, meaning IRON (*op. cit.* 147) with –Ā-KA'DI, meaning ITS-OCCURRENCE (page 380).

MADAWESWACADIE. MĂDOOĔSWĀKĂDE, meaning A GOOD PLACE FOR PORCUPINES (Rand, *op. cit.* 200), a combination of MĂDOOĔS', meaning PORCUPINE (*op. cit.*)with-Ā-KA'DI, meaning OCCURRENCE-PLACE (page 380).

MEMAJWENUACADIE. MEMĂJOO'ĔNOOĀ'KĂDE, meaning A SETTLEMENT (Rand, *op. cit.* 230), a combination of MEMĂJOOENOO, meaning A PERSON (*op. cit.* 194) with –Ā-KA'DI(K), meaning THEIR-OCCURRENCE (page 380).

NUMACHWACADIE. NŬMĀCHWA'KĂDE, meaning PLACE OF FISH, WHERE FISH ABOUND (Rand, *English-Micmac Dictionary*, 111), a combination of NŬMĀĀCH meaning FISH (*op. cit.*) with –Ā-KA'DI meaning THEIR-OCCURRENCE (page 380). It is possible that this is the full form of 'MCHĀGADICHK, the Micmac name for St. Anns (page 400).

SEGUNUMACADIE, SEGOONUMA-KADDY, meaning GASPEREAUX PLACE (Rand, in Dawson's *Acadian Geology*, second edition, 3), a combination of SEGOONŬMĔKW', meaning GASPEREAU (Rand, *English-Micmac Dictionary*, 119) with -Ā-KA'DI, meaning THEIR-OCCURRENCE (page 380).

SOOLEAWACADIE. SOOLEĀWA'KĂDE, meaning MINE OF SILVER (Rand, *English-Micmac Dictionary*, 170), a combination of SOOLEĀWA', meaning SILVER (*op. cit.* 236) with –Ā-KA'DI, meaning ITS-OCCURRENCE (page 380).

Connected in some way with this name are perhaps the SOOLĀKADE and SOOLEĀWAGITK mentioned on page 426.

ULNOOACADIE. ULNOOĀKADIE or ELNOOĀKADĒ, meaning A MICMIC SETTLEMENT (Rand, *Micmac-English Dictionary*, 47), a combination of ULNOO or ELNOO, meaning A NATIVE INDIAN or MICMAC (*op. cit.*) with –Ā-KA'DI, meaning THEIR-OCCURRENCE (page 380).

UTKUDAKUNACADIE. OOTKOODÂKŬNĀ'KĂDE, meaning A GRAVE YARD (Rand, *op. cit.* 124), a combination of OOTKOODÂKŬN, meaning A GRAVE (*op. cit.*) with –Ā-KA'DI, meaning THEIR-OCCURRENCE (page 380).

WENJEGWOMACADIE. WĔNJEGWŌMĀKĂDE, meaning A "WHITE" VILLAGE (Rand, *English-Micmac Dictionary*, 275,) a combination of WĔNJOO, meaning FRENCH (*op. cit.* 117), WIGWŎM, meaning HOUSE (*op. cit.* 134), with Ā–KA'DI, meaning THEIR –OCCURRENCE (page 380). Compare also Gesner's form WENJOUĀKĂDE, later, on page 439.

WENJUSUNACADIE. WĔNJOOSOONĀKĂDE, meaning an ORCHARD (Rand, *op. cit.* 186), a combination of WENJOOSOON', meaning APPLE (*op. cit.* 18) with –Ā-KA'DI, meaning OCCURRENCE-PLACE (page 380).

WIKPEACADIE. WIKPEĀ'KĂDE, meaning AN ELM GROVE (Rand, *op. cit.* 97), a combination of WIKPE, meaning ELM TREE (*op. cit.*), with –Ā-KA'-DI, meaning THEIR-OCCURRENCE, (page 380).

WISOSULEACADIE. WISOWSOOLEĀWĀ'KĂDE, meaning MINE OF GOLD (Rand, *op. cit.* 170), a combination of WISOWSOOLEĀWĀ' (*op. cit.* 122) meaning GOLD, with –Ā-KA'DI, meaning ITS-OCCURRENCE (page 380).

In addition there are three topographical terms (and probably many more) which have become fixed as place-names, as mentioned in the appropriate places in the foregoing pages, viz., APCHECKUMOOCHWACADIE, KOONDAWACADIE, and MESKEGUACADIE.

D. Certain aboriginal place-names commonly but erroneously supposed to involve the suffix root –ACADIE, –KONTE.

Damariscotta.

The name of a River, actually an elongated tidal Inlet, on the coast of Maine east of Kennebec.

The word is commonly believed to be Indian, a view which apparently originated in 1798 when Rev. Paul Coffin was given by Sebattis, "as sensible and mild an Indian, as is to be found" among Indian interpretations, "Madamascontee, now Damariscotta, many little alewives" (*Collections of the Maine Historical Society*, IV, 1856, 379). This was of course the basis of Ballard's explanation in his paper elsewhere cited (page 399), where he makes MATAMASCONTEE identical with MATAMISCONTIS, a branch of the Penobscot, and derives the word from MAH-DĀMĀS, meaning ALEWIVE, and KONTEE meaning PLENTY, thus bringing the word into the series of –ACADIE –KONTE names to which this paper is devoted. A very similar interpretation was given, evidently quite independently, by Nicolar, the Penobscot Indian, in his book, *The Life and Traditions of the Red Man*, 146, where he makes this name identical with MAR-DAR-MES-KUN-TEAG, meaning YOUNG SHAD POOL. And the same idea underlies the meanings FISH PLACE, and RIVER OF LITTLE FISHES, and RIVER WHERE THE FISHES FLOCK OR RUSH, cited without authority by Douglas-Lithgow in his *Dictionary* earlier cited (page 407). The word is made Indian also, but with a very different meaning, by Father Maurault in his *Histoire des Abenakis*, vi, where it is derived from PAMAP-

SKOTA, meaning WHERE THERE ARE DWELLINGS, in allusion to the Gorges settlement at the mouth of the Kennebec. This interpretation is, however, like most of its author's explanations, merely a random guess made without any reference to the history, etymology or geography of the name. Potter makes the name "evidently a corruption of NAMAASKAUKE or NAMAASKEES–AUKE" but without explanation, and clearly only as a guess (*Collections of the Maine Historical Society*, ve., 1856, 189).

There is no doubt, however, it seems to me, that the name is not Indian at all. Mrs. Eckstorm has traced back the word in great detail through the early Maine deeds and sends me the evidence to show that never once is there any trace of the letter N in the termination, which the –KONTE theory of its origin requires, while on the other hand it keeps substantially its present spelling back to 1659, when it is DAMARIS COTTY. (*York Deeds*, XVI, fol. 113). Ballard (*op. cit.*) gives TAMESCOT from Heylin, whose *Cosmographie* was published in 1657. Earlier than that, however, in 1651, the place appears to be called DAMIRISCOVE River (*Suffolk Deeds*, I, 24). Now DAMARISCOVE (sometimes DAMISCOVE) is the name of a well-known Island at the mouth of DAMARISCOTTA River, so that evidently the River was in this instance at least named from the Island. Taking the name DAMARISCOVE of the Island, Mrs. Eckstorm's records show that it goes back in an unbroken line to DAMIRELLS COVE Island (1650, *Suffolk Deeds*, III, 48, 49), and back of that to DAMERILS ISLES, in which form it appears in the description of this coast made in 1614 by Captain John Smith, who gives it in his work in a way to imply that the word is not Indian, but the name of some Englishman, probably somebody in England whom Smith wished to honor, or some early adventurer who used it as a fishing station or the like. Thus it seems very clear that there is a connection between DAMARISCOVE ISLAND with its purely English origin, and DAMARISCOTTA River. It is scarcely within the bounds of possibility, under the circumstances, that one of these two associated names could be English and the other Indian.

Having thus, as I believe, traced the word out of an Indian origin, it becomes no part of my present duty to follow it further, and I must leave to others its ultimate analysis. It may possibly prove to represent a corruption of DAMARISCOVE OUTER RIVER, in application to the outer tidal part as distinct from the inner freshwater stream; or the latter part of the word may prove to have a connection with John Cotter, the Indian Sagamore who, as the early deeds show (*York Deeds*, XVI, 344), sold lands on this river to the first white settlers. It may also have a connection with SHEEPSCOT, the next River to the westward, of which the name still needs explanation, and which itself may have had originally a termination identical with that of DAMARISCOTTA. There is, indeed, a curious problem involved in these names, for the early deeds indicate not only a certain connection of DAMARIS with ANDROSCOGGIN, both DAMROSCOGIN and DAMRALLSCOGON appearing in early records, (*Collections of the Maine Historical Society, Baxter MS.* Vol. VI, 151, 177); but a similar connection between SHEEPSCUT and PEJEPSCUT (*York Deeds*, XV, Vol. 99), the name for a place on the lower Androscoggin. These matters, however, have no connection with our immediate subject.

Tracadie.

The name of four places, in three cases extant, in New Brunswick, Prince Edward Island, and Nova Scotia. The name has the same pronunciation in all cases,—the vowels being short except for the dipthong ie, and the accent on the first syllable. We consider them separately.

A. The Tracadie of New Brunswick.

A River, Bay (on the maps Lagoon), Beach and Village on the northeastern coast of New Brunswick about midway between Bay Chaleur and Miramichi; also a neighbouring smaller River called Little Tracadie. The place is fully described and mapped in *Acadiensis*, VI, 1906, 18.

History of the Name. It appears first in 1603 in Champlain's *Des Sauvages* as TREGATE (*Laverdière's edition*, 114), while in his *Voyages* of 1613 he has TREGATTÉ (*op. cit.* 170), and on his map of 1632 TREGATAY, while Lescarbot in 1609, in his explanation of his large map, has TREGATE. It is TRACADI on the important Jumeau map of 1685 (Champlain Society's edition of Father le Clercq's *New Relation of Gaspesia*, 10), and TRACADY on the great Franquelin deMeulles map of 1686 (*these Transactions*, III, 1897, ii, 364). The Survey map made in 1724 by Sieur l'Hermitte has TRACADILLE, the final ILLE apparently representing merely a liquid LL reproduction of the Y of the other forms, (*op. cit.* 376). On the fine *Carte de la Partie Orientale de la Nouvelle France*, of Bellin, of 1744, it is TRACADI; and thereafter on various maps I find TROCADIE, TROCHADY, and even the misprint FOCADIE. The earliest map on which I find TRACADIE, our present spelling, is Wright's *New Chart of the Gulf of St. Lawrence*, of 1790, though it probably appeared earlier. The New Brunswick maps and records, however, continue to have TRACADY or TRACADI, with an occasional TRACADIE, down to the time of Wilkinson, whose adoption of TRACADIE upon his great map of 1859 fixed that form firmly as a standard, which it has ever since remained.

B. The Tracadie of Prince Edward Island.

An enclosed Bay on the north coast of Prince Edward Island, northeast of Charlottetown; extended also to neighbouring settlements.

History of the Name. It appears first, so far as I can find, as TROCADIE, in 1744, upon Bellin's *Carte de l'Acadie*, and this form is retained upon Bellin's later maps. It is, however, TRACADIE in the important Census of 1753 by Sieur de la Rocque (*Report on Canadian Archives*, 1906, II, 146), as it is the next year on a MS. map of the Island by Sieur Franquet (*copy in the Canadian Archives*). On the copy of Holland's great map of the Island of 1765, given in Munro and Grant's *Acts of the Privy Council*, VI, it appears as TRACADI; nevertheless, I believe that the original has TRACADIE, partly because Holland was so careful to adopt a French form for other names on the Island (e.g. Bedeque considered in the preceding paper, page 276, and Malpeque and Cascumpeque later to be explained), and partly because a London map of 1775 which follows Holland closely has TRACADIE. However this may be, from the time of the London map down to the present the spelling TRACADIE seems to be universal.

C. The Tracadie of Nova Scotia.

A Harbour, with a small River and a small Lake; a Village, including a Railroad Station; and a Township; all on the northern coast of Nova Scotia, not far from the Gut of Canso.

History of the Name. Despite considerable search, I have not yet been able to find an earlier use of the word than is contained upon Purdy's *Map of Cabotia*, of 1814, where it is TRACADIE, as at present; but it must occur much earlier.

D. The Tulugadik, Micmac name for Shubenacadie Grand Lake.

Rand, in his *English-Micmac Dictionary*, 123, and also his *First Reading Book*, 88, gives TŬLŬGĂDIK and TŬLŬGADĬK for Grand Lake, Halifax County, while in his *Micmac-English Dictionary*, 156, 190, he identifies the name, here spelled

TULAKADIK and TELAKADIK, with the Tracadie of Prince Edward Island. To the testimony of form is added that of meaning, indicated below, leaving no doubt at all as to the identity of this name with that of the three Tracadie's.

Analysis of the Word. The collective data seem to point to an identity of both form and meaning in the case of all four of the Tracadies, reckoning TŬLŬGADĬK as one of them. The name is obviously Micmac,—Lescarbot, indeed, in the place above cited, giving it among Indian names. Turning to Rand, our first authority, we find that, he gives for TŬLŬGADĬK, the meaning CAMPING GROUND (*First Reading Book*, 88, 101), while in his *Micmac-English Dictionary*, 190 he makes it mean THE INHABITED PLACE or SETTLEMENT. I have myself obtained the word from a Micmac chief at Bathurst, New Brunswick, as TLA′–KA-DIK (in the exact form of my notes), while the late Michael Flinne, teacher of the Indian school at Eelground above Newcastle, New Brunswick, obtained it for me as TL-A-GA-TE, TLAGTI, and T'LA′–K–DIK. Father Pacifique writes it TLA-GATIG. It must be remembered, however, that with places so long settled as the three Tracadies, the present Indian pronunciation of the names must be greatly influenced by that of the whites, if, indeed, they have not wholly lost their own aboriginal form of the name.

The resemblance of TRACADIE to so many other names that involve the termination –ACADIE leads naturally to the inference that TRACADIE also involves our familiar combination –Ā-KA′DI-, of the many names in this paper. This was apparently at one time the view of Rand, who is quoted by Dawson (in his *Acadian Geology*, 2nd edition, 3) as authority for a derivation from TULLUCK-KADDY, meaning PLACE OF RESIDENCE; DWELLING PLACE; but the derivation is qualified by a "probably," and moreover does not reappear in any of Rand's own works, seeming to show that he later abandoned this view. Again, Father Pacifique, our most competent present authority upon the Micmac tongue, seems to hold this opinion, for in a recent letter to me, he includes TRACADIE in a list of names involving the root –Ā-KA′DI-K (his –EGATIG), and adds,—"this is the very root with etli, there......any special settlement is etlagatig or tetlagatig, Tracadie." Compare also page 443 later.

Nevertheless it seems to me very clear that there is no connection, at least no direct connection, between the –ACADIE of TRACADIE and the –ACADIE of the other names of this paper, the resemblance being a case of familiarization to identical form of two somewhat similar roots. *First*, the idea involved in TRACADIE, as a SETTLEMENT or DWELLING PLACE, does not seem consistent with the idea expressed by the genuine –ACADIE names, viz., that of distinctive occurrence of some special natural object. *Second*, the termination in all of Rand's works for this name, viz., UGĂDIK and –AKADIK, is one that he *never* uses for the genuine –ACADIE names, which he has always –ĀĀKADE, AGWODE, or something similar, seeming to show that he did not consider them the same termination. *Third*, and most important, taking the meaning of TRACADIE upon which Rand and Father Pacifique agree, viz., SETTLEMENT, RESIDENCE, DWELLING PLACE, we find that there is a Micmac verb, which means TO DWELL, TO LODGE, TO RESIDE (Rand, *English-Micmac Dictionary*, 94, 160, 218), viz., ETLŬGADŬM, which is so like TULUGADIK, or TLAKADIK that we can hardly question the identity of the two words. Omitting the faintly sounded preliminary vowel, and converting the final verbal ending UM into a locative –IK, all very slight and usual changes, the two words become identical. This conclusion is in perfect harmony with all of the data taken collectively, and there would seem therefore to be no doubt that our place-name TRACADIE is simply a locative noun TŬLUKĂDIK meaning DWELLING PLACE, formed from the verb ETŬLAGĂDUM, meaning TO DWELL.

Thus the name cannot belong directly with those involving the ordinary term –ACADIE, but the possibility is not excluded that ultimately or remotely the two roots may have a common origin. Rand seems to have thought that the first part of ETLŬGADŬM involves a root referring to camp fires (compare *Micmac-English Dictionary*, 55), in which case the latter part ŬGĂDUM may involve the same elements as –ACADIE, as earlier analyzed (page 380).

Curiously enough this explanation here given for TRACADIE was hit upon by Father Vetromile, though in conjunction with other errors, in his usually very inaccurate and untrustworthy work, *The Abenakis*; for on page 45 he says "We have yet in Nova Scotia a place called *Tracadie*, which must be the Indian word *tedlacadem*, or *t'dlacadem, where we dwell.*" I suspect that Father Vetromile obtained the basis of this explanation in some way from Rand.

What now as to the appropriateness of the name to the four Tracadies in particular? What differentiates those places from the innumerable other camp-grounds of the Indians throughout the Provinces? All four have this in common, that they are attractive places lying each at the focus of important lines of travel. The New Brunswick Tracadie, which I know personally, was a place of favoured Indian resort, as the paper in *Acadiensis* earlier cited fully shows; and I have every confidence that the same will be found true for the others. I take it these were central places where the wandering bands were especially prone to camp together for considerable periods, for companionship, councils, and the arrangement of matters of importance to the tribe. There is probably an equivalent in the Maliseet KLUNQUADIK (page 396), though possibly not; and I think essentially the same idea is involved in ETLIMLATS the original of our modern GRIMROSS on the lower Saint John River, as will later be shown.

Other Explanations of the Name. Of these I have found two. Mr. Flinne, above mentioned, obtained from his Micmacs the meaning WEDGE SHAPED, as I did myself independently, from a Miramichi Micmac, and this was the basis of that interpretation in *these Transactions*, II, 1896, ii, 277. Evidently our informants connected TULAKADIK with TŬLÂKŬN meaning A WEDGE (Rand, *English-Micmac Dictionary*, 278), and as evidently the interpretation rests only upon a purely accidental resemblance of roots. The second explanation is that of an eminent authority, Trumbull, who in his fine work on Algonkin names already mentioned (page 391), points out that in Abenaki there are two roots which may be confused with –KANTI, the Abenaki equivalent of –ACADIE, viz., KA8DI, meaning LODGING PLACE, and AK8DÉ meaning UP STREAM; and he suggests that the latter, referring to fishing places on tidal rivers and not Rand's TULLOCK-KADDY, may have given origin to our Tracadie. But his root AK8DÉ in this sense seems wholly unknown in Micmac, and in any case his mere guess at an explanation could not stand in face of the evidence pointing to the explanation we have given. It is, however, possible that his root KA8DI, meaning LODGING PLACE is involved in our ETLŬGADŬM. Certainly it is connected with another important Acadian place-name, viz., WIGUDI, the name for the Indian settlement at St. John, taken by Champlain and Lescarbot for the name of the River Saint John itself (*these Transactions*, II, 1896, ii, 269; and Grant and Biggar's edition of Lescarbot's *History of New France*, Champlain Society, III, 84). But to this latter word I shall return later in this series.

Summary. The name TRACADIE is a corruption of the Micmac TULUKADIK, which means DWELLING PLACE, in description, probably, of especially important central Indian camp grounds.

Tracadiegash.

The name of a Point and Pond on the northwest coast of Bay Chaleur in Quebec. It is interpretated by Rand (*First Reading Book*, 101), and also by Father Pacifique (in letters to me) as TŬLŬGADEGĀCHK, a diminutive of TRACADIE, making it mean LITTLE CAMPING GROUND, or LITTLE SETTLEMENT. This may possibly be correct, but it is difficult on this explanation to interpret the G, which should not be there, while, on the other hand, the most ancient uses of the name on the maps (e.g. TRAGUARIQUECHE on l'Hermitte's map of 1724), implies a different origin, as will later be considered.

E. A list of aboriginal place-names which may involve the suffix root –ACADIE, –QUODDY, –KONTE, but as to which the evidence is uncertain.

ASWAGUSCAWADIC. Name of a branch of the Mattawamkeag, according to Hubbard (*Woods and Lakes of Maine*, 195) whose brief discussion is very inconclusive.

KILMAQUAC. The Passamaquoddy name for the Village of St. Croix, in York County, New Brunswick, meaning EEL WORKS (*these Transactions*, II, 1896, ii, 268). The word may be an abbreviation of KILMAQUATIK, meaning EEL TRAP-OCCURRENCE-PLACE.

MENHAWADIK. Passamaquoddy name for Letang, as given me, in the form MEN-HA-WA′-DIK, by one of that tribe (*these Transactions*, II, 1896, ii, 245).

MENSKWAK. The Micmac name of Chester, Nova Scotia, according to Rand (*Micmac-English Dictionary*, 185), who gives it as MENSKWĀK. The termination suggests an abbreviated WĀKADI. But the name is given somewhat differently in the *First Reading Book*, 86.

MEROUASCADI. Name applied on Bellin's map of 1744 to Cross Island near Lunenburg, Nova Scotia.

OOWCHAADOOCH. Micmac name for the mouth of the Margaree River in Cape Breton, called on old maps OWCHADIE, and meaning WHERE THEY GET IT (the red ochre), according to Rand (*First Reading Book*, 94).

POKATEKATEK. The Maliseet name for the Sherwood Lakes, on the West Branch of the Musquash River in the southwestern part of New Brunswick, according to Chamberlain's *Maliseet Vocabulary*, 60, which gives the word, without meaning, as PO′-KA-TE-KA′-TĔK. I have as yet no clue to its meaning, and hence to the identity of the first root POK, though the latter part *seems* to involve the root –Ā-KA′DI-K.

PSISCONTIC. Given by Hubbard (*Woods and Lakes of Maine*, 210), as the name of Brassua Lake, near Moosehead Lake, with the meaning, which he queries, HANDIEST PLACE TO BUILD CANOES.

QUIDDY. Name of a Brook near Martins Head on the coast of New Brunswick. It appears thus in early records with nothing to give clue as to a prefix.

SLUGUNDY. Name of a Fall on the Mattawamkeag, and rapids elsewhere (*these Transactions*, XII, 1906, ii, 49). MAGUNDY *op. cit.* 31, is probably of different origin.

TALALAGODISSIK. The Penobscot name for Websters Island, in the Penobscot above Bangor, according to Greenleaf's list of 1823 (*Moses Greenleaf, Maine's First Mapmaker*, 121). He defines it as PAINTING PLACE FOR SQUAWS. The part TAL-AGODI, bears a resemblance to TALAKADI, original form of TRACADIE, the termination involving the diminutive SIS.

TEMISCOUATA. Name of a well-known large lake, affluent to the River Saint John in southern Quebec. There are several explanations of the word, mostly connected with Indian legends, but the termination suggests a probable connection with -KA'DI- especially in the form KWA'DI.

F. The origin of the Place-name ACADIE or ACADIA.

The foregoing account of the many Micmac place-names which end in *-acadie* or its equivalent, recalls the fact that the very frequency of this termination is generally supposed to have originated the important word *Acadie* or *Acadia*, the name formerly applied by the French to the present Provinces of Nova Scotia, New Brunswick and Prince Edward Island, and still retained in historical and literary usage. Widely accepted and very pleasing though this view certainly is, it has yet no foundation in fact, as I believe the evidence amply attests. This is a suitable place in which to bring together the data that bear on this interesting matter.

First I shall trace the origin of the present belief. The very earliest suggestion of a connection between the name *Acadie* and the Micmac termination *-acadie*, the familiar combination so fully considered in the foregoing pages, occurs, so far as I can find, in 1825 in a valuable little work published anonymously at Halifax, and entitled *A General Description of Nova Scotia....a new edition Printed at the Royal Acadian School.* The first edition, published two years earlier, I have not been able to see. In this work occurs the passage already cited in this paper, viz.,

> The two largest rivers of Nova Scotia, are the Shubenacadie and the Annapolis. The former, called by way of pre-minence [sic] Shubenacadie, or the River of Acadia, (Shuben being the Indian name for a river) is very large, rapid and circuitous.

Thus this passage, though much in error as already noted (page 424), does incidentally connect *Acadia* with the termination *-acadie* of the important Micmac place-name Shubenacadie.

It was probably the suggestion thus given which influenced Abraham Gesner, the geologist, in elaborating the complete *acadie-aka'di* theory as it occurs in his book *The Industrial Resources of Nova Scotia*, of 1849, pp. 2, 31, as follows;—

> In the Micmac Indian dialect ākāde signifies a place. Thus Anglishouākāde means a place where Englishmen reside, Wenjouākāde a place where French people live, or a French settlement. The Shubenacadie is called by the natives Saagaabēn-ācăde, a place where their favourite root, the Sagaabun, grows; thus the origin of the term Shubenacadie now applied to the river, where those roots were formerly very abundant. The terms Cadie and L'Acadie have evidently been derived from the Micmac ākāde—a place.

Thus Gesner, in this passage, was the first, so far as I can find, to actually publish the theory that the name *Acadie* is derived from the frequent Micmac termination *-aka'di.* It was not he, however, who was responsible for its wide dissemination and well-nigh universal acceptance, but another geologist, a great Nova Scotian, best known to us as Sir William Dawson, who in 1855, in the first edition of his great work *Acadian Geology*, page 1, wrote thus:—

> The aboriginal Micmacs of Nova Scotia, being of a practical turn of mind, were in the habit of bestowing on places the names of the useful articles which could be found in them, affixing to such terms the word *Acadie*, denoting the local abundance of the particular objects to which the names referred. The early French settlers appear to have supposed this common termination to be the proper name for the country, and applied it as the general designation of the region now constituting the provinces of Nova Scotia, New Brunswick, and Prince Edward Island; which still retain Acadia as their poetical appellation, and as a convenient general term for the Lower Provinces of British America as distinguished from Canada.

In the second edition of the same work, in 1868, 1-3, Dawson, evidently under the stimulus of the erroneous interpretation of Mudge and Featherstonhaugh presently to be mentioned, entered much more elaborately into the subject. He stated that in his own boyhood, the meaning of the Micmac termination *acadie* had been explained to him by an aged Micmac,—who had "illustrated by the word Shubenacadie," which he derived from "Sgabun" meaning ground-nuts or Indian potatoes, and acadie, meaning abundant. Further, with the aid of Rand, then rising into that prominence which made him later by far the greatest of authorities upon the Micmac language, he gave a list of some ten names ending in *Kaddy* or *Kwoddy*, in further illustration of his contention; and he expressed his belief in the probability of the derivation of Acadia from "the frequency of names with this termination in the language of the natives," adding the following passage in explanation of the probable method:

> The early settlers were desirous of information as to the localities of useful productions, and in giving such information the aborigines would require so often to use the term "Cadie," that it might very naturally come to be regarded as a general name for the country.

This treatment of the subject was not altered by Dawson in the third and fourth editions of his work. It was reprinted in the *Canadian Antiquarian*, V, 1876, 84.

Meantime, Rand appears to have communicated a similar view to various inquirers, for, although I cannot find the material in any of his published works, he is the accredited authority for the meaning "place of plenty" assigned to *acadie* in Ballard's account of the name Passamaquoddy in the *Report of the United States Coast Survey* for 1868, 255. Also he is as obviously the authority for place-names cited by P. C. Bliss in support of Gesner's meaning "place" in *Collections of the Maine Historical Society*, I, reprint of 1865, 27; (also the same, second series, I, 1869, 234).

The great merits of Dawson's *Acadian Geology* gave its statements a prominence and authority which, in conjunction with the apparent reasonableness and marked attractiveness of his theory of the origin *Acadie*, led to the wide acceptance thereof. Some further impetus, moreover, was given it by Bourinot, who, considering there could be no doubt as to its correctness, supported it in a prominent paper on Canadian place-names (in the *Canadian Monthly*, VII, 1875, 291, 292). Again, he gave it further emphasis in his well-known work on Cape Breton, in which, after saying that it seems well established, he cited a list of seventeen Micmac place-names, taken from Rand's *Dictionary*, in illustration (*these Transactions*, IX, 1891, ii, 327); and he repeated it in a later work, though this time with far less confidence (*these Transactions*, V, 1899, ii, 4). Then, either from Dawson direct, or from Bourinot, or from one another, various later writers have adopted the explanation, usually without the cautious "probable" of Dawson, until now it is widely current in historical works as well as popular literature.

Meantime, however, a partially similar but partially distinct explanation had arisen quite independently and obtained a considerable currency. It appeared first in 1840 in an official Report made to the British Government and published in a *Blue-book* of that year by Messrs. Mudge and Featherstonhaugh, two commissioners sent out to examine the territory in Maine and New Brunswick at that time in dispute between the United States and Great Britain. This part of their report reads thus (page 12):—

Even before the appointment of De la Roche in 1598, as Lieutenant-General of the country [*Acadie*], including those parts adjacent to the Bay of Fundy, the Bay into which the St. Croix empties itself, was known by the Indians of the Morriseet tribe, which still inhabits New Brunswick, by the name of Peskadumquodiah, from *Peskadum*, Fish, and *Quodiah*, the name of a fish resembling the cod.*

*The provincial name of this fish is Pollock, and it still continues to frequent that bay. (Footnote in original.)

The French, according to their usual custom, abbreviated the Indian name, which we sometimes, in the old records, read *Quadiac* and "Cadie," and at length we find it taking the general designation of "Acadie."

The English race, have turned the original Indian name, into *Passamaquoddy*, and the Indians of the district have long been by them familiarly called Quoddy Indians, as, by the French, they have been called *Les Acadiens*. To this day, the Morriseet Indians call the Bay by its original Indian name of Peskadumquodiah.

But De Monts, finding the position he had selected to winter in bleak and inconvenient, and very inferior to Port Royal (now Annapolis Royal), abandoned the St. Croix, and made a permanent settlement at Port Royal. The Peninsula, south-east of the Bay of Fundy, where the Port is, began thenceforward to be called "Acadie."

The passages here cited abound in historical errors and pure inventions, but the only statements that concern us now are these,—

that the name Acadie originated from the termination of Passamaquoddy, through Quodiah, Quadiac, and Cadie, that this word Quodiah, and therefore Cadie, means the fish called Pollock, and that a tribe of Indians has the same name. I can find no antecedents for this explanation, and there seems every probability that it was original with Mudge and Featherstonhaugh, worked out on the basis of information given by the Indian guides with whom they travelled extensively in Maine and New Brunswick. The astonishing error, by which they transferred the meaning of the first part of Passamaquoddy, —the word Peskatum, really meaning Pollock, as shown earlier on (page 411), —to the latter part –quoddy, which really is a form of –acadie (page 377 earlier), is most readily explained by the supposition advanced by Dawson, in his well-grounded criticism of the Commissioners' conclusions, viz., that they took quoddy to mean pollock "very likely because its sound resembled that of cod, or because some Maliceet Indian had rendered the name into his imperfect English by the word 'Pollock fish here' " (*Acadian Geology*, second edition, 3). However it arose their derivation of Acadie from Quoddy, and their error that Quoddy or Quodiah meant Pollock, exhibited a surprising vitality, for it appears frequently in historical writings, the Quodiah often spelled Aquoddie or Aquoddiauki &c. Thus it is repeated in the *Historical Magazine*, I, 1857, 84, by Parkman in *Pioneers of France in the New World*, and by Shea in his great translation of Father Charlevoix's *Histoire*, (I, 254n), and others. Obviously it formed also the basis upon which Judge Potter constructed his fanciful derivation of Passamaquoddy from pos, meaning great, asquam meaning water, and aquoddie meaning pollock (*Collections of the Maine Historical Society*, IV, 1856, 191; *History of Manchester New Hampshire*, 1856; *Historical Magazine*, I, 1857, 84); and this explanation, wholly erroneous as shown on an earlier page (417), has appeared in numerous works, including Hind's *Report on the Geology of New Brunswick*, 1865, 260, A. Leith Adams' *Field and Forest Rambles*, 34, and others. Sometimes, moreover, by a freak of memory, the Indian tribe and not the place has been made the origin of the name (*Collections of the Maine Historical Society*, I, 1865, 27). In later times, however, the Mudge-Featherstonhaugh view ceased to find acceptance, and went down to defeat, it is obvious, before the simpler, more reasonable, more attractive, and better advocated theory so forcefully developed by Gesner, Rand and Dawson.

Another explanation, coming from a source apparently authoritative, though actually, as I have earlier shown (page 418), unworthy of confidence, is that (or rather those, for there are two) given by

Father Vetromile in his book *The Abnakis and their History*, 1866, 45, where we read:—

I was at one time led to resolve *Acadie* into the two Abnaki words *Aki-adie* (land of dogs). Yet, after more recent investigation, I consider it more natural to trace it to the Micmac word *academ* (we dwell), or *tedlacadem* (where we dwell), that is, *our village*. We have yet in Nova Scotia a place called *Tracadie*, which must be the Indian word *tedlacadem*, or *t'lacadem*, *where we dwell*, and perhaps it is the original word of *Acadie*. The principal river in Nova Scotia is called *Shuben-acadie*, *river where we dwell*, or *village-river*.

While this passage, like so many in Father Vetromile's work, including many that have been much quoted, contains much assumption and error, he is correct, I believe, in one point, viz., the derivation he gives for Tracadie (compare page 437 earlier). His main explanation of Acadie, however, that it is identical with the latter part of Tracadie, is quite negatived by the testimony which follows in this paper.

Somewhat similar is the explanation of Acadie given by Father Pacifique, who, in his valuable little work, *Une Tribu Privilégiée*, of 1910, 3, wrote thus:—

Acadie ou *Arcadie*, du mot micmac *algatig:* qui vient de *algatigei*, "s'établir, demeurer, camper çà et là"; pour indiquer un village ou une colonie particulière, ils disaient *etlagatig*, de là *Tracadie*. (*Acadie* or *Arcadie*, from the Micmac word *algatig*, which comes from *algatigei*, "to settle, reside, camp here and there;" in order to indicate a village or particular settlement, they say *etlagatig*, whence Tracadie).

In a recent letter to me, Father Pacifique repeats this derivation, and identifies the termination of these words with the *–acadie* of the many names to which the present paper is devoted. But I have already given reason why I think that Tracadie is not connected with the other *–acadie* names (page 436), while the historical evidence in the following pages seems to me to show that neither is the *–acadie* of Tracadie connected with our *Acadie*.

The views of the origin of the word *Acadie* just given are not the only explanations that have been offered, although they are much the best known. Thus, in a rare little work entitled *A Genuine Account of Nova Scotia*, published in London in 1750, we read:—

When the *French* got possession of it, they called it *L'Acadie*, in allusion to *Arcadia* in the *Grecian Peloponnesus*, but with what propriety I cannot pretend to determine."

This very same view is contained in Douglass' *Summary* 1755, I, 305, and it is given in Williamson's *History of Maine*, I, 1839, 188. Presumably it represents a pure guess, based simply upon the resemblances in the two words.

Finally, for completeness, and, incidentally, recreation, we may notice the explanation of the anonymous author of the book

A Peep at the Western World, published in London in 1863, which tells us that the name Acadia is derived from "a simple, unobtrusive, hardy little flower of that name which grows wild in the country." In this statement, which involves evidently the Mayflower, the provincial floral emblem of Nova Scotia, we have obviously an example of the drawing of a wrong combination from the too hastily filled mind of a not very critical tourist.

Summarizing, now, this part of our subject, we see that the Gesner-Rand-Dawson theory of the origin of *Acadie* from the Micmac place-name termination *–acadie* achieved wide acceptance, displacing all other explanations. Such was the condition in 1896 when the first protest was entered. As a result of somewhat extensive studies upon the place-nomenclature and cartography of New Brunswick, involving secondarily the Acadian region as a whole, as embodied in Monographs published in the *Transactions* of this Society, I was led to the conviction that the current explanation of the origin of *Acadie* was wrong; and I expressed this opinion briefly in my Monograph upon Place-nomenclature, in *these Transactions*, II, 1896, ii, 216, where I pointed out that the name can be traced back through historical records to a form that precludes a Micmac origin, and to a collection of names wholly European in origin without any suggestion of native influence. This argument I elaborated at greater length in the *New Brunswick Magazine*, III, 1899, 153-7, with a synopsis in the *Educational Review* (St. John), XVI, 1902, 12, an addition of some further cartographical data in *these Transactions*, VII, 1901, ii, 161, and a brief statement in my edition of Denys' well-known *Description*, published by the Champlain Society in 1908, 126. The only writers, however, so far as I know, who have yet taken account of this view are two, viz., Dr. S. E. Dawson, who, in his excellent book *The Saint Lawrence*, 1905, 249, discusses it, (without bibliographical citations), to an unfavourable conclusion, and Messrs. Grant and Biggar, who, in their translation of Lescarbot's *Histoire* published by the Champlain Society (II, 1911, 211), mention it with the comment that strong reasons therefor are given by the author. And such remains the status of the matter at present.

I shall now re-state the evidence which seems to me to disprove the native Micmac origin of *Acadie* and to indicate a European origin for the word.

In the first place, Gesner, Rand, and Dawson base their view that *Acadie* is the Micmac place-name termination *–acadie* solely upon the resemblance between the two, without any appeal to the history of the word or other documentary support. Logically the argument is this:— the country has been called *Acadie* from early times; in this country are many native place-names ending in *-acadie;* therefore the two are (probably) one and the same. Dawson alone feels the need for explaining the method by which the Micmac termination of local place-names could become transmuted into a general name for the country, and his hypothetical explanation of the way the early settlers would notice the termination *-acadie* and later use it as *Acadie* has already been cited earlier, on page 440. Quite fatal, however, to this explanation, is the fact that the name *Acadie* goes back to a period anterior to the advent of settlers,—goes back at least to the charter of de Monts, of 1603, a document which antedates by one or two years any settlement of the country whatever. Thus the word could not have come into use in the way that Dawson supposes. Furthermore, there is a piece of direct evidence that the earlier settlers did not know the name at all; for in 1616 Father Biard, who lived at Port Royal, where all the settlers of Acadia were then collected, wrote in his *Relation* that of the name Acadie "there no longer remains any remembrance in the country" (Thwaites, *Jesuit Relations*, III, 41). Thus it seems clear that *Acadie* was used simply as an official and map name, but was not in use among the first colonists, who considered the country as a part of New France. Indeed, I cannot find any trace of the use of *Acadie* by the residents until considerably later. And if we substitute for the "settlers" in Dawson's explanation the word "explorers," or "fishermen" the case is not helped, as the evidence to follow will show.

Let us now trace the name backward through the historical records. It appears in numberless documents, treaties and maps in an unbroken chain backwards, sometimes as *Acadie* (also *Accadie, Acadye*), and sometimes as *Acadia*, the former representing the French and the latter the English usage. The form *Acadia* I find first in an English document of 1668 (*these Transactions*, VII, 1901, ii, 185), where it clearly represents a legal form of the French *Acadie*, presumably based upon the latinization of the latter in some official document written in Latin. Back of that date we can trace *Acadie* from document to document, without a break, to 1603, where, as so often pointed out, it occurs as *La Cadie* in the commission of the Sieur de Monts (copy in Grant and Biggar's translation of Lescarbot's *Histoire*, Champlain Society, II, 211). Cotemporaneously, however, it appears in the works of Champlain, who, in his well-known *Voyages*, of 1613, has sometimes *Acadie* and sometimes *Arcadie*. In his earlier *Des Sauvages*, however, published in 1604 but describing events of 1603, he uses invariably *Arcadie* excepting in one case, where he has *l'Arcadie* (*Laverdière's edition*, 57, 64, 115, 122, 123, 127), applying the name to that very country which later bore the name *Acadie*. Thus in the year 1603 he have two forms of the name *Acadie*, the *La Cadie* of an official French document, and the *Arcadie* of the narrative of Champlain, the experienced and competent geographer. Going still farther backward, I have found the name in but a single book, and that is in the *Cosmographie universelle* of Thevet of 1575, where it also appears as *Arcadie* (translation in the *Magazine of American History*, VIII, 1882, 133). Thevet had, however, no original knowledge of this region, and must have taken the word from some map. Upon the maps of the time, the word does indeed appear many times, as I have already shown in *these Transactions*, II, 1896, ii, 216; VII, 1901, ii, 161. As an example we may take the Zaltieri map of 1566, printed in the *Transactions* last cited, 163, upon which, on a peninsula lying between R. S. Lorenzo and R. Fondo (clearly the St. Lawrence and the Bay of Fundy), is printed *Larcadia*, in the same type as is used for other large territorial divisions, such as Labrador and Florida. The same usage is found in many other maps, notably in the Globe of Franciscus Bassus of 1570, which has *Arcadia*, (*Kretschmer's Atlas*, XXIX) and on the map of about 1560 forming No. 13 in Muller's *Remarkable Maps;* and it occurs also, as *Arcadia* or *Larcadia*, either as a territorial or a local name, on maps by Porcacchi of 1575, by Bertelli of 1560, by Ruscelli of 1561, and several others. The very earliest map on which it is known to occur is the map of New France contributed to Ptolemy's *Geography* of 1548 by Gastaldi, of which a sketch is given by Winsor in his *Narrative and Critical History of America*, IV, 88. The essential correctness of that sketch, with its spelling of *Larcadia*, I have confirmed by comparison with an original in the Lenox Library.

The fact that the name *Acadie* thus goes back in an unbroken line to the *Larcadia* of these very early maps has not escaped the notice of students, for Kohl, in his well-known work on the discovery of Maine, comments on its appearance on the Ruscelli Map of 1561 (*Collections of the Maine Historical Society*, second series, 1869, I, 234); Slafter, in his scholarly annotations to the *Prince Society Champlain*, II, 73, mentions its occurrence on the Gastaldi map of 1548; and Bourinot, comments to like effect (*these Transactions*, V, 1899, ii, 4), all of these authors, by the way, accepting an Indian origin of the word. But the occurrence of the name on maps of such early date seems to me quite fatal to the possibility of an Indian origin. In the first place, as the name goes back at least to 1548, it long antedates any settlement of any sort, and even any exploration except of the most hurried character, quite insufficient to have given the voyagers any idea of the frequency of the termination *–acadie* in the place-names, or any opportunity to develop such knowledge into a place-name for the country. In the second place the termination *ia* is not at all the *e* or *ie* sound which the Indian theory requires. In the third place (and this is much more important) the presence of the *r*, which is invariable in the sixteenth century forms, excludes a Micmac origin, since, as all who know the language agree, there is no trace of an *r* sound in that tongue, nor can the Micmacs sound it when they try. In the fourth place, and most conclusively of all, the name appears upon the earliest maps, especially that of Gastaldi of 1548, in company with an assemblage of other names which are exclusively European, not a single one of those upon the Atlantic coast at least, having a native origin.

How then did the *Arcadia* or *Larcadia* of the sixteenth century maps become the *Arcadie* and *La Cadie* of Champlain and the commission of de Monts? That seems to me very easy of explanation. We know that towards the close of the century, great interest, with plans of colonization, were centered upon that region. Naturally all records would be searched for information concerning it, and especially all available maps would be studied for its geography. As attention became directed especially towards the region which lay between the large and indefinite Florida on the one side and the even larger and more indefinite Canada or New France on the other, it was found that while some maps gave to this region no name, others called it *Arcadia* or *Larcadia*. This name would therefore come into prominence in all of the discussions relating to colonization and trade in that country. With conversational use of the name among those concerned, the word would gradually be familiarized into forms more consistent with the genius of French speech, making *Arcadie* or *Larcadie* instead of *Arcadia* or *Larcadia*, while, as the maps themselves did not agree exactly in the form, some differences in the familiar usage would naturally occur. Then, in 1603, Champlain and the writer of the Commission of de Monts each wrote the word in the form most familiar to himself. It was neither a time nor a subject for the refinements of exact scholarship, and anything that served a purpose sufficed.

Thus the name Acadie goes back to Larcadia which appears under circumstances that seem to preclude a native Micmac origin. Whence then did it come, and why does it appear upon Gastaldi's map? Obviously this question is no concern of the present inquiry, since my duty in the case is ended with the transference of the word from an Indian to a European category. Nevertheless the matter is of interest, and I venture to add some comment. Upon Gastaldi's map of 1548 it occurs in company with a series of European names, viz.: S. maia, Larcadia, Angoulesme, Flora, Le Paradis, Tierra de los breton, Buena

Vista, hermoso, and others. Now, these other names occur mostly upon two earlier maps from which Gastaldi evidently copied them, viz.: that of Verrazano of 1529, and that of Maggiolo of 1527 (the former in De Costa's *Verrazano the Navigator*, and the latter in *these Transactions*, III, 1897, ii, 331), but Larcadia occurs upon neither. Therefore, Gastaldi either interpolated Larcadia, or it is a misprint of some name on the earlier maps, which by the way contained far more names than Gastaldi, and in a very different order. Upon the Maggiolo map there is nothing between the names Anguileme and S. Maria, but far to the eastward occurs a place *lorto de larcelay*, (or *de racday* in Stevenson's recent photographic reproduction), while on the Verrazano map occurs between Angolesme and Santa M, an obscure word which has been read by De Costa as *lanprunela*. While the erroneous transcription of one of these words or some other to the *Larcadia* of Gastaldi is possible, it is also equally probable that Gastaldi himself added the word, to occupy a convenient space, in recollection of Arcadia in Greece, of happy associations, under the suggestion of the other words of fortunate omen, Flora, Paradis, and Hermoso, the L being the article, as in his Le Paradis. Here, however, I must leave the subject, with only this further remark, that I am sure the matter can be solved by intensive comparative investigation.

Mémoires de la Société Royale du Canada
SECTION I

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Le folklore canadien-français.

PAR C.-MARIUS BARBEAU.

PRÉSENTÉ PAR M. LOUVIGNY DE MONTIGNY, M.S.R.C.

(Lu à la réunion de mai 1915.)

En venant au Canada, nos ancêtres apportaient avec eux leur part des coutumes et des traditions séculaires de France. A cette époque déjà reculée, les croyances anciennes, la littérature orale populaire et les arts provinciaux n'avaient pas encore été étouffés sous le souffle niveleur du modernisme intellectuel et matériel. Dans les bourgs lointains des paysans, des marins et des petits bourgeois illettrés, on croyait encore aux métamorphoses, aux fées, aux revenants, aux sorciers et à leurs sortilèges; on célébrait annuellement les pardons et les fêtes du soleil ou des divinités païennes; et, en l'absence des grandes industries, chacun savait pourvoir à ses humbles besoins.

Les Canadiens ont conservé ce patrimoine traditionnel presque intact jusqu'à la fin du siècle dernier. Des vieillards, encore aujourd'hui, sourient en connaisseurs quand on leur parle des mendiants jeteurs de sorts, des loups-garous, de la chasse-galerie, des feux follets, des revenants, des feux de la Saint-Jean et des longues soirées d'hiver où l'on s'amusait 'comme au temps passé.' Si vous cherchez bien, vous pourrez peut-être entendre raconter, à une soirée de village, les aventures épiques de Petit-Jean ou de Parlafine luttant contre les géants, détruisant la bête-à-sept-têtes et délivrant des princesses 'gardées'. Et ailleurs, il arrive encore aux enfants de s'endormir au rythme de chansons anciennes ou de complaintes à multiples couplets. Ici et là, quelques-uns, encore attachés aux choses d'autrefois, ont conservé quelques reliques, un moule à chandelles ou un fanal rond en métal ouvré, une boîte à tabac sculptée, un rouet, un métier, une ceinture *fléchée*, une *tuque*, ou un coffre à *équipet*. Ce n'est là, toutefois, que l'écho d'un âge disparu. Le livre ou le journal, la machine et l'industrie, comme partout ailleurs, ont accompli leur œuvre inévitable. Personne aujourd'hui ne croit aux merveilles qui captivaient l'imagination des anciens. L'enfant même n'écoute plus les contes et les légendes que sa grand'mère pourrait lui redire. Il sait lire! Et le conteur, devenu rare, se tait faute d'auditeurs. Ses contes s'oublient. Le conteur disparaît, meurt, et les contes se perdent. Quand le manufacturier, suivant les chemins de fer, introduisit partout sa marchandise moderne, les rouets et les métiers s'arrêtèrent. Les petits artisans perdirent leur clientèle. Au lieu de confectionner, on aima mieux acheter. Les arts manuels domestiques devinrent méprisables, et à la suffisance aisée on préféra la servitude industrielle.

Aujourd'hui que l'éducation moderne forme le petit Canadien à l'image de tout le monde, et que nos vieilles traditions orales et nos arts domestiques se perdent, quel effort fait l'historien pour en conserver la mémoire? Quelques essais isolés ont déjà été couronnés de succès. Une centaine de nos vieilles chansons populaires et quelques légendes et anecdotes ont été recueillies et publiées. On s'est arrêté là. Dernièrement, l'étude systématique des variations de la langue française au Canada a été entreprise, et cette étude se continue fort heureusement. Malgré ces documents précieux, on ne pourra se faire qu'une bien faible image, dans cinquante ans, de ce qu'étaient les ancêtres. Les coutumes et mœurs quotidiennes, les superstitions, les fêtes et amusements, les contes et chansons, les arts, métiers, costumes, enfin tout ce qui contribuait à former le cadre pittoresque de la vie de l'ancien Canadien se sera effacé sans presque laisser de traces, même dans les livres et les musées.

Ne parlons ici que des contes populaires traditionnels anciens. Dans tous les pays et chez tous les peuples civilisés, les folkloristes ont, pendant ces derniers siècles, recueilli une multitude de récits oraux de toutes sortes. La littérature écrite où on les a consignés est presque inépuisable. Deux savants ont dernièrement catalogué en de gros volumes[1] les centaines de versions à eux connues de plus de cent contes répandus dans toute l'Europe.

Or, il y a deux ans, à un congrès anthropologique, un savant américain demandait: "Les Canadiens-français, eux, ont-ils conservé leurs traditions orales et leurs contes?" Personne ne put répondre à cette question, faute de documents. L'auteur de ce mémoire s'engagea à faire des recherches. La littérature canadienne écrite offrit une réponse négative, les récits assez nombreux qu'on y lit étant pour la plupart des anecdotes ou tableaux de mœurs fabriqués de toutes pièces par les écrivains. Une conclusion plus satisfaisante, toutefois, s'imposa à la suite d'une visite faite à quelques vieux pay-

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[1] Bolte et Polivka, *Anmerkungen zu den Kinder- u. Hausmärchen der Brüde Grimm*, 1913-1915 ("Commentaires sur les contes domestiques des frères Grimm.")

sans des environs de Québec. Des contes de fées, de magiciens, d'animaux parlants, de princes *amorphosés* (métamorphosés), de Petit-Jean, de Parlafine? Oui, on en savait! Et près de trente contes, récités à Lorette, furent sans retard pris à la sténographie, en août, 1914. Dix contes, peu après, furent obtenus à la Beauce. L'existence de traditions semblables était en même temps signalée dans LaPrairie et aux environs de Montréal. Dans le comté de Kamouraska, en juillet, 1915, quatre conteurs récitèrent plus de soixante contes populaires, qui furent aussi recueillis sous dictée, à la sténographie. La conclusion s'imposa, au cours de ces recherches, que les conteurs sont encore assez nombreux, surtout dans l'est de la province de Québec, et que des milliers de récits traditionnels pourraient facilement être recueillis. La collection d'une centaine de contes que nous possédons maintenant provient presque exclusivement d'illettrés, dépassant l'âge de cinquante ans. Les principaux sont: Paul Patry (Beauce), Prudent et David Sioui (Lorette), Achille Fournier, Georges-S. Pelletier et autres (Sainte-Anne, Kamouraska). Aussitôt que l'instruction pénètre quelque part, le conteur a terminé son rôle. Les enfants même trouvent bientôt leurs récits puérils et ne les écoutent plus. L'ordre des choses nouvelles efface celui des anciennes. Les deux âges ne se mêlent point.

Quels sont ces contes ou récits traditionnels, et quelle était leur utilité?

Transmis oralement, appris et récités, ils se sont propagés d'autant plus universellement qu'ils sont plus anciens. Ce qui les caractérise surtout, c'est leur forme relativement rigide, qui ne s'altère que légèrement au cours de plusieurs siècles de transmission chez des peuples de langues variées. D'origine généralement ancienne, ils ont été transformés graduellement pour mieux répondre aux circonstances et suivant les vicissitudes de la mémoire collective. A ces récits on ajoute et on retranche. Les traits dominants, les personnages et les événements essentiels restent intacts, tandis que les détails, le style surtout, s'adaptent aux goûts du milieu. Les sujets sont, à peu près sans exception, fictifs; et ils se distribuent depuis les âges les plus reculés jusqu'aux temps modernes. Des cent récits que nous possédons maintenant, pas un peut-être n'a été entièrement créé au Canada. Sous différentes formes, nous les retrouvons dans les nombreux recueils scientifiques ou populaires de contes français, allemands, italiens et autres. L'influence française et espagnole s'est aussi fait sentir sur la mythologie des Indiens de l'Amérique, où, depuis longtemps, les éthnologues ont distingué de nombreux éléments étrangers. Il est maintenant facile de reconnaître l'origine française de la plupart des contes qui se sont disséminés le long des sentiers des coureurs-des-bois canadiens.

Ces récits traditionnels, soit dit en passant, ne doivent pas être confondus avec les anecdotes personelles qu'on trouve fréquemment dans la littérature canadienne. Les premiers sont toujours appris, récités, et généralement considérés comme fictifs. Ils commencent à peu près tous par les formules: "Une fois, il est bon de vous dire, c'était," "Une fois, il y avait . . ". Quant aux anecdotes, ce sont des souvenirs personnels ou des faits de la vérité desquels le narrateur se montre certain. Tels sont les récits qu'ont rapportés de Gaspé, Fréchette et leurs contemporains.

Chez les peuples dépourvus d'écriture, et partant de littérature écrite, les traditions orales en tenaient lieu. La mémoire, au lieu du parchemin, était le réceptacle des mythes, des fictions populaires et des souvenirs collectifs. Dans chaque génération, des individus particulièrement doués apprenaient et retenaient textuellement ces récits pour les transmettre, en guise d'archives nationales, à la postérité. Il se trouve encore au Canada des conteurs à mémoire féconde. Achille Fournier, par exemple, nous a récité plus de trente contes dans l'espace de quelques jours. On nous a aussi indiqué des familles dont la plupart des membres sont des narrateurs réputés, tels les Coulombe et les Patry, dans la Beauce et dans le comté de Dorchester.

Si la récitation des textes formels se faisait autrefois dans un but religieux ou patriotique, il n'en est pas ainsi chez nous. Les traditions historiques et les mythes religieux semblent s'être perdus, tandis que les randonnées, les chansons, les légendes et les contes ont survécu jusqu'à nos jours.

L'utilité de cette littérature populaire se bornait au plaisir que les auditeurs en retiraient. Aux longs soirs d'hiver surtout, on se rassemblait tantôt chez les uns, tantôt chez les autres. Deux ou trois conteurs favoris y déclamaient ou chantaient tour à tour quelques pièces de leur abondant répertoire. On invitait même un diseur reputé d'un village lointain, et on s'assemblait en foule pour l'entendre. Des rivalités amusantes se faisaient quelquefois jour en de telles occasions. C'était à qui saurait le plus grand nombre de contes et se répéterait le moins souvent. La soirée où l'on dit des contes n'a pas encore entièrement disparu, dans maintes localités de l'est de Québec; ainsi on nous en a mentionné une qui s'est tenue en août dernier à Château-Richer, près Québec.

Le conteur, autrefois, prenait son rôle au sérieux. C'était, en quelque sorte, le personnage ou l'oracle du canton. On le rencontrait aussi sous les traits d'un mendiant qui, le long de la grand'-route, payait son écot en récits ou en chansons. Ces nomades étaient bien connus, et leur passage périodique était le signal d'une soirée de contes, où l'on se divertissait souvent fort bien de l'originalité de l'étranger. Les grand'mères aussi ont quelquefois, de nos jours, conservé leur part de ces traditions orales qu'elles mettent encore à profit pour amuser les enfants.

La fiction populaire canadienne est de nature complexe. La forme varie; on y trouve la prose et les vers, les genres descriptifs et lyriques. Quant à la nature même du sujet traité, plusieurs catégories se dégagent assez clairement, à savoir:

1.—Les mythes et les contes où le merveilleux domine;

2.—Les fables où les animaux parlent et agissent comme des êtres humains;

3.—Les contes héroï-comiques où des personnages légendaires imitent le merveilleux en le parodiant, et jouent des tours;

4.—Les légendes de caractère semi-chrétien où les personnages sont le Christ, les apôtres, les revenants, et le diable, dont les ruses sont ordinairement déjouées;

5.—Les récits romanesques ou les facéties du moyen âge ou des temps modernes.

Il convient d'en citer ici des exemples et des extraits. (On verra que l'auteur s'est fait un devoir de suivre de très près le texte des conteurs, malgré toutes ses naïvetés.)

PIÈCES RIMÉES OU À RETOURS RYTHMIQUES.

A l'exception des complaintes et des chansons, les pièces rimées ou à retours rythmiques semblent peu nombreuses. Nous allons en citer deux exemples, la randonnée de "Minette m'a volé mes roulettes," et le poème de "Michel Morin." Récitée par Prudent Sioui, à Lorette, la randonnée était aussi connue à la Beauce.

Minette m'a volé mes roulettes:

Un jour, j'ai joué avec Minette;
Minette m'a volé mes roulettes.
J'ai dit à Minette:
"Tu vas me redonner mes roulettes."
Minette dit: "*T'auras* pas de roulettes sans croûtes."
J'ai été trouver mon père pour avoir des croûtes.
Mon père dit: "*T'auras* pas de croûtes sans *heurles.*"
J'ai été trouver les loups pour me faire *heurler.*
Les loups m'ont dit: "*T'auras* pas d'*heurles* sans veau."
J'ai été trouver le veau pour avoir du veau.
Le veau m'a dit: "*T'auras* pas de veau sans lait."
J'ai été trouver la vache pour avoir du lait.
La vache dit: "*T'auras* pas de lait sans foin."
J'ai été trouver la faux pour avoir du foin.
La faux dit: "*T'auras* pas de foin sans lard."
J'ai été trouver la truie pour avoir du lard.

La truie dit: "*T'auras* pas de lard sans glands."
J'ai été trouver les chênes pour avoir des glands."
Les chênes dirent: "*T'auras* pas de glands sans vent."
J'ai été trouver la mère des vents pour avoir des vents.
La mère des vents m'a *venté;* j'ai *venté* les chênes;
Les chênes m'ont *glanté;* j'ai *glanté* la truie;
La truie m'a *laré;* j'ai *laré* la faux;
La faux m'a *fointé;* j'ai *fointé* la vache;
La vache m'a *laité;* j'ai *laité* le veau;
Le veau m'a *cussé;* j'ai *cussé* les loups;
Les loups m'ont *heurlé;* j'ai *heurlé* mon père;
Mon père m'a *croûté;* j'ai *croûté* Minette;
Minette m'a tout redonné mes roulettes.

Quant au poème héroï-comique et partiellement rimé sur Michel Morin, plusieurs versions en ont été obtenues. La meilleure vient de M. l'abbé J.-E.-B. LeVasseur, qui l'a apprise, il y a longtemps, à Saint-Pacôme (Kamouraska). Il suffira ici d'en donner quelques extraits:

Éloge funèbre de Michel Morin, bedeau de l'église de Beauséjour.

(Epitaphe:) *Mortus est beatus* Gaspard Jean, docteur de la commune, qui contemplait un jour *sur* la mort des légumes et des *beatus*, armé de fourches et d'*artibus*. . . .

Un jour, Michel Morin invita à dîner quatre de ses bons amis et moi, *qui* faisait cinq. Je ne me souviens pas si c'était un vendredi ou un samedi, la veille d'une fête ou d'un dimanche; *toujours que* c'était un jour maigre. Michel Morin n'avait rien pour recevoir son monde. Alors il courut à la rivière, se dépouilla de ses vêtements et se jeta à la nage. Nous le crûmes noyé; mais point du tout! Il revint avec deux brochets aussi longs que d'ici à demain, éventra l'un de ces deux brochets, passant son coutelas sur le pavé, *britchte*, *brètchte*, *vritchte*, *vrètchte*, en fit une matelote *qu'on* s'en *délicha* les quatre doigts et le pouce. Après que nous eûmes bien mangé, il fallut chacun raconter son histoire. Michel Morin s'y prit en ces termes, *dit-il:* "Je me meurs! moi qui avais un si bel âne, d'une si bonne race, *dont* la mâchoire *du* cousin germain avait servi à tuer Caïn.

La blanchisseuse, un jour, voulant porter du linge à la grenouillère,
Me dit: "Compère!"—"Mais qu'est-ce qu'il y a donc, commère?"
—"Il y a bien loin de chez la blanchisseuse à la grenouillère.
Si nous attelions le bel âne à la charrette,
Ce serait bien plus tôt *faite.*"
Je lui dis: "En effet, prenez-le."
Elle le prit donc, le bel âne, et l'attela à la charrette.
Mais en passant par le *fossette* Albec,
Le bel âne s'est enfoncé depuis la queue jusqu'au *bec.*
Elle me dit: "Compère!"—"Mais qu'est-ce qu'il y a donc, commère?"
—"Votre bel âne est mort."
—"Ah! pleurez, mes yeux! Versez autant de larmes qu'il y a d'eau dans la rivière!"
On a tant versé de larmes que le bel âne

Se rendit au royaume des *Taux* (d'Yvetot ?).
Pour le tirer de là, pour lui ôter ses sabots,
Pour le porter en terre, pour le porter à l'île Macrèle,
Il nous faut Jacquelin, Jacqueline, Couleuvrine et ses petits.
On a eu pour tout héritage. . .
La viande! Les chiens en ont fait leur partage.....

Un jour, Michel Morin vit des pies qui avaient leur nid dans le haut [d'un sapin.
Il gagea une pinte de *whisky* avec son voisin
Qu'il irait dénicher les pies.
"Gageons, dit-il à son ami,
Gageons une bouteille de *whisky*
Que j'irai dénicher les pies."
Il y alla, mais par malheur monta sans échelle.
Arrivé au haut du sapin, il s'écria: "Victoire!
Mon voisin, nous allons la boire!"
Mais une branche cassa, et il dégringola de branche en branche.
Il tomba et se *cassit* les reins.
Le voilà pas trop bien.
"Avant de me porter en terre,
Qu'on m'amène monsieur le notaire,
Avant de me porter au monument,
Que je fasse mon testament. . . .
Employez pour moi, monsieur le notaire, du bon et du propre;
Ecrivez à ma mode,
Et vous serez payé en méthode. . . .
Je lègue. . . . . (*suivent plusieurs legs*)
Je donne à mon petit-fils Jarène,
Avec sa grand'mine blême,
Mon bâton, mon *creux*, et mon tàbac,
Et pour mémoire, mon estomac."
—"Merci, mon père!"
—"Ecrivez, notaire!
Je donne à ma fille unique
Ma plus grande *colique*.
Je consens bien à son mariage,
Dans notre village.
Par son contrat,
Elle restera fille tant qu'elle voudra."
—"Merci, mon père!"
—"Ecrivez, notaire! . . . .
Je donne à mon fils Pierrot
Ma serpe à faire des fagots.
Je t'en prie, mon fils Pierrot,
Ne fais pas de fagots de rondins
Pour te dégourdir les reins.
Ne fais pas de fagots d'asperges,
Garnis de feuilles et de feuillages;
Mais de ces bons fagots de cabaret,
Qui durent une heure à peu près.
Fagots, fagotins, *fagotier*,
Fagots liés de tous côtés,

Fagots portant la mesure de toute la science,
Et tu deviendras la meilleur *fagotier* de France."
—"Merci, mon père!"
—"Ecrivez, notaire!"
Ici le notaire s'impatiente:
—"Sapristi! Michel Morin,
Si on écrivait tous vos desseins,
On n'en verrait jamais la fin!"
Michel Morin se proposait d'en dire bien davantage; mais la Mort qui l'environnait de tous côtés lui coupa le souffle de la vie.

I.—Contes païens.

De toutes les variétés de récits en prose, la plus remarquable et la plus populaire est sans contredit celle dont l'élément prédominant est le merveilleux. Les anciennes croyances ou superstitions païennes y apparaissent sans alliage. Il n'y est question que de magiciens, de fées, de géants, de nains, de monstres et de talismans opérant des merveilles. Les quarante-quatre contes de ce genre maintenant en notre possession se repartissent en plusieurs types. Dans les uns, des fées ou des animaux parlants protègent des faibles ou des orphelins persécutés. Dans d'autres encore plus nombreux, certains personnages, favorisés d'une telle protection, délivrent des princes ou des princesses métamorphosés, et réussissent à la fin à devenir rois ou princes. Les épreuves ou les malheurs temporaires que les sorcières ont causés à bien des endroits forment aussi le sujet d'un certain nombre de récits. Les titres de ces contes sont: 'Le Corps-sans-âme', 'La Sirène (ou Serène)', 'Le Dragon-de-feu', 'La Bête-à-sept-têtes', 'Le Lion et la belle', 'Thomas-bon-chasseur', 'Le prince de l'Epée-verte', 'Prince-Joseph', 'Petit-Jean et la princesse', 'Petit-Jean et le Cheval blanc', 'Le petit teigneux', 'Le Coq, la Poule et la Vache', 'La Belle-jarretière-verte', 'Les géants Quatre-vents', 'Le château du Pied-pendant', 'La fée galeuse de la mer Rouge', 'La chemise invisible', 'Cendrillon', 'Les paroles de fleurs, d'or et d'argent' et maints autres. Quelques extraits suffiront ici à titre d'exemples:

LE CORPS-SANS-ÂME (EXTRAITS)[1]

. . . Il aperçoit le long du sentier un vieux cheval mort et à moitié dévoré. Passant tout droit, il se hâte; mais, au bout d'une heure, il entend un vacarme épouvantable. Un lion, un aigle et une chenille se battaient pour avoir le cheval. Le lion dit à l'aigle: "Toi, l'aigle, va vite dire au jeune homme qui vient de passer de venir nous le séparer pour nous faire plaisir. Nous le récompenserons."

[1] Recueilli à Sainte-Anne (Kamouraska) en juillet, 1915, de N. Thiboutot.

L'aigle prend sa volée, et, arrivant au jeune homme, lui dit: "Venez donc séparer le cheval entre nous, un lion, un aigle et une chenille, qui nous battons pour l'avoir."—"Ah! je suppose que vous, bêtes, avez fini de manger cette pauvre carcasse."—"Ne craignez rien!" répète l'aigle. Bien en peine, le jeune homme *revire*, se disant: "J'étais toujours pour mourir quand même. J'y vas." Le voyant arriver, le lion dit: "Bonjour, maître des braves!" La chenille en dit autant. Et ils demandent: "Sépare ça entre nous; et ce que tu feras sera bien fait. Nous te récompenserons." Le jeune homme prend donc son canif (magique), coupe le cou du cheval et donne la tête à la chenille, disant: "Toi, la chenille, tu n'es pas grosse; tu mangeras la moëlle dans les os, et le crâne te servira d'abri dans le mauvais temps." Puis il éventre le cheval et donne les tripes à l'aigle, disant: "Toi, l'aigle, on te voit toujours sur la grève à manger du poisson. Ceci est pour toi." Et au lion il dit: "Je te donne le restant; ayant de bonnes dents, tu peux manger les os." Le lion s'écrie: "Merci, monsieur! c'est justement pour ça que je me battais." La chenille répète la même chose, et l'aigle en dit autant. "Pour te récompenser, dit le lion, je vas te donner la meilleure chose au monde." —"Quoi, mon lion que vas-tu me donner?"—"Regarde sous ma patte gauche de devant, et prends-y un poil blanc. Enveloppe-le dans ton mouchoir pour ne pas le perdre. Quand tu voudras devenir lion toi-même, tu n'auras qu'à dire 'Adieu, lion!', et tu seras le plus beau des lions et le maître de tous les lions." L'aigle, à son tour, dit: "Moi aussi, je vas te donner ma récompense. Regarde sous mon aile gauche, il y a une plume blanche. Arrache-la et conserve-la. Et quand tu voudras devenir aigle, tu n'auras qu'à dire 'Adieu, aigle!' et tu seras le maître des aigles et le plus beau de tous les aigles." Il reste encore la chenille. Elle dit: "Moi, je ne suis pas grosse, mais je te donne ma récompense *pareil*. Prends ma patte gauche d'en arrière et arrache-là. Quand tu voudras devenir chenille, tu n'auras qu'à penser à moi, et tu seras la plus belle et la maîtresse de toutes les chenilles. . . . . "

(*Autre extrait:*)

Comme le Corps-sans-âme se prépare à sortir de son château, la princesse 'gardée' dit: "Mon Corps-sans-âme! pourquoi sortez-vous et me laissez-vous toujours seule. Je crains que vous ne veniez à vous faire tuer"—"Ne crains pas! Il n'y a point de danger; personne ne peut me tuer."—"Mais comment donc?"—"Pour me détruire il faudrait qu'on me tue quand je suis en lion, qu'on éventre le lion et dans son corps prenne le pigeon qui s'y trouve; qu'on ouvre le pigeon et y prenne les trois œufs, et qu'on vienne me les casser sur le front."—"Ah! puisque c'est comme ça, il n'y a pas grand danger de malheur."

Le soir, l'aigle arrive encore et se *jouque* à la fenêtre. Ouvrant le chassis, elle le fait entrer. "Qu'est-ce-que le Corps-sans-âme t'a dit?" demande-t-il. Et elle lui raconte tout. Quand elle achève, il dit: "Moi, je puis faire tout ça, princesse."—"*Si tu en es capable*, jeune homme, mon père a fait battre un ban dans tout son pays que celui qui me délivrerait m'aurait en mariage."—"Ma princesse, ça sera demain une chose faite. Quand j'aurai tué le lion, il viendra ici en personne, bien malade; et il te demandera à boire. Prends bien garde de lui en donner. Si tu le faisais, il pourrait t'arriver malheur. En te frappant il te donnerait la mort."—"Ne craignez pas!" répond-elle.

Le lendemain, les deux lions se rencontrent, et voilà la chicane qui prend. *Ça se bat!* Toujours que le Corps-sans-âme finit par voler en éclats. Et quand le lion est mourant, le Corps-sans-âme arrive en personne au château. Il tombe paralysé, incapable de grouiller. "De l'eau, vite, vite!"—"Attends, répond la princesse; tu vas *beto* avoir ce qu'il te faut." De son coté, le jeune homme prend son canif d'argent, éventre le lion. Un pigeon en sort et s'envole dans les airs. Pensant à son aigle, le jeune homme devient aigle, et chasse le pigeon. L'ayant attrapé, il l'ouvre, prend les trois œufs et les enveloppe bien précieusement dans son mouchoir.

Il arrive au château du Corps-sans-âme, y entre, et le trouve paralysé: "N'approche pas ici, dit le malade, ou tu es mort si je saute sur toi."—"Ah! tu n'es pas dangereux." Prenant les trois œufs de pigeon, il les lui casse sur le front, d'abord un, et ensuite les deux autres. Voilà le Corps-sans-âme mort. . . . . .

TI-JEAN ET LA CHATTE BLANCHE.[1]

C'est un roi qui a trois fils. Un s'appelle Jean, un autre Cordon-bleu et l'autre Cordon-vert. Le roi, un jour, leur dit: "Tous trois vous êtes maintenant en âge. Celui de vous qui ira chercher le plus beau cheval aura ma couronne." Les garçons se *grèyent*, partent et marchent . . . Rendus à la fourche de trois chemins, Cordon-vert dit: "Je prends ce chemin." Cordon-bleu ajoute: "Et moi, ce chemin;" et Ti-Jean achève: "Et moi, l'autre chemin." Avant de se quitter ils se disent: "*Tel jour*, nous nous retrouverons tous trois à la fourche des chemins."

Mon Ti-Jean marche, marche jusqu'au bout du chemin. Là, il prend un petit sentier dans la forêt, et il marche. Arrivé près d'une petite cabane couverte de paille, il aperçoit une grande chatte blanche charroyant de l'eau avec quatre crapauds. Il s'assied et regarde.

[1] Récité par Paul Patry, en août, 1914, à Saint-Victor (Beauce). Patry dit avoir appris ce conte de sa mère, Geneviève Coulombe (née Patry).

Ayant empli une cuve d'eau, la chatte y met ses quatre crapauds, et *rrnyâo, rrnyâo,* s'y fourre elle-même. Et de la cuve d'eau sort une belle princesse, telle que Ti-Jean en a jamais vu. Elle lui demande: "Que cherches-tu ?"—"Un cheval, répond-il; nous sommes trois garçons, et notre père, le roi, a promis sa couronne à celui de nous qui ramènerait le plus beau cheval." La princesse lui dit: "Demain matin, je serai encore la grande chatte blanche que tu as vue. Tu iras dans mon écurie et prendras le plus galeux de mes crapauds. Une fois rendu chez ton père le roi, tu le renfermeras, et le lendemain, il sera devenu le plus beau cheval de la terre."

Comme de fait, le lendemain matin, Ti-Jean prend le crapaud et s'en va à cheval dessus, *patati patata.* Aux trois chemins, il rencontre ses frères, dont les chevaux sont fort beaux. Regardant Ti-Jean et son crapaud, ils disent: "Ne te montre pas ainsi à notre père, ou tu vas te faire tuer." Mais lui, il part par derrière eux, *patati patata,* fouettant sa monture d'une petite hart. "Ne nous suis pas, dirent-ils; c'est un vrai déshonneur!"—"Ça ne fait rien; allez-vous-en!" Ils arrivent sur le tard chez leur père, et mettent leurs chevaux à l'écurie. Ti-Jean passe l'étrille sur son crapaud, *perarrar.* . . . Et ses frères disent: "Tu va briser l'étrille de notre père."—"*Poupa* a les moyens d'en avoir une autre."

Le lendemain matin, Cordon-bleu et Cordon-vert se lèvent et vont montrer leurs beaux chevaux au roi. "Et Ti-Jean ?" demande-t-il. Ils répondent: "Ah, lui ? c'est un *crapotte.*"—"*Crapotte* ? Il faut que je le voie." Ti-Jean se lève après les autres. Son crapaud, c'était le plus beau cheval qu'on ait jamais vu, le crin en argent, et ferré en or. "Ah! s'écrie le roi, c'est Ti-Jean qui a gagné la victoire; c'est lui qui a le plus beau cheval. Mais, vous savez qu'un roi a trois paroles. *Ast'heure,* celui de vous qui me rapportera la plus belle toile *d'habitant* aura ma couronne." Et ils partent tous les trois sur leurs chevaux. Rendus à la fourche des trois chemins, Cordon-bleu dit: "Je prends le même chemin." Cordon-vert prend aussi le sien. "Moi, je prends aussi le mien," finit Ti-Jean, en partant. Il marche, marche, et arrive au petit sentier, et, de là, à la maison recouverte de paille. La grande chatte blanche charroie encore de l'eau avec ses trois crapauds. Ti-Jean s'assied et les regarde faire. Une fois la cuve pleine, *rrnyâo, rrnyâo,* la chatte blanche se fourre dans la cuve, et en ressort une belle princesse. Elle dit: "*Ast'heure,* mon Ti-Jean, que cherches-tu ?" Il répond: "Je cherche la plus belle toile du pays que mon père ait jamais vue."—"Demain matin, reprend la princesse, je serai redevenue une grande chatte blanche. Tu regarderas dans ma petite commode, et tu y prendras la plus vilaine noix qui s'y trouve et la mettras dans ta poche. Arrivé chez ton père tu la fendras avec un couteau; et il en sortira trente aunes de la plus belle toile qui se puisse voir."

Cordon-bleu et Cordon-vert se rencontrent aux trois chemins. Ah! qu'ils ont de la belle toile! Mais Ti-Jean, ayant mis la noix dans sa poche, n'en avait pas. Un de ses frères lui demande: "Ti-Jean, je *cré ben* que tu n'en as pas?" A quoi il répond: "Je *cré ben* qu'avec autant de toile que vous en avez, mon père en aura assez."

Chez leur père le roi, le matin, ils se lèvent et s'en vont montrer leur toile. Leur toile est belle. Celle de Cordon-vert surtout est *dépareillée.* "Quant à Ti-Jean, je *cré ben* qu'il n'en a pas." Mais Ti-Jean *ressoud* et donne la noix à son père, en disant: "Fendez-là sur la table avec un couteau." Le roi fend la noix et en tire trente aunes de la plus belle toile qu'il ait jamais vue." Il dit: "C'est encore Ti-Jean qui a gagné la victoire. Mais vous savez qu'un roi a trois paroles. *Ast'heure,* il vous reste encore une chose à faire." —"Qu'est-ce que c'est?" demandent-ils. "Celui qui ira *q'ri* la plus belle femme aura ma couronne, et, cette fois, c'est le *boute.*" Ils repartent donc tous trois, Cordon-vert et Cordon-bleu sur leurs chevaux, et Ti-Jean sur son crapaud. Cordon-bleu dit: "Je reprends encore le même chemin." Cordon-vert: "Moi aussi." Et Ti-Jean: "Je prends aussi le mien." Marche, marche, et Ti-Jean arrive à la cabane couverte de paille, et revoit encore la grande chatte blanche charroyant de l'eau avec ses crapauds. *Rrnyâo, rrnyâo,* et la chatte plonge dans la cuve pleine d'eau et en ressort belle princesse. Et Ti-Jean en *tumbe* sur le cul d'admiration, tellement il la trouve belle. "Dis-moi donc, Ti-Jean, ce que tu cherches? Voilà bien ton troisième voyage ici." Et sa réponse est: "Mon père le roi, vous savez, a trois paroles. Il a dit: 'Celui qui m'amènera la plus belle fille, c'est le *boute,* il aura ma couronne'." Et il ajoute: "*Ast'heure,* je n'en vois pas sur la terre de plus belle que vous."—"Moi, dit-elle, je suis métamorphosée, et je ne redeviendrai princesse que si le fils d'un roi m'épouse." Ti-Jean dit: "C'est bon!"—"Demain matin, ajoute-t-elle, je serai encore grande chatte blanche. Tu atteleras mes quatre crapauds à mon vieux carrosse, et nous nous en irons ensemble."

Le lendemain matin, Ti-Jean se lève et revoit la princesse métamorphosée. Au carrosse il attelle les crapauds et s'assoit sur le petit siège, la grande chatte blanche près de lui. *Ça fait de manière qu'*elle se frôlait contre lui, se promenait sur ses genoux et frottait ses joues contre les siennes, *rrnyâo, rrnyâo.*

Ses frères arrivent à la fourche des quatre chemins. *Acré,* ils avaient des belles filles! Puis ils regardent Ti-Jean avec sa chatte blanche et les quatre crapauds, et disent: "*De ce coup-là,* c'est le restant; Ti-Jean va se faire tuer!" Et ils avaient un plaisir! "Avec ce vieux carrosse et ces quatre crapauds, ne nous suis pas, au moins!"—"Allez-vous en donc!" répond-il. Et le voilà par derrière eux, fouettant d'une hart ses crapauds, tandis que la chatte blanche se frôle dans son visage en miaulant, *rrnyåo, rrnyåo.* Les trois frères arrivés chez leur père, Ti-Jean emmène la chatte blanche dans sa chambre, et va étriller ses crapauds *bring, brang, brang.* "Ti-Jean, tu va briser l'étrille de notre père le roi."—"Notre père est capable d'en avoir une autre."

Le matin, ah! le roi trouve que Cordon-vert et Cordon-bleu ont des belles *criêtures.* Et il demande: "Ti-Jean?"—"Ah, lui! il a une grande chatte blanche."—"Que ce soit ce que *ça voudra,* il faut que je la voie." Et mon Ti-Jean *ressoud* avec sa princesse par la main. *C'est pas ça!* le roi n'en revient pas. Il n'a jamais vu de si belle *criêture* de sa vie. Et ayant attelé les crapauds, Ti-Jean arrive avec quatre chevaux sans pareils et un carrosse comme on n'en avait jamais encore vu. Les trois frères partent et s'en vont ensemble se marier à chacune de leurs belles, et Ti-Jean avec la princesse. "C'est mon Ti-Jean qui a gagné ma couronne," dit le roi; et enlevant sa couronne de sa tête, *bang!* il la met sur celle de Ti-Jean.

Ça fait de manière . . J'étais aux noces. Mais depuis ce temps, je n'ai pas revu ces gens-là, et je ne sais pas comment ça se passe là-bas.

TI-JEAN ET LE CHEVAL BLANC[1] (EXTRAITS).

. . . . La vieille magicienne l'engage donc, et dit: "C'est pour soigner un cheval noir et un vieux cheval blanc. Tiens! au cheval blanc tu ne donneras que de la paille; et voici un bâton; tu le battras tant qu'il te plaira. Mais, mon cheval noir, tu le soigneras au foin et à l'avoine et tu le brosseras tous les jours." Ti-Jean répond: "Ça sera fait."

Ast'heure, elle l'emmène au château et lui montre tout, ouvrant les portes sur un sens, sur l'autre, et partout. Arrivant à une porte, elle dit: "Quant à celle-ci, ne l'ouvre pas, ou je te mettrai à mort."—"Ne craignez pas!" répond-il. . . .

La vieille partie, Ti-Jean va soigner ses chevaux. Le cheval blanc lui dit: "Ne me bats donc pas et me soigne bien. Je te rendrai service plus tard. Quant au noir, donne-lui de la paille, et *foute*-lui la volée, à son tour. Tu verras!" Ti-Jean dit: "Tiens! tu parles, toi?"—"Ah, oui! et je te sauverai la vie." Le petit garçon soigne son cheval blanc au foin et à l'avoine, et donne une bonne volée à l'autre. Ah! le noir trouve ça dur, lui qui n'y est pas habitué.

[1] Récité par Paul Patry, en août, 1914, à Saint-Victor (Beauce). Patry dit avoir appris ce conte de sa mère, Geneviève Coulombe (née Patry).

L'ennui le prenant, Ti-Jean *débarre* la porte défendue. . . . . Un grand trou sans fond, et une échelle qui descend. "Dis-moi donc ce qu'il peut bien y avoir là!" Prenant l'échelle, il descend, descend, descend. —Il était comme moi, il avait les cheveux longs *effrayant*. Rendu au bas de l'échelle, il se fourre la tête dans la fontaine d'or, et sort de là avec une belle chevelure dorée. "*De ce coup-là*, pense-t-il, la bonne-femme va me tuer." . . .

Avant le retour de la magicienne, le cheval blanc dit à Ti-Jean: "Mon petit garçon, c'est le temps de déserter. Tu te ferais tuer pour t'être mis la tête dans sa fontaine d'or." Et ils se *grèyent* pour partir. "Prends l'étrille et une bouteille, dit le cheval blanc; bride-moi et partons! Quand elle arrivera, ça ne sera pas drôle." *Comme de fait*, Ti-Jean prend l'étrille, une bouteille, et les met dans sa poche, bride son cheval blanc; et ils partent. Le cheval dit: "Touche, et filons!"

La magicienne *ressoud*. Pas de cheval blanc ni de garçon. Elle dit: "Le petit bougre, il a fait quelque méchant coup!" Et pendant que Ti-Jean et le cheval blanc se sauvent à l'épouvante, ils voient venir, en arrière, une tempête terrible. Le cheval dit: "C'est la vieille magicienne qui court après nous. Si elle nous rattrape, c'est la mort." Et la tempête approche. Quand elle est tout près, le cheval dit: "Jette ton étrille!" Jette l'étrille; et voilà une montagne d'étrilles dans laquelle la vieille et son cheval noir s'empêtrent. Ti-Jean et son cheval continuent; et *ça mène!* Après une *escousse*, ils s'aperçoivent que le temps noircit, regardent en arrière, et *je vous dis que ça* vient! Le cheval blanc dit: "C'est encore la vieille. S'il faut qu'elle nous rejoigne, nous sommes morts tous les deux. Quant elle sera tout près, jette la bride." Et Ti-Jean jette la bride. Voilà une montagne de brides *épouvantable*. La bonne-femme voit l'heure qu'elle ne s'en *démancherait* pas, tandis que les autres filent. Après *un bout de temps*, elle s'en *démanche*, et part encore après eux. Le temps devient encore noir et la tempête casse et arrache les arbres. "S'il faut qu'elle nous *pogne, de ce coup-là*, c'est fini. Jette la bouteille!" Ti-Jean jette la bouteille; et voilà une montagne de bouteilles *épouvantable*. Prise dans les bouteilles, essayant de monter, la vieille roule toujours en bas. C'est impossible! elle ne peut pas s'en *démancher*. . . . . .

(*Extrait*)

. . . . Le roi, en arrivant, dit: "Un beau prince tout en noir a encore gagné la victoire et fini la guerre." Il fait battre un ban que celui qui lui apporterait le bout de la lance cassée (*dans la cuisse du héros*) aurait sa fille en mariage et sa couronne. On vient de tous *bords et tous côtés* avec des bouts de fourche, de *broc* et de faucille, pour essayer de les coller à la lance. Mais c'est inutile. . . .

Le vieux cheval blanc dit: "Mon Ti-Jean, allons-y vêtus tout en noir, comme au dernier jour de la guerre, quand tu as été blessé." Et ils partent pour le château, Ti-Jean habillé en noir et ses beaux cheveux d'or lui battant sur le dos. "C'est le dernier prince venu à ma guerre," dit le roi. On essaie encore de le prendre au passage, mais sans y réussir. Le roi remarque: "C'est bien curieux! on ne peut pas les prendre, ni trouver qui ils sont." . . . .

. . . . Au roi qui entre au château, Ti-Jean, le jardinier, dit: "Venez voir, sire le roi, si ce bout de lance ajuste à la vôtre." L'ayant essayé, le roi reconnaît que c'est le vrai, cette fois. "J'ai promis ma fille en mariage et ma couronne à celui qui m'apporterait le bout cassé de ma lance." Et le prenant par la main, il l'emmène voir ses trois filles, en disant: "Prends celle que tu voudras!" Ti-Jean tend la main à la plus jeune et la plus belle des trois. Fâchées, les deux autres se mettent à *brailler*, "*Voir que* le beau prince a choisi la plus jeune."

Après le mariage, le roi remet sa couronne à Ti-Jean. Le vieux cheval blanc vient et dit: "Mon Ti-Jean, tu es marié. Je viens donc te voir pour la dernière fois. *Ast'heure*, tue-moi et fends-moi en deux." Ti-Jean prend une hache, tue son cheval blanc, le fend en deux; et un beau prince en sort, disant: "Merci bien!" Le vieux cheval blanc était un prince que la vieille sorcière avait *amorphosé*. . .

LES DEUX MAGICIENS[1] (EXTRAIT).

. . . Quand le magicien est parti, les servantes vont à l'écurie et voient le cheval se frotter à la *barrure* pour montrer qu'il a faim et soif. Elles disent: "Ce pauvre cheval a faim et soif. Sortons-le de l'étable et allons le faire boire." Elles l'emmènent à la rivière. Mais, ayant encore la bride etl a selle, il ne veut pas boire, et se frotte pour tâcher de les ôter. Les servantes disent: "Pauvre cheval! ôtons sa bride et sa selle, pour qu'il puisse boire." Aussitôt dessellé et débridé, il leur échappe et *se file en quatre dans* la rivière.

Le vieux magicien arrive le même soir. "Avez-vous fait boire le cheval?" Elles répondent: "*Quand on pense!* Nous sommes allées le faire boire à la rivière, mais avec sa bride et sa selle, il ne voulait pas boire. Aussitôt que nous les lui avons ôtées, il nous a échappé et *s'est filé en quatre dans* la rivière." Le magicien engage cinq cents pêcheurs et cinq cents seines pour pêcher les carpes dans la rivière. Pour ne pas être attrapé, le prince, devenu carpe, se change en beau

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[1] Récité à Sainte-Anne (Kamouraska), en juillet, 1915, par Achille Fournier, qui dit l'avoir appris, il y a près de 25 ans, d'une vieille dame Louis Dionne, alors agée de 80 ans.

diamant jaune sur le bord de la rivière. Une princesse, passant par là, trouve le beau diamant, le prend, le met dans son estomac et s'en va. Plus loin, le diamant se change en prince et sort de son estomac en disant: "Oui, je me suis changé en diamant jaune *pour pas qu'il* me *seinît* dans la rivière. Je vas me mettre dans une pomme, et quand le vieux magicien passera chez vous, demain, vous prendrez la pomme et la lancerez contre le mur. Tous les pépins vont *revoler* dans la place; et vous mettrez le pied sur celui qui tombera *à ras* vous."

Le lendemain, le magicien arrive chez la princesse, et dit: "Princesse, avez-vous trouvé un beau diamant jaune sur la grève, hier? Je voudrais l'avoir." En répondant: "Oui, je vas vous le donner," elle prend la pomme et la jette *après* le mur. Comme les pépins *revolent* dans la place, le magicien se change en coq, et il se met à les manger. La princesse lève aussitôt le pied, et voilà le pépin qui se change en renard. Et crac! le renard dévore le coq. Le magicien est détruit. . . .

LES PAROLES DE FLEURS, D'OR ET D'ARGENT[1] (EXTRAIT).

Une fois, il est bon de vous dire, c'était un roi qui avait une belle petite fille. S'étant marié en secondes noces à une veuve qui avait aussi une fille du même âge, il passait son temps à la chasse. La belle-mère, elle, tenait l'enfant du roi en esclavage, devant la cheminée, et l'appelait sa 'petite *Cendrouillonne.*'

Voulant la faire détruire, elle lui dit, un jour: "Ma petite *Cendrouillonne*, va à la cabane des fées chercher de l'eau de *la rajeunie.*" La petite fille s'en va donc à la fontaine, où elle rencontre la vieille magicienne. "Que cherches-tu, ma petite fille?" Elle répond: "Je suis venue chercher de l'eau de votre fontaine."—"Bien! cherche-moi des poux dans la tête." Et pendant que la petite fille cherche, elle demande: "Que trouves-tu dans ma tête?"—"Je vous trouve des grains d'or et d'argent."—"Quand tu parleras, ma petite fille, il sortira de ta bouche de l'or, de l'argent et des belles fleurs." Ayant pris de l'eau de *la rajeunie* à la fontaine, elle s'en va trouver sa belle-mère. "Tiens! en voilà de l'eau de la fontaine de la vieille magicienne." Comme elle parle, des fleurs, de l'or et de l'argent tombent de sa bouche. Voyant ça, la belle-mère se dit: "Il faut que j'y envoie aussi ma fille." L'enfant arrive chez la fée magicienne de la fontaine, qui lui demande: "Que viens-tu faire ici, ma petite fille?"—"Je viens chercher de l'eau de *la rajeunie* à la fontaine."—"Bien, dit-elle,

[1] Récité à Sainte-Anne (Kamouraska) en juillet, 1915, par Achille Fournier, qui dit avoir appris ce conte d'un vieux Edouard Lebel, aussi de Sainte-Anne, et décédé il y a une douzaine d'années.

cherche donc dans ma tête." Et quand la fille cherche, elle demande: "Que trouves-tu dans ma tête, ma petite fille?"—"Je vous trouve des poux et des *landes*." Fâchée, la vieille magicienne refuse de lui laisser prendre de l'eau de la fontaine, et lui dit: "Quand tu parleras, il te sortira de la bouche des crapauds et des couleuvres." Comme elle arrive chez elle, sa mère lui demande: "As-tu apporté de l'eau de *la rajeunie*?" Elle parle, et des crapauds et des couleuvres tombent de sa bouche. . . .

Un certain nombre de contes de caractère païen semblent appartenir à trois groupes additionels. Dans le premier, le héros est un personnage bienveillant, mais doué d'une force redoutable, qui réussit toujours dans les entreprises les plus extraordinaires; dans le deuxième, le héros—comme Parlafine ou Petit Poucet—est petit, faible, et passe même pour un idiot. Mais rien n'échappe à sa ruse, pas même les géants. Le troisième groupe est celui de certains objets merveilleux qui font la fortune de leur possesseur, quel qu'il soit. Les contes des héros puissants ont pour titre: 'Petit-Jean-petit-bois', 'Fesse-ben', 'Ti-Jean et le nain', 'Dom Jean', et 'La petite Capuche-bleue'. Ceux du héros faible mais rusé sont: 'Le conte de Parle', 'Ti-Jean s'*essèye* avec les géants', 'Antoine et Joséphine', et 'Parlafine ou Petit-Poucet.' Les contes où des charmes passifs, obéissant à leurs possesseurs, produisent des effets merveilleux, sont: 'Le médaillon', 'Petit-Jean commerçant', 'L'âne, la serviette et le bâton', et 'Bâton tape'. Des extraits serviront d'exemples:

PETIT-JEAN-PETIT-BOIS[1] (EXTRAITS).

. . . A l'âge de quatorze ans, Petit-Jean-petit-bois s'en va chez le roi, et dit: "Sire le roi, vous n'auriez pas besoin d'un engagé?"—"Oui, si tu veux aller battre au fléau dans ma grange, je suis prêt à t'engager." Une fois engagé, Petit-Jean-petit-bois s'en va à la grange, cherche le fléau, mais ne le trouve point. Il revient et demande: "*Ous-que* vous avez mis le fléau, sire le roi?" Le roi répond: "Sur les entraits".—"Mais, sire le roi, ce n'est pas un fléau, c'est une hart! Je vas aller m'en chercher, un fléau." Et dans la forêt, il s'en fait un gros comme une tonne, et le *maintien* en proportion. *Ça fait* qu'il dit au roi: "Donnez-moi donc du cuir pour faire mon fléau."—"Comment-*ce qu*'il t'en faut? Il y a un *quatre-côtés* au grenier, prends-le." Et Petit-Jean-petit-bois emploie tout le *quatre-côtés* de cuir.

Une fois le fléau complet, Petit-Jean-petit-bois s'en va à la grange et se met à battre. Au premier coup de fléau, voilà la

[1] Récité à Sainte-Anne (Kamouraska) en juillet, 1915, par Achille Fournier, qui dit l'avoir appris, il y a près de quarante ans, d'Edouard Lizotte, anciennement de Saint-Roch-des-Aulnaies.

grange qui *tumbe à terre.* Quand le roi voit sa grange à terre: "Dis-moi donc! ce n'est pas qu'un petit homme, ce Petit-Jean-petit-bois-là." Il dit à sa femme. "Tiens! ma femme, il faut s'en défaire. Je vas l'envoyer au moulin du diable, pour le faire détruire."

Le roi, le lendemain, fait charger une charrette de poches de grain; et quand elle est pleine jusqu'aux *échelles et haridelles*, il dit à Petit-Jean: "Va chercher deux chevaux, attelle-les à la charrette, et va porter ce grain au moulin."—"Sire le roi! je n'ai pas besoin d'atteler vos mouches." Et malgré qu'un cheval en eût eu plus que sa charge, il s'attelle lui-même dans les *menoires*, part, et arrive au moulin pendant que le diable est *après* moudre. Prenant une poche de grain chaque main, Petit-Jean-petit-bois les envoie *revoler* dans le moulin, et demande: "As-tu le temps de moudre mon grain?" En répondant "Oui!" le diable se met à engrener son grain, pendant que les moulanges font tic et tic et tic et tac, tic et tic et tic et tac. . . . Puis, prenant une poignée de grain, le diable la jette dans les yeux de Petit-Jean, qui dit: "Tu ne comptes toujours pas m'envoyer de la farine dans les yeux? Tu n'as plus que deux fois à le faire avant que je te donne la plus fine volée que tu aies jamais eue." Et le diable continue à engrener son grain. . . . Le moulin marche, marche encore, tic et tic et tic et tac. . . . Tout à coup le diable prend une poignée de farine et la jette encore dans les yeux de Petit-Jean-petit-bois, qui, prenant des grosses tenailles, accroche le diable par les narrines, derrière sa charrette. "Petit-Jean, crie le diable, lâche-moi! Je n'aurai jamais droit sur toi." Le lui ayant bien fait promettre, Petit-Jean le relâche, prend sa *moulée de grain*, et s'en retourne au château. . . .

DOM JEAN[1] (EXTRAITS).

Il est bon de vous dire qu'une fois, il y avait un pays. C'était la coutume, dans ce pays, de vendre au piquet, tout comme des bœufs, les hommes qui étaient capables de lever plus que leur propre poids. Or, Dom Jean, un homme de ce pays, ayant levé un poids plus lourd que lui, fut mené à la ville pour y être vendu. Et l'encanteur cria: "Que m'offre-t-on pour Dom Jean?" Pas de réponse. "Que m'offre-t-on pour Dom Jean, un gros travaillant, un beau gars?" Le roi se trouvant à passer par là, un fainéant qui s'était accroché à sa voiture répond: "Dix piastres, au nom de monsieur le roi."—"*Ah ben*! dit le roi, je ne puis pas mentir à ma parole; il me faut donc payer." Et il emmène Dom Jean avec lui au château. "Tiens, la reine! dit-il en entrant, j'ai acheté un homme au piquet,

[1] Recueilli et écrit par Mademoiselle Evelyn Bolduc, de Saint-Victor (Beauce) en automne, 1914. Conteur, Paul Patry.

Dom Jean; sûrement, tu es contente?" La reine, une *criéture* espiègle et maligne, répond: "Oui, oui! toi, tu voudrais être entouré de tous les fainéants et les voyous du canton. Je ne veux pas voir Dom Jean à la maison." Pour plaire à la reine, le roi envoya son nouveau serviteur travailler au jardin, où il y avait déjà quatre jardiniers. Voyant arriver Dom Jean, ces hommes se mirent à bougonner. "Nous n'avions pas besoin de celui-là; le roi devient ennuyant avec toutes ses idées."—"Mais mettez-le au plus dur de la besogne," dit le roi qui, les ayant entendus, voulait les apaiser. "C'est bon, c'est bon, monsieur le roi!" Et ils envoyèrent Dom Jean à un coin du jardin, dans un marécage où il ne venait que des halliers, des framboisiers et des saules. *Cri, cra,* Dom Jean arrachait, sarclait, aplanissait. Vers dix heures du matin, il fit un beau carré, où il sema des graines qu'il avait apportées avec lui. Et, le soir, il y cueillit trois beaux bouquets, qu'il alla porter, l'un au roi, l'autre à la reine, le troisième à la princesse leur fille. "Vous voyez, dit la princesse, c'est le premier de vos serviteurs qui pense à me faire un présent."—"Oui, reprit la reine, tu prends toujours pour ton père; aussi, tu n'as de goût que pour les fainéants." . . . .

LE CONTE DE PARLE[1] (EXTRAITS).

Une fois, c'était une veuve et ses trois garçons, Georges, Charles et Jean. Le *soubriquète* de Jean était 'Parle'.

Un bon jour, la guerre éclate. Charles et Georges disent à leur mère: "*Mouman*, nous allons à la guerre. Parle va rester ici pour vous aider et avoir soin des animaux." Parle dit: "Moi *itou* j'y vas." Mais ses frères répondent: "*Mouman*, il n'est pas *ben fin*, lui, gardez-le ici." Ils partent; mais Parle, qui va vite, les rejoint le lendemain. Le voyant venir, ses frères disent: "Va-t'en, Parle, tu viens pour nous faire honte. Va-t'en! on n'a pas besoin de toi" . . . Georges et Charles arrivent chez le roi et s'engagent. Et Parle s'engage ensuite. . . .

En visitant ses troupes, un jour, le roi dit à Georges et à Charles: "Mais, ce jeune homme-là qui est venu avec vous est intelligent *effrayant*." Jaloux de leur frère, ils répondent: "Sire le roi, votre Parle, que vous dites si fin, savez-vous ce qu'il a dit?"—"Non, non, mes soldats, je ne le sais pas."—"Bien! il s'est vanté d'être capable d'aller chercher les bottes du géant, qui marchent sept lieues au pas, et qui sont enchaînées sous son lit avec une chaîne de fer aux mailles de trois pouces *de gros*." Le roi reprend: "Ah, par exemple! s'il a dit ça, il va le faire. Des bottes de sept lieues seraient bien commodes

[1] Recueilli à Sainte-Anne (Kamouraska) en juillet, 1915, de Narcisse Thiboutot, qui dit avoir appris ce conte, il y a une dizaine d'années, de feu Charles Francœur.

à la guerre." S'en allant trouver Parle, il dit: "*Cou'don*, mon Parle, tu t'es vanté d'être capable d'aller chercher les bottes du géant, qui font sept lieues au pas?"—"Non, sire mon roi; je ne m'en suis pas vanté. Mais, s'il le faut, je vas y aller, *d'abord que* vous me donnerez ce que je vas vous demander."—"Que me demandes-tu, mon Parle?"—"Je demande un habillement couleur d'invisible, avec une lime qui coupe un pouce du coup."—"Oui, mon Parle, tu vas les avoir. Et s'il ne te faut que ça, tu vas aller chercher les bottes." . . . . Quand on les lui donne, Parle se met l'habit, prend le chemin et arrive chez le géant pendant qu'il soupe avec sa femme et sa fille. Rentrant sans être vu, il passe dans la chambre et se fourre sous le lit où les bottes sont enchaînées. Après la veillée, le géant et sa bonne-femme se couchent et dorment. Quand ils commencent à ronfler, Parle se dit: "Voilà le temps pour couper la chaîne." Il prend la lime et *groung*, en donne un coup. Faisant un saut, le géant dit: "Aie, ma bonne-femme! il y a quelqu'un sous le lit."—"*Dôrs* donc, mon pauvre fou! Tu vois bien que tu rêves; personne ne viendrait ici, sous le lit." Il répète: "Certain! il y a quelqu'un sous le lit. J'y vas voir." Sans perdre de temps, la vieille lui *pousse une claque sur la gueule:* "Tu vas dormir, toi, mon *mor'né!*" Et le géant s'*endôrt* de nouveau. . . . Pendant ce temps-là, Parle, sous le lit, se met une botte à chaque pied, donne une troisième coup de lime, et la chaîne casse. Il prend la porte vitement, et court chez le roi. . . .

Le lendemain, pendant que le roi visite encore ses troupes, Georges et Charles lui disent: "Sire le roi, Parle s'est vanté d'être capable d'aller chercher la lune du géant, qui éclaire *notre besoin*."—"Ah! s'il s'en est vanté, répond le roi, je vas la lui envoyer chercher, comme les bottes du géant." S'en allant trouver Parle, il lui dit: "Tu t'es vanté de pouvoir aller chercher la lune du géant, qui éclaire *notre besoin*?"—"Sire le roi, je ne m'en suis pas vanté. Mais s'il le faut, je vas y aller, *d'abord que* vous me donnerez ce que je vas vous demander."—"Que te faut-il?"—"Je ne demande pas grand'chose, un petit sac de sel de cinq livres." Le roi lui donne un sac de sel.

Parle met son habillement invisible, part, arrive chez le géant, qui *est après* faire de la bouillie dans un grand chaudron, pendu dans une cheminée du temps passé. Sans être vu, il grimpe dans la cheminée et verse son sac de sel dans la bouillie. Quand la bouillie est cuite, le géant *hâle* la bouillie, la met sur la table et commence à manger avec sa fille: "Mais, *la mère!* tu as bien salé la bouillie, *à* soir." —"Pauvre vieux fou! je n'y ai pas mis de sel."—"La bouillie est salée *effrayant*; elle n'est pas mangeable." Et il dit à sa fille: "Va chercher de l'eau." Elle répond: "Oui! mais il fait *ben que trop* noir pour aller chercher de l'eau à la fontaine." Son père dit: "Prends la lune qui est dans sa boîte, et mets-là sur son *bas-côté*." Prenant la lune, la fille la place sur son *bas-côté*, et s'en va chercher de l'eau à la fontaine. Parle aussitôt saisit la lune, la met dans son gilet, prend le chemin et s'en va chez le roi, la lui remettre. . . .

ANTOINE ET JOSÉPHINE[1] (EXTRAIT).

. . . Après avoir passé sept ans dans la forêt, Antoine dit à sa petite sœur: "Il ne faut pas rester ici plus longtemps, les loups hurlent *à cœur de* jour. A la fin, nous nous ferions dévorer. Fais bien attention! Je vas monter dans le plus grand arbre; et du côté où je verrai une lumière, je jetterai ma calotte. Mais fais bien attention!" Une fois monté dans l'arbre, il aperçoit une petite lumière, bien loin. De ce côté il jette sa calotte. Et puis, tous deux partent dans cette direction, s'en allant à peu près, dans la forêt. Tout à coup ils aperçoivent une clarté, et ils arrivent près d'une petite maison où trois géants sont à jouer aux cartes. Une grande chose pendait au nez d'un des géants, qui ne prenait pas le temps de se moucher. Antoine dit à sa sœur: "Ah! qu'il me donne mal au cœur! je vas le moucher."—"Il ne faut pas faire ça. Tu sais que ce sont des géants et qu'ils vont nous dévorer." Prenant son arc et une flèche, le petit garçon vise à travers un petit trou dans le mur de la cabane; et le géant est mouché. Voilà les géants pris, se battant ensemble. L'un dit: "Qui m'a mouché? Oui, c'est toi!"—"Non, ce n'est pas moi." —"Oui, c'est toi!" Et tout ça pour savoir qui l'avait mouché. Ils se raccordent ensuite et recommencent à jouer aux cartes.

La chandelle qui les éclaire est toute pleine de chapeaux, comme ils ne prennent pas la peine de la moucher; ils et ne voient presque plus. Antoine dit: "Je mouche la chandelle."—"*Va donc pas!* tu as vu comme ils se sont tout à l'heure battus ensemble. Ils vont nous dévorer, c'est certain."—"J'aime autant me faire dévorer que de crever de faim." Il prend son arc, et d'une flèche mouche la chandelle. Voilà la chandelle tuée. Les géants disent: "Il faut toujours *ben* voir qui nous joue des tours comme ça, qui nous mouche et mouche la chandelle." Les enfants, dehors, ne sont pas *gros*, surtout quand ils voient les trois géants approcher. . . . .

L'ÂNE, LA SERVIETTE ET LE BÂTON (EXTRAIT).

. . . La fée dit: "Vous devez coucher quelques part sur le chemin, où on vous joue des tours (*et prend ce qui vous appartient*)" —"Oui, je couche à une maison, sur le chemin."—"Tiens! *ast'*-

[1] Raconté par Mme P. Sioui (née Picard), à Lorette, en août, 1914.

[2] Raconté par Paul Patry, de Saint-Victor (Beauce) en août, 1914.

heure, dit-elle, voici un gros bâton. Quand tu diras 'Guerre, mon rond bâton!' il fessera partout jusqu'à ce que tu dises 'Arrête, mon rond bâton!"

Le vieux couche encore au même endroit, met son bâton derrière la porte, et dit: "Ne touchez pas à mon bâton, car en disant 'Guerre, mon bâton rond!', il fesse partout." Durant la nuit quelqu'un se lève et dit: "Il faut voir si c'est vrai; ça serait *ben* bon pour la guerre." Ils prennent donc le bâton, disant: "Fesse, bâton rond!" Et le bâton rond se met à jouer à leur tête et partout, les jettant *à* terre à force de fesser. Rien ne peut l'arrêter. Allant réveiller le bonhomme, ils disent: "Arrête le bâton, il achève de nous tuer!"—"*Ast'-heure,* j'arrêterai le bâton quand vous me remettrez mon âne et ma serviette." Le petit âne *crottant* l'or, et la serviette donnant à boire et à manger, je vous dis qu'ils les lui redonnent!

En arrivant chez sa bonne-femme, il dit: "Tu vas voir, *de ce coup-là,* je les ai." Il souhaite une belle table et tout ce qu'il faut pour boire et manger. Et *d'un crac,* voilà le repas *grèyé* sur la serviette. Ah! la bonne-femme est *ben* contente. Elle dit: "*Ast'heure,* allons à notre petit âne."—"Tu vas voir!" dit le vieux. "Ah! tu vas encore me jouer un tour?" Elle met un vieux tablier, pensant: "C'est assez bon, pour le faire encore salir!" Le vieux fesse *sur* la queue du petit âne avec une hart, disant: "*Crotte,* mon âne!" Et *brrr brrr,* le tablier de la vieille en défonce. Elle dit: "Si tu m'avais dit ça, j'aurais mis un tablier neuf." . . .

II.—LES FABLES.

Les fables et les récits où des animaux ont le don de la parole ne semblent pas très nombreux au Canada. Jusqu'ici nous n'en avons réuni que quelques-uns, à savoir: 'L'Ours et le Renard', 'Le Loup menteur', 'Le Loup et le Renard', 'Les secrets du Lion, de l'Ours et du Loup', et deux versions du conte du 'Chat au pays des Rats'. Il est bon de noter que les fables, aussi bien que les contes, sont tous dénués de conclusion explicite ou de morale philosophique ainsi que la mode l'exigeait dans les temps historiques, en Europe. La préoccupation du conteur canadien était plutôt d'amuser que de moraliser ou d'instruire. En voici des exemples:

LES SECRETS DU LION, DE L'OURS ET DU LOUP[1] (EXTRAITS).

. . . . Son frère l'emmène au bord d'une rivière dans la forêt, et là, il le jette à l'eau. . . . L'aveugle à la fin réussit à s'accrocher à une branche au bord de la rivière, et à se retirer de l'eau. Dans la

[1] Raconté par Mme P. Sioui, en 1914, à Lorette. Ce conte lui venait de Marie Michaud (née Picard), sa mère.

crainte de se faire dévorer par les loups, il vient à bout de grimper dans un arbre, en se disant: "Là, du moins, je ne me ferai pas manger."

Vers le soir, un ours, un lion et un loup arrivent ensemble au pied de l'arbre. Pendant qu'ils conversent, l'ours dit: "J'ai un secret, moi." Le lion répond: "Moi aussi." Et le loup: "Moi aussi, j'en ai un." L'ours reprend: "Le prince est bien malade, mais je suis capable de le guérir. Il y a un gros crapaud sous son lit: c'est ce qui le tient malade. Je n'aurais qu'à l'ôter de là, et le prince reviendrait à la santé." Le lion dit à l'ours: "Voici mon secret: le roi est aveugle; je n'aurais qu'à prendre une feuille de cet arbre-ci et à lui en frotter les yeux pour qu'il recouvre la vue." Quant au loup: "Moi, j'ai un secret: dans le village, *ils* n'ont pas une goutte d'eau. Ils n'auraient qu'à ôter une pierre sous l'église pour que l'eau revienne."

Ayant entendu cette conversation, le jeune homme dans l'arbre prend une feuille, s'en frotte les yeux, et voit clair; prend une autre feuille et le met dans sa poche. . . . (*De là, il va guérir le prince et le roi, et fait jaillir l'eau en ôtant la pierre.*)

. . Une fois parti, mon garçon rencontre *ben* son frère: "Tiens! bonjour mon frère; tu vois clair!" Et se jetant à ses pieds, il lui demande pardon. "Dis-moi n'importe quelle pénitence, et je la ferai." Son frère lui répond: "Mais va donc à l'endroit où tu m'as quitté aveugle. Là, monte dans l'arbre au bord de la rivière." C'est ce que son frère fait.

Le soir venu, l'ours, le lion et le loup arrivent encore à la même place, sous l'arbre; et en colère de voir leurs secrets découverts, ils se mettent à regarder dans l'arbre. Y apercevant un homme, ils s'écrient: "C'est lui qui nous a déclarés, mangeons-le!" Et ils le dévorent à belles dents. . . .

III.—Contes fantastiques où le merveilleux est imité ou parodié.

Les récits assez nombreux qui se rangent sous cette rubrique sont pour la plupart comiques et doivent le plus souvent leur popularité aux effets mimiques et aux gestes du conteur. Quoique le héros ne soit pas capable d'accomplir de merveilles, il feint, joue des tours et réussit, grâce à ses ruses et aux circonstances, à faire fortune ou à épouser la fille du roi. Ici le merveilleux n'existe point, ou, s'il apparait ici et là, ce n'est qu'incidemment. Il s'agit simplement de déceptions ou de tours comiques destinés à tromper la bonne foi d'un roi ou de personnages naïfs. Ces contes ont pour titre: 'Martineau-pain-sec', 'Pierre-Maurice et le capitaine', 'Petit-Jean patient', 'Pierrot-morveux', 'Le Veau d'or', 'Jean-Sotte', 'Pois-verts', 'Petit-Jean et

Petit-Pierre', 'Le conte des voleurs', 'Ti-Pierre et son curé', 'Criquet' et 'Beaucanal'. Certains objets merveilleux sont introduits au milieu de prouesses, dans les contes suivants: 'Le conte de la vieille', 'Les Lapins du roi' et 'Le fou qui fait rire la fille du roi'.

MARTINEAU-PAIN-SEC[1] (EXTRAITS)

Une fois, il est bon de vous dire, c'était un nommé Martineau-pain-sec, un paresseux. . . . Martineau dit: "Laissez-moi tranquille, les mouches! Je vas vous donner à manger *beto*." Quand il a fini de manger, il émiette du pain et du sucre sur une planche, y met du lait et invite les mouches à venir manger. *Pensez s'il* y en a, des mouches, c'est épouvantable! Il en tue mille d'un coup et cinq cents du revers . . .

Il se fait faire un écriteau: "Martineau-pain-sec en a tué mille d'un coup et cinq cents du revers." De là il s'en va se coucher sur le ventre dans une *veilloche de foin*. Le roi, *s'adonnant* à passer, lit . . "a tué mille d'un coup et cinq cents du revers." Il dit à son cocher: "Va donc le réveiller."—"Oui, je vas aller me faire tuer!"—"Va le réveiller poliment." Il y va donc: "Monsieur Martineau!"—"Que me voulez-vous?"—"Monsieur le roi a affaire à vous." S'approchant du roi, il dit: "Monsieur le roi, que me voulez-vous?"—"Est-ce vrai, monsieur Martineau, que vous en tuez mille d'un coup et cinq cents du revers?" Il répond: "Oui!"—"Voulez-vous vous engager?"—"Oui!" —"Il y a des bêtes féroces dans ma forêt; je voudrais les faire détruire."

"Martineau, dit le roi, j'ai dans ma forêt une licorne qui tue tout le monde. Pourrais-tu m'en débarrasser, toi?"—"J'irai *ben*! Mais il me faut des provisions, car je pourrais bien m'écarter."—"Tu vas en avoir." Et lui donnant des provisions, le roi le mène au petit sentier, disant: "Suis ce sentier, et tu vas *ressoudre* près de la vieille masure d'église, où la licorne se tient."

Martineau-pain-sec part, marche, marche, marche, se disant: "Si je la vois, cette maudite bête, je vas toujours *ben* me sauver." Et il marche. Tout à coup, voilà la licorne qui se lève près d'un rocher, et mon Martineau, surpris, continue, incapable d'arrêter. La licorne part derrière lui. *Ce qu'il marche!* Arrivée à la vieille masure d'église, il en fait le tour en courant, y entre, et se cache derrière la porte. La licorne, à sa suite, s'y lance tout droit avec tant d'élan qu'il a le temps d'en sortir vitement et de fermer la porte. Voilà la licorne renfermée dans la vieille église. Les yeux gros comme mes poings, elle frappe les murs de sa tête, pendant que Martineau monte sur le mur et la regarde. *C'est ça qu'elle joue!* Et en se disant:

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[1] Raconté par Paul Patry, en sept., 1914, à Saint-Victor (Beauce).

"Elle ne sortira toujours pas!" il s'en va chez le roi, qui dit: "Toi ?"—"Oui, moi! Je l'ai prise par la queue et jetée dans la vieille masure d'église, d'où elle ne sortira plus."—"Je ne te crois pas."—"Vous allez voir, monsieur le roi." Ne le croyant pas, le roi s'en va voir. Pour commencer, Martineau dit: "Je vas ouvrir la porte."—"*Ne va pas!*" reprend le roi. "Je vas la prendre par la queue."—"Pas du tout! si tu allais la manquer!" Bien content de ne pas avoir à le faire, Martineau ajoute: "Il faut *toujou ben* la regarder." Et tous deux montent sur le mur et regardent la licorne qui, les yeux gros comme mes poings, se frappe la tête au mur. Le roi dit: "Martineau, viens-t'en!" Et ils s'en vont, laissant renfermée la licorne, qui finit par mourir. Le roi est content de son Martineau et l'aime. . .

LE CONTE DE POIS-VERTS[1] (EXTRAITS).

. . . Le curé fait donc condamner Pois-verts à être mis dans un sac et jeté à la mer. Pois-verts est satisfait. Le soir les deux serviteurs du curé viennent le chercher, le mettent dans un sac à sel et partent pour la mer. "Non, je ne veux pas y aller! non, je ne veux pas y aller!" crie Pois-verts tout le long du chemin. Passant devant une auberge, les serviteurs entrent prendre un coup, et laissent le sac dehors, sur la galerie. "Je ne veux pas y aller, je ne veux pas y aller!" crie toujours Pois-verts, pour se désennuyer. Pendant que les serviteurs boivent, un pauvre passe et, curieux, écoute Pois-verts crier dans le sac: "Je ne veux pas y aller!" Approchant, le pauvre touche au sac et demande: "Où ne veux-tu pas aller ?"—"On m'emmène coucher avec la princesse; mais jamais ils ne m'y feront consentir."—"Veux-tu me donner ta place ?" Pois-verts accepte avec plaisir: "Détache le sac et prends ma place." Pois-verts sort, et le pauvre s'y fourre. A peine Pois-verts en fuite, les serviteurs arrivent, prennent la poche, et pendant qu'ils marchent, le pauvre crie comme Pois-verts: "Je ne veux pas y aller, je ne veux pas y aller!" Au bord de la mer, ils posent le sac à terre, et se disent entre eux: "Donnons-lui un bon élan, pour qu'il tombe au large." Voyant qu'on va le jeter à l'eau, le pauvre crie: "Non, non, je ne veux pas y aller!"—"Veux, *veux pas*, répondent les serviteurs, c'est au large que tu vas aller." Tenant le sac à chaque bout, ils comptent un, deux, trois, et vlan! lâchent le sac, qui tombe au large.

Le lendemain matin, le curé demande à ses serviteurs: "L'avez-vous jeté au large ?" Et ils répondent: "Soyez tranquille monsieur le curé, Pois-verts vous a joué assez de tours; il ne reviendra jamais!"—"Enfin j'en serai débarrassé!" pense le curé, en se promenant comme d'habitude *sur sa galerie*.

[1] Récité par P. Sioui, Lorette, en août, 1914.

Après dîner, il voit venir un troupeau de bêtes à cornes; et plus il approche, plus celui qui les mène ressemble à Pois-verts. Appelant un de ses serviteurs, le curé lui dit: "Voilà un beau troupeau de bêtes à cornes; mais regarde donc en arrière; ça m'a l'air de Pois-verts."—"Ça ne se peut pas," répond l'autre; "hier *au* soir, nous l'avons *fouté* à l'eau."—"Regarde *com'i'faut*, serviteur, ça m'a l'air de Pois-verts." De fait, Pois-verts, le bâton à la main, menait le troupeau et de temps en temps criait: "Ourche, mourche!" Sur le bout des pieds pour mieux voir, le curé dit: "C'est Pois-verts!"—"Bonsoir! monsieur le curé; monsieur le curé, bonsoir!" fait Pois-verts, en passant devant le presbytère. "Comment, Pois-verts, mais c'est *ben* toi?"—"Oui, monsieur le curé, c'est *ben* moi!"—"Mais d'où viens-tu avec toutes ces bêtes à cornes?"—"Ah! monsieur le curé, ne m'en parlez pas! Si vos serviteurs m'avaient seulement jeté dix pieds plus loin, je vous ramenais les plus beaux chevaux noirs qu'on ait jamais vus dans la province. Mais ils m'ont jeté au milieu de ce troupeau de bêtes à cornes, que j'ai ramené avec moi." Le curé tombe encore dans le panneau et croit Pois-verts. "Si j'y allais moi-même, Pois-verts? toi qui connais la distance . . ?"—"Je vous garantis, monsieur le curé, que je ne manquerais pas mon coup. Si un de vos serviteurs m'aide, ce soir, je vous jetterai en plein milieu des beaux chevaux." Accepté. Pois-verts continue et mène le troupeau sur sa ferme. Quand il revient, le soir, il aide le curé à entrer dans le sac, et s'en va avec un serviteur le porter au bord de la mer. "*Foutons* monsieur le curé au large," dit Pois-verts; et vlan! monsieur le curé s'en va rejoindre le pauvre au fond de la mer, où il est resté. . .

IV.—Légendes semi-chrétiennes.

Dans les contes qui ont trait à des croyances ou des personnages du christianisme, le conteur ne se conforme ordinairement pas à la théologie orthodoxe. On y trouve souvent le merveilleux, les talismans et même les allégories du paganisme. Les personnages secondaires des contes de 'Larrivée et son sac,' de 'Pipette' et de 'Frédérico va au ciel' sont le Christ, saint Jacques, saint Pierre, le diable et la Mort. Le diable joue le principal rôle dans 'Cacholet', 'Le diable et la bougie,' 'Les messes noires', 'L'étau' et 'Le diable et la mariée'. A la recherche d'une âme qu'il achète ou qu'il convoite, il est toujours déjoué, à la fin, par un plus rusé que lui. Les légendes du 'Revenant', de 'L'apparition' et de 'L'ange gardien' sont d'un genre différent. Comme exemples, citons:

PIPETTE[1] (EXTRAITS).

Une fois, c'était Pipette. Un gars paresseux s'il y en avait un, il vivait chez son père sans travailler. Son père lui dit, un jour: "Pipette, tu es capable de travailler, va-t'en!" . . Et le bonhomme qui est en moyens, lui donne ses droits—assez d'argent.

Voilà Pipette parti. Rendu à une auberge, il entre et se met à fêter. Notre-Seigneur, dans ce temps-là, *s'adonnait à* rouler sur la terre avec le bon saint Jacques, *tous les deux*. Rencontrant Pipette dans l'auberge, ils se traitent et fêtent. D'une auberge à l'autre, à force de fêter avec ses amis, Pipette arrive au bout de son argent. Avec les quelques sous qui lui restent, il entre dans une maison s'acheter du pain. Prenant la route, il entre dans un bois et marche le long du sentier, marche, marche . . . . Tout à coup il rencontre Notre-Seigneur et le bon saint Jacques. "Ah! disent-ils, bonjour, mon pauvre Pipette, bonjour! Je suis certain qu'il ne te reste rien?"—"Non! il ne me reste rien; je suis pauvre comme un rat d'église." Le bon saint Jacques dit: "Pipette, tu es *d'un bon cœur*; tu as toujours été généreux, je voudrais te faire un petit don."—"Qu'est-ce que c'est?"—"Voici une petite baguette. Tout ce que tu souhaiteras, elle te le donnera." En disant: "Merci bien!" Pipette met la baguette dans sa poche. Notre-Seigneur, le voyant faire, dit: "Que veux-tu que je te donne?"—"Je le sais-*ti*, moi!" Le bon saint, en arrière, le pousse: "Pipette, demande-lui donc le paradis à la fin de tes jours, c'est Notre-Seigneur!"—"Laisse-moi donc tranquille! Je le gagnerai comme les autres, quand je le pourrai." . . . . Notre-Seigneur prend encore la parole: "Que vais-je te donner?"—"*Cou'don*, donnez-moi un jeu de cartes qui me fera gagner quand je voudrai." Notre-Seigneur le lui donne. . . .

. . . Pipette vécut bien des années. Le bon Dieu dit, un jour: "Sais-tu bien qu'on a oublié Pipette?"—"Je ne veux plus y aller," répond la Mort. "Puisque la Mort ne veut plus y aller, dit le bon Dieu, il faut envoyer le diable le *q'ri*." Le diable part et arrive chez Pipette. "Bonjour, Pipette!"—"Bonjour, toi!"—"Je suis le diable, et je viens te *q'ri*."—"Tu viens me *q'ri*? mais il fallait donc me le dire, je ne suis pas changé, je n'ai pas la barbe faite, *ni foute ni rien*. *Assis-toi* dans cette chaise!" dit Pipette, en poussant sa belle grande bergère. Le diable *s'assit* durant que Pipette va chercher du beau bois sec, qu'il corde dans la cheminée, sur le feu. Assis devant ce gros feu qui le brûle, le diable se *reboute*. "*Largue-moi*, Pipette, tu me brûles!" Mais l'autre pousse la chaise plus près du feu, pousse encore. Et il fait si chaud que les orteils du diable

[1] Récité à Saint-Victor (Beauce) en août, 1914, par Paul Patry, qui disait l'avoir appris de son oncle, François Coulombe.

en rougissent. "Pipette, *largue*-moi, *largue*-moi!"—"Je te *larguerai* quand tu m'auras promis que jamais je n'irai dans ton enfer." Le diable le lui promet et se sauve.

Toujours que voilà mon Pipette vieux *extraordinaire*. Un jour, il fait demander tous ses gens autour de lui, et leur ayant donné tous ses biens, il se fait enterrer en vie. Une fois enterré, il est mort. Mort, il s'en va à la porte du Paradis: "Saint Pierre, ouvrez-moi la porte?"—"Qui est là?"—"Pipette." Le bon Dieu dit: "La Mort n'a pas pu t'emmener; je ne veux pas te laisser entrer au paradis. Va-t'en en enfer, je te donne au diable; vas-y!" Pipette part et s'en va à l'enfer. "Ouvre-moi la porte!" demande-t-il au diable. "Va-t'en, Pipette! je ne veux pas te voir dans mon enfer. Tu m'as trop fait brûler." S'en retournant au paradis, Pipette dit: "*Cou'-don*, il faut toujours que je couche quelque part, et le diable ne veut pas de moi. Saint Pierre, ouvrez-moi la porte."—"Tu sais bien que le bon Dieu ne veut pas."—"Laissez-moi donc me cacher derrière la porte; il faut bien que j'aille quelque part." Saint Pierre laisse entrer Pipette, qui s'accroupit derrière la porte et ne grouille pas. A la fin, Pipette sort ses cartes, et à un autre *à ras* lui, qui est assis sur un petit *billotte*, il dit: "Veux-tu jouer aux cartes avec moi?"—"Comment, jouer aux cartes?"—"Oui, jouons place pour place." Ils jouent trois parties et Pipette gagne. Le voilà assis sur le petit *billotte*. Un autre, tout près, est assis sur une chaise. "Veux-tu jouer aux cartes?" demande Pipette. "Comment, jouer aux cartes?"—"Oui, jouons place pour place." Jouent trois parties. Pipette gagne encore et se trouve assis sur une chaise. Après ça, Pipette passe son temps à jouer aux cartes. A celui qui est assis près du bon Dieu, il demande: "Veux-tu jouer aux cartes avec moi?"—"Comment, jouer aux cartes?"—"Oui, jouons place pour place." Jouent donc place pour place; et Pipette gagne encore. Le voilà assis près du bon Dieu: "Bon Dieu, bon Dieu! veux-tu jouer aux cartes avec moi?"—"*Cou'don*, Pipette! tu es *ben* là, restes-y!"

Et moi, ils me l'ont envoyé raconter.

CACHOLET[1] (EXTRAITS)

. . . . . Quand le mari revient, le soir, il remarque que sa femme a l'air *ben* piteux . . . "Qu'as-tu?" lui demande-t-il. "Rien!" répond-elle.

C'était le lendemain que le diable revenait. Le bûcheron dit à sa femme: "Tu vas *toujou ben* me dire pourquoi tu es si triste!" Elle répond: "Tu sais, la tâche que tu m'as imposée? Tu m'as donné autant de laine à filer dans trois jours que trois *criétures* se-

[1] Raconté par Mme P. Sioui, Lorette, en août, 1914.

raient capables d'en faire dans un mois. Eh *ben!* quand tu es parti, l'autre matin, un homme a frappé à la porte; je lui ai dit d'entrer. Il m'a demandé ce que j'avais à être si triste, à pleurer. Lui montrant la laine que j'avais à filer, je lui ai dit mon découragement. Il m'a répondu: "Voulez-vous m'en donner; je vas vous aider; et vous allez voir comme je prendrai peu de temps à le faire. Je ne vous demanderai pas un sou, si vous devinez mon nom." Je l'avais pris pour un homme de la place; mais je suis à présent sûre que c'était le diable. Il avait un pied de cheval. Comment deviner son nom? Je suis bien certaine qu'il va m'emporter." . . . .

L'homme s'en va au bois, comme d'habitude, et s'assoit sur une bûche pour se reposer. Tout à coup, il entend *virer* un *rouette;* et le *rouette* file à en faire du feu; et quelqu'un chante: "Si tu savais que je m'appelle Cacholet, tu ne serais pas si en peine que tu l'es." . . .

Le lendemain, le diable arrive: "Tiens! la voilà, ta laine. Ton mari ne te tueras pas; mais il faut que tu devines mon nom." La femme fait semblant de ne pas savoir. "Mon cher monsieur! votre nom, c'est *malisé* à deviner, vu que personne dans le canton ne vous connaît."—"Oui! mais vous savez votre promesse. Si vous ne pouvez deviner mon nom, vous m'appartenez, et je vous emmène avec moi." La femme pense, et puis dit: "Est-ce que vous ne vous appelez pas Cacholet, par hasard?" Se trouvant déjoué, le diable part en une telle fureur qu'en sortant il arrache la porte et l'emporte avec lui.

LE REVENANT[1] (EXTRAITS).

. . . Un jour, cet homme meurt, laissant ses biens à sa veuve. Le seigneur, son créancier, va la trouver et dit: "Madame, je viens chercher les cent louis que j'ai prêtés à votre mari."—"Avez-vous un billet?" demande la femme. Il répond: "Non!—"Sans billet vous n'aurez pas un sou de moi." Et elle ne voulut plus rien entendre. C'est pourquoi le seigneur, tous les jours de sa vie, *maudit* (son débiteur) *dans* le feu éternel."

Il fallait donc que le mort revienne sur la terre gagner la somme de cent louis. . . . (*Il s'engage et travaille comme sept hommes. Mais on remarque une clarté dans sa chambre, la nuit, et le maître en est averti*). Il regarde donc aussi par la serrure, aperçoit l'homme qui se déshabille, met son *butin* sur le lit et se couche sur le feu de la cheminée, où les flammes l'entourent.

Le lendemain, le maître demande à son engagé: "Monsieur, qu'est-ce que ça veut dire? Je vous ai vu, hier soir, ôter votre *butin* et vous coucher sur la grille dans la cheminée, où les flammes vous

[1] Raconté par Achille Fournier, à Sainte-Anne (Kamouraska) en juillet, 1915.

entouraient?" L'homme répond: "Monsieur, je suis maudit tous les jours par *un tel,* qui me souhaite dans le feu éternel. Je suis mort sans lui remettre la somme de cent louis qu'il m'avait prêtée; et tant que ma dette ne sera pas payée, je brûlerai dans le feu éternel. . ."

V.—Contes ou facéties du moyen âge ou des temps modernes.

Les matériaux abondants qui peuvent être considérés comme relativement modernes sont de différentes genres. On y voit des récits romanesques, des contes moraux, des légendes et des facéties de toutes sortes. Des anecdotes peuvent même se mêler à ce groupe. Les récits romanesques jusqu'ici recueillis sont: 'Les sœurs jalouses', 'Jean-Parle'—le Barbe-bleue canadien—, 'L'eau de la fontaine de Paris', 'La belle main', 'Les trois poils d'or', 'Jean-cuit', 'Les quarante voleurs', 'Le grand voleur de Paris,' 'Le voleur provincial et le voleur de Paris', 'Bernadette, la fille des bois', 'Le petit Bonhomme-de-graisse', 'Le charbonnier', 'Le petit engagé du curé,' 'L'évêque et les voleurs' et 'Le conte du vinaigrier'. Sont d'un caractère plus moderne les récits à tendance moraliste suivants: 'La femme sotte', 'La gageure du commerçant', 'La femme sans reproche' et 'La terrinée d'argent.' Parmi les facéties, nous avons: 'Les cartes du nommé Richard', quelques versions de 'Monsieur Michel Morin', 'Gilbert et le roi', 'Ti-Pierre et Jacqueline', 'Les tours des Gascons', 'Pierre-pleume', 'Les Gascons et l'œuf', 'Le rêve des Gascons', 'Le rêve des chasseurs'. Les extraits suivants sont donnés à titre d'exemples:

Jean-Parle[1] (extrait)

. . . Quelque temps passe, et Jean-Parle, ayant volé les habillements de l'évêque de la place, se déguise en évêque et s'en va encore chez la veuve. "Madame, pouvez-vous m'enseigner le chemin pour aller à Rome?" Elle répond: "Monseigneur! vous, qui êtes évêque, devez connaître le chemin de Rome bien mieux que moi. Je ne suis qu'une pauvre veuve sans instruction."—"Oui, mais sans être instruite, vous pouvez toujours bien m'enseigner le chemin le plus court pour aller à Rome. C'est un voyage pressant que j'ai à faire."—"Eh bien! prenez la première route à droite; suivez-là jusqu'au premier chemin de travers, où vous passerez tout *dret.* Rendu à la deuxième route, vous trouverez le grand chemin qui conduit à Paris. Et là, vous prendrez information."—"Oui, madame, c'est bien dit. Mais envoyez votre fille quelques minutes me montrer la deuxième route."—"Ma fille n'est pas pour *embarquer* avec vous. L'autre fois, un curé est venu engager Javotte, ma fille, et depuis, nous

[1] Récité par N. Thiboutot, en juillet, 1915, à Saint-Anne (Kamouraska).

n'en avons reçu ni vent ni nouvelle."—"Oui, mais si vous n'en reçevez pas de nouvelles, pensez-vous que je suis pour vous voler votre fille?" En disant: "*Mouman*, je vas lui montrer le chemin, un *boute*." Finette *embarque* et va le reconduire. Voilà monseigneur qui roule fort, sans vouloir arrêter et laisser *débarquer* Finette. "Je ne suis pas un évêque, dit-il; mon nom est Jean-Parle, et je suis celui qui est venu chercher tes deux sœurs, Charlotte et Javotte. Tu t'appelles Finette? On va voir si tu es aussi fine que ton nom." En arrivant au château: "Tiens, ma petite Finette, si tu es fine, tu seras *ben icite*." Il lui remet les clefs du château et lui donne des servantes au besoin. Quelque temps après, il dit: "*Cou'don*, ma petite Finette, tu es bien fine, mais j'aurais un voyage à faire, qui durera quinze jours."—"Oui, monsieur Jean-Parle, vous pouvez faire votre voyage. Avec mes servantes tout se fera ici comme de coutume." En partant, il lui dit: "Pendant ces quinze jours, tu visiteras toutes les chambres du château, une par une, mais je ne veux pas que tu mettes les pieds dans cette chambre-ci, ni toi, ni les servantes. Et garde bien les clefs."—"Ah! monsieur Jean-Parle, s'il n'y a que ça à faire, vous pouvez partir sans crainte."—"Prends garde à toi, Finette! Si tu veux être bien ici, tu fais mieux de ne pas y aller voir."

Une dizaine de jours passent, et Finette a visité toutes les chambres du château. La seule qui reste, c'est la chambre que Jean-Parle à défendu d'ouvrir. Un bon matin, Finette prend la clef, la plus brillante de toutes, la regarde bien, *débarre* la porte défendue, et aperçoit les robes de ses sœurs, pendues à l'*accrachat*. "Comment! c'est ici que mes sœurs ont été tuées?" Ouvrant la trappe, elle voit ses deux sœurs mortes. Il faut bien qu'il soit sorcier, ce Jean-Parle?" se dit-elle. Elle ferme la trappe, sort, et arrache la clef de la serrure. La clef est toute rouillée! Finette pense: "Arrête un peu, toi! Si tu es sorcier, tu vas voir qui est le plus fin." Prenant la clef, elle s'en va la saucer dans le sang où baignent ses sœurs, et la met à la serrure. Puis ayant recollé la tête de Charlotte à son corps, et celle de Javotte au sien, elle sort de là. Arrache la clef de la serrure, et la retrouve aussi brillante que quand elle l'a reçue. . . .

LES SŒURS JALOUSES[1] (EXTRAIT).

. . . Pendant l'absence du prince, la princesse, sa femme, *achète* un petit garçon, le plus bel enfant qui se soit jamais vu au monde. A la vue d'une telle merveille, les belles-sœurs, pas très jolies elle-mêmes, deviennent jalouses. Elles s'entendent avec la vieille garde-malade pour faire disparaître l'enfant, avant le retour du prince. S'en emparant donc, elles l'enveloppent dans des langes,

[1] Récité par Mme P. Sioui, à Lorette, en août, 1914.

une serviette blanche, le mettent dans une corbeille d'or et vont le déposer sur la grève.

Le prince avait hâte d'arriver et de voir son enfant, on n'en parle pas! Mais sa belle-sœur, la boulangère, lui dit: "J'ai une chose à vous apprendre, mais ça me coûte de vous la dire. Vous allez vous fâcher?"—"Oui! mais où est mon enfant? Je veux le voir."—"Votre enfant, il faut l'avouer, je l'ai fait mourir: c'était un singe!" En fureur de voir que sa princesse avait *acheté* un singe, il la fait enfermer dans un cachot où la lumière du jour n'entrait point. Elle a beau vouloir parler, se plaindre, il ne veut rien entendre.

Au milieu d'un bois éloigné, un vieux et sa vieille vivaient seuls dans une petite maison, sans enfants. Tous les matins, le vieux, dans sa barge, parcourait le bord de la mer à la recherche de débris. Un bon jour, il aperçoit au loin un objet. Etonné, il s'approche et examine. C'est une corbeille d'or. Prenant la corbeille, il y voit le plus bel enfant qui soit au monde. Il arrive à sa maison, et d'une fièreté sans pareille, dit à sa vieille: "Tiens! en voilà un enfant. Tu l'as désiré si longtemps que le bon Dieu nous l'a envoyé pour qu'il ait soin de toi et de moi sur nos vieux jours." Apercevant un si bel enfant, si bien vêtu, et dans une corbeille d'or, la vieille pense que le bon Dieu lui-même l'a envoyé du ciel. . . .

L'EAU DE LA FONTAINE DE PARIS[1] (EXTRAIT)

. . . . Dans l'ancien temps, c'était l'habitude de chanter après souper. Le prince dit à la dame: "Chantez-nous donc une petite chanson."—"Non, mon prince, c'est bien à vous à commencer." Le prince commence:

"C'est une jeune dame à l'abandon,
"Un beau pâté à trois pigeons (*bis*),
"*Kyrie christi,*
"Un beau pâté à trois pigeons,
"Qui riait,
"*Kyrie eleison!*"

—"C'est bien chanté!" dit la dame. Le prince réclame: "C'est votre tour." Mais elle répond: "Demandez au cocassier; ça convient, vu qu'il est plus vieux que moi."—"Non, dit le cocassier, c'est le tour de la dame de la maison." Elle commence donc:

"Mon mari est allé *z*'à Paris;
"Il n'est pas *paré* d'en revenir (*bis*),
"*Kyrie christi,*
"Il n'est pas *paré* d'*en* revenir
"A sa maison,
"*Kyrie eleison.*

[1] Raconté par Mme P. Sioui, Lorette, en août, 1914.

—"C'est bien chanté! c'est bien chanté!" disent les autres. A présent, on demande à la servante sa chanson. La servante répond: "Non! ça conviendrait mieux au vieux qu'à moi."—"Voulez-vous chanter une petite chanson?" demande le prince au cocassier. "Pour ne pas vous désobliger, répond-il, je vas vous en chanter une:

"Dans mon chemin, je l'ai rencontré;
"Je l'ai fait *mettre* dans mon panier,
"Je l'ai fait *mettre* dans mon panier,
"*Kyrie christi.*
"Mon panier est dessous le lit,
"Dans la maison,
"*Kyrie eleison!*"

—"*Ça*, c'est bien chanté!" disent les autres. Le prince dit aussi la même chose: "Bien chanté!" mais il n'aime pas la chanson. "Le mari est peut-être dans le panier?" pense-t-il.

"*Ast'heure*, vous allez chanter, la servante!" Elle répond: "Je sais guère comment chanter; mais pour ne pas vous désobliger, prince, *m'as* chanter:

"J'entends le cocassier qui dit
"Que mon maître est dans son panier (*bis*),
"*Kyrie christi,*
"Qui dit que mon maître est dans son panier,
"Dessous le lit,
"*Kyrie eleison.*"

Le cocassier demande: "Mon prince! voulez-vous que je fasse chanter mon panier?" La dame dit: "Vous voyez *ben* que c'est un *sapré* fou; faire chanter son panier? *Voir si* un panier chante!" Assez curieux et aimant tout entendre, le prince dit: "Laissez-le donc chanter. Peut-être a-t-il quelque chose qui chante dans son panier."—"Mon vieux, faites-le donc chanter, le panier." Le cocassier va dessous le lit chercher son panier, le met dans le milieu de la place, et lui *fout* un coup de pied en disant: "Chante, panier!" Et voilà *ben* le panier qui commence à chanter:

"J'étais à Paris, et j'en suis revenu;
"*T'as* été malade, mais tu l'es *pu*.
"Tu sortiras de ma maison,
"*Kyrie christi;*
"Tu sortiras de ma maison,
"A coup de bâton,
"*Kyrie eleison.*"

Je vous dis que le prince sortit de la maison! Il paraît que, depuis, il n'a jamais eu l'idée d'y retourner.

C.-Marius Barbeau.

Nos amis les Écossais.

PAR L'HONORABLE RODOLPHE LEMIEUX, M.S.R.C.

(Lu à la réunion de mai 1915.)

Je veux parler des liens politiques et intellectuels qui ont toujours unis l'Écosse à la France. Les Canadiens-français, suivant l'expression d'un éminent académicien, étant les grevés de substitution de la France en Amérique, il convient qu'en ces jours d'épreuve et de gloire ils fassent valoir les créances de l'ancienne mère-patrie, auprès de ceux qui seraient tentés d'oublier leurs obligations envers elle. Les Écossais n'oublient pas, eux, car leur amour pour la France est une tradition qui remonte très loin dans l'histoire.

Ici même, au Canada, Écossais et Français s'entendent très bien. Dans les Cantons de l'Est ils font bon voisinage; à ce point que les Ecossais, dont l'esprit de clan est pourtant légendaire, consentent à se laisser absorber par les Canadiens-français. L'histoire de la seigneurie de la Malbaie en est une preuve convaincante. Ils sont nombreux dans nos villages les Ross, les Campbell, les Fraser, les McNicoll, les Stuart qui ne parlent ni le gaélique ni l'anglais, et dont l'attachement à la langue française est vraiment filial.

Cette affinité, entre deux races si distinctes l'une de l'autre, n'est pas le simple fait du hasard. Elle repose sur des liens politiques et intellectuels vieux de plusieurs siècles.

L'alliance traditionnelle de l'Écosse et de la France ne fut pas conclue à l'origine entre deux rois, mais véritablement entre deux peuples. C'est l'intérêt des deux pays qui motiva cette alliance. Quel était cet intérêt?

L'Angleterre était, à cette époque lointaine, la rivale héréditaire de la France. Vassal du roi de France, le roi d'Angleterre rêvait de réunir les deux couronnes sur sa tête. L'Écosse, alors libre et indépendante, refusait de reconnaître la suzeraineté du roi d'Angleterre. De là des conflits continuels entre l'Angleterre d'un côté, la France et l'Ecosse de l'autre. Une invasion des Anglais en France coïncidait toujours avec une invasion des Écossais au delà de la frontière anglaise. L'Écosse, moins grande et plus faible que l'Angleterre, pouvait toujours compter sur sa grande alliée, la France.

Les deux pays convoités par Albion eurent donc un intérêt commun dans toutes ces guerres qui se prolongèrent depuis la fin du treizième siècle jusqu'à la Réforme. Exposés tous deux à l'agression anglaise, ils résistèrent héroïquement. Ils se prêtaient mutuellement aide et secours. Il y avait, entre les deux pays, échange d'officiers et de soldats, comme il y eut toujours, entre les universités des deux pays, échange de maîtres et d'élèves.

Sur le continent, l'Angleterre avait, elle aussi, ses alliés contre la France; c'étaient les Pays-Bas et le Saint-Empire.

La ligue franco-écossaise date de la fin du treizième siècle. Edouard 1er régnait alors en Angleterre. Il eut tôt fait de chercher querelle à John Baliol, roi d'Écosse, et à Philippe IV, roi de France. Ces deux rois, menacés dans leurs domaines respectifs, conclurent une alliance offensive et défensive contre l'usurpateur. Intervention mutuelle dans le cas d'invasion anglaise, et quant à la paix, elle ne devait être conclue que du consentement réciproque des deux alliés.

Cette alliance renouvelée à divers intervalles au cours des siècles, marque pour l'Écosse le commencement d'une résistance glorieuse contre l'envahisseur. Le héros national, Robert Bruce, personnifie cette résistance contre Edouard II. Malgré ses revers, Edouard II n'en persiste pas moins à proclamer sa suzeraineté sur l'Écosse. Et, comme garantie de l'avenir, Robert Bruce renouvelle, avant sa mort, l'alliance avec la France. Le traité est signé par Charles IV au nom de la France (1325-26).

Sur les entrefaites, Edouard III monte sur le trône d'Angleterre. Insidieusement il appuie la candidature du fils de Baliol au trône d'Écosse, à l'encontre des droits de David II, fils de Robert Bruce. Le fils de Baliol avait traiteusement consenti à devenir le vassal d'Edouard.

Les montagnards d'Écosse se tournent alors vers Philippe IV, roi de France, et réclament son appui. Leur appel est entendu, car Edouard III venait de prendre le titre de roi de France. Grâce à l'alliance, les Anglais sont chassés tour à tour d'Écosse et de France.

Les Écossais harassent l'ennemi par de fréquentes excursions à la frontière pendant que les Anglais cherchent à démembrer la France. Ils essuient même des défaites désastreuses, toujours au profit des alliés, en 1346 et en 1355. Vaincus à Crécy et à Poitiers, les Français ne perdent pas courage. La ligue franco-écossaise est l'obstacle qui se dresse devant Edouard III dans ses tentatives d'absorption des deux couronnes. La tâche est trop forte pour le souverain anglais. "La France, a dit Michelet, a de nobles réveils", et c'est au lendemain des plus sombres défaites qu'elle prend sa revanche. Charles V monte sur le trône, et avec l'épée de DuGuesclin et les gardes-écossaises, il reprend à l'ennemi le territoire perdu par les rois Philippe et Jean. Edouard III meurt en 1377, sans avoir pu réaliser son rêve. L'Écosse est libre et la France également. Il est vaincu par la ligue franco-écossaise.

C'est l'hospitalité des montagnards d'Écosse qui lui enlève le fruit de sa conquête française, et c'est la force des armes françaises qui préserve l'indépendance écossaise.

Si, à cette heure critique, Edouard III eût vaincu et l'Écosse et la France, l'histoire de l'Europe eût été bien différente de ce qu'elle fut par la suite.

Edouard III disparu de la scène, la ligue franco-écossaise subsiste toujours. Elle est particulièrement active à trois époques de l'histoire.

De 1415 à 1451, la France, pour mieux résister à l'assaut de la couronne anglaise, appelle à son secours ses fidèles alliés du nord. Sur les champs de bataille, Henri V et Henri VI aperçoivent les montagnards vêtus de leurs plaids, marchant au son de la cornemuse et agitant leurs "claymores".

C'est la noblesse écossaise qui les commande. Les Buchan et les Douglas triomphent avec leurs alliés à Beaujé (1421). Ils partagent avec eux une défaite glorieuse à Verneuil (1424).

"Je ne puis aller nulle part, s'écrie avec amertume Henri V, sans trouver devant ma barbe des Écossais morts ou vifs".

Au seizième siècle, la noblesse française se rallie sous l'étendard de Jacques IV qui succombe héroiquement à Flodden, pendant que Henri VIII fait un suprême effort pour ravir à Louis XII la couronne de France (1531).

Trente-cinq ans après, la France, qui n'oublie pas le sang versé pour elle par ses fidèles highlanders, organise une expédition par la Manche afin de faire échec à Somerset qui veut de gré ou de force réunir la couronne d'Écosse à celle d'Angleterre. Les Écossais éprouvent un désastre à Pinkie (1547) et la maison de France offre généreusement un refuge à la jeune et désormais infortunée reine Marie.

Et c'est à ce moment tragique de l'histoire que la ligue franco-écossaise est rompue. La reine épouse le dauphin, et c'est ce mariage qui fait pressentir la rupture entre les alliés. Le péril est déplacé. Il n'est plus du côté de l'Angleterre car, par ce mariage diplomatique, c'est peut-être la couronne d'Écosse qui, cette fois, sera réunie à celle de France!

L'Angleterre se rapproche alors de l'Écosse dont l'indépendance est menacée par l'alliée d'hier. Et voici que la Réforme s'annonce au monde. Divisées au point de vue politique, les deux alliées le sont davantage au point de vue religieux. L'union de l'Écosse et de l'Angleterre devenait bientôt un fait accompli.

L'alliance française avait valu aux Écossais de précieux privilèges, notamment celui des lettres de naturalisation. Aux archers écossais était confiée la garde du roi de France. Il faut lire *Quentin Durward* de Walter Scott, pour se rendre compte du rôle glorieux joué en France par la noblesse écossaise.

De plus, le commerce écossais jouissait de privilèges spéciaux dans les ports français.

Des honneurs étaient conférés et des domaines royaux concédés aux Écossais qui s'étaient distingués au service du roi et de la France.

Dans le domaine purement intellectuel, l'alliance franco-écossaise n'a jamais été rompue. Les étudiants d'Écosse ont toujours afflué aux universités de Bordeaux, de Poitiers et de Paris. Le collège des Écossais fut fondé à Paris en 1325.

Après la Réforme, il y eut encore échange de professeurs et d'élèves entre les universités des deux pays. Les lois et la procédure en vigueur en Écosse sont encore aujourd'hui empreintes de l'esprit français.

Les tribunaux d'Edimbourg, à l'époque où vivait Erskine, étaient sur le modèle du Parlement de Paris. La jurisprudence elle-même était puisée aux sources françaises. Le Lord-Advocate, c'était le Procureur du Roi, et le Dean of Faculty of Advocates, c'était notre bâtonnier.

Le droit romain et le droit civil français sont encore cités devant les tribunaux d'Écosse.

Quant à la vie sociale, longtemps après son union avec l'Angleterre, l'Écosse se ressentit de l'influence française. Les coutumes, les modes, la langue elle-même, démontraient combien profonde avait été l'emprise française sur l'Écosse. Les jeunes étudiants d'Écosse devaient faire leur tour de France. Pour eux, c'était le tour du monde!

Et en France l'on se réclamait avec orgueil de ses ancêtres écossais. Le grand ministre Sully se disait allié au clan des Beaton par son ancêtre Bethune.

Jeanne d'Arc eut dans son armée une compagnie de volontaires écossais.

Le devise de la ville d'Aberdeen est "Bon accord". C'était le mot de passe échangé entre alliés français et écossais lors d'une prise d'armes contre l'Angleterre. Et de nos jours, les paysans de France disent d'un homme indépendant et courageux: "Il est fier comme un Écossais".

Le président de la République, M. Raymond Poincaré, vient d'être élu recteur de l'université d'Edimbourg. A celà, rien d'étonnant; c'est le retour à une vieille tradition qui remonte à la monarchie française.

Les universités écossaises sont au nombre de quatre: Saint-Andrews, Glasgow, Aberdeen et Edimbourg. Les trois premières datent du 15ème siècle et Edimbourg du 16ème. Saint-Andrews, Glasgow et Aberdeen datent donc de la Renaissance, et elles reçurent leurs statuts et privilèges de la papauté et de l'église catholique. Edimbourg date de la Réforme; mais toutes quatre sont affiliées à l'université de Paris, Il a toujours été de tradition que les chefs de l'Etat français reçussent un titre honorifique de l'une ou de l'autre de ces universités écossaises.

Les universitaires écossais ont toujours joui d'un grand renom en Europe. En 1898, 40 délégués des quatre grandes universités écossaises vinrent à Paris renouer une alliance, qui datait déjà de fort loin, entre les intellectuels écossais et la Sorbonne; en 1897, c'était au tour des universités d'Écosse de recevoir officiellement les délégués des universités françaises. Depuis, une revue franco-écossaise a été fondée, dont le programme consiste surtout à diffuser les études scientifiques et philosophiques les plus remarquables des deux pays.

L'Angleterre, l'Écosse et la France combattent aujourd'hui pour la civilisation et la liberté. Entre l'Angleterre et la France l'Entente Cordiale existe enfin après des siècles de conflits; mais entre l'Écosse et la France c'est une vieille alliance séculaire qui se renoue.

Nos amis de langue anglaise pourront peut-être mieux comprendre la France après la victoire, en raison du rapprochement que leur aura facilité un dévouement commun.

Si la France n'a pas toujours guidé l'humanité, elle a toujours été à l'avant-garde, déployant sur le monde le drapeau du progrès et de la civilisation. D'autres peuples marchaient dans les larges sillons creusés par elle, tout en dénonçant ce qu'ils croyaient être ses fautes et ses erreurs. Ils ne manquaient pas de s'attribuer tous les lauriers et toutes les couronnes, mais comme suprême hommage, c'est encore la langue française qu'ils apprenaient à parler, après leur langue maternelle. Cette langue est restée et restera toujours la plus belle, la plus riche, la plus souple et la plus pure. Et les Écossais qui ont toujours maintenu ce "BON ACCORD" dont se pare la devise de la ville d'Aberdeen, n'auront pas peu contribué à faire aimer, non-seulement la langue, mais aussi les traditions de France.

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SECTION II

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Fundamental Processes in Historical Science.

(Part II: The Incorrect Processes).
With an Introduction on the Present Position of Historical Method.

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Presented by W. D. LESUEUR, LL.D.
(Read by Title, May 26, 1915).

References.

Part I of this paper (the *Correct Processes*) appeared in the Transactions of The Royal Society of Canada, 1912, vol. vi, pp. 133-164, and will be referred to in this part simply as "Part I."

The references to Bernheim's *Lehrbuch der historischen Methode*, which first appeared in 1889, are to the edition of 1908.

CONTENTS.

INTRODUCTION.

The Present Position of Historical Method.

In Part I of this paper an effort was made to locate a scientific basis for necessity in historical conclusions; and the author there expressed the hope to examine, in Part II, the scientific basis, the origin, and the results of the prevailing use of probability as an historical criterion. This examination, like the argument for necessity in Part I, is made by an experimental and a theoretical test; and in the theoretical, the examination is not confined to history alone; but an appeal is taken, with special reference to history, to the common basis of science in general.

This appeal is not only proper in itself; but the author, in taking it, follows the lead of champions of the prevailing historical method. These champions, when reproached with the uncertainty that characterizes history under their method, answer, like Bernheim (*Lehrbuch*, p. 200), with nonchalance, "Name a science which has not, beside assured knowledge, many results that are only probable and hypothetical."

Probability has indeed an important function in all science. In order to determine this function, an accurate definition of the term is indispensable. There are divers forms of probability, besides the ordinary. The author has sought to define these forms and their principal uses, and also the rights of probable conclusions, in the ordinary sense, to publicity in scientific investigation.

The experimental test is based on cases drawn, as the name implies, from actual experience. It occupies more than a third of the paper, but further reference to it need not be made here. The results must speak for themselves.

The term "theoretical test" is employed in the higher sense of the word "theory," signifying the general or abstract principles of any branch of science, or of science as a whole. The principles especially involved here are the fundamental and methodic principles of science, of which the fundamental are defined in Section II of Part I of this paper, and the methodic in Section I of the present part. The central point of these principles is found in the necessity and the results of employing, in scientific activity, only correct processes, *i.e.*, processes that, rightly followed, lead necessarily to correct conclusions. The four fundamental principles state this necessity and these results, and the four methodic give the rules by which the correctness of scientific processes are tested and maintained. These eight principles together constitute general and ordinary requirements of science, which every branch, including history, must fulfil, in order to qualify as one of the sciences.

Mathematical science affords the simplest and most thorough illustrations of correct processes. Any mathematical process, *e.g.*, that of addition or any other of the four rules of arithmetic, rightly followed leads necessarily to a correct result, and only by inadvertent or other deviation from a requirement of the process can the operator introduce an error into the result, because in the process itself, apart from such deviation, there is no room for error.

The same principle is true fundamentally of all other branches of real science. Thus in chemistry the fundamental correct process is actual experimentation: its opposite, the fantastic extravagances of the visionary section of the later alchemists. In astronomy the correct process is systematic astronomical observation and the mathematical digestion of its results: its opposite, the crude speculations of ancient astrology. Modern medical science rests fundamentally on a correct process in diagnosing disease according to the symptoms and applying a remedy adapted as nearly as possible to the condition found. If the physician can apply this process rightly, *i.e.*, if he can make a perfect diagnosis, and has a remedy perfectly adapted to the condition, a correct result must follow. A contrary process in this case in the practice of charming, or the methods of treatment followed by medicine men in barbaric and savage trives. These processes, though accurately applied according to their own requirements, need not result correctly at all.

Modern courts exemplify fundamentally a correct process when the judge or jury seeks to distinguish which of the witnesses are trustworthy, or which of the statements of each witness are trustworthy, and give a decision according to this test of all the personal, documentary and other relevant evidence offered. If this distinction be correctly made, the decision must be correct. A contrary process in this case is the ancient and mediæval practice of trial by ordeal, or by corsned, or by the eucharist, or by wager of battel, or even the rule of Roman and Canon law, under which testimony was governed strictly by the numerical system, witnesses being counted not weighed (*numerantur non ponderantur*), and the corresponding practice in Anglo-Saxon and Norman times, when, according to the importance of the case, proof was made six-handed, twelve-handed, etc., he who had the greater number of witnesses prevailing. All the requirements of such processes could be perfectly fulfilled, and yet the result be incorrect.

Thus throughout the various branches of science, theoretical and practical, exact and inexact, the same principle of correct processes fundamentally prevails. It produces also, throughout all these branches, fundamentally the same result. Under accredited operation (a condition equivalent practically to competent operation, because an accredited operator, who is, or may become, incompetent, will be promptly discredited by an excess of error in his results), correct processes cannot ordinarily prevent incidental error entirely; but they guarantee an average of essential correctness corresponding in height to the exactness of the branch of science involved. Even the exact science of mathematics can provide ordinarily, in a series of results prepared for use by others, only a high average of essential correctness. Thus in such a work as Chambers' *Mathematical Tables*, containing approximately 200,000 numerical quantities, the editor anticipates, and experience teaches, that there is a percentage of unlocated errors: and if, *e.g.*, the number of such undetected errors be taken at the irreducible minimum of 1, the approximate proportion of incidental error and average of essential correctness would be respectively 1/200,000 and 199,999/200,000; if at 10, 10/200,000 and 199,990/200,000; and if at 25, 25/200,000 and 199,975/200,000.

Trautwine, in his *Civil Engineer's Pocket-Book*, the standard and foremost work of its kind in America, says that he has detected a great many errors in mathematical tables in common use. The presence of even one such unlocated error stands as a proportion of error against the table as a whole, thereby reducing to an uncertainty the correctness of any individual quantity in it when applied by the user without further test, and leaving as the only certainty in connection with the table an average of essential correctness. The user applies the individual quantities in his own operations ordinarily without further test, not as being certainly correct, but as being the result of accredited operation of correct processes, and therefore *prima facie* correct (4th fundamental principle, Part I, pp. 141-144). To do otherwise would defeat the very purpose of the table and prevent his own proper activity; and this is not necessary because such untested use of the individual quantities will reproduce in the user's own operations as a whole an average of essential correctness corresponding approximately to that of the table.

The correct processes of historical science located by actual experiment in Part I of this paper are the testing of verbal and recorded utterances by their exemplification of the following five requisites of trustworthiness: (1) Right discernment and clear statement, (2) Serious effort to inform the hearer or reader according to his interest, (3) Exercise of impartiality, (4) Preservation of poise, (5) Exclusion of admittedly unnecessary conclusions. It is by these requisites that the courts seek to judge which witnesses, or which statements by any witness, are trustworthy. Perfect exemplification of the entire five in verbal or recorded utterances leads necessarily to perfectly correct statements; therefore the historian testing his verbal and recorded material by them, in substantially the same manner as the courts test their verbal and documentary evidence, applies 5 processes which are correct in the strictest scientific sense: apart from error by himself in the application, the processes must show without fail what records or statements are trustworthy, because in the processes themselves, apart from incorrect application by the operator, there is no room for error. These 5 fundamental processes of the historian are not exact processes, and cannot make history an exact science, but by them she can attain to the essential correctness, which is all that any branch of science can achieve. In a narrative formulated on the basis of these processes, the historian cannot provide certainty in the individual statements. But neither does mathematics, the exactest science, provide this certainty in a series of results prepared for use by others. In such an historical narrative, which essentially is also a series of results prepared for use by others, the certainty provided by the historian is exactly the certainty provided by the mathematician—an average of essential correctness corresponding in height to the exactness of the branch of science involved. Where records exemplify the 5 requisites, or historical narratives are formulated on the basis of the corresponding 5 correct processes, the individual statements in such records or narratives, like the individual quantities in a mathematical table, being the product of correct processes, are *prima facie* correct, and ought to be accepted by any user (reader or subsequent historical investigator) without further test, if such test be impossible or unreasonably inconvenient. This acceptance is for the same reason as in the case of the table: to do otherwise would defeat the very purpose of the record or narrative, and this is not necessary because such untested use will reproduce in the user's data and own investigations and narrative an average of essential correctness corresponding approximately to the average of essential correctness in the records or narratives so used.

All that could ever be proved against such records, narratives and tables, and against the results of such users, would be a proportion of incidental error not sufficient to lower their average of correctness beneath the required average of the respective branches of science involved. Under the application of correct processes, the average of essential correctness in history, though not equal to the mathematical, exceeds that of medical practice and of the courts, because physicians and courts are obliged to make a decision even if the available data and evidence are unsatisfactory, but the historian, when in doubt, can always preserve silence. Under the prevailing method, however, history is the great exception among all the sciences. It has no fundamental correct process or processes. The nearest approach to one is its test for certainty by agreement of two or more independent sources in confirmation of any specific point. According to Seignobos, however, who is one of the two more prominent recent writers on the prevailing method, this confirmation by two or more records is most frequently lacking save in recent history; and even where the confirmation is available the original independence of the confirming records cannot be conclusively shown except in modern periods.[1] Bernheim, the other writer, believes that this estimate of the number of confirmed points is too small, but one need not depend on the opinion of either: it is clear in itself what a blanketing and disruption of history would follow if all singly attested periods and points were stricken from its reckoning. The most important single features in any historical method are its test for trustworthiness in records and its treatment of conflicting statements in trustworthy records where the circumstances of the discrepancy are unknown. In the prevailing method the treatment of such discrepancies is to attempt a harmoniza-

[1] Langlois & Seignobos, *Introduction aux Études Historiques*, pp. 168, 174. Seignobos wrote the part of the book containing the passages cited. He is professor of contemporary history at the Sorbonne (University of Paris). Bernheim is professor of history at Greifswald in the Prussian province of Pomerania.

tion; and though Bernheim would like to deny it, it is a fact which can be proved in itself and from his own manual that the present method's grand test for trustworthiness in records is their contemporaneousness. Both the treatment and the test are incorrect and purely probable processes. As long ago as 1891 Ottokar Lorenz, an approved scholar and author, in a work[1] which Bernheim (p. 183) calls a "direct declaration of war" on the prevailing method, drew attention to the fact that the contemporaneousness of a record, on which point "critical gentlemen lay so much stress" proves nothing at all about its trustworthiness. It is, moreover, a fact well known and established by specific tests that out of any considerable group of observers with equal opportunities, all present together and therefore all contemporaneous to a dot, a few will report the features of an occurrence with substantial correctness, and the remainder will not. But still the fetich holds. In a portly volume on historical method, the qualities which, present in the few, necessarily made them trustworthy, and, wanting in the many, left them necessarily untrustworthy, may be unnoticed and unanalyzed or receive at best a bare mention in a few lines, while page upon page are devoted to a careful analysis of contemporariness and similar features in which the incorrect and correct reporters alike shared, and which, as Lorenz said, prove nothing at all about trustworthiness.

When Lorenz placed his finger on this tender (because diseased) spot in the present method, Bernheim, unwilling to admit and yet unable to deny outright the correctness of the other's contention, made the following heated answer (p. 327):

"I doubt much whether, as Lorenz maintains, there are among historical investigators any with intellects so limited as to fancy that a narrative is correct because shown to be contemporary—every half-ways sensible historian regards this as but one of many things to be considered.[2] . . . It is strange that I should be required thus to censure an approved scholar, but it is not my fault if he takes a delight

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[1] "*Die Geschichtswissenschaft in. Hauptrichtungen und Aufgaben*" (in two parts, 1886 and 1891). Between 1859 and 1895 Lorenz wrote nine works in fourteen volumes, collaborated with another writer in a tenth, and edited an eleventh, or in all sixteen volumes of a purely historical nature or closely connected with the study. He was director of the Austrian archives from 1857 to 1865, and professor of history at Vienna from 1860 to 1885, when he accepted a call to Jena.

[2] After this reply one would expect that Bernheim in his own subsequent treatment of trustworthiness would relegate the test by contemporaneousness to a subordinate place and that the "many other things to be considered" would there come to the fore. But instead he says in that treatment (1) that the "determination of the time when a record originated is important because its value as evidence depends upon the nearness or distance in time (von dem näheren oder entfernteren Zeitverhältnisse . . . abhängt) between the record and the events" (pp. 391-392), *i.e.*, upon whether or not the record is contemporary; (2) that "the determination of the

in smart paradoxes which unless refuted must become a source of disturbance."

Bernheim's attitude here is typical of all the "orthodox" who wish to preserve an erroneous system because they fill in it what they regard as a creditable niche. Before their eyes the structure that houses them may crumble, but they cannot see. If a Lorenz reminds them of its decay, he is a "disturber," and they will not hear. But the crumbling and the decay continue. The extent of it and the result in general of the emphasis and use of the above test and other probable instead of correct processes in history may be inferred from the fact that Professor Dunning in the presidential address above mentioned, when describing the "subject-matter of the science," frankly added the qualifying words, "if science it be."

Is History under the Prevailing Method a Science?

The doubt of Professor Dunning is the more significant because he speaks as a sympathetic adherent of the method. But this crucial question should not be left at the stage of sympathetic doubts. There should be a definite test; and the way by which it is proposed here to make that test is by stating, from the utterances of supporters of the present method, (i) the minimum requirements of history as a science, and (ii) the manner in which those requirements have been met.

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place where the record originated is not nearly so important as that of the time" (p. 398); but (3) that "most important is the determination of the author" (p. 400) because the "decision as to trustworthiness depend chiefly (*in erster Linie*) upon whether the record is an original source" or "as the question is usually formulated, upon whether the author is a contemporary," and "secondarily (*in zweiter Linie*) upon correct observation, or in the absence of direct observation, upon correct report" (pp. 507-508). In other words, by Bernheim himself, notwithstanding his language toward Lorenz, not only is much stress, but much the most stress, is laid upon contemporariness as the test for trustworthiness in records. And notwithstanding his statement concerning investigators with little intellect and half-ways sensible historians, the same stress is laid on the same test by men of much intelligence and who are a great deal more than half-sensible. Professor W. A. Dunning, in the presidential address of the American Historical Association (1913; *cf. American Historical Review*, January, 1914, p. 219) said, "He (the scientific historian) must know precisely what happened and he must know it from the original contemporary evidence." And Professor F. M. Fling, in illustrating the use of his *Source Book of Greek History* (*History Teacher's Magazine*, September, 1909, p. 7) rated Aeschylus' *Persians* as a more valuable account of the battle of Salamis than that of Herodotus because the play was presented only a few years after the event but Herodotus wrote about fifty years later. An extremer application of the test by contemporaneousness could scarcely be conceived; for solely on the ground of that test the palm is awarded to a poetical drama when in fact no historical value ought to be ascribed to it in itself, and still less in comparison with an historian, because the purpose of theatrical productions is not necessarily to convey historical information at all.

The supporters of the method name two requirements:—

1. History as a science should not stop at, or sink into, uncertainty and scepticism, but must supply assured knowledge: "In the historical method there are two difficulties (one in the material and the other in our understanding) which may give rise to doubts as to the possibility of sure results and have indeed repeatedly caused serious scepticism concerning the 'certainty of history.' These doubts dare not be left undiscussed, for it is one of the most essential characteristics of all science that it supplies assured knowledge."—Bernheim, *Lehrbuch*, p. 189.

2. History should not stop at, or sink into, mere collections of historical material. Its ultimate object is to synthesize these materials into trustworthy, organized, and literary narratives, without which the material will remain, even to the expert, only a discontinuous incoherent mass: "We cannot help using the narrative as our primary authority, and our other sources of knowledge as something subsidiary. The narrative is commonly continuous; if it does not tell us the whole tale, it at least tells us the tale as a whole. The documents and other sources of knowledge are for the most part not continuous; they come in only now and then; the knowledge that they give us is piecemeal."—Freeman, *Methods of Historical Study* (1886), p. 170.

Of these requirements the 1st is the chief general requirement of historical, in common with all other, science; and the 2nd is the chief specific requirement of historical science in particular. The fulfilment of the 2nd depends upon the fulfilment of the 1st because no historian can formulate a trustworthy synthetic narrative of events concerning which he has no assured knowledge.

The fulfilment of the 1st requirement by the prevailing method will be tested from two stand-points, (a) a comprehensive experimental application of the method to an extensive field of history, and (b) the general attitude of representative books of method towards historical certainty and the success of the method in general in forestalling or overcoming scepticism.

(*a*) *Comprehensive experimental application of the present method.* Professor Fling of the department of history in the University of Nebraska is himself the author of an *Outline of Historical Method* (1899) with the thorough knowledge which must come from such authorship and from long experience as an instructor. He thinks so highly of the method that he believes the teaching of it even in secondary schools is of more importance to the pupils than historical information in itself. For this reason he published the *Source Book of Greek History* (1907) previously mentioned, and gave a "specific illustration" of its use in the *History Teacher's Magazine* (September, 1909), with the extracts from his book on the battle of Salamis. By a characteristic application of the essential features of the prevailing method to these extracts, he reduced his conclusions concerning this momentous contest of antiquity "possibly only to the fact that the battle took place;" and having suggested that the class be required to write a narrative embodying the results obtained and to compare it with the accounts of the battle in two or three of the best school histories, he sums up the entire discussion and article thus:—

"They will be somewhat surprised to learn that these accounts contain no suggestion of the uncertainty that surrounds the history of the battle, but describe it with all the confidence that might be displayed by a historian of events established by a cloud of witnesses. It may be objected that this sort of source work will raise very serious doubts in the pupils' minds as to whether we know anything with certainty about the history of the early centuries. But what if it does? What harm has been done, if the impression is a correct one? Is not much of our knowledge concerning the history of the Greeks and Romans of the most fragile character? Why attempt to conceal it? Should not the pupils be taught by this kind of critical study that much of what is repeated with confidence as history has hardly a shred of valuable evidence to rest on?"

The position of Professor Fling as an advocate wishing to meet possible objections to the introduction of the prevailing method into secondary schools requires that he should present the best results it can offer; and if his knowledge and experience of the method had justified the course, he would have been pleased to advance as its characteristic product something more satisfactory than this comprehensive scepticism and uncertainty.

(*b*) *General attitude of representative books of method and success in general in overcoming scepticism.* With a view to independent impartial selection, the two works (and the only two) named as representative books of method in the article on "history" in Nelson's *Encyclopædia*—the French work of Langlois and Seignobos, *Introduction aux Études Historiques* (1898), and the German work of Bernheim—will be considered here. Seignobos who wrote the section of the French work on internal criticism dealing with trustworthiness and certainty in history reached the following general conclusion (p. 174):—

"For antiquity and the middle ages historical knowledge is restricted by scarcity of records to general features (*faits généraux*). In contemporary history it can extend more and more to single events (*faits particuliers*)"

For nearly the whole of history Seignobos' scepticism is thus practically complete; and on the same basis the steady recession of recent and contemporary history into the past, in so far as there may be an accompanying diminution of records now available, will project into the future a like scepticism concerning the history that now is contemporary. The grounds of this scepticism are noted above (p. 494). He pressed them further in a subsequent work (*La Méthode Historique appliquée aux Sciences Sociales*, 1901), of which he is the sole author.

Bernheim, the other representative writer under consideration, states (pp. 197-198) that recently in the very wake of the keenest critical investigation the blunt French scepticism of the 17th and 18th centuries which declared that "history is only a fable agreed upon," has reappeared anew, and in finer but all the more wide-spread form it seeks often to "steal with its doubts upon the historian at his work." Before this danger Bernheim assumes a superb confidence. "We are in a position," he declares (pp. 199, 206) "to repel sceptical attacks upon the certainty of historical knowledge, from whatever quarter they may come. They only lead us to deal methodically with the various sources each according to its character, and to apply the methodical rules and precautions, in order to penetrate through all the confusion to the actual truth. The ways and means to this end are supplied in the *Kapitel der Kritik*."

This "Kapitel der Kritik" or chapter on criticism in Bernheim's own manual, expounding at length (238 pages in the edition of 1908) the characteristic features of the prevailing method, has been before the public since the year 1889. The manual thus commended by its own author as an unfailing specific against the ills of a "despondent scepticism" is more esteemed in America than in the country of its origin,[1] and therefore the good results which he anticipates from its use should be more in evidence here than there. Nevertheless, in December, 1913, Professor Dunning, speaking not in an ordinary connexion but as the official head of the national organization of the historical profession in the United States and principal historical body in all the Americas, the members of which body received the address with manifest appreciation (*American Historical Review*, April, 1914, p. 479), made the following three statements:—

1. " 'Pilate saith unto Him, What is truth?' Thus ends the report of one of the most famous conversations ever recorded. That the colloquy should have terminated without an answer to the question

[1] Bernheim's work is a bulky volume of 852 large octavo pages (edition of 1908), but the standard German annual review of historical publications *Die Jahresberichte der Geschichtswissenschaften* rated it, on its first appearance, as of much less value than J. G. Droysen's slender booklet *Grundriss der Historik*.

of the Roman procurator, must always raise regret in the mind of the reader and writer of history. For we are told often and conclusively that history has truth for its subject-matter and the discovery of truth for its end. An authoritative definition of truth, therefore, would have been a priceless boon. It has indeed been often asserted that the question of Pilate was interrogative in form only, and that his real thought was to affirm the hopelessness of ever reaching a definition. If such was the case, one might reasonably conjecture that the Roman had lately been engaged in historical research; for in no other occupation is there more powerful stimulus to the despair that his remark expresses." (*American Historical Review*, January, 1914, p. 217).

(2) "That the critical spirit in the study of history during the nineteenth century has produced some astonishing results, is beyond all controversy. Its reconstructions of human life in the past have been no less significant than the amazing changes wrought by the physical sciences in our ideas of the material universe. No wonder that the mantle of scepticism has enveloped the whole historical gild, so that only the hardiest of the fraternity dares venture a commonplace without the original source as a foot-note to sustain him." (*Ibid.*, p. 226).

(3) "The search for original material has occupied the first place in the attention of historical students (during the last two generations) and has proved beneficent in two ways at least: it has enormously increased the mass of such material for the use of the man competent to make a synthesis from it, and it has furnished an all-engrossing occupation for many who might otherwise have tried their hands, and the patience of their readers, in the hopeless task of synthesizing. The high ratio of monographic collections of material to organized and literary narrative is one of the most familiar characteristics of recent publications in history." (*Ibid.*, p. 219).

Bernheim (p. 237) dates the real beginning of history as a science in the modern sense (=the prevailing method) at the appearance of Ranke's *History of the Latin and German Nations* in 1824. On this basis the sweeping victory of scepticism recorded in the first two of the above statements by Professor Dunning has followed upon nearly a century's trial of the present method in general, and a twenty-four years' test of its virtues as expounded by Bernheim in particular.

Summarized, therefore, the acknowledged situation as to the 1st or general requirement of history, in common with all other sciences, that it dare not stop at, or sink into, scepticism and uncertainty, but must supply assured knowledge, is as follows:—

i. Of the two representative and more prominent exponents of the method, Professor Seignobos is not only fundamentally sceptical, but increasingly so in his successive works.

ii. Professor Bernheim, the other exponent, was confident, as long ago as 1889, that the present method could supply assured knowledge and repel every attack of scepticism from every quarter; but *per contra:* (1) In 1898 and 1901, or 9 and 12 years later respectively, there appeared the fundamentally and increasingly sceptical works of Professor Seignobos; (2) in 1907 and 1909, or approximately 20 years later, Professor Fling, in an experimental and comprehensive application of the prevailing method, could offer as its net and best result only a comprehensive uncertainty; and finally (3) in 1913, or 24 years later, so far from the present method having cleared the field of scepticism, Professor Dunning, who says that truth and its discovery are the subject-matter and end of history, says also that historical research (=the application of the present method) leads to "despair of truth," and that the whole historical gild (who are applying that method) are enveloped in the mantle of scepticism.

As to the 2nd or chief specific requirement of historical science in particular, which is that it should provide trustworthy, synthetic, organized and literary narratives, and which depends for its fulfilment on the fulfilment of the 1st or general requirement: According to the 3rd of the above statements by Professor Dunning, the number of organized and literary narratives by historians is sinking before the number of monographic collections of material; many have abandoned the hopeless task of synthesizing; instead they are gathering for the present a mass of material in the hope that it may be used some day by some man who may prove competent to make a synthesis. In other words, after a century's trial of the present method, historical science is sinking, with respect to its own chief specific requirement, more and more into the place where it is only marking time.

The men whose position and own utterances on this question are thus stated and summarized are not only friends and supporters of the present method. They are scholars of the first rank; academic instructors with mature experience; the foremost authors upon the method; the most competent judges who will view it, not with cold justice, but with sympathetic appreciation. These men have thus gone upon record that the method does not meet the minimum requirements which they themselves have set for history as a science: therefore, to the question here under test, "Is history a science?" the answer, under the prevailing method, according to the adherents of that method, is that it is not.

I. The Methodic Principles of Science.

In testing the scientific status of any process or method of investigation and solution of problems, theoretical or practical, the following four principles are necessary; and for convenient identification henceforth in this paper they will be designated collectively as the four methodic principles of science, and severally as the first second, third and fourth methodic principle respectively:—

i. An incorrect process is one in which the operator deviates from a requirement of a correct process, believing that such deviation is proper.

Illustration:—A student who is required to find the sum of the upper three of the following numbers gets as a result the fourth number:

$$\begin{array}{r} 851 \\ 353 \\ 424 \\ \hline 1{,}528 \end{array}$$

The correct total is 1,628. The student has obtained his total by omitting to carry 1 from the middle column to its proper denomination in the left column according to the requirement of the process of addition in this case, the sum of the middle column being 12. If this omission is unintentional and due only to an oversight on the part of the student, he has merely made an incidental error in the application of the process of addition. If, however, the omission was intentional and he habitually makes such omissions in the belief that it is not necessary to carry forward such numbers from one column to their proper denomination in the next column, the student has a process of his own for taking the sum of a series of numbers; and this process, because it deviates from a requirement of the correct process, is incorrect.

ii. Where an operator deviates from a correct process, the result, if correct, is nevertheless unscientific because accidentally obtained.

Illustration:—In the above problem in addition if the student omitted for any reason, *i.e.*, intentionally or otherwise, to carry 1 from the middle column to its proper denomination in the next column, he could obtain the correct total, 1,628 only if, in adding the next column, he made a further mistake which would counterbalance exactly his previous omission, *e.g.*, if he called the sum of 3 and 4, erroneously, 8 instead of 7. The occurrence of such an exactly counterbalancing error could be only accidental; therefore, if the student made the first omission and still obtained a correct result, such result, though correct, would not be properly ascertained and for that reason it would be unscientific.

iii. IF A CORRECT AND AN INCORRECT PROCESS COINCIDE IN PART, CORRECT RESULTS OBTAINED BY THE APPLICATION OF THE INCORRECT PROCESS WITHIN THE COINCIDENT PART ARE ONLY ACCIDENTAL AND AFFORD NO GROUND FOR ACCEPTING AS CORRECT THOSE RESULTS WHICH ARE OBTAINED BY THE APPLICATION OF THE INCORRECT PROCESS WITHIN THE NON-COINCIDENT PART.

Illustration:—If a student in taking the sum of a series of numbers omits habitually to carry the numbers from one column to their proper denomination in the next column but observes in all other respects the requirements of the correct process of addition, he will, notwithstanding his incorrect process, add correctly such a series of numbers as the following:

$$\begin{array}{r} 111 \\ 354 \\ 413 \\ \hline 878 \end{array}$$

His success in obtaining this correct result is due to the circumstance that in adding these numbers, there happens to be nothing to carry from one column to another. Aside from this point his method coincides with the correct process; therefore, in this particular problem in addition, he happens to use only that part of his incorrect process which coincides with the correct. His success in obtaining accidentally a correct result under these circumstances affords no ground for accepting as correct the results which he will obtain where he must apply that part of his incorrect process which does not coincide with the correct.

iv. Where, under proper application, a process considered to have been established by experience as correct fails in any instance to produce a correct result, the process is thereby scientifically condemned and ought to be abandoned unless the failure can be differentiated, *i.e.*, unless a controllable cause of it can be located and the process so adjusted as to prevent similar failures,

Illustrations:—(a) *Where differentiation is possible:* The bridge of the Quebec Bridge and Railway Company over the St. Lawrence river near the city of Quebec collapsed in course of erection on August 29, 1907. The span that collapsed was designed for more than twice the length of any previously constructed in America. In the subsequent official inquiry it was ascertained that a variety of causes, including the excessive unit stresses of the entire structure, tended to induce the disaster; the actual point of failure, however, was in the lower chords of the anchor arm near the main pier, the failure being due to the weakness of these compression members or columns, and especially to insufficient latticing of the chords. The defective design of the lattice was not due to a lack of common professional knowledge on the part of the responsible engineers. These engineers, who were prominent members of their profession in America, depended necessarily, in designing a span of the adopted length, on the experience of themselves and others gained on much smaller bridges. With respect to the lattice of the columns or posts, they exercised their judgment in points which are necessarily left to the individual judgment of the engineer. This judgment proved faulty; but the engineering profession, though it has learned much from their mistake, is not yet in a position to determine the percentage of their error. Until this determination has been made, it will be impossible to design latticing for such lengthy spans that will be unquestionably safe and not unnecessarily heavy. Meanwhile, however, it is not necessary to forego their construction because, while the professional knowledge of the day is not sufficient to design such structures economically, a bridge of the adopted span that will be unquestionably safe can be built by using a considerably larger amount of metal than might be required if this knowledge were more exact. In other words, with respect to lengthy spans, the engineering process of bridge construction which hitherto proved in experience to be correct, is not scientifically condemned and need not be abandoned on account of the Quebec failure, because that failure has been differentiated, *i.e.*, a controllable cause of it was located in the weakness of the columns or posts and by using an excess of metal in these posts that process has been sufficiently, though not as yet accurately, adjusted to prevent similar failures.

(b) *Where differentiation is impossible:* In experience it has been found that the thumb prints of two persons are never exactly alike, and for this reason an exact similarity of thumb prints has been accepted in experience as a correct process of identification. If, now, contrary to all previous experience, a case should be found in which the thumbs of two persons would make exactly similar prints, a failure would be established against thumb print identification as a correct process. Such a failure could not be differentiated because no controllable cause could be located for a failure due to a highly exceptional recurrence in nature. The process of thumb print identification, therefore, in view of such a case, could not be so adjusted as to prevent similar failures, but would be condemned scientifically and would have to be abandoned, save as a corroboration of other evidence. A conviction in capital cases would be impossible on thumb print evidence alone. Such a case was thought to have been discovered in England in 1911, but this was subsequently disproved. (See, on this case, Appendix B in the author's paper on the *Origin and Treatment of Discrepancy in Trustworthy Records* in the Transactions of the Society for 1911, vol. v, p. 176).

The 4th methodic principle is akin to the 4th fundamental principle of science (See Part I, p. 141) in so far as they are both governing principles in actual intercourse, and are capable of illustration by examples drawn from that field. The 4th fundamental principle, however, governs the relations of men in their ordinary course, and is capable, therefore, of well nigh endless illustration; but on the contrary, the instances where processes previously found correct in experience fail under proper application constitute a great exception, and illustrations of the 4th methodic principle are correspondingly rare. The activity of the one principle is continuous, that of the other occasional; yet where occasion demands, the application of the 4th methodic principle is as necessary and certain as that of the other, and, in fact, from the field of correct mechanisms, illustrations may be obtained of the daily application of a principle which is practically the same as the 4th methodic principle. A correct mechanism is a mechanical process that rightly operated leads necessarily to correct results, and where such a mechanism is self-operating, it constitutes a correct process in itself. One of the commonest and best examples of such a mechanism is an ordinary watch that is kept in proper order and wound. A watch in this condition necessarily measures time correctly, and if it has proved correct in the owner's experience, he will be governed by it concerning the most important engagements. But if the cannon-pinion of such a watch becomes too loose, the time-piece may stop for a half an hour or an hour and then start of itself and run correctly for several weeks before a similar lapse occurs. Thus the owner may suddenly find the watch wound up and apparently going properly, yet fully a half an hour or more behind time; and though, if the hands be reset, it may keep time accurately for several weeks without a similar occurrence, the owner should not, after one such lapse or failure, and he will not, after several of them, be governed by the time-piece in any important engagement until the watch (=the process) has been adjusted to prevent similar failures. The principle here illustrated corresponds to the 4th methodic principle, and among the millions of watches in use, the disorder in question, though one of the less frequent, is a common and daily occurrence; hence a principle concerning correct mechanisms corresponding to the 4th methodic principle is shown to be, like the 4th fundamental principle, in continual operation.

II. EXPERIMENTAL AND THEORETICAL TEST OF PROBABILITY AS A CRITERION OF CONCLUSIONS IN HISTORICAL SCIENCE.

What is Probability?

In any standard dictionary a definition of probability will be found in the following or equivalent terms: "having more evidence for than against"; "supported by evidence which inclines the mind to belief but leaves some room for doubt;" "having more than half the chances favorable;" "a preponderance of argument on one side, inclining the mind to receive it as the truth, but leaving some room for doubt." This is the ordinary meaning of probability as a term in general use. It is also the ordinary meaning of probability in historical science. Bernheim, a supporter of the prevailing historical method, says, (page 201): (*Translation*) ("In historical investigation we call a fact probable if the reports or other reasons for believing that it occurred outweigh the reports or other reasons for believing that it did not occur, although its non-occurrence remains always a possibility."

In standard dictionaries probability is defined further in a specific logical and mathematical sense as the "amount of rational confidence with which a contingent event may be expected or a problematic statement may be accepted as true. In this sense an event has some degree of probability if there be any chances at all in its favor, even though the majority of the chances may be against it." "Were 5 black and 10 white beans thrown into a box, the probability that a white bean would be touched first by a blindfolded person would be 10/15 or 2/3 (=10 chances out of 15, or 2 chances out of 3), while the probability against this event and in favor of the touching of a black bean first would be 5/15 or 1/3 (=5 chances out of 15 or 1 chance out of 3)."

The *Century Dictionary* (New York; The Century Company), in a lengthier definition of probability and of the fundamental rules governing it in its logical and mathematical sense, enunciates the following two principles:—

> (1) "Probability has been defined as the degree of belief which ought to be accorded to a problematical judgment; but this *conceptualistic probability*, as it is termed, is strictly not probability, but a sense of probability. Probability may be measured in different ways. The conceptualistic measure is the degree of confidence to which a reason is entitled; it is used in the mental process of balancing reasons pro and con. . . . But the measure which is most easily guarded against the fallacies which beset the calculation of probabilities is the ratio of the number of favorable cases to the whole number of equally possible cases, or the ratio of the number of occurrences of the event to the total number of occasions in the course of experience. This ratio is called the probability or chance of an event. Thus the probability that a die will turn up ace is 1/6." (=1 favorable case or chance out of 6).
>
> (2) "The chief practical application of probability is to insurance and its only significance lies in an assurance as to the average result in the long run."

The reference in the 2nd principle here enunciated is not to the inferior conceptualistic measure of probability or "balancing of reasons pro and con," but to the superior measure or ratio described in the 1st principle as most easily guarded against fallacies.

PROBABILITY AS A CRITERION OF HISTORICAL CONCLUSIONS, EXCEPT WHERE THEY REPRESENT AVERAGED RESULTS, IS CONDEMNED BY IMPARTIAL DEFINITIONS.

The Century definition is drawn from the stand-point of science in general, therefore it is impartial with respect to any one of its branches, such as historical science, which is here especially under consideration. According to the definition there are two measures of probability, an inferior and a superior, and even the superior measure cannot produce results individually correct, but its only significance is as to average results in the long run. According to Bernheim, probable conclusions in history rest on the inferior measure, because he states specifically that a probable conclusion in historical investigation is one in which the reports or other reasons in favor of the conclusion outweigh those against it. This is essentially a process of balancing reasons pro and con, described in the *Century* definition as the *conceptualistic* or inferior measure. From these definitions in Bernheim and the *Century Dictionary* it is, therefore, a necessary deduction that probable conclusions in history, except where they represent averaged results, are without significance or value because they rest ordinarily on the inferior measure, which must be less able than the superior to produce individually correct results, the superior in turn being without significance in producing these.

PROBABILITY TESTED EXPERIMENTALLY.

Bernheim's definition of probable conclusions in history is essentially correct. They rest ordinarily on a variety of opposing reasons of different values, and the respective groups of favorable and unfavorable reasons as a whole are weighed or balanced against each other in order to strike what historians call a "balance of probability" for or against the conclusion. The probability of conclusions so drawn cannot rise above the level of the inferior conceptualistic measure. In actual experience, however, and therefore also within the historian's special field, cases may arise where two opposing reasons are so prominent, and subsidiary reasons, if not excluded entirely, are relatively so insignificant, that the opposing favorable and unfavorable chances may be determined accurately or be estimated with enough accuracy to raise the resulting conclusion to the level of the superior measure of probability. This superior measure is described in the Century definition above quoted as the ratio of the number of occurrences of the event to the total number of occasions in the course of experience and it is there illustrated by the throwing of a die: the probability that the die will turn up ace is 1/6, or 1 favorable chance out of 6, because the die has equal chances of falling on any one of its six sides and only one of these sides is ace. By a series of cases located in actual experience where the chances for and against the conclusions can be accurately determined or conservatively estimated, the author proposes to test experimentally the deduction made from the foregoing definitions. The cases will be given in narrative form and in harmony with the conditions actually prevailing in historical investigation. Almost invariably in the study and writing of history the evidence relating to any event becomes available, not in a mass and at a single juncture, but in successive parts separated usually by considerable, and often by great, intervals of time. Within each of these intervals an historian must base his conclusions and formulate his narrative on the evidence then available. For this reason in the present test each case will be dealt with on the basis that the trustworthy evidence relating to it becomes available, not at a single point of time, but in successive stages or parts separated by intervals. At each of these successive stages a probable conclusion will be formulated on the basis of the evidence then available. The degree of probability of the conclusion so formulated will be accurately determined or conservatively estimated. Its actual value will be shown by the subsequent addition of evidence.

CASE I.

Case I will first be stated analytically in order to illustrate the principles and working of the test. The case so analysed will then be put in narrative form as an example of the remaining cases, which will be given, without introductory analysis, only in that form.

a. Analytical Statement of Case I.

(Evidence, Part 1): "On a summer day, a lady, clad for the street, emerged from her home. Opposite her in the sky, otherwise bright and clear, were clouds of very threatening aspect. As she stepped from the veranda, she raised her head in the direction of the clouds with a motion of surprise, and stopping short she turned and re-entered the house."

If the evidence ceases at this point, it will afford ground for a probable conclusion that the lady returned to the house to avoid the threatened rain. The degree of probability in favor of this conclusion will be fixed, according to the superior measure of probability as defined in the *Century Dictionary*, by the ratio of the number of occurrences of the event to the total number of occasions in the course of experience; *i.e.*, in the present instance, approximately by the number of ladies who, within a given large extent of territory and within a given lengthy period of time, emerge from their homes under circumstances similar to those described and return to the house for shelter, as against the total number of ladies who, within the same territory and period of time, and under the same circumstances, return to the house for any reason, whether for shelter or for any other purpose, such as to get an umbrella or rain-coat. It is impracticable to secure definite statistics on such a point, but in view of the unwillingness of ladies even with an umbrella and rain-coat to venture out, save for a necessary purpose, in the face of impending rain, a conservative estimate of the ratio will be 2/3 or 2 out of 3, *i.e.*, out of every three ladies who, in such a territory and period of time, return to the house under the above circumstances, two do so for shelter and one for some other purpose, *e.g.*, to get an umbrella or rain-coat. The popular expression for this ratio is two to one (2:1), but the fractional expression 2/3 is scientifically superior. To determine numerically the probability of an event, some value must be assigned to absolute certainty, or that state of the case where all the chances without exception are favorable. This value is usually taken as *unity* or 1, so that a probability short of absolute certainty is always represented by a proper fraction having for numerator the number of favorable chances and for denominator the total number of favorable and unfavorable chances; and impossibility, or that state of the case where all the chances without exception are unfavorable, is represented by *zero* or 0.

(Evidence, Part 2): "Presently she reappeared carrying an umbrella, and continued on her way."

This addition to the evidence disproves the 1st probable conclusion that the lady, abandoning an errand abroad, returned to the house for shelter; but the evidence as extended affords ground for another conclusion, namely that the lady noticed the clouds and therefore returned for the umbrella. At bottom, however, this is only a probable conclusion. The evidence, even as extended by part 2, contains nothing that shows necessarily whether the lady noticed the clouds or why she re-entered the house. The degree of likelihood in favor of the 2nd probable conclusion will be fixed approximately by the number of ladies who, within a given large extent of territory and within a given lengthy period of time, emerge from their homes under circumstances similar to those described and return for an umbrella because they notice the clouds, as against the total number of ladies who, within the same territory and period of time and under the same circumstances return to the house and reappear presently with an umbrella, whether this was because they noticed the clouds or for any other reason. On this point, as in the 1st probable conclusion, it is impossible to secure definite statistics, but the 2nd conclusion is manifestly much more probable that the 1st (2/3 or 2:1) and its degree of likelihood may be conservatively estimated to be at least 20/21 or 20:1, *i.e.*, out of every twenty-one ladies who in such a territory and period of time re-enter their homes under the above circumstances and reappear presently with an umbrella, twenty do so because they noticed the clouds and one does so for other reasons.

(Evidence, Part 3): "The lady herself had not noticed the clouds. As she stepped from the veranda, she recalled that she had not taken a paper which was necessary for her errand and which she had laid out especially for the purpose. When she returned for the paper, her father who was standing at the window drew her attention to the clouds, and at his suggestion she took the umbrella."

b. Narrative Form of Case I.

The successive portions of available trustworthy evidence are printed in ordinary type, introduced respectively by the bracketed expressions, Parts 1, 2, 3. The successive probable conclusions are printed in smaller type between the parts of available evidence. These conclusions are introduced respectively by the bracketed expressions, Nos. 1, 2; and at the end of each is indicated, likewise in brackets, the degree of probability.

(Part 1): "On a summer day, a lady, clad for the street, emerged from her home. Opposite her in the sky, otherwise bright and clear, were clouds of very threatening aspect. As she stepped from the veranda, she raised her head in the direction of the clouds with a motion of surprise, and stopping short she turned and re-entered the house."

(No. 1): "Probably the lady, abandoning an errand abroad, returned to the house for shelter from the threatened rain." (2/3 or 2:1).

(Part 2): "Presently she reappeared carrying an umbrella, and continued on her way."

(No. 2): "Her purpose in returning to the house was not, as it seemed, to take refuge from the impending rain; but very probably, because she noticed the clouds, she returned for the umbrella." (20/21 or 20:1).

(Part 3): "The lady herself had not noticed the clouds. As she stepped from the veranda, she recalled that she had not taken a paper which was necessary for her errand and which she had laid out especially for the purpose. When she returned for the paper, her father, who was standing at the window, drew her attention to the clouds, and at his suggestion she took the umbrella."

According to the 1st and 2nd applicative principles of historical science (See Part I of this paper, 152, 155), where evidence is trustworthy, *i.e.*, where it exemplifies the five requisites for trustworthiness, one is required to accept the statements contained in such evidence as correct save in those points, if any, in which one can adduce necessary grounds for rejection. The present test is made on the basis that all the successive parts of available evidence are trustworthy, therefore a narrative confined to any part or parts of this evidence and necessary inferences therefrom will constitute a narrative of necessary conclusions in the above sense. Where probable conclusions such as Nos. 1 and 2 in this case are admitted, the narrative may be regarded on the contrary as one based on probability; hence the present experimental test of probability as a criterion of historical conclusions may serve also as a test of the respective merits of necessity and probability in narration. In a narrative of necessary conclusions incidental error may occur, but subsequent additions of trustworthy evidence ought not to alter essentially the account formulated on the lesser amount or amounts of previous evidence. Thus in the present case it will be noticed that in the narration confined to necessary conclusions, consisting of Parts, 1, 2, 3 of the evidence read uninterruptedly without regard to the intervening probable conclusions, each addition to the narrative forms a perfect juncture with the part preceding. At no point is there a correction of a previous conclusion; and at the first and last as well as at the intervening stage, the account is concise and accurate in every particular. On the contrary in the narrative opened to probable conclusions, each addition to the evidence necessitates a weeding out of previous statements, probable and yet erroneous; and the narration, so far from being concise and accurate, is burdened from the beginning with successive errors and corrections. This inaccuracy remains until the last addition of evidence disposes finally of the probable conclusions and forces the narrative back to the basis of necessary conclusions.

Case 2.

Narration.

(Part 1). "In the early part of the last century there lived in a city of France an old man named Jean Poisson. His dwelling was a single attic chamber in the poorest quarter, his fare was of the scantiest and worst, and his garb so mean that the arabs of the street were accustomed to follow him and to jeer at his rags and tatters."

(No. 1): "In all probability he was a pauper." (100/101 or 100:1).

(Part 2): "After his death, securities were found in his possession which showed that he was a millionaire."

(No. 2): "Instead of being a pauper, therefore, he was shown to be most probably a wretched miser." (25/26 or 25:1).

(Part 3): "All his wealth was bequeathed for the purpose of bringing from a neighbouring source an ample supply of good water for the poorer parts of his native city. In his youth he was impressed with the sickness and suffering prevailing there on account of scanty and bad water; and resolving to remedy the evil, he lived throughout a long life singly for that purpose, denying himself all but the barest necessities of existence."

Ordinarily in actual experience more than 100 out of every 101 persons living in apparent poverty are really poor. But when a person lives in such extraordinarily wretched circumstances that even the poor deride him, the question whether he may be a miser comes more into play; hence the above estimate in the 1st conclusion. In the 2nd conclusion the degree of probability is fixed approximately by the number of persons in actual experience who live penuriously for the mere sake of hoarding and leave a very large property at death, as against those who do this with an ultimate philanthropic purpose. A more recent case of such a philanthropic hoarder on a large scale, reported by the Vienna correspondent of the London *Standard* in 1912, is the Vienna "miser," Joseph Spitzberg. He lived singly, in a room without heat or light, on dry bread and tea, in order to bequeath two million crowns, practically all his fortune, for the founding of a children's hospital.

In Case 2 the narrative of necessary conclusions, consisting of the several parts of evidence read uninterruptedly, has, in addition to the ordinary advantages noted in Case 1, a moral superiority because, unlike the narrative based on probability, it makes no unnecessary reflections on the dead. The narrator gives simply the information available. For the rest, the reader may draw further conclusions, probable or improbable, as he may see fit. If such conclusions by the reader, *e.g.*, that the dead millionaire was a miser, be shown subsequently to have been erroneous and unjust, the narrator will not have contributed to the error and injustice.

Case 3.

Historical narratives on the basis of necessary conclusions consist chiefly of features drawn directly from various sources of trustworthy evidence and woven into an impartial account of the matter under consideration. Occasionally, however, the narrative may contain points which are not directly mentioned in the evidence and yet are necessarily inferred from it. Case 3 illustrates this feature. Part 3 of the available evidence ends at the word "total," and the subsequent sentence printed in italics is a necessary inference from the evidence then available. In Case 7 similar necessary inferences are also printed in italics in two parts of available evidence, the actual additions of evidence being the portion in ordinary type.

Narration of Case 3.

(Part 1): "Of the persons listed under the initials A to E inclusive in the directory of the leading men of America entitled

"Who's Who is America," it was found in 1909 that those not of city birth were about twice as many as the city-born."

(No. 1): "Accordingly it would seem likely that birth and early training in non-urban surroundings are more conducive to the development of ability than are birth and early training in urban surroundings." (*High*).

(Part 2): "At the last previous decennial census in the United States (1900) the non-urban population was twice as numerous as the urban."

(No. 2): "The division of the leading men as to non-urban and urban origin in the proportion of two to one respectively does not indicate, therefore, that non-urban origin is more conducive to the development of ability; on the contrary, this proportion, corresponding as it does with the proportion of the total non-urban to the total urban population, shows rather that the two origins are equally conducive to such development." (*High*).

(Part 3): "During the last century, however, the urban population in that country grew so much more rapidly than the non-urban that in 1860, the period when the present leaders were born, the urban population formed but one-sixth of the total. *This section, by supplying one third of the present leaders as listed in the above directory contributed twice its proportionate share to that particular group.*"

Parts 1 and 2 of the evidence in this case are based on two letters of Professor Frederick Adams Woods, giving the results of his examination of this question, in *Science*, N.S., vol. xxix, No. 745, April 9, 1909, pp. 577-579, and vol. xxx, No. 757, July 2, 1909, pp. 17-21. The proportionate increase of urban population in the United States during the last century is given in *Nelson's Encyclopaedia*, vol. xii, p. 293, ("United States," section on "Population.") In the 1st probable conclusion one cannot infer that the degree of probability is 2/3 or 2:1 because the leaders of non-urban origin outnumber the urban by two to one. On this basis, in the 2nd conclusion the degree of probability would be only 1/2 or 1:1 because there the two groups seem proportionately equal. On the contrary, according as the non-urban group is substantially greater than, equal to, or less than the urban, there is a like degree of probability that non-urban origin is more conducive than urban to the development of ability, or equally conducive, or less conducive respectively. This degree of probability is very great, but it is difficult to suggest a basis for a numerical estimate, hence the degree in these cases has been rated simply as "high." The 1st conclusion, however, has an element of superficiality which the 2nd has not; for in the 2nd conclusion one would scarcely expect, apart from evidence, so great a change in the respective proportions of the two groups of population since the present leaders were born, while in the 1st, even without evidence, a possible difference in the size of the two sections of population might well be anticipated. As a matter of fact, this possible difference has been frequently overlooked;

and in view of the absolutely, but not proportionately, greater number of able men who come from rural districts, it is a common opinion that the brains of the nation come mainly from the farm.

CASE 4.

This case illustrates the feature that an addition of evidence may be of insufficient interest to find a place in a narrative of necessary conclusions, and especially that scientific results should be stated as a rule in positive, and not in negative, form because persons receiving information wish as a rule to know what a thing is, not what it is not. On this ground Part 2 of the evidence would ordinarily be excluded from a narrative of necessary conclusions, and for this reason it is bracketed.

Narration of Case 4.

(Part 1): "John Smith held insurance of $500."

(No. 1): "The insurance was probably against fire." (20·3/33·3 or 20·3 : 13).

(Part 2): ("The insurance was not against fire.")

(No. 2): "In that case it is likely that the insurance was on his life." (17/26 or 17:9).

(Part 3): "The insurance was on goods in transit."

(No. 3): "The insurance on the goods being $500, very probably that was what they cost him." (10/11 or 10:1).

(Part 4): "The goods cost him $300."

(No. 4): "In that case he probably insured them for $500 because he could not duplicate the goods under that amount." (10/11 or 10:1).

(Part 5): "The goods were insured at $200 above cost because they were antiques that could not be duplicated and he had a purchaser for them at $500."

In this case the narrative of necessary conclusions would not adopt *verbatim* the parts of evidence used, as in Cases 1, 2 and 3. The narrative here would read as follows, the upright lines being inserted to indicate the respective extensions made in view of Parts 3, 4, 5 of the evidence:

"John Smith held insurance of $500 | on goods in transit | costing $300 | because they were antiques that could not be duplicated and he had a purchaser for them at $500."

The probability of the 1st and 2nd conclusions is based on the volume of insurance in Canada. According to the *Canada Year Book, 1911*, Second Series, (Ottawa, King's Printer, 1912), pp. 296, 302, 324, the net amount in force in all companies in 1910 was, for fire $2,034,276,740, for life $856,113,059, and for risks of all other classes \$452,171,396, or approximately a ratio of 20·3 : 8·5 : 4·5. According to this ratio the favorable chances in the 1st conclusion would be 20·3 out of 33·3, and in the 2nd, the volume of fire insurance being there excluded by Part 2 of the evidence, 8·5 out of 13 or 17 out of 26. In the preceding years of the semi-decennium 1906-1910 the relative amounts of different classes of insurance in Canada were much the same as in 1910. In the 3rd conclusion the probability is fixed approximately by the number of instances where goods in transit are nsured at actual cost, as against those instances where they are insured at other values, especially at the cost of duplication if this, as is occasionally the case, differs materially from the first cost. The ordinary practice is to insure at actual cost, hence a conservative estimate of the probability is 10/11 or 10:1. In the 4th conclusion the probability depends on the number of shipments where goods are insured at the cost of duplication because this differs materially from the first cost, as opposed to those instances where, for any other reasons than such difference, the shipment is insured at other than actual cost. The former instances are comparatively rare, but the latter are much rarer, hence a conservative estimate is 10/11 or 10:1.

Case 5.

Narration.

(Part 1): "Shortly after midnight a train with two hundred passengers left the rails under full speed. Several coaches, in one of which was a mother with a child of six months, rolled twenty feet into a ditch. It was half an hour before all were rescued from the wreck."

(No. 1): "Probably the whereabouts of the child would be easily known by its cries." (3/4 or 3:1).

(Part 2): "The child was lost in the confusion that followed the accident, and the grief of the mother was piteous to behold."

(No. 2): "In view of the child's silence, it seemed indeed hard to believe that the infant could be alive." (2/3 or 2:1).

(Part 3): "The infant, however, was found presently beneath a seat in the midst of the wreckage, and it was breathing."

(No. 3): "Very probably it was unconscious from injuries." (100/101 or 100:1).

(Part 4): "On closer examination it proved to be uninjured and sound asleep."

In this case the narrative of necessary conclusions consists again of the four parts of evidence read uninterruptedly. In the accident in question which occurred near Tottenham, Ontario, June 27, 1908, forty of the two hundred passengers were injured, fifteen of them seriously, but no life was lost. Old railroaders remarked that they never saw such damage with so few passengers injured. But even in serious accidents, unless they are followed by fire or the coaches are submerged in water, the number killed rarely exceeds one-tenth of the passengers. The child if conscious would be so likely to cry that the probability of the 1st conclusion is fixed approximately by the chance that it had escaped death, plus the further chance that it had escaped injuries which rendered it unconscious. One the above basis in the present case an adult's chance of escaping death would be 9/10 or 9:1. A tender infant's would be less. To offset this tenderness and to cover the further chance that the child might be unconscious from injuries, the probability of the 1st conclusion is reduced to 3/4 or 3:1. In the 2nd conclusion, the child being silent, the principal opposing chances are that it was dead or unconscious. Statistics are not available to ascertain exactly these opposing chances, but under the circumstances the hope of finding the infant alive would be comparatively small, hence the probability that it was dead has been estimated at 2/3 or 2:1. In the 3rd conclusion, the child being discovered alive and yet silent, it must have been either (1) unconscious from injuries, or (2) asleep, or else (3) awake and yet quiet. Under the circumstances the chances of (2) and (3) were so slight, and the risk of serious injury was so great, that the probability of unconsciousness from injuries is conservatively estimated at 100/101 or 100:1.

CASE 6.

A narrative of necessary conclusions may be abbreviated, instead of extended, by additional evidence, not necessarily by way of correction or omission of any point, but because the additional evidence converts a previous conclusion into one of higher value. Thus, in Case 6, "ostensibly" is omitted from the previous narrative in view of Part 3 of the evidence.

Narration of Case 6.

(Part 1): "In a newspaper with a daily and weekly edition a letter dated May 8 appeared on May 17, ostensibly replying to a letter in the paper for May 3."

(No. 1): "Probably the reply was written at a point far from the place of publication, and both the original letter and the reply appeared in the daily edition, the former on May 3 and the latter on May 17." (3/4 or 3:1).

(Part 2): "The reply was dated at the place of publication, and the issue of May 17 in which it appeared was the weekly edition."

(No. 2): "In that case it is highly probable that the issue of May 3 in which the original letter appeared was also the weekly edition." (100/101 or 100:1).

(Part 3): "Both letters appeared in both editions, the original letter in the daily for May 3 and the weekly for May 10, and the reply in the daily for May 9 and the weekly for May 17."

In the narrative of necessary conclusions in this case the successive parts of evidence are added by insertions as well as by extensions, and will read finally, omitting "ostensibly," as follows:

"In a newspaper with a daily and weekly edition a letter dated May 8 at the place of publication appeared in the daily for May 9 and the weekly for May 17, replying to a letter in the daily for May 3 and the weekly for May 10."

The 1st probable conclusion depends chiefly on the proportions of letters respectively in the daily and weekly editions of all papers having these editions. In view of the greater number of daily issues and of the difference of interest which in most papers reduces correspondence in the weekly to a minimum, a conservative estimate of this proportion would be 10:1, *i.e.*, there are on the whole ten times more letters in the daily issues than in the weeklies of such papers. An editor, whom the author consulted, estimated the proportion at 25:1. The probability has been further reduced from 10:1 to 3/4 or 3:1 because the exact interval of fourteen days between the dates May 3 and May 17 suggests the possibility that it was the weekly. It should be noted, however, that here it is not yet in evidence that either of the issues was a weekly; and there are six times as many issues of the daily as of the weekly, between which this exact interval of fourteen days might occur.

In the 2nd conclusion it is in evidence that the answer was in the weekly. In actual experience men constantly answer letters of the weekly in the weekly, and of the daily in the daily, and they very seldom answer letters of the daily in the weekly, or of the weekly in the daily; hence the high probability of this conclusion, estimated at 100/101 or 100:1, that the answer in the weekly of May 17 was a reply to a letter in the weekly of May 3.

Case 7.

Narration.

(Part 1): "A.B., dwelling at Berlin, received simultaneously two letters, both stamped July 26, 1913, at Warsaw in Russia."

(No. 1): "Probably it was Berlin in Germany and the letters were a day or less in transmission." (100/101 or 100:1).

(Part 2): "A.B. dwelt at Berlin in Canada, where both letters were stamped August 19, 1913."

(No. 2): "In that case apparently the letters must have been twenty-four days in transmission." (1,000/1,001 or 1,000:1).

(Part 3): "The first date was according to the Old Style or Julian Calendar still used in Russia, which is thirteen days behind the New Style or correct calendar used in Canada, *the Warsaw stamp being equivalent therefore to August 8.* The first letter opened was dated July 24, 1913."

(No. 3): "Probably this date was in the Old Style, or really August 6, and the letter was mailed two days after writing." (1,000/1,001).

(Part 4): "The second, from the same correspondent, was dated August 7, 1913, and explained that the mailing of the first letter was accidentally overlooked for several weeks. *Both letters were dated in the New Style.*"

(No. 4): "The letters were dated in the New Style probably out of courtesy to the recipient." (*High*).

(Part 5): "The letters were dated in the New Style because the writer was a resident of Russian Poland, where in private intercourse the Russian calendar is disregarded and the people use instead the New Style or Gregorian Calendar adopted by them under the former kingdom of Poland in 1586."

In this case the narrative of necessary conclusions, formed by successive insertions and extensions, will read thus:

"A.B., dwelling at Berlin in Canada, received simultaneously two letters, both stamped July 26, 1913, at Warsaw in Russia, and August 19, 1913, at Berlin in Canada. The first date was according to the Old Style or Julian Calendar still used in Russia, which is thirteen days behind the New Style or correct calendar used in Canada, the Warsaw stamp being equivalent therefore to August 8. The first letter opened was dated July 24, 1913. The second, from the same correspondent, was dated August 7, 1913, and explained that the mailing of the first letter was accidentally overlooked for several weeks. Both letters were dated in the New Style, the writer being a resident of Russian Poland, where in private intercourse the Russian calendar is disregarded and the people use instead the New Style or Gregorian Calendar adopted by them under the former kingdom of Poland in 1586."

Poland, as a Catholic power, adopted early the Gregorian Calendar, so called because it was introduced by Pope Gregory XIII (October 15, 1582) in pursuance of a decree of the Council of Trent (1545-1563). Among Protestant countries religious considerations long delayed an acceptance of the reform. Russia and the members generally of the Orthodox Greek Church adhere still to the Old Style. Among Russians there is no tendency to disregard the Old Style in their personal intercourse. They date their letters to each other in that style. In private letters to Polish people they use the Old Style, or both styles together, placing the Old first (as 16/29 September or 18 September/1 October), or only the New Style if they wish to be very polite. Russian Poles, on the contrary, both Roman Catholic and Protestant, use, in private life and in correspondence with friends in Poland and abroad, exclusively the New Style. If they write to a Russian acquaintance, they date the letter in the two styles together, placing the New first (29/16 September). In official letters they have to use the Old Style, except notaries and the Catholic and Protestant clergy, who must use both styles together, as otherwise misunderstandings would often arise in records of births, marriages and deaths.

In the 1st probable conclusion the estimated probability of 100/101 depends on the total number of letters passing under ordinary circumstances from Warsaw in Russia to Berlin in Germany, as opposed to the total number from the former city to the various places elsewhere in the world, especially in America, which have adopted the name of Berlin. The German capital has a great population conducting in ordinary times an important commerce and correspondence with the neighboring Polish centre, while the other communities with the name of Berlin are mostly insignificant in population, the largest with some twenty thousand, and they have little occasion for correspondence with the remote country of Poland. In the 2nd conclusion, the difference in calendars between the two countries not being in evidence, the estimate of 1,000/1,001 represents the ordinary chances that a letter is actually in transmission between the dates stamped by the sending and receiving offices. Among the millions of letters sent errors in stamping are rare, and the probability that the letter was twenty-four days in transmission will be correspondingly great. In the 3rd conclusion, according to the evidence then available (date of letter, July 24; stamp of mailing office, July 26, Old Style; difference between styles, 13 days), the letter, if written on July 24, New Style (=July 11, Old Style), must have been kept 15 days before mailing; while, if written on July 24, Old Style, the number of days it was kept would be only two. The probability of 1,000/1,001 or 1,000:1 in this conclusion is estimated therefore on the proportion of instances in actual experience where letters are kept for two days before mailing, as against those instances where they are kept for fifteen. In the 4th conclusion the attitude of Russian Poles toward the Russian calendar is not in evidence. All that is known is that a correspondent writing abroad departed from the calendar of his own country and dated his letter according to the calendar of the recipient. On this evidence the probability is very great that the action was due to courtesy, but it is difficult to suggest a basis for a numerical estimate; therefore, the degree of probability has been rated here, as in similar conclusions in Case 3, simply as "high."

CASE 8.

Narration.

(Part 1): "Mrs. Jones has two grown daughters, Mary, the elder, and Anna the younger, with different surnames."

(No. 1): "The difference in surnames is due probably to the elder being married." (1+/2+ or 1+:1).

(Part 2): "The elder daughter is single."

(No. 2): "Then it is most probable that the younger acquired another name through marriage." (60/69 or 60:9).

(Part 3): "The younger daughter is also single."

(No. 3): "In that case the most probable explanation is that Mrs. Jones was twice married and had a daughter by the first husband." (5/6 or 5:1).

(Part 4): "Mr. Jones is the father of both daughters."

(No. 4): "It appears, therefore, that one of the daughters acquired another surname by legal adoption into another family." (10/11 or 10:1).

(Part 5): "Mary, being of age at the time and in an independent calling away from home, kept the old surname which was changed in Anna's case when her father took the name of Jones in place of Brown in order to qualify as heir under his uncle's will."

In this case the narrative of necessary conclusions, formed by successive insertions and extensions, will read thus:

"Mrs. Jones has two daughters, Mary, the elder, and Anna, the younger, both single, and children of Mr. Jones, yet with different surnames. Mary, being of age at the time and in an independent calling away from home, kept the old surname, which was changed in Anna's case when her father took the name of Jones in place of Brown, in order to qualify as heir under his uncle's will."

The 1st probable conclusion depends approximately on the chances that the elder daughter is married rather than the younger. Nothing is known except that both daughters are grown and therefore of marriageable age. Their respective attractions, the period of life and the difference in their ages are not specified; hence there is an indefinite superiority of probability, represented by the expression 1+:1, in favor of this conclusion, that the difference of surname was due to marriage by the elder. Were the difference in age slight, *e.g.*, only a year, this superiority would amount only to a balance of probability; but under other circumstances the superiority might be marked. Thus, according to comprehensive statistics of the German empire summarized in Brockhaus's *Konversationslexikon*, 14th ed., vol. ii (Leipsic, 1894), p. 928, out of every 10,000 women at the age of 30, the number of married, widowed and divorced (forming the total who had ever married) was 6,359, but out of every 10,000 women at the age of 20, the corresponding number was only 134. On this basis, if *e.g.* the elder daughter was 30 and the younger 20, the indefinite probability in favor of the 1st conclusion would be not merely a balance of probability but a ratio of 6,359:134, approximately 47/48 or 47:1. In the 2nd conclusion the probability depends approximately on the chances that the younger daughter is married, as opposed to the chances that the mother was twice married. According to the statistics of five principal countries summarized in the same volume of Brockhaus, p. 927, an average of 5,888·6 persons (or about 6,000) out of every 10,000 of marriageable age were either married, widowed or divorced. This would make the probability of the daughter's marriage approximately 60/100. In the same edition of Brockhaus, vol. v, p. 747, the averages of every 100 women marrying in six principal countries are given as 90·97 spinsters, and 9·03 widows and divorcées. This would make an approximate probability of 9/100 that Mrs. Jones was twice married, and the chances for and against the 2nd conclusion respectively would be 60/100 and 9/100, yielding a probability of 60/69 or 60:9 in favor of the conclusion.

In the 3rd conclusion the principal alternatives are children by successive husbands or full and legal adoption of one of the daughters into another family. While the binding out especially of orphan children, under their own names, as semi-servants until of age, is not unusual, permanent adoption with change of name, particularly while the mother is living, is comparatively rare. On the other hand, mothers not infrequently have children by successive husbands; therefore the probability of this conclusion is conservatively estimated at 5/6 or 5:1. In the 4th conclusion the probability is fixed by the instances where sisters have different surnames by complete adoption of one of them into another family, as opposed to those instances where such difference in surnames arises from any other causes (barring those excluded by the evidence here available). Instances of such adoption, especially when both father and mother are living, are rare, but the opposing instances are much rarer; hence the probability of this conclusion has been estimated at 10/11 or 10:1.

Case 9.

Case 4 illustrated the feature that scientific results should be stated ordinarily in positive, and not in negative, form because persons receiving information wish generally to know what a thing is, not what it is not. An exception to this rule is where positive information on one point of interest to the reader raises in his mind a question on a related point, concerning which he would like an answer either positive or negative. In such circumstances even a negative statement acquires a positive interest for the reader, and may be properly made. Case 9 illustrates this exception.

Narration of Case 9.

(Part 1): "Brown recently expended 22s. 6d. in buying John Galt's *Annals of the Parish.*"

(No. 1): "Probably he bought a new copy, the least expensive of recent issue, 22s. 6d. being presumably its ordinary retail price." (10/11 or 10:1)

(Part 2): "A recent illustrated edition of this work bound in buckram sells at 5s. retail. Brown has a copy of the second edition."

(No. 2): "In that case the second edition is probably also a recent edition, but larger and more elaborate than the one in buckram, and selling therefore at the higher price of 22s. 6d. (10/11 or 10:1).

(Part 3): "The second edition, issued in 1822 at the retail price of 8s., has no illustrations and is otherwise less elaborate and smaller than the recent edition in buckram."

(No. 3): "Brown, therefore, as it seems, did not buy a new copy of the work, but rather an old edition, which, on account of its present scarcity, cost him 22s. 6d., or nearly thrice its original retail price." (10/11 or 10:1).

(Part 4): "Brown paid 4s. for his copy of the second edition; but being interested in old books, especially the novels of Galt, he bought also a copy of the first edition of the same work, issued in 1821."

(No. 4): "Apparently he paid 18s. 6d. for his copy of the first edition." (20/21 or 20:1).

(Part 5): "Brown paid 6s. for his copy of the first edition, but he bought also a copy of the recent illustrated edition, bound in velvet calf, which cost him 12s. 6d."

(No. 5): "12s. 6d. is probably the ordinary retail price of the recent edition in the velvet calf binding." (10/11 or 10:1).

(Part 6): "The ordinary retail price of the recent edition in velvet calf is 10s. 6d. Brown first bought a copy in buckram at 5s. Subsequently, preferring the other binding, he obtained an allowance of 3s. for his cloth copy in exchange for the one in leather, making the total cost of the book to him 2s. more than the usual price."

In this case the successive parts of evidence will be embodied in the narrative of necessary conclusions not only by extensions, but by rearrangement of the previous narrative, along with the additions, into a briefer and simpler account, no previous conclusion, however, being omitted or modified. If the narrative is designed for readers who are interested only in Brown and his purchases of the *Annals*, the first sentence of Part 2 telling of the recent edition in buckram at 5s. retail would not be included at that point in a narrative of necessary conclusions, because there is nothing at that stage of the evidence necessarily connecting this edition with Brown's purchases. If the narrative is intended for readers with a double interest, on the one hand, in Brown's purchases of the *Annals*, and, on the other, in the merits and prices of various editions of the work, the whole of Part 2 would be included at once in the narration. In Part 3 the reference to the recent edition being more elaborate and larger than the second edition would be dealt with similarly; and in this part also the statement that the second edition bought by Brown had no illustrations, would be excluded there from a narrative with a single interest in Brown's purchases, as being purely negative. The point, however, would be included at once in a narrative with the double interest, because, in readers interested in the merits and prices of the various editions, the information that the recent edition is illustrated arouses curiosity whether the earlier one had illustrations too and for such readers this negative information has a positive interest. Thus the respective narratives of necessary conclusions at Part 4 will read as follows, the one with the single interest being in the left column, and the one with the double interest in the right:

"Brown, who is interested in old books, especially the novels of John Galt, recently expended 22s. 6d. in buying that author's *Annals of the Parish.* He has a copy of the first edition, issued in 1821, and also of the second, issued in 1822, having paid 4s. for the latter edition which was published originally at 8s. retail."

"Brown, who is interested in old books, especially the novels of John Galt, recently expended 22s. 6d. in buying that author's *Annals of the Parish.* He has a copy of the first edition, issued in 1821, and of the second, issued in 1822. He paid 4s. for the latter edition, which was published originally at 8s. retail and has no illustrations and is otherwise less elaborate and smaller than a recent illustrated edition selling at 5s. retail."

In Part 5 it is brought into evidence that Brown bought a copy of the recent illustrated edition, and therefore the single and double interests coincide in Parts 5 and 6. The final narrative of necessary conclusions, for either interest, may be re-arranged as follows:

"Brown, being interested in old books, especially the novels of John Galt, recently expended 22s. 6d. for three editions of that author's *Annals of the Parish:* 6s. for the first edition, issued in 1821; 4s. for the second, which was published in 1822 at the retail price of 8s. and has no illustrations and is otherwise less elaborate and smaller than a recent illustrated edition selling in buckram at 5s. retail;

and 12s. 6d. for a copy of this recent edition, bound in velvet calf. The recent edition sells ordinarily in velvet calf at the retail price of 10s. 6d. Brown first bought a copy in buckram at 5s. Subsequently, preferring the other binding, he obtained an allowance of 3s. for his cloth copy in exchange for one in leather, which made the total cost of the book to him 2s. more than the usual price."

John Galt (1779-1839), the founder of the Canada Company and of the city of Guelph, and whose name is borne by the city of Galt in Ontario, was a Scottish novelist, not of the first rank, and yet of merit in depicting provincial life in Scotland a century ago. In Part 1 of the evidence, nothing is specified about the date of Galt's writings, hence the probability of the 1st conclusion is fixed by the chances in general that a person would buy but one copy of a book (other than the Bible, of which book many persons have several copies, and some have many), and that he would buy a new and less expensive issue rather than one that was older or more costly. This is the ordinary practice of book buyers, therefore 10/11 or 10:1 is estimated as the probability. In the 2nd conclusion the early date of the second edition is not in evidence, and therefore the probability of 10/11 or 10:1 is fixed, as in the 1st conclusion, by the general chances that a buyer would take but one copy rather than several, and a new book rather than an old one. In the 3rd conclusion the early date of the second edition is in evidence, and the estimated probability of 10/11 or 10:1 depends on the general chances that a buyer will take but one copy and not several copies of the same book. The probable inference on this basis is that Brown expended the 22s. 6d. on his one copy of an old edition, old editions being frequently more expensive, on account of their scarcity, than modern editions. In the 4th conclusion the estimated probability is increased to 20/21 or 20:1, because it is here in evidence that Brown is interested in old books, especially the works of Galt. The first edition of an old book, being particularly prized by such bibliomaniacs, commands usually much the highest price; and according to the habits of these persons, even though Brown already had a copy of the *Annals* dated in 1822 which cost him but 4s., he would very probably pay more than four and a half times that price for a homelier copy, simply because it was dated in 1821 and there was none earlier. In the 5th conclusion the probability of 10/11 or 10:1 represents the chances in general that buyers of recent publications pay the ordinary retail price, and not less nor more either by buying at second hand or for other reasons. Recent publications are sold ordinarily at first hand and at the regular retail price.

Case 10.

Narration.

(Part 1): "An east-bound passenger train travelling at the rate of 36 miles an hour, which was due at Port Huron at 12:15 a.m., left Sarnia the same morning at about 2:30."

(No. 1): "Probably the ordinary time between these points is about two hours and a quarter, and the distance about 81 miles." (5/6 or 5:1).

(Part 2): "The train was travelling on *Standard Time*, and Port Huron is in the *Central Time* division while Sarnia is in the *Eastern Time* division."

(No. 2): "In that case the ordinary time between these points is probably only one hour and a quarter, and the distance about 45 miles." (5/6 or 5:1).

(Part 3): "The train was a half an hour late at Port Huron."

(No. 3): "Then the ordinary time between the two points is probably three-quarters of an hour, and the distance about 27 miles. (5/6 or 5:1).

(Part 4): "The train stops at Port Huron for 15 minutes."

(No. 4): "Accordingly it is probable that the ordinary time between the points is about a half an hour, and the distance about 18 miles." (5/6 or 5:1).

(Part 5): "Sarnia is a border point where the train made its usual stop of some 15 minutes for custom's inspection, etc."

(No. 5): "In view of this circumstance the ordinary time between the points would probably be but 15 minutes, and the distance about 9 miles." (5/6 or 5:1).

(Part 6): "The distance between Port Huron and Sarnia is about 3 miles."

(No. 6): "In that case the train, already a half an hour late at Port Huron, probably had an additional delay either at that place or at Sarnia.". (10/11 or 10:1).

(Part 7): "Between Port Huron and Sarnia the railway passes the St. Clair river by a lengthy tunnel through which the train travelled at the usual much reduced speed."

In this case the narrative of necessary conclusions, formed mostly by successive brief insertions, will finally read thus:

"An east-bound passenger train, travelling on *Standard Time* at the rate of 36 miles an hour, was a half an hour late at Port Huron, where it is due at 12:15 a.m. (*Central Time*) and stops for 15 minutes. It left Sarnia, a border point three miles beyond, after the usual passage at much reduced speed through the lengthy St. Clair river tunnel and after the usual stop of some 15 minutes for custom's inspection, etc., at about 2:30 a.m. (*Eastern Time*)."

In conclusions 1 to 5 in this case the probability of 5/6 or 5:1 depends on the chances that a train is run substantially on time, so that, if it is due at any one station at a certain hour and leaves another station at a subsequent hour, the train will have spent substantially that interval of time in actually covering the distance between these two points. The punctuality or unpunctuality of the railroad in question and the season of the year are not in evidence, hence the probability is fixed here by the average punctuality of all railroads at all seasons. On some railroads the trains are nearly always substantially on time, while on others there is some unpunctuality, especially at certain seasons; but taking all stations, trains, roads and seasons together, it is a conservative estimate that there are five arrivals made at stations by trains substantially on time to one such arrival made substantially late. In the 6th conclusion the probability of 10/11 or 10:1 depends on the chances that a train already half an hour late would lose additional time through being held involuntarily at stations, especially at a border and custom's point where such additional delays are not infrequent, as opposed to the chances that it would incur further delay by reducing its speed, or otherwise, between stations.

Case 11.

Narration.

(The narrative of necessary conclusions in this case consists again simply of the successive parts of evidence read uninterruptedly, without regard to the intervening probable conclusions.)

(Part 1): "On the whole one finds throughout the world an approximate equilibrium of the two sexes."

(No. 1): "From this fact it is a strong probability that there is a similar approximate equilibrium in every country." (*High*).

(Part 2): "In some countries, however, there is a pretty constant, though in itself moderate, relative excess of female persons; while in others on the contrary there is a similar excess of males. Thus it has been found that, for every 1,000 males, the number of females in Norway was 1,075, in Sweden 1,065, in Great Britain and Ireland 1,060, in Switzerland 1,056, in Denmark 1,051, in Austria 1,044, in the German Empire and in Spain 1,040, in Holland 1,024, in Hungary 1,015, in France 1,007, and in Belgium 1,005. A deficiency of females, on the contrary, was found, among other countries, in Italy with 995 females per 1,000 of male population, in Japan with 980, in Bulgaria with 965, in Roumania and Canada with 964, in the United States with 953, and in Serbia with 948."

(No. 2): "Probably the number of male and female births varies in the respective countries, the female births preponderating where the female population preponderates, and the male births preponderating where the preponderance in population is with the males." (*High*).

(Part 3): "Among the factors of sex · quilibrium the first to be considered is the ratio of male and female births. Investigations into the number of persons born into the two sexes date from the beginning of statistics relating to population. Even in the 18th century Suessmilch drew attention to the fact that there is a constant relative excess in the number of boys; and Wappaeus (1812-1879) found by a study of fifty-eight and a quarter million births in the larger states of Europe that, for every 100 girls, the number of boys born was 106·31. Recent calculations lead to pretty much the same result. Thus, in the years 1872 to 1888, for every 100 girls, the number of boys born in the German Empire was 106·2; in 1871-1885, for every 100 girls, the number of boys born in Prussia was 106·3, in Bavaria 106·4, in Saxony 106, in Switzerland 106·2, in Austria 106·6, in Norway 106·4, in Belgium 105·7, and in Italy 107; in 1872-1885, for every 100 girls, the number of boys born in Würtemberg was 105·1, in Baden 105·5, and in Alsace-Lorraine 106; and in 1876-1885, for every 100 girls, the number of boys in Hungary was 105·6, in France 104·3, and in Sweden 106·2. The surprising regularity of this phenomenon has given rise to various attempts at explanation, but for the present the regular excess of male births must be regarded as a scientific enigma."

(No. 3): "Since there is a relative excess of males born everywhere, it is probable that migration has produced the preponderance of female population found in some countries." (*High*).

(Part 4): "In addition to the factors of birth and mortality, migration has an effect on the distribution of the sexes. In the United States especially, the stream of European immigrants has affected the ratio by increasing the proportion of men. In sex distribution migration, indeed, may become a factor of very great importance in smaller districts and especially in towns, but it is of receding consequence in the collective study of great groups of states or entire continents."

(No. 4): "Migration being on the whole a subordinate factor in sex distribution, and the main factors being the ratios of births and deaths, it is very probable that the female preponderance in population in some lands, and also the approximate equilibrium of the sexes throughout the world, are due chiefly to a higher mortality of males from about the 5th to the 40th years of life, on account of the greater violence, strains and risks involved in the amusements and callings of boys and men as compared with girls and women, during this period of greatest exposure and least discretion." (*High*).

(Part 5): "Beside the ratio of male and female births, the greater infant mortality of males has an important part in sex equilibrium. In the German Empire in the years 1872-1885 the percentage of males among those born alive was 51·3 and of females 48·7, but among the still-births the percentage of males was 56·23 and of females 43·77.

Even before and at birth, therefore, the lives of boys are more endangered than the lives of girls. In the same empire in the years 1871-1881, out of every 106,200 males and 100,000 females born, there survived, at the age of one year, 79,360 males and 78,260 females, at the age of forty 51,799 males and 51,576 females, and at the age of sixty 33,054 males and 36,293 females. In the case of Germany, then, the prime factor in converting a male preponderance of 6·2% in births into a female preponderance of 4% in population was the greater mortality of boys in the first twelve months of life. As a result, the original relative excess of 6,200 boys per 100,000 of female births was reduced in one year to 1,100. According to the subsequent rates of mortality, the second principal period of relative decline in the number of males was from the 40th to the 60th years of life. In this interval a slight relative male excess of 223, still remaining out of the original 6,200 at the 40th year, was converted by the 60th into a relative male deficiency of 3,239."

Case 11 is based on Brockhaus's *Konversationslexikon*, previously cited, vol. ii, 926; vii, 633; xv, 327. The mortality table in Brockhaus, xv, 327, is given only per 100,000 births of each sex. From this table the author has calculated the survivors from 106,200 males, the number of males born in Germany in those years being 106,200 per 100,000 females. At the end of the 5th, 10th, 20th and 30th years of life, the original relative male excess of 6,200 per 100,000 female births, which sank to 1,100 in the first year, stood at 767,702, 639 and 264 respectively.

The four conclusions in Case 11 are all of very great probability; but a basis for a numerical estimate is not easily available. Hence the degree, as in similar instances in Cases 3 and 7, has been simply rated as "high."

CASE 12.

Cases 1 to 11 were selected to test experimentally the value of the superior measure of probability defined as the "ratio of the number of occurrences of the event to the total number of occasions in the course of experience." Case 12 is added as an illustration and experimental test of the inferior conceptualistic measure used in the "mental process of balancing reasons pro and con." The narrative of necessary conclusions in Case 12 consists of the successive parts of evidence read uninterruptedly without regard to the intervening probable conclusions.

Narration of Case 12.

(Part 1): "Jones was a merchant and Smith was the local manager of a bank with a number of branches. Neither possessed the full confidence of his fellow citizens. Jones had made an assignment, but immediately re-entered on business on a greater scale, only to become more deeply involved. Mrs. Smith was a woman with considerable means. Smith himself was dependent solely on his salary. This was reasonably large, but hardly enough for a man of his tastes.

Jones owed Smith's bank $35,000 in short term notes, and Smith had instructions from his head office not to add to this loan. Jones drew a note of $2,500 for one year in favor of Mrs. Smith, and Smith, after obtaining his wife's endorsement on the note, sold it at its face value in cash to Brown. At the end of the year Smith redeemed the note by paying Brown the $2,500 with interest. A year after this payment, however, Jones made a second assignment, at fifty cents on the dollar; then he sued Smith for the $2,500 with interest. In the brief interval of a few weeks between the entering of the suit and the trial of the case, the head office of the bank promoted Smith to the managership of a much larger and more important branch. At the trial the merchant asserted under oath that the banker got the note from him by threats that otherwise he would use his influence to have the head office refuse an extension of the notes of $35,000 and thus force Jones again into bankruptcy; and in fact that the only value given by Smith for the $2,500 note in favor of Smith's wife was $700 of oil stock which Jones took very unwillingly because it was depreciating rapidly in value, the stock being worth at the time only $450 in cash, and some months later nothing.

The banker, also under oath, asserted that Jones appealed to him so urgently for money that he wished to help him if at all possible. Being forbidden to increase the bank's loan, he tried to raise the money elsewhere. He found that Brown was willing to advance $2,500 on Jones's note, if it was endorsed by Mrs. Smith. He took Jones's note, with Mrs. Smith's endorsement, to Brown whom he requested to give the $2,500 in currency instead of by cheque. Subsequently, in his own office, he gave Jones, the two being alone at the time, $1,800 in currency and the $700 in oil stock. If the merchant had sold this stock at once for $450, all that he would have given for the use of Mrs. Smith's name was $250, an amount which the banker declared was not excessive, considering the risk, in the then condition of Jones's business, that she might be called upon to pay the whole note when due, and might ultimately lose a good part of the $2,500. The banker said that he got the money from Brown in currency in order to give Jones the $1,800 without cheques or other papers showing such a payment on the books of the bank, for he anticipated that the bank's inspector, if he happened to notice the transaction, would object to his having contributed to an increase of Jones' liabilities even outside of the bank's funds. Though the $1,800 was paid in cash and without witnesses, he had not felt the need of asking a specific receipt, partly because Jones had also entrusted to him the signed note of $2,500 without cash or receipt, and also because at the same interview he paid an account of $150 for goods from the merchant's store, and he wrote on the bill before it was receipted by Jones, 'As a settlement in full of all claims.'

Jones admitted that he met Smith alone at the time and place stated, and that he then receipted the bill in the form described and as produced in court; but he denied that he had then or at any other time received $1,800 in cash or otherwise on account of the note. The form in which the bill was receipted was understood by him to refer only to claims in connection with the store.

Brown confirmed the banker's statement that he required Mrs. Smith's endorsement before he would advance money on the note, and also concerning the payment in currency. He had wished to give Smith a cheque for the $2,500, but Smith, without explaining why, had asked and received the amount from him in bank-notes.

At the trial it was shown that in the days immediately following the date of the receipted store bill, Jones gave $1,775 to a former business partner, as a final settlement of their business connection."

(No. 1): "Such a payment made just at this juncture and corresponding so closely with the amount which Smith claimed to have given to Jones at their interview alone, seems to give considerable probability to the banker's account of that meeting."

(Part 2): "The merchant's business, however, was of such extent that he could make a payment of this amount at almost any time by diverting to this one purpose his cash receipts for several days, including especially a Saturday. Among certain papers produced by him in support of his case, there was one dated near the beginning of a year. In this date the year was written over another year, which was erased and not noticeable in ordinary reading. The erased year, when examined under a glass, was found to be the year subsequent to the superimposed year, and not the year previous, as is ordinarily the case in such errors made naturally at the beginning of a new year."

(No. 2): "This would indicate that the merchant either tampered with the paper, or fabricated it entirely to suit his case; and a case resting on such garbled evidence probably had a poor foundation in fact."

(Part 3): "The merchant's case did not rest at all on this paper, or even on the group of papers, of which it was but one. These papers together related only to an incidental and unimportant feature. Concerning the crucial interview where Smith and Jones were together alone and in which Smith maintained that he made a payment of $1,800, no specific evidence of importance was brought by either side that would throw light on the flat contradiction between the merchant and the banker. One or the other was guilty of perjury. In general the degree of confidence placed in the two men was equal. In this particular case each of the contradictory versions was consistent and reasonable in itself and fitted well into the acknowledged situation. The merchant admitted that he had financial difficulties. The banker claimed that he was anxious to assist. If this was true, the manner in which he claimed to have gone about it was reasonable enough. According to the merchant, on the contrary, the only use made of the situation by the banker was to extort the note; he submitted to the wrong while he was still trying to avoid a second assignment; when he failed in this effort, the banker's hold on him was gone; then he sought redress. To an unscrupulous man the situation afforded as good an opportunity for such extortion as to give assistance; and if the banker chose to abuse his opportunity, Jones' account of his own course in the matter was also quite reasonable."

(No. 3): "As neither plantiff nor defendant was wholly trustworthy, and no corroboration of their respective statements as to the payment of the $1,800 was available, the jury, in view of this contradiction on this point, probably failed to agree on a verdict." (6/7 or 6:1).

(Part 4): "The jury decided the case on a division of ten to two, the minimum majority necessary in a civil case."

(No. 4): "In view of this close division and of the unsatisfactory state of the evidence, probably the verdict was reached with great difficulty and delay." (10/11 or 10:1).

(Part 5): "Their verdict was reached in a comparatively brief interval."

No. 5): "Probably it was against the merchant because the burden of proof rested primarily on him as plaintiff, and on the main point he had no evidence beyond his own unsupported word, which was contradicted by the defendant; and moreover, the contemporary payment of $1,775 to a former partner and the peculiar dating of the paper, though they were points of doubtful importance in themselves, might naturally prejudice the jury somewhat against the merchant's case."

(Part 6): "The jury found for the plaintiff."

(No. 6): "The reason for the verdict was probably that the bearing of Jones at the trial made a more favorable impression on the majority of the jury than that of Smith and led them to give the verdict in favor of the merchant." (25/26 or 25:1).

(Part 7): "The reason for the finding was that the majority of the jury resented a noticeable leaning toward the defendant on the part of the judge, and they determined to show him that they, and not he, should decide the case. It was the judge who examined the erased date with his reading glass and drew attention to its peculiarity. The lawyers for the defence made little reference to the point in their argument, but the judge in his charge remarked that in such a case where one or the other must be guilty of perjury and direct evidence to decide between them was not available, sometimes a straw showed how the wind blew, and the erased date might be such a straw. His charge otherwise was so strongly against the plaintiff that the defence, after the verdict was rendered, made a request, though without success, that the judge in view of his own charge should allow Jones no costs."

(No. 7): "Probably the judge was wrong and the majority of the jury right, because litigation under any circumstances is so expensive and uncertain that men even with considerable means dread the courts, and it seems unlikely that Jones would risk a lawsuit in the midst of his financial difficulties unless spurred by some such grievous wrong as he ascribed to Smith."

(Part 8): "Jones, after his second assignment, withdrew from commercial life but lived in very fair style. Presently Black, an elderly man without much business acumen, assigned to him a valuable property which was mortgaged only to half its value; and practically the only consideration given for it by Jones was an undertaking to pay off this mortgage. The property was all that the old man possessed. He always maintained that he was deceived in the transaction; but notwithstanding Black's protests, Jones established himself in possession; then by his own slackness he lost the property to others. Jones, in his efforts to regain possession, entered so many expensive and unsuccessful lawsuits against the new owners that his name became a by-word for reckless litigiousness in the community; insomuch that on moving elsewhere and re-appearing subsequently in its courts, he was twitted by an opposing attorney who remarked that his removal from town was a "loss to the legal profession." Jones gave a smiling assent.

Smith, meanwhile, who had been promoted to a larger and more important branch of his bank on the eve of the trial with Jones, was left in that post notwithstanding the verdict and filled the place successfully."

(No. 8): "So far from being in financial difficulties and afraid of litigation at the time of the trial with Smith, Jones apparently, notwithstanding his two assignments, must have set aside considerable means which he was ready enough to use on any semi-favorable opportunity in the courts. In view of these developments and of the difference in the careers of the two men after the trial, it appeared likely that the judge, who was a much abler and more penetrating man than any of the jurors, estimated correctly the characters of the plaintiff and of the defendant before him; and probably he and the bank officials were right in sustaining Smith, and the majority of the jury wrong in their decision."

(Part 9): "The banker, after serving at his new post satisfactorily for several years, lost it suddenly by running away with another man's wife."

(No. 9): "By this act he showed such an utter want of character that it seemed probable that the judge was mistaken in sustaining him at the trial and that the jury, though not with a proper motive, arrived at a correct verdict."

(Part 10): "Smith returned presently and was reconciled to his wife. When the bank would not restore him to its service, he founded a similar financial institution on a large scale in a neighboring city, and hundreds of people in the adjoining sections of the country invested large sums of money in this institution, of which Smith was the chief administrative officer. Jones, on the other hand, who was still living well, duped several men into bad investments and the loss of their property for his own gain, and as a result of these misfortunes the reason of one person was affected and the life of another was shortened."

(No. 10): "It seemed then, after all, that whatever might be the characters of Smith and Jones in other respects, Smith was the more trustworthy man in financial dealings, and therefore the judge was probably right and the jury wrong at the trial."

(Part 11): "Within a few years, however, Smith wrecked the institution which he was administering, and thus reduced to poverty many who had entrusted to it the savings of a lifetime. At the investigation he admitted that he had turned over hundreds of thousands of dollars of its assets to doubtful or fictitious business enterprises; and another great block of its funds had been simply abstracted, for what purpose he would not say. He was condemned to a term in prison."

Conclusions 1, 2, 5, 7, 8, 9, and 10 in this case illustrate probability in the inferior form of a mere balancing of two groups of opposing reasons pro and con. To a large extent the two groups continue in play throughout all these conclusions. The subtraction of one feature here or the addition of another there, now to the advantage of one side and again to the advantage of the other, casts the balance of probability continually back and forth. The inferiority of this form of probability may be recognized from the fact that there will not necessarily be unanimity concerning the conclusions. In the superior form of probability illustrated in Cases 1 to 11, where the conclusions are fixed by the ratio of the number of occurrences of the event to the total number of occasions in the course of experience, there is practically no room for disagreement. Thus, in Case 5, if a baby is upset in a railway coach, similar instances establish as a matter of actual experience and not mere opinion that the baby will probably be crying, or failing that, dead or unconscious. Or again, in Case 9, if a man pays 12s. 6d. for a recent publication, similar instances establish as a matter of actual experience that 12s. 6d. is probably the ordinary retail price of the book; but in weighing a variety of reasons against each other, there is no possibility of striking an exact or conservative ratio from experience. The weight to be attached to each of the several or many reasons on either side is a matter of individual opinion, and individual opinions will differ, or the opinions of the same person at different times may differ. Thus in the 1st conclusion of Case 12, if Jones was not able at any time to accumulate $1,775 from the cash receipts at his store, A might think at one time that the contemporary payment of that amount to the former partner was quite a strong point against Jones' version of the interview with Smith; but another thought might occur to A, or to B, that if Jones had to make the payment and counted on getting the $1,800 for the purpose from Smith but Smith disappointed him at the interview, then Jones as a matter of course would make a great effort to borrow it elsewhere and in this he might succeed. On this basis the conclusion would lose much of its probability, regardless of cash receipts in the store. Again in the 2nd conclusion of this case, A might think the tampering with the date on the paper a bad sign; but another thought might be that if Smith did actually commit such a wrong against Jones, the merchant, being at a disadvantage, might well feel justified in improving his slender chance of redress for so great a wrong by such a slight deviation from rectitude. Such second thoughts, whether they be better than the first or not, will be more apt to appeal to A and alter his first opinion if they occur to himself than if they are introduced to him by B, C, or D as an objection to his view. Each of two countervailing reasons respectively may also make a stronger appeal to men of different temperaments or of different positions in life. Thus a timorous mind will be more apt to realize the probability that Jones would shrink from litigation in the midst of financial difficulties unless spurred by a great injustice; an adventurous spirit, on the contrary, might think it more likely that Jones received the $1,800 at the interview, but resented the unloading of the oil stock and he saw a chance, hazardous yet not hopeless, of turning the tables on Smith by recovering $2,500 in court. Such a triumph would secure for him the full amount of the oil stock (thus wiping out the $250 "commission") plus a further $1,800 beyond the original $1,800 received at the interview, or $4,300 in all. Or, again, the average citizen might feel that the fact that the bank sustained Smith after years of experience of his service was a recommendation of his trustworthiness; but on the other hand bank officials as a class and those who are responsible for the dignity of great institutions might feel that the bank, even though uncertain of Smith's trustworthiness, would prefer on the whole to sustain him and thus better his chances for a favorable verdict, rather than acknowledge voluntarily that a man occupying for many years a high position in its service was probably guilty of such a discreditable act. Thus, from the nature of the case, it will be generally found, after close examination, that practically as much can be said on either side of any probable conclusion of the inferior form reached by balancing of reasons pro and con. Any person with a tendency either for or against the conclusion, can usually convince himself that there is enough positive ground, or enough weakness in the opposing position, to justify a conclusion according to that tendency; or in the last analysis, by emphasizing one or two of the reasons on one side, or minimizing one or two on the other, he can arrive at the desired result without conscious strain upon his conscience.

In the 3rd, 4th and 6th conclusions of Case 12 it is possible to estimate conservatively the degree of probability according to the superior measure or ratio. In the 3rd conclusion the probability that the jury will not agree on a verdict where the evidence on either side is practically equal, depends not on a clear recognition of that equality. If the equality were clearly recognized, the duty of the jury would be to decide for the defendant because the burden of proof rests primarily on the plaintiff, and, the evidence of the defendant in rebuttal being equally strong, the plaintiff would have failed to establish his case. But where there is such a practical equality, every hearer and especially every juror, feeling the challenge to reach a decision, has a tendency to seize arbitrarily upon some one or more of the points, none of them conclusive, and to lean accordingly to one side or the other. Thus, in the case in question, even the judge, for one or more reasons, among them the erased date on the paper, had a decided leaning toward the defendant. The auditors in the court room and others who were acquainted with the details of the case, also had such leanings, but toward different sides and on different grounds. Largely for this reason, where there is an equality of evidence, there is a tendency for each juror to reach a decision, and the probabilities that he will decide either way are about equal, so that, if p is the probability that a juror will decide for the plaintiff and if q is the contrary probability that he will decide for the defendant, then $p=q=1/2$; and where there is this equal probability that each juror will decide either way, the probability that the necessary 10 out of the 12 jurors will decide the same way, and so carry a verdict, would be equal to the term containing p^{10} in the development of $(p + q)^{12}$. This term is $66p^{10}q^2 = 66 \times (1/2)^{10} \times (1/2)^2 = 1/62{\cdot}06$, *i.e.*, approximately 1/62 or 1:61 The contrary probability that the jury will not agree on a verdict is 61/62 or 61:1. This calculation, however, is on the basis that each juror arrives at his decision separately and without a joint effort to agree on a verdict, whereas in fact the jurors meet in common and a strong effort is made to reach an agreement. For this reason the ratio of 61:1 ought to be much reduced, and a conservative estimate of the 3rd conclusion would be 6/7 or 6:1. Ordinarily where the evidence is contradictory and a verdict is barely reached, a lengthy discussion is necessary to bring about this decision, therefore the probability of the 4th conclusion, that the jury was slow in arriving at the verdict, may be conservatively estimated at 10:1. The 6th conclusion, that the jury which decided for the merchant did so probably because they were more favorably impressed on the whole with his trustworthiness than the banker's, may be conservatively estimated at 25:1. Juries almost always decide according to their impression, on the whole, of the respective merits of the two sides. The personal trustworthiness of the plaintiff and defendant respectively is not necessarily an essential feature in the merits of a case, but in this instance their personal word was all the evidence offered by either of them on the principal point.

Summary of the Experimental Test.

a. Verification of the general principle that probability even of the superior measure does not produce individually correct results. The 12 cases in the experimental test, which have been drawn from actual experience, have been selected intentionally to give as wide a variety as possible within a reasonable space. For this reason the cases range from the simplest incidents to the most important questions engaging human attention, and they deal also with various features in the practical affairs of life. It should be noted that these cases are not only actual, but also typical, occurrences. It would be an exaggeration to say that the number of similar cases is without limit, but it is correct to say that it is impossible to set the limit. Their number is indefinitely great.

The 38 probable conclusions in Cases 1 to 11, and 3 out of the 10 probable conclusions in Case 12, are probable conclusions of the superior form. In 34 of these 41 conclusions, degrees of probability occurred ranging from about 2/3 or 2:1 to 1,000/1,001 or 1,000:1; and in the remaining 7 of these 41 conclusions, the degree of probability rated as "high" was greater than the highest of the 34. The features found in Case 1 continued throughout the test. The successive probable conclusions continually displaced one another, and all were finally eliminated, as a result of subsequent additions of evidence. The test thus verifies experimentally the general principle stated in the *Century* definition, that probability even in its superior measure has no significance in producing individually correct results, and the inferior form of probability is shown in the illustrative Case 12 to be still less able to produce such results. The test, therefore, verifies also experimentally the principle that in history, as in other sciences, probable conclusions even of the superior measure are without significance except where they represent averaged results; and historical probable conclusions, in so far as that term implies the mere balancing of reasons pro and con, or inferior form of probability, are condemned without exception as without significance and unscientific because this form of probability cannot be averaged and has even less significance than the superior in producing individually correct results.

b. General features of the erratic nature of probability. The erratic nature of probability even in its superior form is shown not only by the continual displacement and final elimination of the 41 conclusions as a result of additional evidence, but also by the random manner in which the degrees of probability are found distributed in the successive conclusions of each case. There is no uniform increase in the probability of the conclusions as the amount of evidence increases, but the degree of probability in the successive conclusions rises in some instances and falls in others, and sometimes remains the same. Another general instance of the erratic nature of probability is afforded by probable harmonizations of conflicting statements. Where trustworthy records conflict with one another and the circumstances of the discrepancy are unknown, it is a common practice to attempt a probable harmonization. In order to test the value of this practice experimentally, the author in 1909-1911 gathered from actual intercourse 26 cases in which statements that were conflicting were yet true. On the assumption that the conflicting statements in the 26 cases were recorded without mention of the attendant circumstances, it was found in 14 of the cases that a probable harmonization of the statements seemed easy but in the others impossible. There was nothing in the attendant circumstances of the discrepancies to account for this erratic division into two groups under an identical test. In the 14 cases, moreover, where a probable harmonization seemed easy, the harmonization proved in every instance to be contrary to the facts. The details of this test in the 26 cases are given in a paper on the *Origin and Treatment of Discrepancy in Trustworthy Records* in the Transactions of the Society, 1911, vol. v, 127-178. Upwards of 150 further cases subsequently located by the author in actual intercourse confirm the results shown by the original 26 under similar tests.

c. Special features of the erratic nature of probability. Two special features of the erratic nature of probability are illustrated by Cases 8 and 12 in the present test, as follows:—

1. In Case 8, if it be placed in evidence that there are two daughters with different surnames and nothing further is specified except

that they are of marriageable age, the series of the first three probable conclusions accounting for the difference in surnames will be, (1) that the elder daughter acquired another name by marriage, (2) that the younger daughter acquired another name by marriage, and (3) that the mother was twice married and the daughters were by different husbands. If, however, the ages of the two daughters were 30 and 20 years and this be placed in evidence, the series of the above three conclusions will be, (1) that the elder daughter acquired another name by marriage, (2) that the mother was twice married and the daughters were by different husbands, and (3) that the younger daughter acquired another name by marriage. In the first series the 1st conclusion will have an indefinite superiority of probability over the 2nd conclusion; and according to the tables quoted from Brockhaus in this case, the favorable chances of the 2nd conclusion against the 3rd will be 60:9 or approximately 7:1. In the 2nd series the favorable chances of the three conclusions will be 63·59 : 9 : 1·34 respectively, or approximately 6:1 (63·59 : 10·34) for the 1st conclusion against the 2nd and 3rd, and approximately 7:1 (9:1·34) for the 2nd against the 3rd. Thus evidence fundamentally the same and differing only in detail can give rise to different series of probable conclusions, and each of the two conclusions (2nd and 3rd) whose order is reversed in the 2nd series has in each series a substantial degree of probability.

2. In Case 12 the same material features of evidence provide a basis for two equally probable and yet contradictory conclusions. These material features are, briefly, (1) The merchant's debt of $35,000 to the bank in short term notes and the instructions of the head office that this loan was not to be increased, (2) the merchant's note of $2,500 to the banker's wife, which was endorsed by her and then sold by the banker to Brown, and (3) the transfer of $700 of oil stock from the banker to the merchant, and the merchant's payment of the $2,500 note when due. The merchant's explanation was that the banker extorted the note from him simply for the depreciated oil stock, by threats that he would influence his superiors not to renew the short term notes and thus force the merchant into an assignment; so long as he was under that pressure, he submitted to the injustice, but on finding it impossible ultimately to avoid an assignment, he then promptly sought redress. The banker's explanation, on the contrary, was that he was anxious to help the hard-pressed merchant, and for this purpose he raised $2,500 on his wife's credit, taking for a commission only the difference between the face value and the actual value of the oil stock, or $250; that he paid the merchant, when alone, the remaining $1,800 in currency so as to keep all traces of the

transaction from the books of the bank and from the inspector's knowledge, and he asked for no specific receipt because the merchant had also entrusted him with the signed note without cash or a written receipt. These two explanations are not only equally probable but very plausible. Oh the basis of probability, therefore, the same material features of evidence can give rise to two plausible interpretations and conclusions, each with substantially the same degree of probability, and either of which explodes the other.

d. The Balancing of probabilities. Probable conclusions of the inferior measure rest ordinarily on a variety of opposing reasons of different values, and the respective groups of favorable and unfavorable reasons as a whole are weighed or balanced against each other in order to strike what historians call a "balance of probability" for or against the conclusion. In historical conclusions of this description a weight of favorable reasons twice as great as the unfavorable would be regarded as very strong. As a rule the margin or balance either way is so small that even impartial persons will differ as to the side on which the greater weight seems to lie. Case 12 in the present test illustrated the peculiar weakness of these conclusions having only a narrow margin either way, but further light is thrown on their exact scientific status by a feature in Case 11. It was found there, according to comprehensive statistics, that there is a regular excess of male births over female of about 6 per cent. Thus, in Germany, for every 100 girls born in the years 1872-1888, the number of boys was 106·2. If then it be placed in evidence that a child has been born to John Doe, there is a moderate but definite and stable balance of probability of the superior measure (in Germany 106·2/206·2 or 106·2:100) that this child is a son, and this conclusion has more scientific value than a balanced probable conclusion resting on a variety of opposing reasons, with a margin either way so slight that impartial judges will differ as to the side on which the margin lies. In reaching such a balanced conclusion a person must first decide for himself which of the opposing groups he will select as the weightier; and then follows the final inference in favor of the conclusion supported by the group selected. The final inference is as real a step toward the conclusion as was the first selection, because in all probable conclusions, even where the weight of probability is strongly in favor, there are always chances that the actual facts lie on the contrary or weaker side; and where the favorable margin or balance of probability is small, these contrary chances are correspondingly great. In a balanced conclusion of this description both the first selection and the final inference are made according to probability of the inferior, conceptualistic measure. On the other hand, in the conclusion that

John Doe's child is a son, the first selection is eliminated. The margin of probability here, as in the balanced conclusion, is narrow, but that margin is established as a definite ratio in favor of the conclusion; and thus, instead of two steps with their successive probabilities both of the inferior measure, the conclusion is subject only to one probability and that of the superior measure. Although, as a matter of pure science, this conclusion as to the sex of the child is therefore much the superior, no one would think of attaching importance to it. The chances opposed to its correctness are too definitely in view. The balanced conclusion, on the contrary, notwithstanding its scientific inferiority, has a vogue, for two reasons. In the first place, the fact that the chances opposed to its correctness are practically as great as those in favor, is obscured and overlooked, or blinked, in a confused multiplicity of reasonings pro and con; and secondly, there is a wrong impression that the reasons favorable to the conclusion are to be regarded as express ground for its acceptance, and the unfavorable as express ground for its rejection, so that, if one decides that the favorable outweigh the unfavorable, the excess lends an air of necessity to the acceptance on the principle that the majority should rule. The fact is, however, that in these balanced probable conclusions the favorable and unfavorable reasons are both probable only, and if there were no unfavorable reasons at all to set against the favorable, these would still leave the conclusion only probable. Balanced probable conclusions of the above description, moreover, even with a weight of favourable reasons twice as great as the unfavourable, are essentially on the same footing as those in which the margin either way is so slight that impartial judges will differ as to the side on which it lies. Such a double weight of reasons would practically remove all question in the preliminary selection of the stronger side, but the final inference in favor of this side would still have to be drawn. This inference, since it is made, just as in the case where the margin is slight, on the basis of probability of the inferior measure, must have less value than a conclusion with a corresponding degree of probability of the superior measure (2/3 or 2:1); and concerning conclusions with this degree of probability of the superior measure (2/3 or 2:1), it can be shown, just as in the conclusion concerning the sex of John Doe's child, that no value at all is attached to them in practice. The point can be illustrated by features in connection with Case 4 of the experimental test. It was found there that the total amount of insurance held in Canada was divided between fire, life and all other risks in the proportion of 20·3 : 8·5 : 4·5 respectively. If then it be placed in evidence that John Doe personally held insurance to the amount of $1,000, this would establish a conclusion with a degree of probability of $20 \cdot 3/33 \cdot 3$ (or $20 \cdot 3:13 = 1 \cdot 56:1 = 156:100$) of the superior measure that this insurance is against loss of his property by fire. Or, again, if it be placed in evidence that he personally holds insurance of $1,000, not against fire, this will establish a conclusion with a degree of probability of $8 \cdot 5/13$ (or $8 \cdot 5:4 \cdot 5 = 1 \cdot 888:1 = 188 \cdot 8:100$) of the superior measure that the insurance is on his life. In the first conclusion the favorable chances are more than half again as many as the unfavorable, while in the second the favorable chances exceed the unfavorable by over 88 per cent., a number not materially short of twice as many. In practice, however, value would not be attached to either of them; for instance, a prospective or actual creditor of John Doe, if the security depended on the insurance of the debtor's property against fire, would not consider the needs of the case as met in any sense by the first of the above items of information or evidence, nor by the second, if his security depended on the insurance of John Doe's life. On the contrary, the creditor would consider these items and the probable conclusions based on them to be without practical, as they are without scientific, significance.

Probability Tested Theoretically by the Fundamental and Methodic Principles of Science.

a. Probability tested by the fundamental principles of science. The fundamental principles (Part I, 139, 140) which bear upon the scientific status of probability, are the 1st and 3rd, as follows:

1. *The primary attitude toward all conclusions, whether probable or improbable, must be one of non-acceptance, accompanied by a willingness to make thorough examination by correct processes and to accept those conclusions, and those only, which are shown thereby to be necessary.*

3. *A correct process is one that rightly followed leads necessarily to a correct result.*

Under the 1st principle probability in itself is not a ground for acceptance; and it is apparent that formulating conclusions on the basis of probability is not a correct process according to the 3rd, except in averaged results. With this exception, the process of formulating probable conclusions rightly followed leads only to the most probable conclusions, and these are not necessarily correct. It is the essence of probability that its individual conclusions, including the most probable, are a matter only of favorable as opposed to unfavorable chances. Such a conclusion may chance to be correct; but if so, the correctness, even in the case of a most probable conclusion, is not a necessary result, but only accidental. In history, as in other sciences, therefore, these fundamental principles disallow probable conclusions, and their formulation for acceptance, except in so far as they represent averaged results.

b. Probability tested by the methodic principles of science. These principles, which are necessary for examining the scientific status of any process or method of investigating and solving problems, theoretical and practical, are defined with illustrations on pp. 502-506 above.

i. *An incorrect process is one in which the operator deviates from a requirement of a correct process, believing that such deviation is proper.* If an operator makes such a deviation unintentionally and only by oversight, he has made only an incidental error; but if he makes the deviation deliberately and habitually and in the belief that this course is correct, this practice constitutes a process which, because it differs from the correct process, is incorrect. According to the fundamental principles of science, confirmed in the foregoing experimental test, conclusions should be formulated for acceptance on the basis of probability only in the case of averaged results. Under the prevailing method, however, probable conclusions which do not represent averaged results are systematically included with the accepted results of historical investigation. This deviation from a correct process is manifestly intentional and is made in the belief that the course is proper; hence the practice does not merely involve incidental error, but it constitutes a process, which, because it deviates from a correct process, is incorrect.

ii. *Where an operator deviates from a correct process, the result, if correct, is nevertheless unscientific because accidentally obtained.* Where an operator deviates from a correct process, one is disposed to infer that his result will necessarily be incorrect. Ordinarily it will be incorrect, but not necessarily so. In the illustration of this principle on p. 502, it was found that if an operator devised, *e.g.*, a partial deviation from a correct mathematical process and applied it, he might still get a correct result, but only if he happened to make a further mistake which would exactly counterbalance the first error. The occurrence of such an exactly counterbalancing error, however, could be only accidental. This ultimate analysis of any correct result obtained, after a partial deviation from a correct process, to an accident, corresponds exactly with the result of the complete departure from all correct processes and all scientific principles which is involved in taking probability instead of necessity as the criterion of conclusions; for with probability as the criterion, all correct results, except the averaged, will be only accidental because, with this exception, probability is only a matter of favorable against unfavorable chance, and therefore all its results, correct or incorrect, are accidentally obtained. Such conclusions, historical or other, even though correct, are condemned by the 2nd methodic principle as unscientific, because science must supply assured knowledge and this cannot spring from accidents.

iii. *If a correct and an incorrect process coincide in part, correct results obtained by the application of the incorrect process within the coincident part are only accidental and afford no ground for accepting as correct those results which are obtained by the application of the incorrect process within the non-coincident part.* This principle, as applied to probability in historical science, may be illustrated by the correct, as opposed to the prevailing incorrect, method of determining historical trustworthiness. The process of judging the trustworthiness of a record by its exemplification of the five requisites of trustworthiness is a correct process, because a record, in so far as it exemplifies these five requisites, is necessarily correct. On the other hand, the prevailing practice of judging the trustworthiness of a record by its contemporaneousness with the events narrated is an incorrect process based on probability, because contemporaneous records are not necessarily correct, and the only reason for expecting that they will be so is that a contemporaneous writer presumably will have more opportunities for informing himself concerning the events narrated than a later writer, and for that reason it is held that there is more chance or probability that a contemporaneous record will be correct. These two correct and incorrect processes respectively coincide in part, because some contemporaneous records (=the coincident group) exemplify the five requisites and will therefore be adjudged trustworthy under either process, while other contemporaneous records (=the non-coincident group) do not exemplify the requisites. The fact that, under the incorrect process, any record in the coincident group is rightly adjudged as trustworthy, is only an accidentally correct result from that process, and affords no ground for accepting any of its conclusions respecting the non-coincident group, *e.g.*, that a contemporaneous record which does not exemplify the five requisites is yet trustworthy because contemporaneous, or that a non-contemporaneous record which does exemplify those requisites is untrustworthy because not contemporaneous.

iv. *Where, under proper application, a process considered to have been established by experience as correct fails in any instance to produce a correct result, the process is thereby scientifically condemned and ought to be abandoned unless the failure can be differentiated, i.e., unless a controllable cause of it can be located and the process so adjusted as to prevent* *similar failures.* A correct process, according to the 3rd fundamental principle of science, is one that rightly followed leads necessarily to a correct result, but the method of formulating historical or other conclusions on the basis of probability rightly followed leads only (except in averaged results) to the most probable conclusion, and not to one that is necessarily correct. For this reason, barring averaged results, no ground could ever be found in experience for considering the above method to have been established as correct, and therefore it has never reached, and cannot reach, a standing which would permit of its being tested by the 4th methodic principle. Were such a standing conceded to it against the facts and against possibility, it would fall at once before this test. Where but a single failure is registered against a process having this standing, the 4th methodic principle requires that the process be condemned and abandoned unless a controllable cause of the failure can be located and the process so adjusted as to prevent similar failures. In the above method any one of the continual instances where a most probable conclusion fails to stand before additional evidence, would constitute such a failure. These instances occur continually, and in none of them is there a controllable cause of the failure, because probable conclusions rest on the action of favorable against unfavorable chances, and chance is not controllable. Were such control possible and an adjustment actually made to prevent similar failures, the process would then have ceased to be one based on probability.

III. THE FUNCTION OF REASONED, PURE AND FORMAL PROBABILITY IN SCIENCE AND THE RIGHTS OF PROBABLE CONCLUSIONS TO PUBLICITY.

(*a*). Reasoned Probability (the Inferior Measure).

Probability of the inferior measure, or the balancing of reasons pro and con, which may be termed for convenient identification "reasoned probability," has (1) a positive function in the accumulation of evidence, and (2) a negative function in the formulation of the final conclusions designed for publicity. The evidence available at any given point in an investigation will establish ordinarily a certain body of necessary conclusions; and at the same time it will suggest to the investigator, through his faculty of imagination, a certain number of probable conclusions, theories or hypotheses, some brilliant, and all of more or less interest. None of them, not even the brilliant, have scientific value in themselves. Their usefulness lies in the spur to the investigator to search for further evidence, which will test these hypotheses or probable conclusions. Any increase of evidence resulting from such search may, or may not, confirm the hypotheses or conclusions; it will not change essentially the previous body of necessary conclusions, but ordinarily it will extend them in some form, and also give rise to a modified or new series of probable conclusions calling for further investigation. This fructifying process ought to be repeated indefinitely, until the investigator has exhausted, to the best of his ability, all the sources of information that he can reach. On the basis of this accumulated evidence he then formulates his final, *i.e.*, necessary, conclusions for publicity, e.g., an historian his narrative for publication. Under the prevailing historical method, however, the historian, at this final stage, feels at liberty to adopt for publication, along with the necessary results, those conclusions which he regards as only probable or highly probable. There is, nevertheless, no assurance that conclusions, which seem probable or highly probable at this stage, would not fall before further additions of evidence, if such were available, just as many conclusions, which seemed probable or highly probable at previous stages of the investigation, fell before additions of evidence that subsequently became available. For this reason conclusions that appear to be only probable or highly probable at the final stage ought to be omitted from the published results. The function of probability here changes. The imaginative faculty which the investigator used freely up to this point in devising probable conclusions or theories for further investigation, he should now employ with the same freedom, but as a purely negative force, in testing the actual necessity of those conclusions which up to this point he has classed as necessary. The homely remarks of a well known detective who holds honesty to be the chief requisite of his calling, and includes the imagination among the other necessary characteristics, illustrate the proper use of theory or probability quite as well in scientific as in criminal investigation: "The thing to do is to muster all known facts, consider them carefully, analyse them, and then formulate a theory on those facts. After the detective has thought, and thought hard and long, he goes out to test this theory. Just as often as the facts change, just so often must the theory change, so as to make it always fit the facts. . . But with every other quality, if honesty be lacking, he will fail. A man who is not honest with others cannot be honest with himself either. And unless a man is honest with himself, he can't trail a sandpiper along a wet beach. For he will pretend, even to himself, that he is travelling the right route, though not really sure in his heart of hearts that he is. And why? Because it is easier. Dishonesty always seeks the easy way."

In testing the actual necessity or correctness of his conclusions, there is even more need of this "honesty with one's self" in the historian than in a detective, or in investigators in other fields of science. If a detective seeks to impose an unnecessary, *i.e.*, merely probable, conclusion on others, an opposing attorney, and a judge, and jury are at hand to check him. Or again, if an investigator, *e.g.*, in the mathematical and physical sciences, includes in his published results an unnecessary conclusion, the material and opportunity to test the point will always remain. But in many cases an historical investigation, once made, will not be repeated, or repeated only with reduced material and with poorer opportunities. Correction by others being thus uncertain, the self-discipline of the historian should be the greater. He must be detective, and the friendly and the opposing attorney, and judge and jury in one—the trustee of scientific truth. If his investigation is thorough, he is in a better position than any other historian is now, or may ever be, to separate the necessary conclusions from the unnecessary, the scientific result from the unscientific, in respect of the points investigated. He ought not to mix with his scientific results the unscientific in the shape of ingenious hypotheses and conclusions of a seductive probability, and then, from his vantage-ground, impose the whole on readers and others less favorably situated. All his advantage and all his ingenuity should be used to stand between them and this imposition. In this effort reasoned probability has an important part, as a negative test, both in the primary conclusions directly drawn from records and in the secondary conclusions indirectly inferred from the primary.

Reasoned probability in primary conclusions from records. The exemplification or non-exemplification of the requisites of trustworthiness is not necessarily uniform even in the same record. Ordinarily records are not wholly trustworthy or wholly untrustworthy, but in the trustworthy there are untrustworthy portions, passages or points, and in the untrustworthy there are also trustworthy portions, passages or points. No record as a whole, or in any such portion, passage or point should be accepted as trustworthy unless, so far as accepted, the exemplification of the five requisites is beyond reasonable doubt, *i.e.*, unless reasoned probability, employed as a negative test, cannot suggest a defect in this exemplification as being reasonably probable. A professor of church history, who is as able a scholar as any that this country has produced, once remarked to the author seriously that he almost despaired of any truth in history when he read in a church paper, at the end of the obituary of a very aged clergyman, that the deceased would be "greatly regretted by his fellow clergy;" the fact was he had long been so increasingly troublesome in their deliberative assemblies that they had wished him dead for years; yet the statement was strictly contemporary and originated from men who were really of the highest principles and knew the facts. The case is indeed quite a problem for the prevailing method which tests the trustworthiness of a record by its origin from a contemporary who, in the words of Bernheim, is "intellectually and morally capable of faithfully communicating the facts." It is, however, only a simple example of the proper function of reasoned probability where the trustworthiness of a record is judged, as it should be, by its own exemplification of the 5 requisites. The dates of birth and death, fields of labor, and similar items of such an obituary are intended to inform the reader according to the reader's interest (2nd requisite) and also exemplify ordinarily the other four requisites, and therefore should be accepted as prima facie correct. On the other hand, the concluding statement which was the subject of remark may indeed have been intended for the information of the reader according to his interest, but not necessarily so; there is a reasonable probability that the purpose of such a statement may be only to gratify surviving relatives and friends, and wherever such a defect in exemplification of any one of the 5 requisites can be reasonably suggested as probable, the statement or portion affected, together with all deductions therefrom, ought to be removed by the investigator from his final results, without benefit of doubt. This principle, however, applies only to reasonably probable defects within the exemplification of the requisites, and not to external probable reasons adduced against conclusions resting on unquestionable exemplification of the requisites. For such unquestionable exemplification establishes the conclusions as scientifically necessary; and merely probable reasons cannot undo a necessary conclusion, if they are simply brought from without and weighed as extraneous objections to a conclusion, acceptance of which is still necessary on other grounds. But a reasonably probable defect in a statement's exemplification of the requisites of trustworthiness is not an extraneous objection to such acceptance, which would still be necessary on other grounds, nor a merely negligible pressure against the statement's foundation. It is a defect within the foundation itself and a shortage in the grounds, all of which are necessary in order to justify acceptance; and thus the statement is no longer free of reasonable doubt.

Reasoned probability in indirect inferences from primary conclusions. These indirect inferences range from such manifest instances as are noted in Cases 3 and 7 of the experimental test, to difficult deductions from evidence corresponding to the conclusions reached on circumstantial evidence in courts of law. Circumstantial evidence requires that the established circumstances must all be (1) not only consistent with the truth of the inference, but (2) inconsistent with any other reasonable supposition. In this 2nd test, which involves the exclusion of reasonable doubt, an effort is made to suggest if possible any other supposition contrary to the inference and yet reasonably in harmony with the established circumstances. This test, in opposition to the inference, is made by reasoned probability, and a practical way of bringing the matter to a direct, definite issue is to ask one's self: "Is it possible that the reverse of this inference could be established by additional, direct evidence without disproof of some point or points in the circumstances?" If such a possibility be reasonably conceivable, the inference is merely probable, but if not, then reasonable doubt is excluded, and the inference is to be classed as necessary. The principle involved in this reversed test is that a probable conclusion may be disproved by additional evidence without disproving any of the points on which the probability now rests, but a necessary conclusion cannot be disproved by additional evidence unless the addition disproves some one or more points which now make the conclusion necessary. The application of this test in historical investigation may be illustrated by two typical cases, the identification of the Annals of Rosenfeld and the authorship of the Continuation of Regino's Chronicle. The chronicle identified as the Annals of Rosenfeld, covering the years 1057-1130, was found about a century ago at Lüneburg in lower Saxony (racial, not the present kingdom of Saxony). It was written on a parchment folio wrapped about a protocol book of the 17th century, and contained no mention of name, time or place of origin. The part following the year 1100, which proved to be independent of other annals, was devoted in its details especially to Saxon events. The annalist assumes that his readers will know who is meant, when he refers to the Saxon princes simply as "Margrave Rudolf," etc. He assumes a like familiarity and interest in his readers with respect to the relatively unimportant Saxon family of the counts of Stade. He mentions that this family had established the monastery of Rosenfeld in their domains. And in the final year of his chronicle, 1130, the simple entry stands: "Abbot Kuno died." Other sources show that Rosenfeld was the monastery where Kuno was abbot until 1130. From these established circumstances or points in evidence, the inference has been drawn that this chronicle was written at Rosenfeld, and it has been included accordingly in the *Monumenta Germaniae* under the name *Annales Rosenveldenses*. The chronicle of Regino, abbot of Prüm (in Rhenish Prussia), which closed at 906, was continued to 967 by an unknown annalist. The Continuator has been identified as Adalbert, a monk of St. Maximin at Treves, who was sent on a disastrous mission as bishop to the Russians in 961, was appointed abbot of Weissenburg in 966, and became the first archbishop of the newly created see of Magdeburg in 968. The grounds of this identification are (1) that the Continuator must have been a monk of St. Maximin because it was in that monastery that Regino, on his expulsion from Prüm in 899, found refuge and wrote the chronicle which was under continuation, and the Continuator shows a special interest in St. Maximin by giving regularly the successions in its abbotship and a disproportionate amount of other details concerning its affairs; (2) that the monk of St. Maximin who actually wrote the Continuation was Adalbert, because, among the few personal items given by the Continuator, Adalbert's misfortunes in the above mission figure prominently and are given in a form which show an intimate knowledge of his affairs and feelings; and (3) the Continuation, which could have been written only by a writer with Adalbert's education and high position, breaks off in the very year of his appointment to the important post at Magdeburg. There is no evidence that Regino ever lived in St. Maximin. The statement that he found refuge in that monastery, and wrote his chronicle there, is an assumption based on the discovery of his tomb in St. Maximin in 1581. He could not have found refuge there on coming to Treves in 899, because then the monastery lay in ruins from a Norman raid; and the *Vita S. Magnerici* not only states that Regino was placed over, and restored, the abbey of St. Martin in Treves, then also in ruins from age and the Norman raid, but the same authority, by giving the disposal made of St. Martin's on Regino's death, implies that he remained over it for life. It is, moreover, not the case that the Continuator gives regularly the successions in the abbotship of St. Maximin. Except by assistance from other sources, the occupancy of this post can be definitely known from his entries only from 934 to 945 and from 957 to 967, or in all, some 21 years out of 60, and these not in continuity. Successions in the abbotship are not mentioned only in the case of St. Maximin, but are given also for 5 other monasteries. Other affairs of St. Maximin are touched upon only in 3 items of, in all, 6 lines out of 20 octavo pages of text; and for the most part, corresponding items are given concerning the monasteries of Lorsch, Weissenburg, Fulda and St. Gall. The mission to Russia, which occupies but 17 lines, was sent with a splendid equipment by the king in answer to an embassy from Helena (Olga) queen or princess of the Russians: its failure, and the bare escape of its leader, Bishop Adalbert, with his life, is, therefore, a public, not a personal, item. In this matter the knowledge of Adalbert's affairs and feelings shown by the Continuator, is that he was selected for the unpleasant mission by the advice and machinations of William, brother of the king and archbishop of Mainz, though he had never offended against that prelate—both of which points, so far from being intimate, would in the ordinary course become common knowledge in a comparatively wide circle, especially in so imporaant an affair between dignitaries of the church and state. Thus the 1st and 2nd groups in the above reasons are based on error and exaggeration. There remains the 3rd, *i.e.*, Adalbert's attainments and opportunities for writing such a chronicle, and the coincidence between its close and his appointment as archbishop of Magdeburg. Here let us apply the definite test, "Could additional evidence establish another than Adalbert as author, without disproving either of these two points?" The answer is, Yes, because Adalbert was but one of a number with like attainments and opportunities, and such a chronicle may be discontinued at any time, for any one of many reasons, or for no particular reason at all. On the other hand, to a similar question concerning the identification of the Annals of Rosenfeld, the answer should be, No, because it is not reasonably conceivable that additional evidence could show that these annals were written elsewhere than at Rosenfeld, so long as the bare entry stands under the year 1130 without further specification of the monastery, "Abbot Kuno died," and there is no disproof that Rosenfeld was the monastery over which Kuno presided until 1130. The inference identifying the annals with Rosenfeld, accordingly, is necessary and scientific, while that which identifies Adalbert as the author of the Continuator is unnecessary, and therefore (though his name is bracketed as such in the title of Kurze's octavo edition of the Continuation, because "to-day almost no one seems any longer to doubt it") is unscientific. Adalbert may, indeed, have been its author. Additional evidence may yet show that he was the author. But not even this would be a retrospective justification of present publicity unnecessarily given to an unnecessary conclusion. The scientific requirement would still be to have sought the evidence, not to have anticipated it.

(*b*). Pure Probability (the Superior Measure).

Probability of the superior measure, which may be called for convenient identification "pure probability," produces in any considerable series of results an average of correctness corresponding to the degree of probability involved. This form of probability supplies a scientific basis for some rules of method applicable to constantly recurring situations in historical research. Thus, if, out of three independent, trustworthy records (or witnesses), two are contradicted on any point by the third, and the known circumstances of the discrepancy show that it is due to incidental error, the statement of the two in agreement is accepted; and this course is justified on the following purely scientific grounds. If we assume, for the purpose of this illustration, that in history as a science, and therefore in any of its trustworthy records, the proportion of incidental error and the average of essential correctness are respectively 1/50 and 49/50, then the pure probability that the single record is in incidental error on the point in contradiction will be 1/50, and the probability that it is correct will be 49/50 or 49:1. On the other hand, the pure probability that the two records in agreement are both in incidental error on the point (=joint occurrence of two independent events) will be the product of their separate probabilities $(1/50 \times 1/50) = 1/2{,}500$, and the probability that they are correct will be 2,499/2,500 or 2,499:1. The chances that the two records are right, rather than the one, will be therefore as $2{,}499:49 = 51:1$, and the pure probability in favor of their correctness will be 51/52. In the formulation of an historical narrative or in any other considerable historical research, there will be a series of occasions where the above rule is applicable, and the degree of probability involved (51/52) will develop in this series an average of correct results corresponding approximately to the average of essential correctness (49/50) required by history as a science in such a narrative or research.

(*c*). Formal Probability (the Product of Correct Processes).

In the introduction to the present part of this paper (p. 492), it was noted that, under accredited (competent) operation, correct processes cannot ordinarily prevent incidental error entirely, but they guarantee in a series of results an average of essential correctness corresponding in height to the exactness of the branch of science involved. By setting the proportion of correct results in such a series, *e.g.*, in Chambers' *Mathematical Tables*, against the proportion of unlocated, incidental errors, one can strike a ratio between the respective proportions, and so reduce to a form of probability the question of the correctness of any individual result in the table or series. Thus, in the mathematical tables in question, containing approximately 200,000 numerical quantities, if the number of correct quantities be taken as 199,990 and the number of unlocated, incidental errors as 10, an approximate probability of 199,990/200,000 or 199,990:10 may be deduced, that any individual quantity in the work is correct; and thus also, in the foregoing illustration of the function of pure probability, assuming that the average of essential correctness in a trustworthy record is 49/50, or 49 correct statements to every unlocated incidental error, a probability of 49/50 or 49:1 can be deduced (apart from contradictions or confirmations by other records) that any individual statement in the record is correct. These probabilities of 199,990/-200,000 in a mathematical table, and 49/50 in a trustworthy record, and all similar averages produced by accredited operation of correct processes, may be called for convenient identification "formal probability," because they constitute a form of probability which differs fundamentally from pure probability. Pure probability is the result of favorable chances acting against unfavorable, but in formal probability only the second half of this condition is fulfilled. The incidental error is due to unfavorable chance, but the force acting against this unfavorable chance, and producing the essential correctness in the results as a whole, is not, as it should be in a case of pure probability, merely favorable chance or chances, but a conscious, intelligent and competent operator applying correct processes in a set effort to produce correct results. For this reason, in scientific and other activity, formal probability even of comparatively low degree, if only it reaches the average of essential correctness required by the exactness of the branch of science or activity involved, imparts to its conclusions individually a value which pure probability does not. This difference in values can be established as a fact in actual experience. In actual experience a civil engineer, even when planning a structure, the safety of which involves the lives of men, will use without further test any one of the 200,000 numerical quantities in such a work as Chambers' *Tables*. If the number of unlocated errors in these 200,000 quantities be taken as 25, the probability on which this confident action of the engineer rests will be approximately 200,000:25 = 8,000:1; if the number of errors be taken as 10, the approximate probability will be 200,-000:10 = 20,000:1; and even if the total number of errors be placed at the unreasonably low estimate of 1, the approximate probability will be only 200,000:1. But, in actual experience, it is also found that the heart which lies ordinarily with its lower point turned to the left in the human body is turned in some instances toward the right, and in these exceptional cases the other organs, and their respective positions to left and right in the human trunk, are similary reversed. By members of the medical profession, these instances of reversed organs, which are very rare, are estimated as occurring approximately in the proportion of one out of a million. If, then, a surgeon, having to release a gathering in this part of the body, should assume that the respective organs are in the usual position, and, on this assumption, should insert his needle without further test, *i.e.*, without locating the actual position of the heart by the sound or impulse of its lower point against the left or right walls of the chest respectively, he would take this action in the strength of an approximate probability of 1,000,000:1 that the position of the organs is normal. And yet, if the insertion which he purposes to make should be at a point and of a depth that might involve a vital part if the organs were in fact reversed, he would not be justified in assuming without further test that the organs are in the usual position.

In the first case a probability of 200,000:1, or 20,000:1, or even of 8,000:1, is considered ample to justify action without further test, because these are all formal probabilities, or the product of a conscious, competent operator of correct processes; in the second, a probability of 1,000,000:1 is not sufficient because this is only pure probability; for nature is not a conscious, intelligent operator, whose occasional failures can be attributed to inadvertent or incidental error; and therefore, if even but one failure is registered against one of her natural processes, such as that for placing the human organs in the usual position, her success in achieving this usual result is thereby reduced to the blind action of many favorable, against a few unfavorable, chances.

The question may suggest itself, "Would not the surgeon also make further test in such a case, if the probability of 1,000,000:1 were formal, instead of pure?" Nature being never an intelligent operator but having only automatic processes which are either correct or incorrect (*i.e.*, correct, where no failures have been registered against the process, and incorrect where a failure or failures have been registered against it), such a case of formal probability could never arise in this particular connection. We have also no way of deciding this question on the basis of actual experience, because no conscious, intelligent operator has ever been known to have raised his application of correct processes in any branch of science to an average of correctness as high as 1,000,000:1. On these two grounds, the one particular and the other general, the suggested question is to be classed as in itself fictitious. A negative answer to it is, nevertheless, fully justified by precedent and experience. There is not the least reason to suppose that a surgeon would hesitate to act upon a formal probability of 1,000,000:1, or that any one would feel that he should make further test of it; for much lower formal probabilities than this are constantly acted upon without further test in equally critical connections. Thus, in the case cited in Part I of this paper (p. 143), the formal probability that a druggist will compound a prescription correctly is not nearly 1,000,000:1, and an error in this respect might be fatal; yet even an analytical chemist, who is well able to test the actual contents of any such compound supplied to him by a druggist, will take the remedy without making this test unless there are manifest grounds for suspecting an error by reason of an unusual appearance or odor in the mixture.

A comprehensive illustration of the same difference in the values attached to pure and formal probabilities is afforded by the prevailing attitude towards the dangers of lightning and railroads, respectively. In a "census of fears" taken by Clark University, the dread of lightning stood in the foremost place. A severe thunderstorm is a positive terror to many persons who fear nothing else; and yet the number of persons struck by lightning is only 1·5 per 100,000 of population in the United States, and of these, one out of three recover, leaving a ratio of but 1 death per 100,000 of population. The railroads of the United States in 1909 (Nelson's *Encyclopædia*, x, 184, 185) killed 7,807 persons and injured 91,076. Of these numbers, employees of the roads represented 2,610 killed, and 75,006 injured; passengers, 253 killed, and 10,311 injured; other persons 4,944 killed (by far the largest proportion of these being trespassers), and 5,759 injured. On this basis, the ratio of passengers killed per 100,000 of population (total population, census of 1910: 91,972,266) is only ·27, or about one-quarter of the proportion killed by lightning. Where a sudden casualty, however, may end erratically either in a fatality or only in injuries, men do not distinguish sharply between the two alternatives, but fear both as a joint, inseparable danger; and the total casualties (killed and injured, 10,564) among railway passengers constitute a ratio of 11·48 per 100,000 of population, or 765 per cent. of the ratio of total casualties (persons struck) by lightning. In every other respect, moreover, the dangers of the railroads are, as compared with lightning, the greater. In 1909, 1 out of every 20 railway employees in the United States was injured; of trainmen, such as enginemen, firemen, and conductors, 1 out of every 205 was killed, and 1 out of 9 injured. The number killed in the third of the above groups alone (4,944), chiefly trespassers, constitutes a ratio of 5·3 per 100,000 of population, or 530 per cent. of the proportion killed by lightning; and the total deaths (7807) and total casualties (98,883) in the above three groups together constitute ratios respectively of 8·48 and 107·5 per 100,000 of population, or 848 per cent. and 7,166 per cent. of the corresponding proportions for lightning. The probable security against casualties by lightning, as compared with the probable security against railway casualties, is, therefore, not only greater, but much the greater. In the case of lightning, however, this security is a matter of pure chance or pure probability, because there is no correct process, which, apart from error in its application, will necessarily exclude the danger, but the security depends on the blind action of a great number of favorable chances upon a few unfavorable. The security against railway casualties, on the contrary, is formal probability because the railroads themselves apply correct processes with set effort. which, apart from inadvertent, incidental errors by the operators, must necessarily exclude accidents; and even the trespasser has ways or processes whereby he expects, if he does not fail in their application, to exclude an accident; and therefore, while men shrink in terror from lightning with its lesser perils, they accept as railway employees the greater dangers of the railroads with equanimity; they plan, as passengers, railway journeys for pleasure; and from trespass, they are deterred, if at all, by railway detectives and fear of the courts, not by the dangers involved to life and limb.

Summary of precedence and proper use of the three forms of probability; and the required average of essential correctness in history.

1. *Formal probability*, or the application of correct processes, should be invariably used where this is possible. Where further test is impossible or unreasonably inconvenient, any individual conclusion reached by formal probability should be accepted in scientific investigation, and in practical applications of the sciences, and in practical affairs generally. Formal probability is the basis of all trustworthy intercourse. Formal probability is also the basis of all professional and expert services required by persons who either cannot perform these services for themselves at all, or who cannot perform them with reasonable convenience. It is the basis, too, of all results prepared (=services rendered) by any scientist for the use of fellow scientists, such as a mathematical table prepared by one mathematician for the use of other mathematicians or of engineers. Formal probability does not exclude incidental error; but universal experience in trustworthy intercourse and in the services rendered by accredited (competent) operators of correct processes, shows that this form of probability guarantees the essential correctness of any series of its results as a whole; and it establishes each of its individual conclusions as *prima facie* correct, and as a moral certainty in the sense that the conclusion, apart from countervailing evidence, is "sufficiently strong to justify action upon it," or "so strong that the opposite may be disregarded especially as a basis of conduct or action."

Under these scientific principles, the historian has the best of rights to use without further test any statement in a record or part of a record exemplifying the requisites of trustworthiness, and nowhere is his scientific right to do this stronger than when such record is the only source for the events in question. Such a record or part of a record, like the series of results in a mathematical table, is essentially correct. The mathematician, in the strength of this essential correctness, is justified and required as a reasonable man to use any individual result in the table (except where he has to contrary grounds) without further test, simply because such a test is unreasonably inconvenient. The historian, in the strength of the same essential correctness, is justified and required as a reasonable man to use any individual statement in the record or part of the record (except where he has contrary grounds) without further test; and this, (where the record is the only source) for the much better reason that such further test is impossible.

2. *Pure probability*, regardless of its height, should not be used where formal probability, *i.e.*, a correct process, is available. The surgeon was not justified in substituting a pure probability even of 1,000,000:1 for the correct process available. In so far as formal probability cannot be applied, pure probability may be used in scientific, including historical, investigation in any series of decisions, if the degree of pure probability applied be of a height which will develop in the series an average of correct results equal to, or greater than, the average of essential correctness required in the branch of science involved.

3. *Reasoned probability* ought not to be used as a positive criterion of conclusions in scientific, including historical, investigation; but reasoned probability has a most important function in guiding the investigator in the search for available evidence, and also as a resisting negative force to assist in the exclusion of reasonable doubt from the final conclusions, and to detect, if possible, latent defects in the application of correct processes in the inexact sciences, such as the exemplification of the requisites of trustworthiness in history, thereby reducing the percentage of incidental error in the final results reached by the application of correct processes or formal probability.

4. *Obligatory decisions in practical applications of the sciences and in practical affairs generally.* In this class of decisions, if a correct process is not available, reasoned probability or pure probability should be applied in so far as either is available, and is better adapted to the conditions; and in any height available. The same is true of semi-obligatory decisions under the above circumstances, *i.e.*, when a decision is not insistent, and yet preferable, because a failure to decide seems to involve on the whole a greater risk than that of a wrong decision.

5. *Required average of essential correctness in science, especially in history.* The average of essential correctness that can and ought to be attained cannot be exactly determined even in an exact science such as mathematics, and still less in an inexact science like history; but the average required is manifestly much less in inexact sciences than in the exact. An erroneous quantity, *e.g.*, in a mathematical

table, if introduced by a user into his calculations, will cause a rapid extension and increase of error under the process of multiplication and division, while in history an erroneous statement adopted from a record will affect the user's results but little, if any, beyond the adopted statement itself. A very small percentage of gross errors, indeed, would deprive a historical record of the character of trustworthiness; but the gross errors to which probability as a positive historical criterion may lead, are not the kind of error that is apt to occur under the application of correct processes. Real errors, indeed, especially those of minor importance, cannot be escaped entirely; and in history, as in other sciences, there are often inaccuracies that are known and unavoidable, yet not of essential importance in the results as a whole. Thus, in a mathematical table, where the limitations of space and the convenience of the user require that the quantities shall run only to a certain number of decimals, the last decimal must ordinarily have an error in deficiency, or if 1 be added to it, there will then be an error in excess. The editor must choose between these two inaccuracies according as to which will be the greater; and neither inaccuracy will affect appreciably the operations of a user. In the same way the laws of perspective and limitations of space will not allow a narrator to speak at the same time from more than one of, it may be, several stand-points, nor to tell all the truth to the last detail even from that one stand-point. The stand-points between which an historian may have to choose, moreover, are sometimes equally good; and what he says from the one stand-point, will seem, to a person viewing it from the other, to be an error (See *Origin and Treatment of Discrepancy*, pp. 167-168). As result in part of real errors of a minor nature and in part of the above unavoidable restrictions, especially in general works of history, a special investigator of any particular period, or series of events, or single event, finds, where a general work touches on his particular field, quite a percentage of points or statements which he feels should have been put differently, or would be the better for a little explanation. An average of 1 of these real minor errors and unavoidable inaccuracies (for want of explanations which space and perspective forbid) together for every 100 statements would seem low, and 1 in 50 moderate (making the required average of essential correctness 99/100 and 49/50 respectively), but even 1 in 25 would not be out of the question, for a narrative that was correct in major points and 24/25 right in minor would still have historical value; and might be worth more than another narrative with a greater pursuit of accuracy in detail and a correspondingly poorer perspective. The value of an historical narrative by no means depends entirely on minute accuracy. Green's *History of the English People*, *e.g.*, has a reputation for minor errors, yet it is on the whole the best work that has been produced in its field, and continental historians wish only that they had its like in the national literatures of their own countries.

(*d*). Rights of Probable Conclusions to Publicity.

Probable conclusions (conclusions not scientifically necessary, or not free of reasonable doubt) have no right to publicity looking to acceptance, more or less conditional, on the mere ground of their probability, but they are entitled, along with the improbable, to whatever publicity is necessary for their thorough investigation. The general principle is, therefore, that the scientist or scholar ought to divulge probable conclusions only to those who are better able than himself, or at least as able as himself, to make further investigation, because only from such persons can he expect to receive assistance on a point which he cannot determine for himself. This principle debars a scientist or scholar from printing probable conclusions in books or periodicals and from stating them in college lectures or elsewhere on the public platform. The readers and hearers are ordinarily less able than he to investigate the probability further; such publicity, therefore, is at bottom an effort, by his mere reputation or academic prestige, to affect their opinions in points which he cannot prove. In seminar instruction, on the contrary, the instructor may properly bring probable conclusions before the class, because there the students join with him in the investigation both of probable and improbable conclusions; in the final results, however, the instructor should countenance the adoption only of those conclusions shown to be necessary by the exclusion of reasonable doubt. It is proper also for a scientist or instructor to suggest to a pupil or other competent person, for examination, a probability which has occurred to him, and the solution of which would be of interest. The scientist or instructor may have greater skill in investigation; but if he be otherwise engaged, and especially he be engaged on more difficult problems, a pupil or other suitable person who has the necessary time is in that sense better able to make the investigation, if it be otherwise within his powers, either under the supervision of the suggester or independently. The case is not so clear for a scholar or scientist bring an hypothesis before a public conference of fellow investigators and inviting their assistance towards its solution. In an important problem he may attract their interest, but the publicity and influence of such a convention in the scientific and newspaper press will give the hypothesis a vogue in the wider public, while its correctness is still under investigation and in doubt and may prove in the end to be not definitely ascertainable at all. Even with respect to problems of the first rank, such a course is of doubtful expediency, because the originator of a truly great hypothesis is its natural, and usually its most successful, investigator. If an hypothesis be of great, and especially of practical, importance, and the scientist for any reason is not in a position to complete the investigation, he may be justified in printing the useful part of his data, if at the same time he eschews the part of an advocate, and instead points out frankly the gaps in the proof which will need to be filled by subsequent investigators. In history the need for any such doubtful expedients does not arise. The historian fulfils the requirements of his science by preparing a narrative of necessary conclusions, and the publicity given to probable conclusions and hypotheses under the prevailing historical method is not for the sake of further investigation by other historians, but with a view to acceptance by readers and hearers.

A systematic generalization explaining without exception an entire group of ascertained, related facts is entitled to publicity, though it be only a probable explanation of those facts. Such generalizations are known as theories and are accepted only provisionally, *i.e.*, so long as no additional fact be discovered which the theory fails to explain. If such a case arises, the theory as a whole is abandoned unless the fact can be differentiated, *i.e.*, unless the theory can be so restated that the additional fact ceases to be an exception and is brought within the modified theoretical law. (This procedure corresponds with the 4th methodic principle in dealing with a failure in a process hitherto considered to have been established by experience as correct. An erratic or undifferentiated exception to the theory, like an erratic or undifferentiated failure of the process, condemns the theory or process as a whole.)

Historical science does not admit of any such systematic generalizations.

It is the disregard of the above principles concerning the degree of publicity rightfully allowed to probable conclusions that has brought upon science the reproach, in so far as such reproach is deserved, that "the science of one generation is the ignorance of the next," and her past is only a "cemetery of exploded beliefs." If probability be confined to its proper function, and probable conclusions receive only their proper degree of publicity, this reproach will cease, and instead there will be a gradual increase of ascertained facts, and a correction of the incidental errors which are an unavoidable but on the whole unimportant feature in the essentially correct results afforded by correct processes; while in those branches of science susceptible of systematic generalizations, there will be a gradual perfecting of these theories until all the related facts are ascertained and brought within the theoretical laws.

IV. THE ORIGIN AND RESULTS OF THE PREVAILING USE OF REASONED PROBABILITY AS A POSITIVE HISTORICAL CRITERION.

(*a*). ORIGIN.

1. *Improper extension of proper function.* The leading part played by reasoned probability in the process of investigation and accumulation of evidence obscures the fact that, when this process is complete and all available evidence has been gathered, its rôle should be reversed, and, instead of forming the positive basis for final conclusions, it should be used only as a negative force to test whether the conclusions which then seem to be scientifically necessary are actually free of reasonable doubt. At previous stages of the investigation, conclusions that were not scientifically necessary, but only reasonably probable, were frequently overthrown by subsequent additions of evidence, and there is no ground to suppose that the same would not occur to many conclusions which seem reasonably probable at the final stage, if further additions of evidence should in fact become available; hence experience and correct scientific principles alike require that they should be left in abeyance and excluded from the final, published, results.

2. *Necessity versus certainty in historical conclusions.* A failure to distinguish between necessity and certainty in conclusions is another source of the prevailing use of reasoned probability. If one suggests that the conclusions of historical science should be necessary and not merely probable, one of the first points that one may expect to be raised is, "If certainty is required in history, will there be much of history left?" In science and in actual intercourse, however, certainty and necessity are not thus interchangeable terms. A conclusion may be necessary because it is certain, but it may also be necessary, *i.e.*, require one's assent as a reasonable man, because it is free of reasonable doubt; and ordinarily, as was shown in the introduction to the present part of this paper, scientific conclusions even in the exact science of mathematics are necessary, not because they are certainties, but because they are *prima facie* correct, and as such, apart from countervailing evidence, free of reasonable doubt. Certainty, indeed, could be established, if need be, for a considerable percentage of conclusions in history. The easiest way for an historian to do this is to abbreviate his narrative till it contains only the broadest features of the events under narration; and it would not be impossible to devise further special rules to the same end. The resulting narrative would not be wholly devoid of interest, but the sacrifice of material involved is neither desirable nor necessary. The substitution of scientifically

correct, in place of the present probable, processes in the interpretation of records will produce essential correctness, and bring the result to the scientific basis of necessary conclusions without rejecting *en bloc* all the present probable conclusions. By that substitution, some of the results now accepted on the basis of probability would be discarded, others that are now discarded would be accepted; but on the whole, much that is now accepted as probable would stand also the test of necessity (because many contemporaneous records exemplify the five requisites and are therefore adjudged trustworthy under either process, p. 544 above) and would require acceptance under a proper treatment of records; and this acceptance, instead of being under the present fog of doubt and uncertainty, would stand upon a common level with all the sciences, including the most exact.

3. *Use of reasoned probability in practical affairs and in practical applications of the sciences.* The present use of reasoned probability as a positive criterion in history is suggested by its use as a positive criterion where none better is available, and a decision is necessary, in practical affairs. These situations continually arise both in ordinary practical affairs, and in practical applications of the sciences such as medicine and the law. Thus, in medical practice, a satisfactory diagnosis is often not possible short of an autopsy; and the physician, therefore, in so far as he cannot fully apply his correct process, rightly makes the necessary decision on the only available basis of probability. The courts, also, being required to decide between two parties, give the decision in civil cases according to the weight of evidence, whether this excludes reasonable doubt, or establishes only a reasonable probability. As an abstract principle, the plaintiff, since the burden of proof rests primarily on him, might be required either to establish his case beyond reasonable doubt, or lose his suit. Practically, however, the enforcement of this principle against a personal claim which is not absolutely established, and yet is supported by a substantial preponderance of evidence, would be a personal hardship and would place a premium upon trespass, because the injuring party can usually plan to take the other unawares and thus has every opportunity to forestall and to destroy all evidence of the trespass. The last is even more true of criminal acts; but since the 18th century criminal charges, at first only in capital cases, but now in others as well (with the doubtful exception of criminal charges arising in civil proceedings), must be proved beyond reasonable doubt; and in this respect the courts exemplify the requirement of pure science. This exemplification and the resulting hindrance to the prosecution involve no personal hardship because the prosecutor, or state, is an impersonal institution. Science is essentially impersonal; and history itself, as a science,

though it deals with persons and personal elements, is above personal considerations. The example of the courts in civil cases, therefore, does not apply here; and the entire series of obligatory probable conclusions in practical affairs, and in practical applications of the sciences, is no precedent for the acceptance of probable conclusions in scientific investigation, because in such investigation no decision is ever obligatory. The scientist has always the privilege of silence, and the historian, wherever he regards a conclusion as not free of reasonable doubt, is at liberty to omit it from his final results.

4. *Mixed phraseology concerning probability.* Mixed phraseology in legal works and dictionaries is another encouragement to the present probable conclusions in history. Thus, a very good legal work (Phipson, *Law of Evidence* pp. 5, 6) uses the phrases "preponderance of evidence" and "preponderance of probabilities" interchangeably, thereby seeming to imply (though the inference is not specifically made, and may not be intended) that probability is as good a thing as evidence. In dictionaries the confusion in definitions reaches the point of complete contradiction. Probability as a term by itself is defined in them in the ordinary sense that the supporting evidence inclines the mind to belief, but still leaves room for doubt. The same dictionaries, however, under the terms "moral" and "certainty," define moral certainty (which excludes reasonable doubt) as a high degree of probability. Earlier editions of *Webster* (*e.g.*, 1856), indeed, state specifically under "probability," that this falls short of moral certainty; but this statement is omitted in a more recent edition (1900), which joins with the *Century Dictionary* (1895) and the *Standard Dictionary* (1893, 1913) in the above contradiction. It is not unusual for the same word to have different shades of kindred meaning and even to show considerable variation from this kinship or common starting-point in meaning. In such cases an indiscriminate use of the word is not permissible; but an exact delimitation of those differences or variations is recognized as necessary in order to prevent misunderstandings, confusion of thought, and errors, which would otherwise arise; and especially to prevent the basing of premises on one meaning and the drawing of a conclusion on another. Where the difference amounts, as here, to a flat contradiction, the need of an exact delimitation is so much the greater. Of the various forms of probability, pure probability, regardless of its height, does not exclude reasonable doubt except in averaged results. Reasoned probability used as a positive basis for conclusions does not exclude reasonable doubt; when used as a negative force to overthrow, if possible, conclusions and inferences seemingly necessary, it can assist in the exclusion of reasonable doubt. Formal probability, the

product of correct processes—apart from countervailing evidence—excludes reasonable doubt; and in this connection, it is of interest to note that, of the three above dictionaries identifying moral certainty with a high degree of probability, the *Standard* offers no illustrative citation of the sort of probability which establishes such certainty and thus excludes reasonable doubt; *Webster* cites, in illustration, "as, there is a moral certainty of his guilt;" and the *Century*, "as, there is a moral certainty that the sun will rise to-morrow." In the courts, moral certainty of guilt is established by circumstantial evidence, in which reasoned probability is used, not as a positive ground for conviction, but as a negative force, which seeks to prevent a conviction by explaining otherwise, if possible, the circumstances pointing to the guilt of the accused; and if this attempt at a reasonable counter-explanation fails, reasoned probability thereby assists in the exclusion of reasonable doubt and in establishing as a moral certainty the guilt of the accused, because this failure shows that the established circumstances are inconsistent with any other reasonable supposition. *Webster's* citation therefore points to the correct use of probability for the purpose in question, while the illustrative citation in the *Century Dictionary* is only an unusually strong case of formal probability; the daily rising of the sun is the result of a natural process, against which a failure has never been registered, and until such a failure is registered, this daily occurrence is to be anticipated as the necessary product of this natural and automatically correct process.

5. *Strength of a probability of 2:1.* The prevailing regard for reasoned probability as a positive historical criterion, and the acceptance of balanced probable conclusions on even a small margin of favorable reasons over unfavorable, is due largely to the view that a probability of 2:1 establishes a remarkably strong case for a conclusion. This view in turn is based on the idea that a statement by one trustworthy record or witness, if confirmed by another trustworthy record or witness, is therefore twice as probable, and that where a statement by two independent trustworthy records (or witnesses) is accepted over a contradiction by a third independent trustworthy record, this manifestly proper acceptance rests on a probability of only 2:1. This popular view, however, is a scientific error. The probability that two independent records in agreement are correct is not the sum, but the product, of their separate probabilities; and as shown in the previous illustration of the function of pure probability in historical science (p. 552), if the probability that any one of three independent records is correct be taken as 49/50 or 49:1, the acceptance of the two records in agreement, as against the third, contradicting record, is based on a probability, not of 2:1, but 51:1. If the average

of essential correctness in historical records be taken as 24/25 or as 99/100 respectively, instead of 49/50, the acceptance of the two records in agreement against a third, will rest on a probability of 26:1, or of 101:1, respectively.

6. *Apparent modesty of probable statements in historical narration.* The prevailing resort to probable conclusions in historical narration springs in part from a feeling in historians that they are more modest in making hypothetical statements than categorical. This apparent modesty is only superficial, and is due to the fact that untruthful braggarts are not hypothetical, but almost always categorical, in their statements. Such braggarts, however, while they externally (but not really) observe the 5th requisite of trustworthiness by making no admittedly probable statements, openly violate all the other four requisites, except occasionally the 1st. Only where the entire five requisites are exemplified together, is a statement trustworthy; and the historian who first exemplifies faithfully the first four, by doing his utmost to obtain and state clearly the information desired by readers, with strict impartiality and without exaggeration, and then observes also the 5th by cutting out rigorously all clever guesses, all pet theories, and all favorite hypotheses, which he can almost, and yet not quite, prove, is the self-abnegatory and truly modest man; but the historian who includes such probabilities in his narrative is fundamentally immodest, because he wishes readers to accept, or at least to attach weight to, these guesses, without proof, and therefore simply because they are *his*. He thereby exceeds his evidence, and since the only ground for acceptance of his conclusions must be either in the evidence or in himself, his appeal to the reader rests necessarily on his personal opinion and prestige.

7. *Contemporaneousness as a test of historical trustworthiness.* In the introduction to the present part of this paper (p. 494), it was stated that two important features in any historical method are its test for trustworthiness, and its treatment of conflicting statements in trustworthy records where the circumstances of the discrepancy are unknown; and that this test and this treatment consist, in the prevailing method, of contemporaneousness and harmonization, both of which are incorrect, probable processes. The test by contemporaneousness originates chiefly from the fact that all trustworthy records must depend directly, or through trustworthy media (men or previous records), on actual participants (and therefore, contemporaries) of the events in question; and thence the deduction is made that contemporaneousness in itself, and its opportunities, are the criterion of trustworthiness. This is an unscientific inference. At Göttingen, in a test of a pre-arranged scene sprung unexpectedly upon

a gathering of 40 men of more than average intelligence, out of their reports, immediately written, only 1 had omissions calculated as less than 20 per cent. of the characteristic acts; 14 had omitted 20 to 40 per cent.; 12 omitted 40 to 50 per cent.; and 13 still more than 50 per cent. Only 6 of the 40 made no positively wrong statements; in 24, up to 10 per cent. of the statements were free inventions; and in 10, or one-fourth of the papers, more than 10 per cent. of the statements were altogether wrong. Similar tests systematically made elsewhere show the same results. In these tests, all the reporters are contemporaries. Only a few are trustworthy. Contemporaneousness, therefore, cannot be the essence and scientific (=necessary) cause of trustworthiness. This essence and scientific cause must be the qualities that, present in the few, necessarily made them essentially trustworthy and, wanting in the many, necessarily left them untrustworthy; and whoever traces out, and depends on, these qualities in men and in their records must himself necessarily produce a record with like qualities, whether contemporaneous or not. Contemporaneousness is one of a number of opportunities to produce a valuable record, just as a lot of trees is one of a number of opportunities to produce a lot of workmanlike tables. But the contemporaneousness in itself does not prove that a valuable record will be produced, any more than a lot of trees proves that there is an artificer about, who will convert them into a lot of workmanlike tables. On the other hand, a lot of workmanlike tables, actually produced, proves that there must have a competent artificer, though anonymous and unknown, with all the necessary opportunities, including the timber, whether as trees, or logs, or rough or dressed lumber; and so, in the parallel case, a valuable record, actually produced and exemplifying the qualities or requisites of trustworthiness, proves that there must have been a competent historian, though anonymous and unknown, with all the necessary opportunities, if not of contemporaneousness, then of trustworthy media (men or previous records) exemplifying the qualities which he evidently realized were requisite for trustworthiness, whether in himself, or in other men, or in their records. In both cases, the actual product is the first, and last, and only decisive, test.

Another feature that induces the present use of contemporaneousness as a test of trustworthiness, is the fact that contemporary records, whether trustworthy or not, reveal the mental and social characteristics of their age with a life and reality that no later narrative can reproduce. One may accurately describe a railway locomotive and its performances; or one may give the characteristic features of a face so well that a detective, by the mere description, may discover the individual in the throngs of a crowded city; but no such verbal description can vie in interest with the living face, or even with a good portrait or photograph; and, to a person who has never seen a locomotive, the best account of it that he has ever heard will seem but a tame affair compared with the real thing, when for the first time it comes thundering down the track at his side. So it is as between contemporary and later records. The change in interests, in modes of thought, and in outlook upon life generally, that creeps imperceptibly over a community even within a generation, may be accurately narrated in review; but the very person who has lived through it all, and can appreciate from his own experience the accuracy of the narrative, will realize more sharply the distance he has travelled from the starting-point, by turning to a book, a magazine, a newspaper, a letter, or any other literary product of forty, thirty, or twenty years ago. This sharper realization, however, is not a matter of trustworthiness in the contemporary product, nor of untrustworthiness in the later narrative. In the pages of the book, magazine, newspaper, or letter, even though untrustworthy, the interests and the whole mental and social atmosphere of the earlier circle and time will be a living, pulsing, breathing thing; but in the later narrative, however accurate, this life cannot live again.

8. *Harmonization of Discrepancy.* The practice of harmonizing conflicting statements in trustworthy records originates as a natural development in the present historical method, because the method as a whole and this practice in particular both rest essentially on the use of reasoned probability as a positive criterion. In this practice, not only is value ascribed to reasonable harmonizations, but the possibility of suggesting one is made the test of error in the conflicting statements. The value of such harmonizations, and the validity of this test, are both disproved experimentally in the paper on the *Origin and Treatment of Discrepancy in Trustworthy Records* mentioned in the paragraph on *General features of the erratic nature of probability* (p. 538 above). The view that, if a reasonable harmonization seems possible, neither of the conflicting statements is in error, but if such a harmonization seems impossible, then one of the statements at least must be erroneous, is so deeply rooted in our modes of thought that, at first sight, it seems strange that the validity of the test should be questioned at all. Nevertheless even such points should be examined wholly without prejudice; and this test marks in fact as extreme a development as there is in the unscientific use of probability in history, because the probability involved is no longer probability on the evidence (which would also be unscientific), but mere probability in itself. The most apparent reason for the popular vogue of the

test is that, in actual intercourse, if a man makes statements conflicting and yet true, he can, on being questioned, give a reasonable explanation from his knowledge of the attendant circumstances. The explanation, however, must be in accordance with these actual circumstances, *i.e.*, truthful. Harmonization of conflicting statements in records is attempted, on the contrary, only where (and because) the attendant circumstances are *unknown*. Were these circumstances known, it would be clear of itself whether the conflicting statements are both correct, or one of them erroneous. The harmonizer, therefore, attempts his harmonization by a pure effort of the imagination, without knowledge of the actual circumstances, and thus necessarily without regard to them. If such a test is proper and legitimate, then a person making conflicting statements in actual intercourse may also properly and legitimately account for them without regard to the actual circumstances, *i.e.*, by any plausible, fictitious explanation that his imagination can suggest. Once this initial weakness in the present test is realized, it becomes clear that the practice is not really defensible. In the above mentioned paper, moreover, its invalidity was definitely shown, because, where statements conflicting and yet true were located in actual intercourse, and were recorded without mention of the attendant circumstances, a reasonable harmonization of the statements seemed impossible in nearly half of the cases, and in the remainder a reasonable harmonization seemed easy, but proved in every instance to be contrary to the facts. This demonstrates that, where the attendant circumstances are unknown, (1) the impossibility of suggesting a reasonable harmonization does not prove that the discrepancy cannot be reconciled in fact, and (2) that such harmonizations, even where possible, have no scientific value in themselves.

(*b*). Results of Prevailing Use of Reasoned Probability as a Positive Historical Criterion.

1. *Decision by authority*. Where an investigator, such as an historian, makes an investigation, there are fundamentally but two grounds on which others can accept his reported results. The first ground is proof by his established findings (=necessary conclusions), the second, his opinion in points not established by his findings (=probabilities). A reader or other person using an historical narrative cannot ordinarily repeat the investigation, and therefore such a person must depend largely, if not entirely, on the historian to determine what points are established by his findings as necessary conclusions. If, however, the historian, in making this determination, uses reasoned probability purely as a resisting, negative force to overthrow,

if possible, his own conclusions, he thereby submits himself to the authority of pure science. In this position he can invite acceptance of his conclusions, even where space and perspective forbid his giving the grounds of a decision, not on his authority as an expert, but simply on his fidelity as a reporter. Where, on the contrary, he uses reasoned probability as a positive criterion, and inserts balanced probable conclusions and other probabilities in his narrative, the historian, not having submitted himself to scientific requirements, invites acceptance of his results, not in the name of science, but on his own personal authority. This is true even where he cites the sources or gives the grounds of his probable opinion, because such sources may cease to exist, or access to them may be unreasonably inconvenient to others, and in any event ordinary readers will not consider these sources and grounds independently of his opinion, but will feel largely bound by his views as an expert; and yet another historian, fully as capable as he, might consider a different, or even an opposite, conclusion quite as probable, or more probable, on the same sources and grounds. In some fields of historical criticism, probability has fuller sway than in others; and in one particular field, all conclusions are acknowledged to be only probable. It is significant that in this field there is strong complaint that no scholar or investigator, however good his argument, can get even a hearing from a fellow scholar occupying an academic post a little more prominent that his own. Such an effort to decide scientific questions on the basis of a sort of academic hierarchy, and not on their own merits, is the negation of science. Under probability as a positive criterion, there is also a constant appeal, especially noticeable in this field, to any consensus of opinion between a group of scholars, and particularly between a majority of them. This is also a form of deciding questions by authority, and not on their merits; and as a test it is illusive and unscientific, for there was once a consensus of opinion, not only between a group or a majority of scholars, but universally among them, that the earth was flat and not round; that the sun moved about us, and not we about the sun; and that our planet was the great, engrossing centre of the universe, and not one of the smaller members of a system that forms but a fraction of space.

2. *Scepticism.* The increasing scepticism among historical investigators, which was noted in the introduction to the present part of this paper, is a natural result of the present criteria and decisions by authority in history. Where the method of a science is fundamentally erroneous, the mere repetition of its threadbare formulae will not avail in the end to hide the error; and in science the fate of all decisions by mere authority is either to be questioned ultimately by

bolder spirits who wish to know the reason why, or these decisions are overthrown completely by additions of evidence. Additions of evidence usually bring a like fate to any consensus of opinions resting on balanced probable conclusions or other mere probabilities; and as often as not, this addition of evidence is developed at the moment when the wideness of the consensus makes the humiliation of the exposure most complete. Such a consensus of opinions is liable also to mortifications of another sort. Where a leading scholar, or several of them, have built up, in the face of an opposing group, a large following of lesser lights, such a leader may suddenly reverse his opinion on a cardinal point, accepting the view that he formerly rejected, and rejecting the view that he formerly accepted. This *volte face* need not be due to increased evidence, but may occur at any time and simply because he chooses erratically to balance his probabilities a little differently. By his new friends, this addition to their ranks, though it adds not a jot scientifically to the strength of their case, will be greeted with acclaim; by the old, his apostasy will be viewed with vexation and regret; but to onlookers generally, and especially to thoughtful men, such kaleidoscopic changes, occurring from time to time, suggest that where coats are turned so easily, one side must be about as good as the other, and neither side can be worth any too much. Under such conditions a general and increasing scepticism is a healthful development: it marks a stage on the road from worse to better; it is a recognition that a radical defect exists; a challenge to the science involved to locate and remedy the evil.

3. *Logical Inconsistencies.* A feature of the present method is its logical inconsistencies. A general instance of these is the attitude towards non-contemporaneous narratives in any period where they are the only sources available. Professing to regard trustworthiness as a *sine qua non* of trustworthiness, the prevailing method ought to strike every such record and period from its reckoning. It refuses to make the sacrifice. Instead it repeats the entire narrative, with a question mark or a multiplicity of these. A scientific historian has no right to narrate untrustworthy history, either with or without question marks. Another instance of these logical inconsistencies in the the present method is its frequent combination of "possibilities" with "probabilities." This combination is so common in Bernheim and elsewhere, that, in defining a "probability," he feels it necessary to join with it a definition of a "possibility" (*a fact against which there is no direct or indirect evidence, and no positive evidence in its favor*). Now if probability is to be a positive historical criterion and probabilities accordingly are to be included in history, improbability is the

reverse of this criterion and therefore improbabilities ought to be excluded. But an improbability, though it has fewer favorable chances than a probability has more favorable chances than a possibility. Thus, if there be 100 favorable chances and only three possible events, 80 chances favorable to one event would constitute it a probability (in the ordinary sense), 19 chances favorable to another event would constitute it an improbability (in the ordinary sense), and 1 chance favorable to the third event would constitute it a possibility. Upon what reasonable ground, then, can a historian (1) narrate probabilities, (2) exclude improbabilities, and (3) include possibilities which have fewer favorable chances (and therefore are less likely to be correct) than the improbabilities which he has excluded?

4. *Abnormal developments.* An error, not recognized as such, tends to increasing extremes. Thus we find in a well-known work by a *regius* professor of modern history in an English university the statement: "The circumstances, if they were known to us, though they could never excuse such a proceeding, might perhaps partially palliate it." In other words, it is no longer sufficient for the historian to suggest what he deems to be probable on the evidence that he has, but we are to have conjectures upon evidence which he has not. A professedly scientific work, in referring to gaps in our records for a certain period of history, remarks that the sources themselves are so meagre that "a use of conjecture, or of what has been called the historical imagination, is inevitable." Under the given conditions, what is the matter with silence? To a person who realizes that "one of the most essential characteristics of all science is that it supplies assured knowledge," it will seem scarcely possible that a professedly scientific scholar could have seriously made this suggestion to use the imagination not merely as a positive criterion of conclusions but even as a substitute for evidence itself. The statement, however, which is by a Scottish professor, was made in a serious connection, and is seriously intended. Again, a brief summary of an historical question in a standard work of reference some decades ago, contained but 4 probable statements; but in a similar summary of the same question in a recent work of the same character, the number of probabilities, possibilities, presumptions, and conjectures, has grown to 11. In this same recent standard work, the number of probable statements, veiled and open, averaged, in 50 pages, approximately 5 per 1,000 words of text; and in more specifically historical parts, this quota rose at points to as high as 8 and even 15 per 1,000 words. Thucydides is accounted generally, even by moderns, as the ablest and best historian in his own, and every other, age; and Caesar, not without reason, is regarded from the purely secular stand-point as the greatest intellect that the

race is known to have produced. Thucydides has a few hypothetical statements in his introductory discussion of the early state of Greece (Book I, chapters 1-21); but in the remainder of his work, and in the historical writings of Caesar, probable statements, open or veiled, are on the whole, conspicuously absent. If definite proof could be given that their practice in this respect was not scientifically correct, their authority ought not to prevail against the established requirements of science; but if the scientific requirement and their practice are at one with each other, the example of these intellectual giants, as such, should receive the more serious consideration.

5. *Essential incorrectness.* The erratic results produced in individual conclusions where reasoned probability is used as a positive criterion, may be also produced, and cause essential incorrectness, throughout an entire series of conclusions, if the series rests solely on that basis. Ordinarily the correct and incorrect processes of historical science coincide sufficiently (many contemporaneous records being trustworthy, not because they are contemporaneous, but because they exemplify the 5 requisites) to save the present method from a complete fiasco in any extensive series of its results. Where, however, an extensive series of its conclusions is grounded solely upon the prevailing incorrect use of probability, there is no assurance that the entire series will not fall before additions of evidence. A comparatively prominent instance of such a development in the field of historico-literary criticism is afforded by the theory of the Homeric poems enunciated in 1795 by Wolf, who reduced Homer to the rôle of a compiler. This theory, extended by Lachman, who dropped the notion of a Homer altogether, found wide acceptance. It was based largely on the probable ground that the Iliad could not have been composed in a primitive age when writing was unknown. But recent discoveries have shown that Greek society in the time assigned to Homer was by no means primitive, and also that writing was far older in Greece than Wolf supposed. In 1900 a great mass of tablets older than the age of Homer was excavated from the palace of Minos in Crete, amounting to over a thousand inscriptions, in a highly developed linear script, with regular divisions between the words, and for elegance hardly surpassed by any later form of writing.

CONCLUSION:

THE CARDINAL FEATURES IN A SCIENTIFIC TREATMENT OF RECORDS, AND THE ERRONEOUS ATTITUDE OF THE PRESENT METHOD TOWARD RECORDS AS SUCH.

(*a*). Scientific Treatment of Records.

A proper, and practical, and the severest, and best, test to which an historical method can be put, is when an historical student presents himself, record in hand, and asks, "Now, what am I to do with it?" If, in reply, such a work as Bernheim's be given him, with the direction, "Search and see," the present author believes himself well within the mark in saying that patient and diligent study of its 852 pages would only drive the student, however capable and intelligent, deeper and deeper into confusion, doubt, uncertainty and scepticism. The work opens with 178 pages on the "conception and nature" (Begriff and Wesen) of historical science, and it has 215 pages on "perception" (Auffassung) of the connection between historical facts; but the present author cannot find even an allusion to so elemental a point as the custody of a record.

The present author submits that, in answer to the above question, the following are the 5 principal points to be considered by the student in dealing scientifically with his record:—

I. Was the record (or, if a copy, was the original record) when first discovered, *i.e.*, when we first have knowledge of its existence, in proper custody?

A record is in proper custody if it be found in a place where it might naturally be. Thus a manuscript discovered in a monastery in northern Germany, and first printed at Rome in 1515, has formed the sole basis of all subsequent editions of Books I, II, III, IV, VI, and a fragment of Book V, of Tacitus' Annals. Italy and Rome would have been the most natural places to find such a MS., yet it was found in proper custody, because a monastery in northern Germany was also a place where it might naturally be. An instance at the other end of the scale is that of a letter blown into a neighbour's yard. The most natural place for the letter is in its owner's pocket or desk; and yet, if found in a neighbour's yard (or in practically no custody at all), the letter, historically speaking, was in proper custody, because that was also a place where it might naturally be. A conspicuous instance of improper custody was that of the so-called Book of Mormon, which Joseph Smith professed to have found in September, 1827, in a hill-side in western New York. This is not a place where such a record would naturally be.

No custody, however remarkable in itself, is improper if it be proved to have actually had a legitimate origin, or if there be proof of actual circumstances which would make it a place where the record might naturally be. In this respect, as in all others, proof by correct processes—formal probability—has full right of way, first and last, against all other grounds.

II. Is the record genuine?

This point should be determined, wherever possible, by specific proof, *i.e.*, by examination of all available internal and external evidence. This examination, however, should be made on the basis of correct processes, not by reasoned probability used as a positive criterion. If the available evidence so examined will not establish a necessary conclusion for or against genuineness, then (a) improper custody constitutes *prima facie* ground for rejecting the record as not genuine, and (b) proper custody constitutes *prima facie* ground for acceptance as genuine. The scientific reason for (b), *i.e.*, for accepting a record in proper custody as genuine, unless the contrary be proved, constitutes another case (like that for accepting the statement of two independent trustworthy records in agreement against the contradiction of a third, independent, trustworthy record, discussed on p. 551 above) in which pure probability supplies a scientific basis for a rule of method applicable to constantly recurring situations in historical research. There are cases not a few, and some of them remarkable enough, of the fabrication of records and documents; but for one such fabricated product there are hundreds of the genuine, hence, apart from all evidence whatsoever, the pure probability that any one record or document is genuine is more than 99/100: and since the occasions for applying this rule constantly recur in historical investigation, the investigator who applies it systematically will develop in this series of applications (apart altogether from the first and invariable test by internal and external evidence wherever this will afford a necessary conclusion) an average of correct results higher than the average of essential correctness required in historical science, whether this required average be 24/25, or 49/50, or 99/100.

Genuineness and fabrication here are not a matter of trustworthiness or untrustworthiness, but simply the question whether, *e.g.*, a note of hand or bank note in actual circulation represents an actual debt or is only a forgery. Thus, historically speaking, an exceedingly untrustworthy letter or pamphlet may be the genuine product of an author, acknowledged or anonymous, *i.e.*, it may be an honest but extremely prejudiced presentation of a subject, or even, in the extremest sense of untrustworthiness, a *genuine* effort to deceive.

III. Is the record trustworthy?

The trustworthiness of a record as a whole, or in its respective parts, or in its respective statements, depends upon its exemplification as a whole, or in the respective parts, or statements, of the 5 requisites of trustworthiness located experimentally in Part I of this paper. These requisites are the same qualities by which we judge, with essential correctness, of the trustworthiness of our fellow men in actual intercourse; and the test, as applied to records, should conform to the test as applied to men. In actual intercourse, when brought into contact with a man with whom we expect to be more or less closely associated or to have business dealings, we do not make a preliminary test of his trustworthiness by selecting a particular body of his statements and faring forth after verification or disproof. We judge of his trustworthiness by his language, bearing and interests, and ordinarily in an association of any length, we do not judge amiss. Only a few do we accept as essentially trustworthy in the fullest sense; a few we reject as essentially untrustworthy; and between these two extremes, there is every variety of intervening grades. The statements of an essentially untrustworthy person we reject as a basis of action, save in points where we have other grounds for believing that he is correct. The statements of an essentially trustworthy person we accept as a basis of action, save in points where we have grounds for believing that he is in error. Moreover even in a person accepted as essentially trustworthy, exceptions in his trustworthiness, and not mere unintentional errors on his part, will in most cases be detected eventually. Thus most men will shield members of their own family, at least by silence, up to a certain point; and few men are wholly without honest prejudices or personal predilections. We discover these points gradually in the case of a trusted associate; we differentiate them in our reliance upon his trustworthiness; but apart from these exceptional points, if their number is not excessive (and ordinarily the number is not excessive), we still give him our general confidence, subject to these differentiations. Differentiations of trustworthy points in untrustworthy persons may be similarly located; and these differentiations of both kinds, with their respective grounds, made in actual intercourse, and assembled and digested, form a valuable amplification of the 5 requisites in judging of the trustworthiness of records as a whole or in their respective parts or statements. Records are but the recorded utterances of men; and just as men in actual intercourse have a language, and bearing, and interests, which may be studied and located by their fellow men, so a record has a language, and bearing, and interests, which may be studied and located by a historian. The only difference, in fact, is that recorded utterances are more stable than the verbal; they may be studied with more accuracy; and their trustworthiness or untrustworthiness may be determined more definitely according to their exemplification or non-exemplication of the 5 requisites in general and all proper amplifications of these in detail. And just as the verbal statements of a person adjudged trustworthy in actual intercourse are accepted as a basis of action, except where we have contrary grounds, so the statements of records, in so far as the records as a whole, or in specific parts, or in specific statements, are adjudged trustworthy, ought to be accepted by the historian for the purposes of his own narrative unless he has contrary grounds. The former practice results universally in essentially correct results in actual intercourse, and the corresponding practice will result with equal universality in essentially correct results in historical research and narration. This is the only scientific test of trustworthiness in men and in records, and in its application no line can be drawn scientifically between contemporary and later records. The contemporary historian must judge wherein his fellow men and available contemporary records exemplify the requisites; the later historian must judge wherein earlier records exemplify the requisites. The tasks are essentially the same; and if the later historian's completed narration itself exemplifies the requisites, we have no more right to believe that he would depend on earlier records without the corresponding requisites, than would a contemporary historian on contemporaries or available contemporary records without these requisites, or than would a trustworthy man depend on an untrustworthy in actual intercourse. This ought not be taken as true of an uncritical compiler of bare annals, who seizes upon notices here and there as he may accidentally find them in earlier annals, and especially where he seizes upon such merely to add a sort of ornamental introduction to a fuller, independent, chronicle of his own time; but an historical narrative of genuine merit, and with a good perspective, covering an extended period of time or an important group of earlier events, is one of the supreme tests of intellectual capacity and literary acumen. A work of this rank, if it exemplifies itself the requisites of trustworthiness, establishes the author's ability, though he be anonymous and unknown, to judge trustworthily of the earlier records and documents quite as well as a contemporary historian can judge trustworthily of contemporaries and contemporary documents; and this is equally true whether the work be the product of ancient or of modern times.

IV. Is a trustworthy record contradicted?

(1) If the contradiction be by an untrustworthy record, the statement of the untrustworthy record is disregarded.

(2) If the contradiction be by a trustworthy record, and the attendant circumstances of the discrepancy are known, then, (a) if the circumstances constitute a legitimate explanation of the conflicting statements, each statement is to be accepted as correct in the sense which the circumstances justify; but (*b*) if the circumstances show that one of the statements must be an error, without showing which, silence should be observed concerning the point in contradiction, unless either record is confirmed by a second, or more, independent trustworthy records; in which case the statement of the records in agreement is to be accepted.

(3) If the contradiction be by a trustworthy record, and the attendant circumstances are unknown, the statement in neither record should be accepted, whether confirmed by other independent trustworthy records or not; the scientific requirement in this case is silence concerning the point in contradiction.

The 3rd rule involves the chief departure from the present treatment of discrepancy. The scientific necessity for this rule is proved experimentally in the *Origin and Treatment of Discrepancy* previously mentioned (Trans. Roy. Soc. Can., 1911, v, 127-178; on point concerning confirmation by other records, p. 173).

V. *Narration.*

Scientific results, including historical narratives, should be presented ordinarily (*cf.* Cases 4 and 9 of the experimental test) in positive, and not in negative, form, because persons receiving information wish, as a rule, to know what a thing is, not what it is not.

Historical narrative should be categorical in form, because, by the fundamental principles of science, all doubtful and hypothetical conclusions are debarred from the accepted final results designed for general publicity, and especially for printed publication; in the words of Goethe, "When a man writes a book, let him tell me what he knows. I have guesses enough of my own."

The treatment of records above outlined constitutes a scientific historical method because it meets the general and ordinary requirements of science and because it conforms to the general and ordinary principles and practice of actual trustworthy intercourse. The prevailing method is constrained to its present incorrect and probable processes by a fundamental error in its attitude towards records as such. With a consideration of this point the present discussion will close.

(*b*). The Erroneous Attitude of the Prevailing Method Toward Records as Such.

This question will be examined under the following heads:—

i. What is the purpose of a record as such?

ii. What are the conditions governing the creation of a trustworthy record?

iii. What is the attitude of the prevailing method toward records as such?

iv. What is the ground of that attitude?

i. *What is the purpose of a record as such?* It is a fundamental and pervading principle of all records as such, including the organized and literary narratives, the creation of which is the ultimate object of historical science, that they are designed primarily, chiefly, and essentially, not for those who have, but for those who have not, access to the recorder's or narrator's sources and opportunities of information. The record or narrative in fact is intended to be a substitute for these sources and opportunities, and to serve the purpose of such persons expressly because they have not this access, and are not in fact, or are not expected to be, in a position to judge of the points or events in question otherwise than by the record or narrative itself. This essential principle can be seen in so simple a case as an entry in a diary: the diarist records the item because he expects that the time will come when his present information on the point will have vanished from his mind and memory, and then, these sources of the information being no longer available, the record is to serve him in their stead. In all historical records and narratives as such, the same essential principle holds. They are intended specifically for users who cannot, or will not, go to the recorder's or narrator's sources of information, either because these sources may presently have ceased altogether to exist, or, if they still exist, the user has not the necessary time, or ability, or desire, or reasonably convenient access; for if he had the same sources and access, and the same time, the same ability, and the same desire, he would not need the other's narrative: he would be his own historian.

ii. *What are the conditions governing the creation of a trustworthy record?* These conditions are two:—

1. *The exact sources or grounds of any statement by the recorder or narrator, unless he reveals them himself, cannot be scientifically (exactly) known.* If, *e.g.*, I state in an obituary of A—— K——, written in the year 1912, that in 1834, he sailed as a child with his parents from the port of Hull in England to Quebec in Canada,

and came thence to Berlin, in the (present) Ontario, how can a reader depending on the obituary for his information know, unless I tell it, that years before A—— K——'s death I had sufficient interest to take notes of the principal events of his life, and that the above statement rested on these notes? How could the reader know, unless I tell it, that A—— K——, when he gave me the notes, was a capable, trustworthy man, sound in mind, and with unimpeachable evidence to fortify his memory concerning the year of this removal? The reader, apart from being told, can only guess in a general way at the writer's sources and opportunities of information; but it is only an exact, detailed knowledge, such as the writer himself possessed, and not blind guesses in a general way, that can show scientifically whether or not the sources were sufficient ground for the statement.

2. *The recorder or narrator cannot interrupt the record or narrative to explain the exact, detailed grounds of his statements, nor can he give these explanations, or cite the sources of his statements, systematically in foot-notes.* In the above instance, one such interruption alone, to explain about the taking of the notes and about A—— K——'s trustworthiness, and his mental capacity at the time, and his unimpeachable evidence for the date of the removal, would turn the obituary into a literary monstrosity. A systematic resort to such explanations for each successive statement would bring the obituary or any other record or narrative practically to a stand-still; and such explanations, if only more or less frequently embodied in the narrative, would destroy all its perspective and cause such confusion that the whole would be rated as the product of a disordered mind, not worth the attention of any reader, and not having the quality of trustworthiness, because no narrative in confusion and without perspective could be accepted as trustworthy. A similar result would follow if the detailed explanations were given systematically in foot-notes: the narrative itself would practically cease because the foot-notes would then monopolize the page to the exclusion of almost everything else.

Even the bare citation of sources as sustaining references in foot-notes, if given exhaustively for each and every statement, would have pretty much the same effect; nor would such citations in themselves, however full, prove or confirm anything for users who, because the sources cease presently to exist, or for any other reason, have no access to these. The dependence of such a user would still necessarily be upon the recorder or narrator and on the trustworthiness of his record or narrative.

This systematic citation of sources, moreover, would be essentially improper and scientifically not permissible in a record or narrative as such, because such a practice would have no scientific status in a work designed specifically for those who have not access to its sources. It is an old, but almost forgotten, maxim that the proper use of the foot-note should ordinarily be to assist readers desirous of further information than the limits of the volume can afford, by referring them to the proper sources. In argumentative and other dissertations seeking to reverse accepted beliefs or presenting the results of minute study of events hitherto not exhaustively investigated, citations of sources and a free, or at least liberal, use of sustaining references particularly in disputed points are scientifically proper. These works are designed primarily, chiefly, and essentially, for a limited class of students and investigators engaged upon like problems and having pretty much the same access to sources as the author. To such readers, using the work in conjunction with other, especially similar, works, the citations have a real significance and value. But historical records as such, including the organized and literary narratives which it is the ultimate object of historical science to create, are intended primarily, chiefly, and essentially for users who are not expected to be, and ordinarily are not in fact, in a position to judge of the events or points in question otherwise by the record or narrative. The information may indeed be paralleled to a greater or less extent in other records or narratives perchance accessible to the user; but with this incidental circumstance the recorder or narrator has nothing to do. The only claim of his work to attention from those for whom it is essentially designed, and therefore its essential right to existence and to publication, is not in so far as it is paralleled, but only in so far as it is not paralleled, in other accessible records and narratives. In a work of this character, therefore, foot-notes, either in their ordinary function for the purpose of citing further sources of information or as sustaining references, can have only an incidental and at most occasional place. Their use for either of these purposes in the record or narrative is never obligatory, because no operator can be required to contravene the essential principles and conditions governing his special activity. But they are also not absolutely excluded even as sustaining references in exceptional points where the narrator realizes that others may be disinclined to believe a statement, because, used incidentally, they need not defeat the essential purpose of the work as a record for those who have not access to the sources; and yet this use may assist incidentally a fellow, especially a contemporary, investigator who may have such access. An extensive or free use of such citations and references, however, has no practical, and therefore no scientific, standing in the works in question.

Summarized, the chief points in the foregoing parts i and ii upon the purpose of historical records and narratives as such and the conditions governing their creation, are:—(1) The narrative is intended essentially for users who have no access to the narrator's sources except through the narrative itself; (2) the narrator's essential duty is to formulate a trustworthy narrative on this basis, so that the user, without further test and without further access to the sources, shall have essentially correct information concerning the events in question; and (3) the narrator, in fulfilling this essential duty, cannot explain, or even cite systematically, the sources of his individual statements, because the limitations of space and laws of perspective in general and the particular purpose of the work as fixed by the users for whom it is essentially intended will not allow him to do these two things at once: he cannot make his narrative trustworthy, and at the same time attempt to prove, in the narrative itself or by foot-notes, that it is so.

iii. *What is the attitude of the prevailing method towards records as such?* Professor Fling, in his *Source Book of Greek History* (preface, p. vi), states this attitude, as follows: "One of the main purposes of this critical work is to make the pupil comprehend the uncertainty and unreliability of much of our information upon Greek history, and that this is due to the character of the evidence with which we are obliged to work. A further purpose is to bring out the idea that in history the only 'authority' is the source,and that the writer of a historical narrative cannot take refuge behind the dogma of infallibility, but must prove all that he asserts by the citation of evidence."

In connection with this attitude and statement, the following three points should be noted:—

1. The attitude contravenes the essential principle, and thus defeats the very purpose, of all historical records and narratives as such. The attitude demands of the recorder and narrator what he cannot give. In some miraculous, superhuman way (for it is not a human possibility), he must prove "all that he asserts by citation of evidence," and yet continue his narrative: *i.e.*, he must do two mutually exclusive things at one and the same time. The inevitable result of this attitude is given by Professor Fling unconsciously within the bounds of his own statement. He names two purposes, and they are exactly complementary. In the second we have an attitude that drops overboard the material of historical science; and in the first we have the "uncertainty" and "unreliability"—or in plainer words, the scepticism—that must descend, not only upon Greek, but upon all, history, as the natural and necessary result of this unscientific proceeding.

2. In the above statement, the narrator who does not prove all that he asserts by citation of evidence is taxed with taking refuge behind the "dogma of infallibility," whereas the only "authority" in

history, we are told, is the source. In historical, as in all other, science, the only "authority" is correct scientific principles. Where a narrator or other scientist makes thorough examination of all available sources, reaches his conclusions by a process of resistance to all hypotheses (attractive or not), reduces his final results to the minimum dictated as necessary by the available evidence, and states these impartially, and without exaggeration, and solely according to the reader's interest —such a person, we have seen, does not utter mere opinions on his personal authority or infallibility. He has submitted himself without reserve to the dictates of science itself, which alone is the authority, and he speaks in his narrative out of full knowledge of the available sources simply as a faithful reporter. But what is the position of a subsequent, especially the modern, interpreter of such a narrative who will not accept its statements in so far as they exemplify the above requisites of science? Who, instead, presumes to test the narrator's trustworthiness by random guesses at the narrator's sources, which the interpreter cannot know because they no longer exist, but which, while they still existed, the narrator could see and examine and knew exhaustively? When such an interpreter discounts and rejects the conclusions which the man who knew found to be necessary, and puts in their place his own probable conclusions—the mere opinions of a man who knows not—does not this interpreter exalt his own imagination above the other's toil, his own ignorance above the other's knowledge, his own personal authority above the authority of science itself? And does he, or does he not, under an outward form of modesty, don in the realest sense the mantle of infallibility?

3. The above statement advances its own reasons for the "uncertainty and unreliability of much of our information upon Greek history": "it is due to the character of the evidence with which we have to work." But, as it happens, our information for this period rests on a group of historians, including Thucydides, who for excellence and ability were as a whole unsurpassed, if they were ever equalled, in any other age. What are the merits of Thucydides? "He is the greatest historian that ever lived."—*Macauley* (February 27, 1835). He "has neither equal nor rival."—*Smith's Classical Dictionary* (1850). "The greatest mind that ever applied itself to history."—*Encyclopædia Britannica*, 9th edition (1881). "Absolutely alone among the historians, not only of Hellas, but of the world, in impartiality and love of truth."—*B. Jowett, regius* professor of Greek in the university of Oxford (1881). "The prince of original writers."—*E. A. Freeman, regius* professor of modern history in the university of Oxford (1886). "He raised history to the full height of untrammelled criticism."—*Brockhaus' Konversationslexikon* (1895). "If the English, German

and American historical scholars should take a vote as to who were the two best historians, I have little doubt that Thucydides and Tacitus would have a pretty large majority. . . . They are superior to the historians who have written in our century because by long reflection and studious method they have better digested their materials and compressed their narrative."—*J. F. Rhodes*, presidential address of the American Historical Association (1899). "As an historian, he holds the foremost place."—*Encyclopædia Americana* (issued under the supervision of the *Scientific American*, 1904-1905). "As a writer of history, he has never been surpassed."—*Nelson's Encyclopædia* (1907-1912). "He has subjected his materials to the most searching scrutiny. The ruling principle of his work has been strict adherence to carefully verified facts. He stands alone among the men of his own days, and has no superior of any age in the width of mental grasp which could seize the general significance of particular events. The political education of mankind began in Greece, and in the time of Thucydides their political life was still young. Thucydides knew only the small city commonwealth on the one hand, and on the other the vast barbaric kingdom; and yet, as has been well said of him, 'there is hardly a problem in the science of government which the statesman will not find, if not solved, at any rate handled, in the pages of this universal master.' "—*Encyclopædia Britannica*, 11th edition (1910-1911). The virtues ascribed to this historian in each of the above citations are also ascribed to him as a whole by them all; and the following passage from *Chamber's Encyclopædia* (1860-1868) may still be taken as a fair and accurate summary of past and present opinion of Thucydides:—"There is hardly a literary production of which posterity has entertained a more uniformly favourable estimate than the history of Thucydides. This high distinction he owes to his undeviating fidelity and impartiality as a narrator; to the masterly brevity of his style, in which he is content to give in a few simple yet vivid expressions the facts which it must have often taken him weeks or even months to collect, sift, and decide upon; to the sagacity of his political and moral observations, in which he shows the keenest insight into the springs of human action, and the mental nature of man; and to the unrivalled descriptive power exemplified in his account of the plague of Athens, and of the Athenian expedition to Sicily. Often, indeed, does the modern student of history share the wish of Grote, that the great writer had been a little more communicative on collateral topics, and that some of his sentences had been expanded into paragraphs, and some of his paragraphs into chapters. But this want cannot have been felt by the contemporaries of Thucydides, while the fate of other ancient historians warns us that had his work, like theirs, been looser in texture, or less severely perfect, it would not have survived, as it has done, the wearing influence of time, or remained, in its own language, the *ktema es aei*—the possession for ever—it has proved to the world."

But it may be asked, "Does the prevailing method apply to this particular historian its erroneous attitude toward records and so create doubt and uncertainty concerning events for which our information rests upon him?" Yes, and the application is made in an extreme form. On pp. 148 and 229 of Professor Fling's *Source Book* for the use of pupils in secondary schools, there will be found the following questions upon extracts from Thucydides, I, 89-93, VI, 30-32, and VII, 59-87: Where did Thucydides (died circa B.C. 400) get his information about the rebuilding of Athens (B.C. 479-478)? Is it valuable? Was Thucydides an eye-witness of the Sicilian expedition (B.C. 415-413)? What is the value of his account compared with his description of the plague at Athens (B.C. 430)? The purpose of these and similar questions is given in the preface of the book (p. vi) as follows: "These questions upon evidence can sometimes be answered by a study of the source extract, sometimes it is necessary to make use of the information in the critical bibliography, and, finally, sometimes they cannot be answered at all, or can be answered only by way of conjecture. For instance, the question might be, 'Where did Thucydides obtain his information about the Sicilian expedition?' Possibly the extract gives no information, and nothing is found in the bibliographical notice that seems to cast any light on the problem. It is clear that Thucydides was not in Sicily and could not have described the events as an eye-witness, as he did in the case of the plague. He must have learned of the events from others, either in the Peloponnesus, or in Athens after his return from banishment. The object of these questions is to impress the thought that this indirect information is less valuable than the statements of a good eye-witness, and that the less we know of the sources of information from which a writer drew, the less confidence we have in his statements."

The extracts from Thucydides himself and the bibliographical notice tell nothing of the sources of his information for the rebuilding of Athens or the Sicilian expedition. The above questions are a case where the pupil can only conjecture; and in the strength of these conjectures the pupil is invited to depreciate and cast doubt upon the statements of Thucydides. This historian who is the embodiment of all the virtues of his calling and of all political wisdom and prescience as well cannot be trusted to gather and give to us on the basis of his patient and indefatigable research essentially correct information concerning an Athenian expedition only 500 miles from the capital or an Athenian event only 80 years before his death. (*Cf*, it is now nearly 82 years since A—— K—— sailed from Hull to Quebec, and should the present writer attain to A—— K——'s age, this span of trustworthy information will be greatly increased). Pupils of a secondary school 5,000 miles from Athens and 2,300 years after the event, without knowledge of Thucydides' sources and without sources of their own, are able to arrive at a more valuable verdict than he, on the basis of conjecture. Because we do not know his sources, or rather because he could not as a narrator communicate that knowledge, the ignorant guess of a fledging who a few years since played in the kindergarten and now is able to read, write and cipher are to have right of way over the scientific conclusions reached in the full light of those sources by the "greatest mind that ever applied itself to history."

iv. *What is the ground of the present attitude toward records?* The ground for refusing credit to a narrator however trustworthy unless we know his sources, is given by Bernheim (p. 506) as follows: "In ordinary life when we wish to confirm the truth of what we are told, we have always known enough to ask our informant whether he saw or heard the thing himself, or from what source he learned it; and we always base our conclusion on this original source. It is a signal instance of man's mental slowness that so simple a principle in daily use should have required centuries to find application as a rule of scientific method. . . . Only by its systematic application in history can . . . assured knowledge be attained." In this statement two points should be noted:—

1. It claims that a systematic application of the principle, and only this, will produce assured historical knowledge. In the same connection, however, Bernheim states that it is nearly one hundred years since this principle was made the central feature of historical criticism and became the fundamental rule of historical research. The present method with this fundamental rule and central feature thus has had a trial of a century; but instead of the result claimed by Bernheim we have at the close of this period a pervading scepticism (which is the negation of assured knowledge) and an increasing inability to produce organized and synthetic narratives, *i.e.*, historical activity in respect of its principal object is coming to a stand-still. By actual test, therefore, the above claim is negatived.

2. The statement appeals to actual intercourse for justification of the principle. Let this appeal also be decided by actual test. Let the reader ask himself how many times this day he has put to a trustworthy informant (in history untrustworthy informants and records

are out of the reckoning) the question, "Did you see or hear that yourself, or from whom did you learn it?" How many times in the past week, or month, or year? He may have asked it once this day, and maybe not. He may have asked it once in the past week or month and maybe not. Doubtless he will have asked it a number of times within a year. But in this day and week and month and year how many hundreds and thousands of statements by trustworthy associates has he received and acted upon without this question, and transacted the business of the day and week and month and year with essential correctness? In the case of trustworthy informants he asks the question only in very exceptional instances where he believes that he has special reasons to doubt the correctness of a statement. If he asked the question systematically concerning every statement made in his hearing, he would be excluded from ordinary life and intercourse. If every person systematically asked the question concerning every statement made in his hearing all useful activity and intercourse in the ordinary sense would come to a stand-still. The same is true of the corresponding practice and principle in historical activity. The treatment of records outlined in part (*a*) of this concluding section is scientific because it rests on the general and ordinary practice and principles of actual trustworthy intercourse and produces in historical activity, as in that intercourse, essentially correct results. The systematic application of the above practice and principle in the present method is unscientific because it rests on an exceptional feature of trustworthy intercourse, and, applied systematically, whether in actual intercourse or in historical activity, it will bring either to a stand-still. Scepticism toward existing trustworthy narratives, and inability to produce their like, go hand-in-hand as the natural results of this principle; but the devotee of the present method bows submissively to the one and struggles vainly against the other. In the words of Professor Dunning, "The mantle of scepticism has enveloped the whole historical gild so that only the hardiest of the fraternity dares venture a commonplace without the original source as a foot-note to sustain him."

Thucydides has no foot-notes. The books of his day being on rolls and not paged did not admit of them. Neither has he sustained himself occasionally by mentioning in the narrative itself some of the sources of his statements. And yet Thucydides is accounted not only a good, but the best, and greatest, historian. Interruptions for the above purpose would have been a blot upon the narrative. And had he in fact named his sources, upon what scientific ground could the bare names add now to our confidence? Our security would still be, as it is now, the principles, purpose and ability which are manifestly shown by his narrative and together exemplify as a whole the requisites of trustworthiness to a degree not found in any other historian. He anticipated what proved to be actually the case, that in the ordinary course of things the sources of his information must soon be forever gone, and instead of vainly citing them, he so used them that his record should stand in their place as a "possession forever;" thereby "preserving from decay the memory of what men had done."

NOTE.

Page 504, lines 11, 22.

The adopted span of the Quebec bridge was 1,800 feet. Of the great cantilever bridges in America, the Monogahela, erected in 1902-1903, has a span of 812 feet; and the Blackwell's Island bridge, erected in 1901-1908, has a span of 1,182 feet. The design and construction of the Blackwell's Island bridge were contemporaneous with that at Quebec, and the Quebec designers had not access to the Blackwell's Island plans.

The Forth Bridge in Scotland, erected 1882-1889, has a span of 1,710 feet. This bridge is in a class by itself, and was built on a system not suited to the established American methods. The system followed in its construction is very expensive, and much excessive weight could be put into a bridge of the American type with a cheaper total cost than that of the Forth bridge. The stress sheets and full engineering studies in connection with this bridge have not been published. No criticism touching the practical success of the design has ever been made, but it is not a class of construction that could be adopted by an American bridge company without making material changes in its shop equipment and methods of handling its business; so that the distinctive features of design, construction and erection of this Scottish bridge were not followed at Quebec.

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SECTION III

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Fat Acid Esters of Ethylene Glycol.

By DR. R. F. RUTTAN, F.R.S.C., AND DR. J. R. ROEBUCK.

(Read May Meeting, 1915).

INTRODUCTION.

Several years ago we prepared in quantity a number of the esters of ethylene glycol with the acids found in fats. Owing to the departure of one of the authors from Montreal, the full study of the series was not then completed. The work has since been resumed and the more important ethylene glycol esters of the higher fat acids have been prepared, and their properties and physical constants ascertained. These esters were prepared with a view to comparing their rate of hydrolysis with that of the true glycerides, and with the object of trying feeding experiments on small animals, to ascertain whether glycerides would be found to replace these compounds of glycol in the liver and other tissues.

They may all be prepared by direct esterification of glycol by the desired acid at a high temperature and constant stirring as described below. The separation of the mono and di derivatives can only be effected by prolonged fractional crystallization in the presence of large quantities of the solvent.

They are generally harder and more crystalline and less soluble in ether and alcohol, and have a higher melting point than the corresponding di-glycerides.

Since only one of the esters resulting from the union of Glycol with a fat acid has been recorded, viz., the di-stearate prepared by Wurtz in 1859, it was thought a careful study of the series would be of value in connection with the general chemistry of fats. Our knowledge of the solubilities, specific gravity, stability, etc., of the pure glycerides is very limited. The work of Chittenden and Smith on the palmitins published in 1886 is about the only serious study of fats since the work of the French chemists Chevreul and Berthelot, early last century.

EXPERIMENTAL.

The Glycol and the Fat acids employed were Kahlbaum's purest preparations and were tested before use. The Glycol boiled at 194·6°C. and the acids after a preliminary recrystallization from warm alcohol gave the following melting points: Palmitic melted at 62·5°C., the Stearic at 69·2°C., The Oleic Acid fused at 14°C. The Margaric acid was prepared by one of us[1] by an adaptation of the Grignard reaction and was especially purified, it melted at 59·7°C.

Würtz[2] synthesized the di-stearate by the action of ethylene bromide on the silver salt of stearic acid. $C_2H_4Br_2 + 2Ag\,C_{18}H_{35}O_2 = 2Ag\,Br + C_2H_4(C_{18}H_{35}O_2)_2$. Two of the esters were prepared by this method viz., the di-stearate and the di-palmitate.

The silver salts employed were obtained in a crystalline form from the corresponding ammonium soaps in alcoholic solution. The ammonium salt of the fatty acid was made by nearly saturating an alcoholic solution of the acid with dry ammonia. This solution was then mixed with an equivalent proportion of an alcoholic solution of silver nitrate, and the excess of ammonia distilled off with a little of the alcohol. On cooling and standing the silver salt crystallized out in fine feathery needles and was filtered off and washed. On account of the comparatively low solubility of the ammonium salt as well as of the silver nitrate, in alcohol near the room temperature, the solutions were bulky and the preparations somewhat tedious.

In preparing the ester, the dry silver salt in fine crystals was added in small portions to an excess of ethylene bromide in a small flask fitted with an air cooled return condenser, and heated in a paraffin bath to about the boiling point of ethylene bromide 131°C. The reaction proceeded slowly requiring 2-4 hours. The excess of ethylene bromide was then distilled off and the ester separated from the silver bromide and any remaining silver salt by extracting with boiling ether and filtering the warm solution. The rapid filtering of a hot ether solution of fats, an operation of frequent occurrence in these preparations, was found to be conveniently effected by the application of a small air pressure over the filtering solution in a warm Buchner filter, by the use of an inverted glass funnel with a rubber contact and the stem connected to a foot bellows. The ether was then distilled off and the residue crystallized from hot, nearly anhydrous alcohol.

The solubility in alcohol of each of these esters decreases rapidly as the temperature falls and with increasing water content in the alcohol; the di-esters readily forming two liquid layers with 60-70% alcohol

[1] Ruttan, Trans. International Chem. Congress, 1912, vol. XXV, p. 431.

[2] Würtz, Ann. de chem. et phys. (3) 55,436.

near the melting point of the ester. The distearate and the di-palmitate were prepared by this method only in small quantity as a confirmation of the less laborious method from glycol and the acid.

In the preparation of the di-stearate and di-palmitate from the above reaction mixtures, search was made for the necessary intermediate product, with only one bromine of the ethylene bromide replaced ($C_2 H_4 Br C_{18} H_{35} O_2$), but without success. In order to remove the product of the first step as quickly as possible from contact with the silver salt, the reaction was repeated, allowing the hot ethylene bromide from a return condenser to drip through a Gooch crucible containing compressed pellets, but none of the bromide stearate could be found in the resulting product. Apparently the second step in the reaction is of much greater velocity than the first under the conditions employed. The similar chloride stearate ($C_2 H_4 Cl C_{18} H_{35} O_2$) described below is quite stable and readily made from the acid and glycol monochlorhydrin.

The most convenient method of preparation of both mono- and di-esters of stearic and palmitic acids was found to be the reaction between glycol and the fatty acid at a temperature of 10-12°C. below the boiling point of the glycol (197°C). About 30 grammes of the acid was mixed with an amount of glycol more than required to convert all the acid into the monoester; this proved a convenient quantity for each charge. In our first experiments this mixture was heated in an open short necked glass flask placed in a double walled copper vessel, a Victor Meyer drying oven, the annular space of the latter being partly filled with boiling aniline, connected with a return condenser. The glycol and the fused acid form two layers, the mono and di-esters formed mix with the acid, and the water formed escaped as vapour. The yield of esters was materially increased and the time of reaction shortened by stirring strongly with a platinum stirrer, rotated by an air motor. The heating was continued 4-7 hours, a bead of glycol always remained on cooling, and 5-10% of the acid remained uncombined. In later experiments a large flask carrying 100 grms. of the acid was heated to about 180-190°C. in a Fries electric oven, and kept thoroughly stirred by a platinum spindle and blade, passing through the opening at the top and rotated by an electric motor. The mixture from the fusion was freed from glycol by washing two to three times with hot water allowing to cool and removing the cake of fat. The excess of acid was determined by titration and was separated by fusing on the water bath with an equivalent of calcium hydrate, extracting with ether and filtering hot. The ether was evaporated and the residue dissolved in hot alcohol. This solution was allowed to cool slowly and successive crops of crystals filtered off at intervals. The di-ester crystallized out first the monoester followed, and a mass amounting to 10-15% of the fusion, of almost noncrystalline very soluble substance always remained. By repeated separation into fractions as well as combining those fractions having similar melting points, the mono-and di-esters were separated and purified to constant melting point.

In all the experiments the yield of the diesters was, even with the excess of glycol, many times greater than the monoester.

The solubilities of the esters in absolute alcohol (at 15·5° C. sp. gr. 0·79451 = 99·86%) at varying temperatures were carefully determined. The alcohol was saturated at a few degrees above that at which the observation was to be made and kept at the temperature of observation for from 5–6 hours; about 10 c.c. of the clear supernatant solution were drawn off by a warm pipette into a stoppered weighing bottle, weighed, the alcohol evaporated and the residual ester dried to constant weight. The results are stated in grammes of acid dissolved in 100 grammes of alcohol. All determinations were made in duplicate and gave concordant results.

The indices of refraction were conveniently and accurately determined by means of a Zeiss Refractometer, at a temperature only a few degrees above the melting point.

The specific gravities of the fused esters were determined at temperatures near their melting points. The determinations were made in a bulb tube of about 3 c.c. capacity on a capillary stem carefully calibrated. The observations were made on the tube suspended with a small accurate thermometer in the inner narrow chamber of a double walled glass vessel. The outer chamber was connected with a reflux condenser and in it was boiled some liquid such as—chloroform, methyl or ethyl alcohol, whose vapor gave the desired temperature. The results were recorded when the temperature and the readings on the capillary stem of the tube remained constant for 20-30 min.

GLYCOL DI-STEARATE $[C_2H_4(C_{18}H_{35}O_2)_2]$ so prepared is a pure white solid, crystallizing from alcohol in beautiful pearly plates, or occasionally from ether in needles forming a paper-like mass on the filter. It melts at 75° C. sharply (Würtz gives 76° C.) and the liquid has a refractive index of 1·4385 at the melting point. The specific gravity of the fused fat at 78° C is 0·8581. It is quite soluble in warm ether, fairly so in cold ether and very slightly soluble in alcohol, it crystallizes out almost completely at room temperature from hot absolute alcohol.

100 grms. of absolute alcohol dissolves
0·010 grms. at 0° C.
0·028 grms. at 25° C.
0·037 grms. at 28° C.
0·112 grms. at 40°C.

Combustion by the oxygen method gave the following results:

		C.	H.
Theory		76·64%	12·55%
Determined	I.	76·14%	12·45%
	II.	76·27%	12·67%

There is such a small variation in the relative proportions of carbon, hydrogen and oxygen in both the fatty acids and these compounds, that the experimental error in a combustion made it of little value as test of purity. These esters were consequently identified by determining the content of fatty acids by a modification of a method devised by Chittenden and Smith in their work on the palmitins.[1]

A weighed quantity of the ester was dissolved in alcohol saponified by boiling with an excess of 3 N. alcoholic potassium hydroxide and evaporated to dryness. The resulting soap dissolved in about 200 c.c. of hot water in a beaker, the acid set free by hydrochloric acid, the beaker kept in hot water and on cooling and after standing over night, the solid fat acid can be easily removed quantitatively, washed until free from chlorine ions, dissolved in ether, evaporated, and the dried fat acids weighed.

Analysis of the distearate gave:

	Theory	I.	II.
Stearic acid	95·62	94·99	95·33

Glycol Monostearate, $C_2H_4OHC_{18}H_{35}O_2$ is a pure white solid with similar crystalline habit to the distearate, it melts sharply at 58·5°C. and the liquid has a refractive index of 1·4310 at the melting point. The fused ester has a specific gravity of 0·8780 at 60°C. It is very much more soluble in ether, in alcohol, and in hydrous alcohol than the distearate.

[1] Am. Chem. Jour. 6, 217.

100 grms. of absolute alcohol dissolves

0·64 grms. at 0°C.
1·31 grms. at 7·4°.
2·10 grms. at 16°.
4·17 grms. at 25°.
10·61 grms. at 29°C.

Analysis for stearic acid gave

	Theory	I.
Stearic acid	86·58	86··34

Glycol Dipalmitate [$C_2H_4(C_{16}H_{31}O_2)_2$] is a white solid with a similar crystalline habit to the distearate. It melts at 68·7C°. sharply and has a refractive index of 1·4378 at the melting point. The fused ester has a specific gravity of 0·8594 at 77·9° C. It is more soluble in alcohol and in ether than the distearate.

100 grms. of absolute alcohol dissolves

0·018 grms. at 0°C.
0·087 grms. at 25°.
0·109 grms. at 29°.
0·31 grms. at 38°.

Combustions gave the following results:

	C.	H,
Theory	75·77%	12·36%
Determined I.	75·30	12·27
II.	75·30	12·33

Analysis for palmitic acid gave

	Theory	I.	II.
Palmitic acid	95·16%	94·93%	94·96%

Glycol Monopalmitate. $C_2H_4OHC_{16}H_{31}O_2$ is a white solid with similar crystalline habit to the dipalmitate. It melts sharply at 51·5°C. and the liquid has a refractive index of 1·4411 at the melting point. The fused ester, has a specific gravity of 0·8786 at 60·5° C. It is much more soluble than either the dipalmitate or the monostearate.

100 grms. of absolute alcohol dissolves

1·62 grms. at 0°C.
5·76 grms at 7·4°.
10·67 grms at 16°.
24·08 grms. at 25°C.

Combustions gave the following results:

	C.	H,
Theory	71·93%	12·09%
Determined I	lost	12·01
II	71·91	12·04

Analyses for palmitic acid gave:

Theory	I.
85·33	85·32

Di-Margarate [$C_2H_4(C_{17}H_{33}O_2)_2$] is a white crystalline solid giving occasionally needles from ethereal solution, but from alcohol crystallizes in waxy scales similar to the other esters. Its refractive index at 67° is 1·4392. The fused ester has a specific gravity of 0·8605 at 67·1° C. It is slightly more soluble in ether and alcohol than the di-palmitate.

100 grms. of absolute alcohol dissolves

0·024 at 0°C.
0·101 at 25°

It melts at 65·5°C. and solidifies at 64·7°C. On analysis it gave

	Theory	I.
Margaric Acid	95·41	95·27

Mono-Margarate. ($C_2H_4OHC_{17}H_{33}O_2$) crystallizes in thin plates from dilute alcohol. Its refractive index at 52° is 1·4440. Is very soluble in both ether and alcohol even at room temperature.

100 grms. of absolute alcohol dissolves

1·72 grms. at 0°C.

It melts at 50·2°C. and gave on analysis

	Theory	I.
Margaric acid	85·99	85·62

The esters with oleic acid were not satisfactorily separated as their solidification points seemed very near each other and that of oleic acid. After separating the excess of oleic acid the oleates could only be obtained in a pasty condition at low temperatures, and rapidly underwent change by hydrolysis and oxidation.

MIXED ESTERS.

Glycol Monochlorhydrin (C_2H_4 OH Cl) appeared to offer a convenient intermediate step for preparing the mixed esters, such as the chloride palmitate and chloride stearate, as well as a second method of obtaining the monoesters. Attempts to prepare it according to the method described by Bouchardt[1] resulted in an exceedingly small yield; but by applying a suggestion in Beilstein of heating the glycol to 148°C. while passing in the hydrochloric acid gas, the yield was greatly increased and time saved. The hydrochloric acid was rapidly absorbed by the hot glycol and the monochlorhydrin formed passed over through the condenser into the receiver. The excess of hydrochloric acid in the distillate was removed by potassium carbonate, and a saturated solution of the carbonate was added when the chlorhydrin with 30-40% of water floated and was removed by a separating funnel. Repeated fractioning of this layer gave a waterclear liquid boiling at 127°C.; the boiling point as stated by different observers is 127°C. and 130-131°C. By this method the yield of the purified substance was about 30% of the theoretical.

For the preparation of the monoesters, equivalent quantities of the silver salt of the respective acids (stearic and palmitic) and glycol monochlorhydrin were heated for 18 hours at 105-115°C. The resulting mass was extracted with hot ether, filtered hot, evaporated, and the residue taken up in alcohol. After several crystallizations this yielded the monoester as well as a little of the diester.

The mixed esters described below were prepared by heating in a sealed tube to 105-115°C. for about 20 hours, equivalent quantities of the respective acid and glycol chlorhydrin. The chlorhydrin was miscible with the fused acid and the water produced by their reaction separated as a lower layer. The reaction stopped with 18-20% of the acid remaining uncombined. The compound sought was easily separated from the other components of this reaction mixture (uncombined acid and a little diester) as it is much more soluble in alcohol than the distearate. It crystallized readily from about 90% alcohol and was comparatively easily purified.

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[1] Comp. rend., 100, 453.

GLYCOL CHLORIDE STEARATE ($C_2 H_4 Cl C_{18} H_{35} O_2$) is a white solid crystallizing with the same habit as the above members of the series. It melts at 48·5°C. and the solidified fused substance is distinctly crystalline. It has a specific gravity of 0·9049 at 49·5°C. and a refractive index of 1·4433 at the melting point. It is much less soluble in alcohol than the monostearate, but more so than the di-stearate.

100 grms. of absolute alcohol dissolves.

0·20 grms. at 0°C.
0·28 grms. at 7·4°
1·29 grms. at 16°
2·10 grms. at 25°
3·62 grms. at 29°C.

Analysis for stearic acid gave

	Theory	I.	II.
Stearic acid	81·98%	81·96%	81·35%

and analysis for chlorine by the sodium peroxide method gave 10·45% while theory required 10·26%.

GLYCOL CHLORIDE PALMITATE. ($C_2H_4 Cl C_{16} H_{31} O_2$) is a white solid crystallizing with the same habit as the others of this series. It melts at 41·5°C. and the liquid has a refractive index of 1·445 at the melting point. Its specific gravity is 0·9097 at 46·1° C. It is much less soluble in alcohol than the monopalmitate, but more so than the chloride stearate.

100 grms. of absolute alcohol dissolves

0·48 grms. at 0°C.
1·16 grms. at 7·4°
3·80 grms. at 16 °
8·87 grms. at 25°
15·31 grms. at 29°

Analyses for palmitic acid gave

	Theory	I.	II.
Palmitic acid	80·38	79·54	79·72

Several attempts were made to prepare the glycol stearate palmitate by heating together the monostearate and palmitic acid The temperature was varied in the different attempts but the fused product was chiefly distearate and dipalmitate and on account of the similar solubilities of all three bodies, and also because the melting point of the stearate palmitate was unknown, considerable difficulty was experienced in separating them. A small quantity of a substance was however separated with a melting point of 64°C.

GLYCOL STEARATE PALMITATE. ($C_2 H_4 C_{18} H_{35} O_2 C_{16} H_{31} O_2$) was prepared by heating the chloride stearate with silver palmitate and also at another time with potassium palmitate. The former was heated 3-4 hours at 140°C. and the cooled fusion extracted with ether. It was found very difficult to filter the ether solution free of finely divided silver chloride. The method with the potassium palmitate required much longer heating, but the ether solution was readily filtered. The residue from the evaporation of the ether was dissolved in alcohol and crystallized in fractions. Small quantities of distearate and dipalmitate were formed and were separated with difficulty as they are only slightly less soluble than the stearate palmitate.

100 grms. of absolute alcohol dissolves

0·011 grms. at 0°C.
0·035 grms. at 25°
0·049 grms. at 29°
0·213 grms. at 39°C.

The latter is a white crystalline solid, crystallizing like the other members of the series. It melts at 65°C. and the liquid has a specific gravity of 0·8584 at 70·5°C. and a refractive index of 1·4391 at the melting point.

It is interesting to note that the melting point and refractive index of the two isomers, glycol dimargarate and the palmitate stearate, are almost identical.

SUMMARY.

The mono and diesters of the fat acids can be easily prepared by direct esterification at high temperature and the chloride fat acid esters from glycol chlorhydrin.

The difference in solubility in warm alcohol permits of easy separation of the two classes of esters.

The more important physical constants of these esters may be tabulated as follows:—

SOME PHYSICAL CONSTANTS OF THE ETHYLENE GLYCOL ESTERS OF THE FAT ACIDS.

Ester	M.P.	Refr. Index.	Sp. Gr. of fused ester.	Solubility in grms.	
				At 0°C.	25°C.
Di-stearate............	75°	1·4385	0·8581	0·010	0·028
Mono-stearate.........	58·5	1·4310	0·8780	0·670	4·170
Di-margarate..........	65·5	1·4392	0·8605	0·024	0·101
Mono-margarate.......	50·2	1·4440	....	1·72	....
Di-palmitate...........	68·7	1·4378	0·8594	0·018	0·087
Mono-palmitate........	51·5	1·4411	0·8786	1·62	24·08
Chloride-stearate.......	48–5	1·4433	0·9049	0·20	2·114
Chloride-palmitate.....	41·5	1·445	0·9097	0·47	8·852
Stearate-palmitate......	65	1·4391	0·8584	0·011	0·035

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Secondary Cathode Rays from Gases.

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Presented by Professor H. T. BARNES, F.R.S., F.R.S.C.

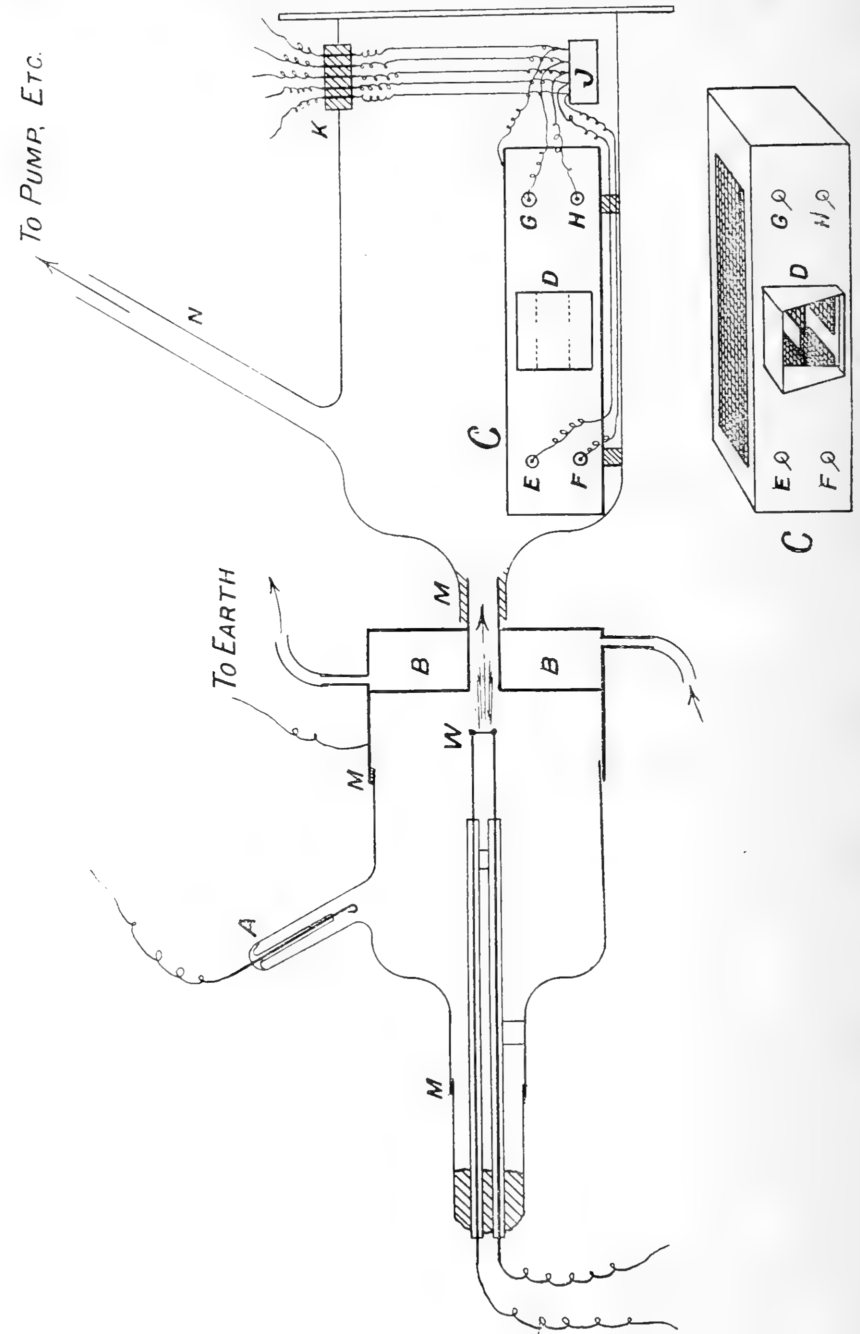
(Read May Meeting, 1915).

1. INTRODUCTION. It is well known that the impact of cathode rays against the molecules of a gas in a "vacuum" tube produces a luminous haze which extends beyond the boundary of the primary beam. In 1908 Sir Joseph Thomson examined this secondary radiation and made a determination of its velocity[1] finding that it consisted of slow electrons the energy of which was apparently independent of that of the main beam, and possibly also of the nature of the gas. The present paper gives an account of some experiments performed with the object of repeating and extending this investigation.

2. APPARATUS. The apparatus described below has been set up for this purpose. A section of the fundamental parts of the apparatus is shown in the figure. W represents a Wehnelt cathode, A the anode, and B a brass water cooler containing a cylindrical tube through which the pencil of rays may be directed. Suitable joints MMM make the adjustment of the position of W an easy matter. C is a small brass box with a wire gauze top and four wire gauze plates arranged as shown. The box is placed so that the pencil of cathode rays from W just passes over the top. Connections from the gauze terminals E, F, D, H pass to a set of mercury cups, J, and thence through an ebonite plug K to electrical connections for charging the gauzes to definite potentials. D represents a window through which the luminosity in C may be observed. The end of the apparatus is closed with a glass plate. A tube N leads to a Töpler pump, McLeod gauge, charcoal bulb and drying flask. Another tube, not shown in the figure, can be used for introducing various gases into the apparatus.

3. THE VELOCITY OF THE RADIATION. The gauze covering to the box, C, was removed and the interior gauzes were insulated. On passing the cathode beam over the box it was found that for a short interval of time, the surrounding haze or glow completely enveloped the gauzes. If the four gauzes (E, F, G, and H) were earthed, the glow was repelled to a distance of from one to two milli-

[1] *Thomson*, Proc. Camb. Phil. Soc., XIV, p. 541 (1908).


To Pump, Etc.
To Earth
N
K
J
G
H
D
C
E
F
M
B
W
A

metres from each of their surfaces, but a patch of luminosity was left isolated between the gauzes. This patch could be decreased by charging the gauzes negatively, a potential difference from the box of about 45 volts being found sufficient to cause the disappearance of the glow. The exact point of disappearance was determined in the following way. The two left-hand gauzes were charged to a potential less than the amount required for the elimination of the glow, while those on the right were charged considerably in excess of this, thereby insuring minimum illumination on this side. The charge on the left-hand side was then slowly increased until, on the reversal of the electrical connections, no flicker could be observed. This process was rendered necessary by the presence of diffused light from the beam above.

This measurement was repeated over the whole range of pressure in which the Wehnelt Cathode would work, but in every case the value of the minimum potential required to eliminate the glow between the gauzes lay between 44 and 46 volts. The potential difference in the discharge tube was varied from 60 to 1,000 volts; but the same constancy was maintained in the stopping potential for the glow. The introduction of carbon dioxide also failed to produce a difference in this figure.

These experiments can be explained in the same manner as those of Professor Thomson, and support the view "that the energy of the secondary rays is determined by the atoms emitting them and not by the energy of the primary rays." When the gauzes were charged negatively to 45 volts or over, no electrons with the capacity for producing luminosity entered the space between gauzes. If charged to less than this value some passed through so slowly that no appreciable glow was produced near the gauze but on reaching the other side the electric field accelerated their motion and a perceptible haze was again produced. In the same way it was possible to obtain another detached glow below the lower gauze.

By charging the lower gauze to a high positive potential the glow between the gauzes was intensified, the electrons being accelerated as they approached. It was thought that if the lower gauze was kept charged to a high positive potential and if a gauze covering was placed over the box C, that this stopping potential could be determined more accurately. The idea was that *any* electrons passing through the upper gauze would be accelerated, and if in sufficient numbers, cause a glow and signalize their presence. In this way one could differentiate between that potential required to stop those electrons which were initially fast enough to penetrate and cause a glow and *that potential required to stop all electrons.* This point was examined in the same way as before and it was found that a negative potential of from 50 to 55 volts for the upper gauze was required to remove the glow from the lower gauze. This would correspond to a velocity of approximately $4 \cdot 2 \times 10^8$ cms. per second for the greatest velocity of any of the secondary rays produced. Apart from this rather high value it will be seen that the behaviour of these rays is in close agreement with that of delta rays from metals.

4. The Direction of Propagation of the Secondary Radiation. It was found that the secondary rays were propagated with greatest intensity along directions making a very small angle with the primary beam. This was easily examined by placing a small screen in such a way that only rays at right angles to the primary beam or from that part which had passed the screen, could enter the testing box, C. If the rays were scattered equally in all directions such a screen should reduce the glow in the box by about fifty per cent, but it was found instead to be almost completely eliminated. Thus the secondary radiation must be mainly in the path and direction of the primary.

It is intended that the velocity of the radiation should be determined accurately in different gaseous media and over a large range of intensities of the primary beam. Further information concerning their nature, their source of energy, and the critical velocity for producing luminosity is anticipated.

The writer is indebted to Professor Sir Joseph Thomson for the suggestion of this research, and desires to express thanks for his kind interest in the preliminary experiments which were performed at the Cavendish Laboratory in the spring of 1913. Many thanks are also due to Professor C. J. Lynde for providing the facilities for continuing the work at Macdonald College.

Macdonald College,
McGill University,
May, 1915.

On the Diurnal Changes in the Magnetic Horizontal Force at Agincourt, 1902-1912.

BY W. E. W. JACKSON, M.A.,

Presented by R. F. STUPART, F.R.S.C.

(Read May Meeting, 1915).

In a paper presented to The Royal Society of Canada at its last meeting, some results of an harmonic analysis of the diurnal inequality of the Magnetic Declination for the years 1902-1912 inclusive were given. In the present paper the results of a similar analysis of the Agincourt Horizontal Force data is given. The mean diurnal inequality of H for each month of the year for the eleven years 1902-1912 including all days was obtained similarly to that for D. The value for any particular hour is the arithmetic mean of the values of the diurnal inequality for that hour for the eleven years. The results are tabulated in Table I. Distinct maxima and minima are in heavy type and the ranges and average departure from the mean are given below. The values are expressed in millionths of a dyne or $\gamma/10$.

TABLE I.

DIURNAL INEQUALITY OF HORIZONTAL MAGNETIC FORCE AT AGINCOURT.
ALL DAYS 1902-1912.

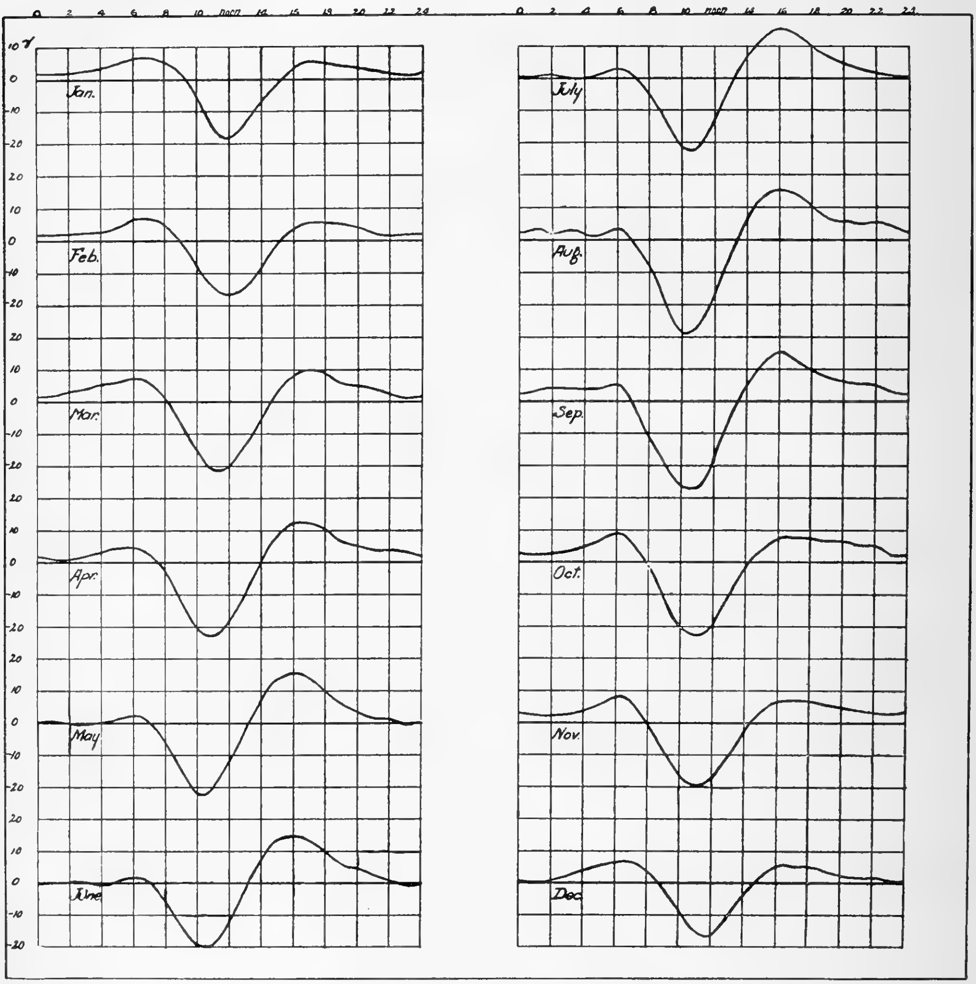
	Jan.	Feb.	Mar.	April.	May	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Hour	$\gamma/10$	$\gamma/10$	$\gamma/10$	$\gamma/10$	$\gamma/10$	$\gamma/10$	$\gamma/10$	$\gamma/10$	$\gamma/10$	$\gamma/10$	$\gamma/10$	$\gamma/10$
1	17	17	16	12	4	0	6	35	33	22	22	8
2	19	20	31	7	− 2	4	8	13	46	22	23	8
3	24	25	36	19	− 5	2	1	29	40	38	24	19
4	34	29	53	30	1	− 4	2	14	44	50	38	35
5	49	36	56	44	11	9	11	13	42	68	52	47
6	66	**66**	71	48	27	19	28	34	53	**84**	**81**	62
7	**67**	65	60	26	1	2	6	− 14	− 2	53	61	**63**
8	55	50	16	− 24	− 62	− 59	− 55	− 82	−101	− 23	− 4	37
9	21	3	− 72	−118	−146	−140	−139	−199	−195	−119	− 86	− 18
10	− 57	− 74	−152	−207	**−220**	**−199**	−214	**−282**	−261	−200	−169	− 88
11	−151	−144	**−215**	**−229**	−199	−195	**−215**	−260	**−271**	**−228**	−196	−152
Noon	**−183**	**−165**	−203	−181	−111	−122	−137	−165	−177	−191	−179	**−162**
13	−137	−145	−135	− 93	− 22	− 28	− 31	− 38	− 53	−102	−106	−107
14	− 76	− 75	− 52	2	78	74	64	65	45	− 12	− 29	− 39
15	− 15	− 14	29	79	134	135	126	137	110	32	30	13
16	34	36	82	119	**159**	**149**	**153**	**156**	**153**	71	68	51
17	52	56	**98**	**120**	139	130	136	143	126	74	65	52
18	48	53	90	104	101	99	99	109	99	78	66	55
19	39	49	57	62	61	56	64	66	78	67	58	37
20	32	42	48	51	35	42	44	57	61	67	50	25
21	20	21	39	39	16	21	23	48	55	52	39	17
22	17	17	23	40	14	6	17	55	51	52	32	20
23	6	15	10	32	− 4	− 6	4	45	31	26	27	11
24	19	20	12	19	2	− 3	3	23	22	24	32	8
Range	249	231	313	349	379	348	368	438	424	312	277	225
Average departure from mean	52	52	69	71	65	63	66	87	90	73	64	47

These values have been plotted and the resultant graphs for the different months are to be seen in Plate 1. Inspection of the tables or

PLATE No 1

ALL DAYS 1902-1912.

AGINCOURT HORIZONTAL FORCE.

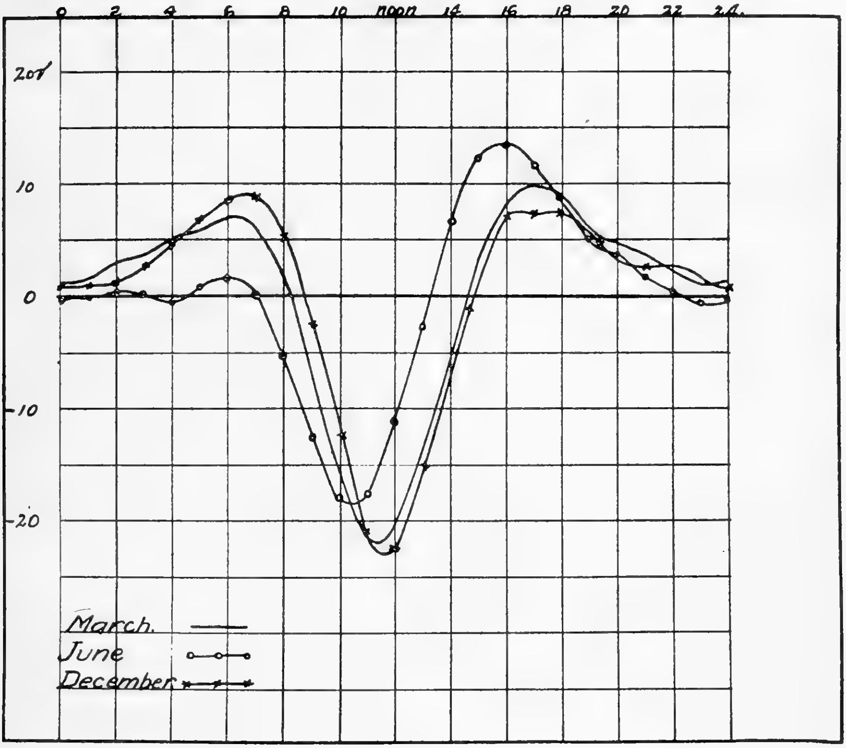


of the figures discloses the fact that during the winter months the amplitude of the range is smaller and the time of occurrence of phase is later in the day. The extent to which the type of the curve varies with the season is better seen by taking the March inequality and drawing it to scale and on the same chart representing the December and June inequalities on scales so related that the mean length of the

24 hour ordinates is the same as for March. This variation of type is shewn on Plate 2. The portion of the inequality confined to the

PLATE No2. AGINCOURT HORIZONTAL FORCE.

ALL DAYS.



daylight hours where the amplitudes are large is much the same in all seasons, but the type of the curves vary greatly during the night hours where the departures from the mean are least and the changes are less rapid. The same result was obtained with the D curves.

The Fourier coefficients for the diurnal inequalities of H as given in Table I were calculated and Table II gives these values for each month of the year for the first four terms of the series C_1 sin. (α_1+t) $+C_2$ sin. $(\alpha_2+2t)+\ldots$ where t represents the time counted from midnight at the rate of 15° to the hour.

TABLE II.—FOURIER CO-EFFICIENTS FOR DIURNAL INEQUALITIES OF H AT AGINCOURT, 1902-1912. 75TH M. T.

Month	C_1	C_2	C_3	C_4	a_1	a_2	a_3	a_4
	γ/10	γ/10	γ/10	γ/10	°	°	°	°
January	55	68	38	11	81	266	89	282
February	57	67	34	10	88	268	89	293
March	76	91	38	11	106	287	112	303
April	86	90	47	8	127	300	130	328
May	82	91	47	14	154	317	141	365
June	80	88	44	14	154	316	138	342
July	84	91	48	16	149	314	137	349
August	113	101	59	16	139	319	146	355
September	111	106	50	14	131	316	152	345
October	88	86	42	13	111	293	146	349
November	75	77	40	12	107	290	131	352
December	48	65	34	10	94	278	110	293
Means	80	85	43	12				

The amplitudes of the different Fourier waves of H do not show the same striking differences with the season as was evident in the D values, in which there were very striking maximum and minimum values. Equinoctial values appear to be the prominent ones in the first three waves and summer values in the fourth, with minimum values in the winter in all waves.

The phase angles exhibit a much more regular progression with the season. The earliest time of occurrence of maximum in any wave being in midsummer and the latest in midwinter. In the 24 hour term the occurrence in June was 73°, or 4 hr. 52 m. earlier than in January. In the 12 hour term the August maximum was 53° or 1 hr. 46 m. earlier than the January maximum.

In the 8 hour term the August maximum was 57°, or 1 hr. 16 m. earlier than the January maximum; but the progression from season to season is less regular than in the first two terms. In the 6 hour term the progression is still less regular than in the longer period terms but the August maximum was 73°, or 1 hr. 13 m. earlier than the January maximum.

On account of the limited number of years from which these results have been obtained the seasonal variations are perhaps better shewn by grouping the months into the different seasons, taking for winter the months January, February, November and December, for equinox the months March, April, September and October, and for summer the months May, June, July and August.

The amplitudes and phase angles of the Fourier waves for the different seasons are given in Table III together with those of Kew for the period 1890-1900.

The Kew[1] values, being for a different group of years than that for Agincourt the results are not strictly comparable, but some idea is given of the difference in type of the waves between the two places.

The sunspot frequency of the Kew group of years is given as 41·7[2] by Wolfer and of the Agincourt group as 33·7[3] The Kew values are for certain days called ordinary days and not as in Agincourt for all days.

TABLT III.

AMPLITUDES AND PHASE ANGLES OF SEASONAL DIURNAL INEQUALITIES OF H AT AGINCOURT (A) AND KEW (K).

	C_1		C_2		C_3		C_4	
	A	K	A	K	A	K	A	K
Winter	59	36	68	39	35	18	9	11
Equinox	89	110	91	59	43	33	11	18
Summer	90	148	93	62	49	24	15	10
Year	73	94	81	51	41	24	11	13
—	a_1		a_2		a_3		a_4	
Winter	94	83	275	277	105	153	302	5
Equinox	120	109	300	303	136	166	335	15
Summer	149	130	316	316	140	198	353	39
Year	124	117	299	302	130	173	334	18

The seasonal variations of the amplitudes in A in all terms show the maximum to occur in the summer, but the equinoctial values in C_1 and C_2 are practically identical with the summer values. A very decided minimum occurs in the winter. Inspection of the Kew values of the amplitudes shows similar seasonal variation in the 24 hour, 12 hour and 8 hour terms; but that in the 6 hour term the maximum amplitude occurred in the Equinox. The amount of the seasonal variation in amplitude is also different at Kew, the range at Kew being

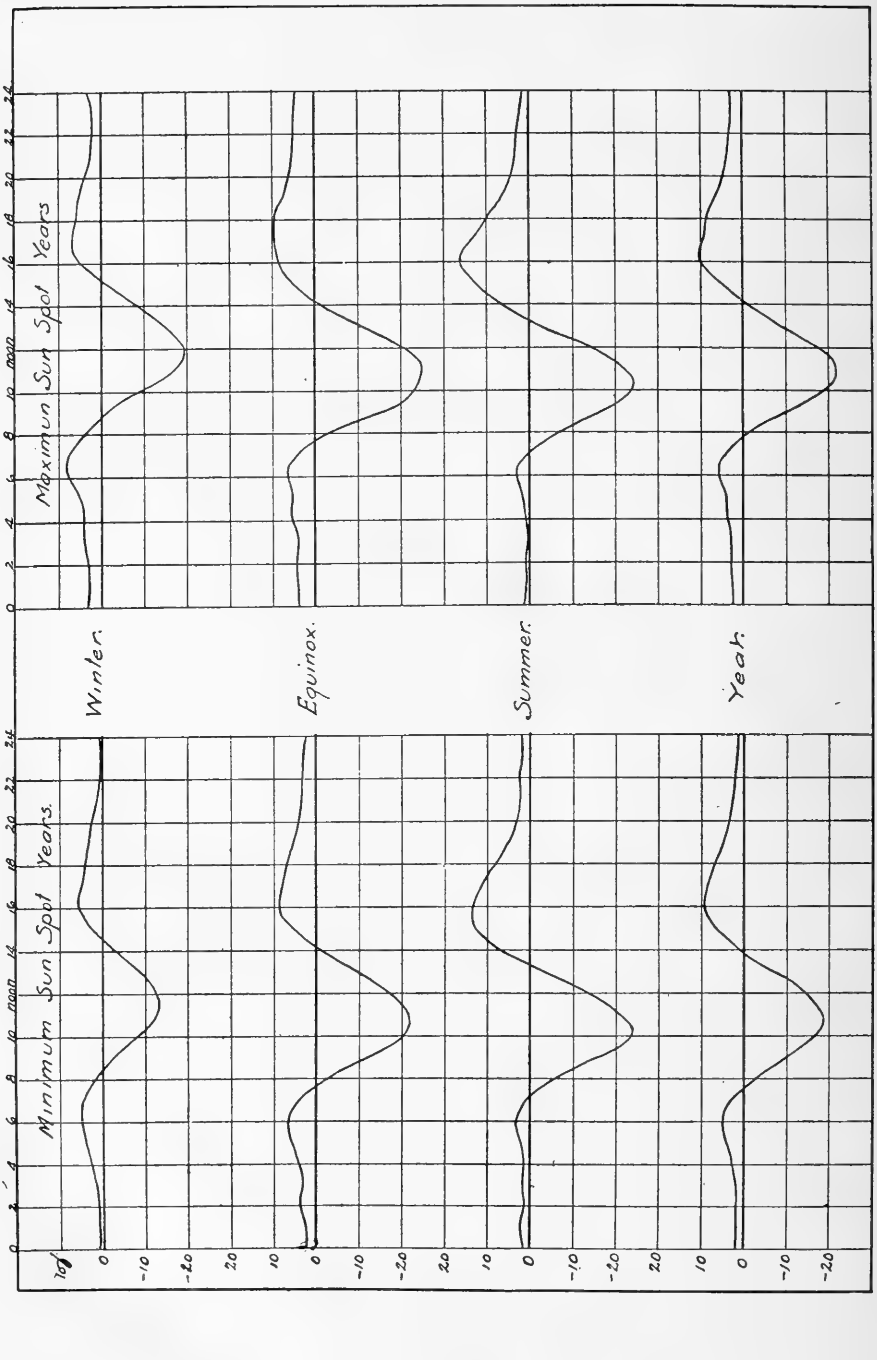
[1] Studies in Terrestrial Magnetism, C. Chree, 1912.

[2] United States Monthly Weather Review, April, 1902.

[3] Bulletin Mount Weather Observatory, Vol. 5. Part 6.

PLATE No 3
ALL DAYS

AGINCOURT HORIZONTAL FORCE



much larger in C_1 and C_4 and smaller in C_2 and C_3. The seasonal variations of the phase angles at Agincourt are in each wave larger in summer than winter and the same is true of the Kew values but the range is slightly larger at A in the 24 hour, 12 hour and 6 hour waves and smaller in the 8 hour wave than at Kew. The 24 hour term has its maximum at A occur on the average for the year 42 minutes earlier than at Kew, the 12 hour term at about the same time, the 8 hour term 56 minutes later at Agincourt than at Kew and the 6 hour term 43 minutes later at Agincourt than at Kew.

Grouping the years 1905 and 1906, and the years 1902 and 1912 whose mean sunspot frequencies, as given by Wolfer,[1] are 58·6 and 4·3 we get the diurnal inequality ranges as given in Table IV. The ranges for all years 1902 to 1912 inclusive are also given.

TABLE IV.

H DIURNAL INEQUALITY RANGES AT AGINCOURT.

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
	γ/10	γ/10	γ/10	γ/10	γ/10	γ/10	γ/10	γ/10	γ/10	γ/10	γ/10	γ/10
All years	249	231	313	349	379	348	368	438	424	312	277	225
Max. Sun Spot years	298	268	345	370	370	361	401	464	410	316	302	244
Min. Sun Spot years	208	175	292	331	355	351	347	419	317	293	200	179
					Percentage Values.							
All years	76	71	96	107	116	107	113	134	130	96	85	69
Max. Sun Spot years	86	78	100	107	107	104	116	134	118	91	87	76
Min. Sun Spot years	72	61	101	115	123	121	120	145	110	101	69	62

The ranges are expressed also in the percentages of their arithmetic mean values, from which the effect during sunspot maximum and minimum is better disclosed. From the ranges it is seen that the values in maximum sunspot years are throughout the year larger than in minimum sunspot years and that the excess is more pronounced in winter than in summer.

From the percentage values the effect produced in maximum-sunspot years is seen to be the bringing together of the winter and summer values.

The results of analyzing the seasonal diurnal inequalities for these different groups of years is given in Table V.

[1]Bulletin Mount Weather Observatory, Volume V, Part 6.

TABLE V.

FOURIER CO-EFFICIENTS. HORIZONTAL FORCE AT AGINCOURT. ALL DAYS 1902-1912. 75th M.T.

	C_1			C_2			C_3			C_4		
	All years	Spot max.	Spot min.	All years	Spot max.	Spot min.	All years	Spot max.	Spot min.	All years	Spot max.	Spot min.
Winter..	59	69	40	68	74	56	35	38	28	9	10	8
Equinox	89	104	81	91	90	82	43	45	42	11	14	12
Summer	90	92	82	93	94	91	49	51	51	15	14	16
Year....	73	81	65	81	82	74	41	41	39	11	11	11
	a_1			a_2			a_3			a_4		
Winter..	94	86	99	275	271	282	105	91	105	302	284	293
Equinox	120	114	115	300	300	302	136	138	139	335	353	352
Summer	149	146	141	316	315	320	140	143	145	353	363	359
Year....	124	118	122	299	298	306	130	128	134	334	310	343

Comparing the amplitudes of each wave the result is seen to be the same as in the case of the declination. During maximum sunspot years the seasonal variation is diminished in each wave. The amplitude is larger in C_1, C_2 and C_3 and the same in C_4. The phase angles show that the time of occurrence of maximum is on the average for the year earlier in all the terms during the minimum sunspot years; but the effect varies greatly with the season. In the 24 hour term the maximum occurs 52 minutes earlier in winter but 20 minutes later in summer than in the minimum sunspot years. In the 12 hour term the range is from 22 minutes earlier in winter to 4 minutes earlier at the equinox, in the 8 hour term the range is from 19 minutes earlier in winter to 1 minute at the equinox, and in the 6 hour term the range is from 9 minutes earlier in winter to 4 minutes later in summer.

These results are tabulated below in Table VI.

TABLE VI.

RETARDATION OF PHASE IN MAX. SPOT YEARS FROM MIN. SPOT YEARS IN MINUTES OF TIME.

Term	Year	Winter	Equinox	Summer
24 hour	16	52	4	−20
12 hour	16	22	4	10
8 hour	8	19	1	3
6 hour	3	9	− 1	− 4

Where minus sign is used the occurrence was earlier in Max. spot years.

A Comparison of Radium Standard Solutions

BY J. MORAN, B.Sc., McGill University.

PRESENTED BY DR. A. S. EVE, F.R.S.C.

(Read May Meeting, 1915).

SECTION 1. HISTORY. (A). SOLID STANDARDS.

The fundamental Radium Standard of the present time is the International Radium Standard at Sèvres, France. It was prepared by Mme. Curie in 1912, on the recommendation of the Congress of Radiology and Electricity which met at Brussels in 1910.[1] It consists of 21·99 milligrams of pure radium chloride, sealed up in a thin glass tube. This standard, before being accepted, was compared with three other purified amounts of radium chloride, prepared by Hönigschmidt for atomic weight determinations. These all agreed with Mme. Curie's standard to within one part in three hundred. One of Hönigschmidt's preparations has been preserved at the Radium Institute of Vienna, as a secondary standard, and termed the Vienna Standard.

Before this, however, in 1903, the first radium standard was prepared at McGill University, Montreal, and termed the Rutherford-Boltwood Standard. A quantity of pure radium bromide was bought from Dr. Giesel of Germany, and generously presented to McGill University by Sir William Macdonald. Of this amount, 3·69 milligrams were weighed out and sealed up in a tube by Professor Eve and Dr. Levin, and thereafter constituted a primary laboratory standard. It is now at Manchester University, England.

Various secondary national standards exist, examples of which are the English standard at the National Physical Laboratory, and the Washington standard in U.S.A. These have all been accurately compared with the International and Vienna standards.

After the preparation of the International standard, the Rutherford-Boltwood standard was carefully compared with it, and also with the Vienna standard. It was compared indirectly with these by means of the secondary standard at the National Physical Laboratory. These investigations showed that the Rutherford-

[1] "Radioactive Substances and their Radiations," 1913 ed. By Sir Ernest Rutherford. See also Phil. Mag. Sept., 1914. Sir E. Rutherford.

Boltwood standard consisted of 3·51 instead of 3·69 milligrams of radium bromide. It is therefore 4·9% low on the International. It is known that radium bromide on exposure to air gives up bromine, and changes over to the carbonate, while water of crystallisation is also formed. This is suggested by Sir Ernest Rutherford as an explanation of the increase of weight.

(b).—Solution Standards.

For laboratory purposes a solution standard is prepared. This is obtained by comparing a small quantity of the radium salt with a solid standard by the γ-ray method. It is then dissolved in distilled water with a little HCl, to keep it in solution.

Such a solution, but with no acid added, was made up by Eve at about the same time as the preparation of the Rutherford-Boltwood folid standard, using about one quarter of a milligram of radium bromide. Determinations by Boltwood a few years later at New Haven with some of this solution led to results which conflicted with those obtained by Eve in similar work, where the solid standard was used. It was shown by the latter that the original solution had weakened by the deposit of radium on the walls of the flask, as no hydrochloric acid had been used in the preparation. Two new solutions were then prepared by Boltwood from a known amount of radium bromide, determined by Eve by the γ-ray method. These solutions were of strength in the ratio of 100:1, one containing $1\cdot57 \times 10^{-7}$ and the other $1\cdot57\times10^{-9}$ gram of radium per c.c. This time a little HCl was added as a precaution, to keep the radium in solution.

Since the Rutherford-Boltwood solid standard is known to be 4·9% low on the International, and the Rutherford-Boltwood solution standards were compared with the former, considerable importance attaches to finding whether its accepted value may not also be in error, and to what extent. The more so, since determinations by Boltwood on the relative amounts of uranium and radium in rocks, and results obtained by Eve and others for the amount of emanation in air, and also of radium in rocks and water, are based upon these solution standards at their present accepted value. The investigation was carried out by comparing the weak solution of the Rutherford-Boltwood standard with a solution of the Washington standard. A litre of the latter was obtained by Eve in September, 1914, from Satterly of Toronto University, containing $9\cdot15\times10^{-11}$ grams of the radium element per c.c. It was certified as follows:

"100 c.c. of acid solution of the Washington Standard of strength $12\cdot2\times10^{-9}$ gram of radium per c.c. 10 c.c. of this were diluted to one litre. 250 c.c. of this were removed, and distilled water added to the remaining 750 c.c. to make up one litre, the strength of which was now three-fourths the strength of the previous litre, or $9 \cdot 15 \times 10^{-11}$ gram of radium per c.c. Radium contents declared right with the International standard to an accuracy of at least one-third per cent. Density of solvent HCl 1·08. Combined errors scarcely one per cent."

Experiments were carried out by the writer both with the strong and the weak solutions of the Rutherford-Boltwood standard. These served to compare further the Rutherford-Boltwood standard solution with the Washington, and thus also indirectly with the International. In addition they served to show if the strong and the weak solutions had remained unchanged throughout the eleven years which have elapsed since their preparation. These solutions having been prepared in the ratio of 100:1, if any deposits of radium had occurred during this interval the amounts deposited would probably be in a different ratio, and there would be a discrepancy in the results.

Section 2. Method.

The emanation method was employed in making the above comparisons. The required volumes of radium solution were drawn off with a clean pipette and accurately weighed. Distilled water and a little HCl were then added, and the solution was sealed up air-tight in a 500 c.c. flask, the solution occupying about half the volume of the flask. The flask was then put aside for the emanation to collect, and boiled off at intervals of about a week.

The apparatus consisted of a sensitive, airtight, gold-leaf electroscope, carefully silvered on the inside, and well earthed. It was exhausted by a water-pump, a sufficient exhaust usually being obtained in a couple of minutes. The air was deprived of moisture by phosphorus pentoxide contained in a U-tube. The gold-leaves were protected from a sudden inrush of air by using a capillary tube. The emanation was admitted by means of a three-way tap, and air allowed to enter afterwards until the pressure inside the electroscope was atmospheric.

The solutions were well-boiled in order to drive off all the emanation, which was collected with the air over water in a bell-jar at room temperature. Care was taken throughout to minimise possible errors, by having the solutions of nearly equal strength, by boiling each the same length of time, and by observing the maximum value of the ionisation current. In the earlier part of the work, readings were taken every few minutes, and the growth of the ionisation current traced. The practical maximum was reached in about five hours.

Here the ionisation current appeared to be constant, as the time-measurement of the movement of the gold-leaf showed a slightly oscillating value of less than one per cent. which was thus the probable error in taking the time of a single reading.

The theory of the work is well known. The natural leak was taken before introducing the emanation, and deducted from the value obtained when the ionisation current had reached a maximum. This value was corrected for atmospheric pressure, reducing all results to standard pressure. Finally, the number of divisions per minute for 10^{-9} curie of radium emanation, could be calculated by using the value of $1-e^{-\lambda t}$ directly from the tables given by Rutherford, interpolating for a fraction of a day: this value we call a "figure of merit." By comparing the "figures of merit," and finally reducing to percentages, we can obtain the relative values of the two standards.

Section 3.—Difficulties and their Solution.—Results.

A number of sets of results were obtained, and practically all showed a very close agreement between the two solutions compared. As the work proceeded, a deterioration in values of the "figure of merit" occurred, as if boiling had a weakening effect. Each value was less than the preceding one. This suggested that some of the radium might have been deposited with boiling, and so a qualitative experiment was carried out with a solution which had been boiled a number of times, by adding some HCl to see if it would dissolve the supposed radium deposit, and hence cause a rise in the value of the "figure of merit." This is precisely what occurred. A higher value, however, was now obtained than any previous one. This suggested the probability of radioactive matter in the HCl which had been added. To test this, a "blank" solution was prepared, consisting of 50 c.c. of approximately 19% strength HCl, obtained by diluting 38% commercial HCl to half strength. After eight days it was tested, and on deducting the natural leak, which was ·083, it gave 2·71 divisions per minute. Two c.c. of this same preparation had been added previously to the Rutherford solution standard, which had been boiled fourteen times. A reading was taken previous to adding the HCl, and it showed the steady decline due to boiling. On next boiling, however, a rise of 12·2% occurred in the "figure of merit." By calculation, 2% of this was due to the radioactive matter in the acid which was added; the remainder must therefore be due to the re-dissolved radium, which had been deposited by boiling or otherwise rendered "de-emanating." This quantitative experiment amplifies and confirms the behaviour of the solution in the qualititave experiment, mentioned in the first part of this section. In the first trial when acid was added, the "figure of merit" went above the normal, due obviously to an excess of acid added, which had sufficient radioactive matter in it to account for the abnormal rise. In the second case, it did not reach the normal value when 2% was deducted for the radioactive matter in the acid added. Apparently all the radium had not been re-dissolved in the second case. These sets of experiments also established the fact that a radium bromide solution deteriorates with boiling, and that, because of this, too great reliance cannot be placed on the result of a single test. Every solution tested showed a steady decline, even after adding the acid. In all, about 70 tests were made.

A similar solution was prepared and used by Dr. Eve in November 1908. This was also tested, and showed only 45% of the strength obtained for the Washington standard. It thus appears that such solutions, which have been boiled a number of times and then allowed to stand very long, are not reliable, and a new preparation should be used for each set of experiments.

The work showed that the weak solution of the Rutherford-Boltwood standard is to the Washington standard solution in the ratio of 98 : 100. The results obtained in the comparison of the strong and the weak solutions of the Rutherford-Boltwood standard showed the strong 2% lower than the weak, or strong: weak :: 98 : 100. This may be considered a fair agreement, and indicates but slight deterioration with time.

We thus have—

Rutherford-Boltwood, strong solution : Washington = 96 : 100
Rutherford-Boltwood, weak solution : Washington = 98 : 100

A more complete set of experiments will be carried out later, and the exact effect of successive boilings further determined.

In closing, the writer has much pleasure in expressing his appreciation for suggestions given by Professor Eve, and also by Dr. McIntosh, in the course of this work.

SUMMARY.

1. The object of this work was to determine the accurate value of the Rutherford-Boltwood standard solution at McGill University by comparison with the Washington standard solution. The former was compared initially with the Rutherford-Boltwood solid standard which is known to be 4·9% too low on the International. If no

errors were made in their preparation, we should expect the solution standards to come out similarly. This work shows fair agreement—about 3% low, whereas the solid standard is 4·9% low.

2. The strong and the weak solutions of the Rutherford-Boltwood Standard, prepared in the ratio of 100:1, turn out to be in fairly good agreement—probably within 2%. This shows that no serious deterioration has occurred with time.

3. It has been found that a radium bromide solution deteriorates with each boiling. Also that if a sufficient amount of hydrochloric acid, free from radioactive matter, is added, the solution will recover its normal emanating power. The cause of this has not yet been ascertained.

May 22, 1915.
Montreal.

The "Ninhydrin" Reaction

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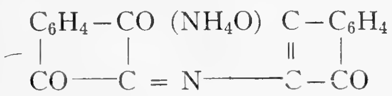
PRESENTED BY DR. R. F. RUTTAN, F.R.S.C.

(Read May Meeting, 1915).

PRELIMINARY NOTE

The so-called "Ninhydrin" reaction is the formation of a blue color when amino acids are heated with a solution of triketohydrindene hydrate. This reaction was discovered by Ruhemann, (1) who found it applicable to a number of α-amino acids, but if the amino acid was substituted on the amino or carboxyl group, then a negative test was obtained. β and γ amino acids responded only feebly to the test. Ruhemann also investigated the chemistry of the reaction and identified the blue coloring matter produced as the *ammonium* salt of *diketohydrindylidene-diketohydrindamine*,



and discovered that when alanine was the amino acid, it gave rise to acetaldehyde and carbon dioxide. The reaction was quickly taken up by Abderhalden (2) and his co-workers, who confirmed Ruhemann's observations on the test, extended the list of reacting amino acids and applied it as means of detecting pregnancy in addition to his optical method. Thus it will be seen that the "ninhydrin" reaction was used as a means of experimental support for Abderhalden's theories on specific defensive ferments and as such combined with its clinical applications, rose rapidly into prominence and importance.

Two papers, however, appeared strongly criticising the specific nature of the "ninhydrin" reaction from a chemical point of view. The first by Halle, Loewenstein, and Pribram, (3) stated that a blue color was produced merely by heating anhydrous glycerol and triketohydrindene hydrate to boiling for half a minute and that many alcohols aldehydes and ketones responded to the test in a similar manner.

Thus the sugars gave a strong positive reaction and the blue color in all cases was intensified by the addition of alkali.

The second by Neuberg (4) showed that ammonium salts and many organic bases gave a strong positive reaction when the "ninhydrin" test was applied to them. Some of these results were in direct contradiction to the earlier results of Abderhalden and Schmidt (loc. cit.) as is shown in the following table:

	Abderhalden & Schmidt.	*Neuberg..*
Suprarenin..................	–	+
Glucosamine..................	–	+
Ammonium Bicarbonate.......	–	+
Ammonium Oxalate...........	–	+

In view of the results it will be seen that a complete critical investigation into the reaction is of prime importance both from a chemical and a physiological point of view, for it is not very easy to discern how such a series of compounds as glycerol, levulose, alanine, ammonium acetate, and ethylamine can give one and the same reaction with triketohydrindene hydrate. Halle, Loewenstein, and Pribram, indeed, recognized two blue colorations, one produced by amino acids, and a second produced by alcohols, ketones, and aldehydes. They distinguished them by several characteristics. Thus the coloration produced by amino acids could be obtained in a vacuum in absence of oxygen and was not intensified by the addition of alkali; whereas the coloration given by glycerol required the presence of oxygen and became much more intense on the addition of alkali. They do not agree with Ruhemann's view on the constitution of the blue color produced with amino acids, but do not themselves put forward any definite statement as to the constitution of either of their own two colorations.

Ruhemann, however, had previously noticed that a blue coloration was given by the action of the hydrates of the alkali metals upon hydrindantin, and that the latter compound could not be reprecipitated from the blue solution by the action of acids. He noticed however that the blue solution was rapidly decolorised by shaking with air.

The delicacy of the "ninhydrin" reaction with amino acids is undoubted. Abderhalden and Schmidt found that glycine gave a blue coloration when 1 part in 65,000 parts of water and histidine when only 1: 74,000. Utilising the delicacy of the reaction Harding and MacLean (5) havedevised a method for the colorimetric estimation of amino acid α-nitrogen in minute amounts, which will estimate from 0·05 mgs. to 0·005 mgs. of α-nitrogen in amino acids with an accuracy of about one per cent. Herzfeld (6) also devised a method of estimating amino acids by a quantitative application of the "ninhydrin" reaction; but Harding and MacLean found the results untrustworthy and a criticism of this has appeared in their paper. The colorimetric method of Harding and MacLean uses as its standard the blue coloration developed by heating 1 c.c. of alanine solution containing 0·05 mgs. of α-nitrogen with 1 c.c. of one per cent "ninhydrin" and 1 c.c. of ten per cent pyridine solution in a rapidly boiling water-bath for twenty minutes. This amount of color and its method of preparation has been used as a standard in the general investigation into the "ninhydrin" reaction which has been in progress in this laboratory during the past eighteen months and the results of which are announced in a preliminary way in this communication. It will be evident that the ability to work in a quantitative manner has enabled us to draw conclusions which otherwise would have been impossible.

THE CHARACTERISATION OF THE AMMONIUM SALT OF DIKETOHYDRINDYLIDENE-DIKETOHYDRINDAMINE IN SOLUTION.

From the brief account of the position of the "ninhydrin" reaction which has just been given, it is evident that some method of definitely characterising the blue coloring matter produced by amino acids and triketohydrindene hydrate is necessary, when only small amounts are present in solution. This we have been able to do in three ways.

(1) The coloring matter gives a broad absorption band in the visible spectrum when viewed in dilute solution. This band extends from the red into the green part of the spectrum, blocking out almost entirely the whole of the yellow.

(2) The blue color changes to a purple when viewed in artificial light, resembling very much the color of dilute potassium permanganate when viewed in daylight.

(3) The color is resistant to mild oxidation. Thus the passage of a rapid current of air for five minutes through the standard color has no effect on the quantity present.

We have also prepared the *ammonium* salt *diketohydrindylidene-diketohydrindamine* from hydrindantin by the action of ammonium carbonate and ammonium acetate according to the directions of Ruhemann and have been unable to detect any difference between it and the coloration given by amino acids with triketohydrindene hydrate. This further evidence only emphasises Ruhemann's view of the reaction, and the analogy with the murexide reaction is increased by the fact that murexide gives a similar absorption band.

The blue color given by hydrindantin and potassium or sodium hydroxide differs in dilute solution very markedly from diketohydrindylidene-diketohydrindamine ammonium salt. Thus

(1) It gives no absorption band in the visible spectrum.

(2) It remains blue when viewed by artificial light.

(3) It is extremely readily oxidised to a colorless solution when shaken with air.

These tests enable one to distinguish between the two blue colorations even in very dilute solution.

THE REACTION BETWEEN TRIKETOHYDRINDENE HYDRATE AND AMMONIUM SALTS.

The results of Neuberg, who in contradiction to the earlier results of Abderhalden and Schmidt, showed that many ammonium salts gave a strong positive color reaction with triketohydrindene hydrate, is of the highest importance as it destroys at once the specific nature of the test as a means of recognising amino acids. Herzfeld had also noticed that ammonium carbonate and ammonium oxalate gave colorations with the triketone, and in the case of the latter salt, during some of the very early work on this reaction in these laboratories we ourselves had obtained contradictory results, By working quantitatively, however, it has been found possible to explain these discrepancies. We have examined the action of nearly twenty ammonium salts of different types with uniform results, which can be expressed as follows:—

(1) In a concentration of one per cent, the ammonium salts of weak acids react positively with triketohydrindene hydrate.

(2) In very high concentration, the ammonium salts of strong mineral acids give a positive reaction with "ninhydrin."

(3) In a concentration of 1 c.c. = ·05 mgs. nitrogen, no reaction is obtained.

(4) In presence of pyridine and in concentration of 1 c.c. = ·05 mgs. nitrogen, all ammonium salts react positively with triketohydrindene hydrate. The amount of decomposition per c.c. is constant at 0·019 mgs. nitrogen, and the blue coloration is due to the *ammonium* salt of *diketohydrindylidene-diketohydrindamine.*

It is at first sight inexplicable that a salt such as ammonium chloride should give the same reaction as an amino acid like alanine, for the mechanism demanded by Ruhemann's constitution of the blue coloring matter requires the reduction of the triketohydrindene hydrate at some stage or other.

THE REDUCING ACTION OF AMINO ACIDS AND THE MECHANISM OF THE "NINHYDRIN" REACTION.

The interaction of alanine and triketohydrindene hydrate results in the oxidation of the amino acid to acetaldehyde and carbon dioxide with the corresponding reduction, and condensation with ammonia, of the triketone. In determining the mechanism whereby the amino acid acts as a reducing agent we have had recourse to the dissociation theory of Dakin and Dudley who have shown that all amino acids in dilute solution dissociate into ammonia and the corresponding glyoxal. Thus alanine gives *ammonia* and *methyl glyoxal.*

$$CH_3 \cdot CHNH_2 \cdot COOH = CH_3 \cdot CO \cdot CHO + NH_3$$

The glyoxals are extremely powerful reducing agents, reducing ammoniacal silver oxide and Fehling's solution in the cold, and it is supposed that methyl glyoxal would reduce the triketone, itself being oxidised to *pyruvic acid.*

$$CH_3 \cdot CO \cdot CHO + O = CH_3 \cdot CO \cdot COOH$$

which by loss of carbon dioxide would yield *acetaldehyde.*

$$CH_3 \cdot CO \cdot COOH = CH_3 \cdot CHO + CO_2.$$

Utilising the theory in this way accounts satisfactorily for the end products of the reaction. The two products of the dissociation of the amino acid would be both utilised—the glyoxal to reduce the "ninhydrin," the ammonia to condense with the reduction product—and thus the dissociation of the amino acid could become complete. The reduction of triketohydrindene hydrate by the glyoxal would give *diketo-B-hydrindol.*

$$\begin{array}{lcl} C_6H_4 & - & CO \\ | & & | \\ CO & \text{——} & CHOH \end{array}$$

which then combining with a second molecule of the triketone would yield hydrindantin. It appears to us, however, improbable that hydrindantin represents an intermediate stage in the formation of the ammonium salt of diketohydrindylidene-diketohydrindamine. The primary action of ammonia on hydrindantin to form diketohydrindylidene-diketohydrindamine, involves the replacement of a hydroxyl group and an ethereal oxygen atom by a nitrogen atom with the loss of two molecules of water—a reaction, as far as we are aware, without parallel in organic chemistry. We believe it much more likely that the succeeding stage in the reaction is the action of ammonia on the diketohydrindol to give *diketohydrindamine*

$$\begin{array}{lcl} C_6H_4 & - & CO \\ | & & | \\ CO & \text{——} & CHOH \end{array} + NH_3 = \begin{array}{lcl} C_6H_4 & - & CO \\ | & & | \\ CO & \text{——} & CHNH_2 \end{array} + H_2O$$

This compound, according to Ruhemann, readily oxidises to the analogue of murexide, readily condenses with aldehydes, and consequently would be expected to condense with triketohydrindene hydrate to give *diketohydrindylidene-diketohydrindamine*,

$$\begin{array}{lcl} C_6H_4 & - & CO \\ | & & | \\ CO & \text{——} & CH\cdot NH_2 \end{array} + \begin{array}{lcl} CO & - & C_6H_4 \\ | & & | \\ CO & \text{—} & CO \end{array} = H_2O +$$

$$\begin{array}{lcl} C_6H_4 & - & CO \\ | & & | \\ CO & \text{——} & CH - N = \end{array} \begin{array}{lcl} CO & - & C_6H_4 \\ | & & | \\ C & \text{——} & CO \end{array}$$

of which the ammonium salt is the required blue coloration.

In this way a satisfactory idea can be gained of the mechanism of the "ninhydrin" reaction with amino acids. To apply it, however, as such, to the reaction with ammonium salts is impossible, for ammonium chloride, nitrate, and sulphate, are not, in any sense of the term, reducing agents. It is to be noted that ammonium salts do not react in very dilute solution but all react in presence of pyridine to give a constant amount of decomposition independent of the acid radicle in the salt. All reduction must thus come from the triketohydrindene hydrate itself. In presence of pyridine the triketone in part hydrolyses to give the yellow colored *phenylglyoxal carboxylic acid*

$$\begin{array}{lcl} C_6H_4 & - & CO \\ | & & | \\ CO & \text{———} & CO \end{array} + H_2O = \begin{array}{lcl} C_6H_4 & — & COOH \\ | & & \\ CO & \text{———} & CHO \end{array}$$

a reaction which is readily observable. In this manner the requisite glyoxal is produced and the mechanism is then supposed to follow the usual path with the unchanged triketone.

INFLUENCE OF REDUCING AGENTS ON THE "NINHYDRIN" REACTION WITH AMMONIUM SALTS.

Reducing agents should assist the auto-reduction of triketohydrindene hydrate and thus increase the amount of coloring matter formed by ammonium salts. From this point of view we have examined the action of a number of common organic reducing agents, which might be supposed from a knowledge of their reactions, not to interfere with any of the further condensations which take place, and measured their influence on the amount of coloring matter formed from ammonium chloride.

The following table shows in detail the influence of glucose on the decomposition of the ammonium salts.

Ammonium Salt	1 c.c. Pyridine (10%)+1 c.c. Ninhydrin (2%)		
	1 c.c. Water	1 c.c. Glucose (0·5%)	1 c.c. Glucose (5·0%)
Chloride.........	·025 mgs. N_2	·025 mgs. N_2	·032 mgs. N_2
Nitrate..........	·025 " "	·027 " "	·031 · ·
Sulphate.........	·026 " "	·026 " "	·032 " "
Acetate..........	·025 · "	·026 " "	·032 " "
Benzoate........	·026 " "	·026 " "	·032 · ·

THE "NINHYDRIN" REACTION APPLIED TO AMIDES AND AMINES.

One or two instances are given in the literature showing a negative result on applying the "ninhydrin" reaction to amides. We have examined several different classes of amides, in various concentrations, with and without the presence of pyridine, and in the former case found the reaction to be very faintly positive. The amount of color produced by any of the amides is much too small to be measured, or for the ammonium salt of diketohydrindylidene-diketohydrindamine to be detected with certainty; the only positive evidence is that the bluish-violet color is resistant to mild oxidation.

This extremely slight reaction given by amides is of interest, for, comparing this class of compounds with amino acids, it is the latter which are much the more resistant to hydrolysis to produce ammonia; and yet it is precisely that class which reacts the more readily with triketohydrindene hydrate. Thus the non-reactivity of the amides supports the idea that the reactivity of the amino acids is due to their dissociation.

Amines, however, have been shown to react with triketohydrindene hydrate by Neuberg and this result we have confirmed in the case of ethylamine. A one per cent. solution of ethylamine gives, on heating with "ninhydrin," and subsequent dilution a strong blue color readily identified as the ammonium salt of diketohydrindylidene-diketohydrindamine. When the concentration is such that 1 c.c. = 0·05 mgs. nitrogen, there is no reaction; but in presence of pyridine, a strong coloration is produced which is more in amount than that given by ammonium salts. The few secondary and tertiary amines which we have examined give only the faintest of reactions. These facts we regard as significant; but we have examined too few a number of bases as yet to warrant the drawing of any definite conclusions. An examination of a large number of bases of varied types is in contemplation and we wish to reserve this part of the subject.

THE "NINHYDRIN" REACTION WITH GLYCEROL, ETC.

The results of Halle, Loewenstein and Pribram who obtained a blue coloration by heating anhydrous glycerol with ninhydrin are of the greatest importance, for if substantiated they would form quite a new development of the chemistry of the test. At first we were unable to repeat their results, but this, we found later, was due to our glycerol containing too large a proportion of water. Since then, and using anhydrous glycerol, we have been able to obtain a bluish shade of color on boiling it with triketohydrindene hydrate for thirty seconds. We soon recognized however, that different samples of glycerol gave very different amounts of color; one, a specimen of Schuchardt's crystallisable glycerol, only gave the faintest trace of pinkish coloration, while another marked "anhydrous" gave quite a strong blue color. This color was identified as the ammonium salt of diketohydrindylidene-diketohydrindamine by the three previously mentioned tests. This of course instantly led us to the conclusion that the coloration given by glycerol was due to traces of nitrogenous impurity and to extend that explanation to the reactions given by glycol, aldehydes, ketones and sugars, for which claims to a positive ninhydrin reaction had been made by Halle, Loewenstein and Pribram. We tested this hypothesis in the following way. One c.c. of ammonium chloride solution containing 0·05 mgs. of nitrogen was placed in a test tube previously thoroughly washed with ammonia-free water. This was then poured out of the test tube and the tube allowed to drain. 0·2 c.c. of one per cent. "ninhydrin" was then placed in the tube and 2·0 c.c. of Schuchardt's crystallisable glycerol, which previously had only given the faintest reaction by itself, added, and the mixture boiled over a free flame for thirty seconds, thus duplicating the conditions given by Halle, Loewenstein and Pribram. A strong blue color developed. The high temperature of the boiling glycerol had evidently caused the dissociation of the trace of ammonium chloride and thus caused a reaction which the glycerol, being a reducing agent in high concentration, had assisted. The presence of oxygen is not necessary for the production of the "glycerol color" as claimed by Halle, Loewenstein and Pribram, nor do their experiments prove such a fact. By carrying out the reaction *in vacuo* those authors merely reduced the temperature of the reaction and so failed to decompose the nitrogenous impurity present in the glycerol. The intensification of the blue color on the addition of alkali is due to the action of the alkali on the hydrindantin which would naturally be formed in excess. This intensification of the "glycerol color" we have been easily able to repeat and we find that the intensified color is destroyed by shaking with air, thus corresponding to the color given by hydrindantin and potassium hydroxide. We therefore cannot see in the work of Halle, Loewenstein and Pribram any new classes of blue color reactions of triketohydrindene hydrate.

CONCLUSIONS.

In reviewing the investigations on the "ninhydrin" reaction, it is clear that under accurately defined conditions of concentration and temperature the test can become specific for amino acids, for it is these bodies alone which respond readily and clearly in very dilute solution. In testing for amino acids we would recommend that not more than one tenth of a milligram of nitrogen be present in every c.c. of the liquid to be tested and that one c.c. of it be heated in a boiling water bath with one cc. of one per cent. solution of "ninhydrin" for a period of fifteen minutes. The procedure which is sometimes adopted of heating to dryness in an evaporating basin the liquid to be tested with the reagent is certainly to be condemned.

In the presence of pyridine, ammonium salts primary amines (?) and amino acids, react strongly with triketohydrindene hydrate. Thus the method of Harding and MacLean of determining colorimetrically amino acid α-nitrogen is at present inapplicable to the analysis of physiological fluids. It is hoped however that further work on this reaction will enable us to solve the problem, because the extreme sensitiveness of the reaction, would render such an application particularly valuable.

REFERENCES.

(1). Ruheman. Trans. Chem. Soc., 1910, **97**, *2025*.
(2). Abderhalden and Schmidt. Zeit. Physiol. Chem., 1913, **85**, *143*.
(3). Halle, Loewenstein, Pribram. Biochem. Zeit. 1913, **55**, *357*.
(4). Neuberg. Biochem. Zeit., 1913, **56**, *500*.
(5). Harding and MacLean. Journ. Biol. Chem., 1915, **20**, *217*.
(6). Herzfeld. Biochem. Zeit., 1914, **59**, *249*.
(7). Dakin and Dudley. Jour. Biol. Chem. 1913, **15**, *127*.

Viscosity of Ethyl Ether near the Critical Temperature.

By A. L. CLARK, B.Sc., Ph.D., F.R.S.C.

(Read May Meeting, 1915).

The problem of the critical point has been discussed for a number of years, but cannot be said to have been settled definitely. The problem may be put thus: Is the critical temperature the true upper limit of temperature for which a substance may exist in the liquid state, or does the liquid state persist above this temperature, even though the substance appears to be perfectly homogeneous. The classical definition of Andrews as the temperature above which the liquid may not exist, or the upper limit of the liquid state, has seemed insufficient to many experimenters. The following experiments[1] may be cited as some of those which have given rise to the objections to the classical theory.

While according to Andrews' theory there is only one volume of filling of a tube, viz., the critical volume, that should allow the meniscus to be observed as it disappears at the critical temperature, it was found by Cagniard de la Tour that there was considerable latitude to the initial volume of liquid in the tube for the meniscus to disappear in the body of the tube. Galitzine[2] found that with ethyl ether these limits were ·28 and ·48 of the volume of the tube, while the critical volume is approximately half way between them. It has been pointed out that the temperature of the disappearance of the meniscus is not identical with the true critical temperature as defined by Andrews and as shown by the point where the isothermal has a horizontal inflexional tangent. Then, too, it has been found that differences in density in different parts of the tube persist after the meniscus has disappeared. It has also been shown that after heating above the critical temperature and cooling again, the position of the meniscus depends on the amount and duration of the heating above the critical temperature. Finally, if two non-miscible liquids are placed in an O-shaped tube and the tube is heated above the critical temperature the manometric heavier liquid does not reach the same level in the

[1] See Mathias, Le Point Critique des Corps Pur for a very comprehensive discussion of the various abnormalities observed near the critical point. Also Kuenen, Die Zustandsgleichung der Gase und Flussigkeiten und die Kontinuitätstheorie for an account of these experiments and the objections to the conclusions drawn from them.

[2] Galitzine. Wied. Ann 50, 521, 1893.

two sides of the tube, at least not until after prolonged or intense heating.

Any one performing the Cagniard de la Tour experiment with fairly rapid rise of temperature will notice the great difference in the values of the refractive index in the upper and lower parts of the tube, which values equalize only at higher temperature or after prolonged heating. The experiments of Teichner[1] seem to indicate great difference in density in different parts of the tube. Experiments like the above and many others involving questions of solution, of electrical resistance, of optical properties, etc., have led certain writers, noticeably Traube[2] and de Heen,[3] to formulate theories which postulate the existence of two kinds of molecules (the so-called *liquidogenique* and *gazogenique*) and attempt to reduce the abnormalities to a regular trend covered by the theory. In brief, these theories require the existence of what we may call liquid molecules and vapour molecules. The former are congeries of the latter and may produce them by disintegration. The vapour phase in the ordinary two-phase condition is composed of vapour molecules in large numbers and of liquid molecules in relatively small numbers. The reverse is true of the liquid phase. As the temperature is raised, the relative amounts of these two kinds of molecules change so as to become more nearly equal, and at the critical temperature they are present in approximately equal proportions. Hence the phases become identical, but not homogeneous in the strictest sense. At the critical point and above it the liquid particles continue breaking up into the more elementary particles and the change occurs slowly near the critical temperature, but more rapidly at higher temperature. In the hands of Mathias this theory is made to account fairly well for most of the abnormalities. It has been attacked by Kamerlingh-Onnes and others[4] who maintain that the effects seen by these observers are due to gravity and to the presence of impurities. There is no doubt that gravity exerts profound effect on the condition of the substance near the critical temperature, as here the substance is very compressible over a limited region of change of volume; and this fact together with the slow diffusion due to the shortness of the molecular path may account for some of the abnormalities. Then, as Kuenen points out, dissolved gases, produced perhaps during the sealing off of the tube after filling, when some of the substance may be decomposed, will result in an

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[1] Teichner. Drudes Ann. 13, 598, 1904.

[2] Traube. Drudes Ann. 8, 269, 1902.

[3] de Heen. Recherches Touchant la Physique Comparée et la Théorie des Liquides, Seconde Partie.

[4] See Kuenen loc. cit. for a resumé of the objections to these theories.

impure liquid which will behave differently in different parts of the tube. This may explain other abnormalities. So it may be that these molecular theories are unnecessary; but it may be also that there are abnormalities which are not accounted for in either of these two explanations. It occurred to the writer that a different line of experiment might contribute data for the settlement of the question and the following paper is the account of an attempt to gain such data. So far as the writer is aware there have been no direct attempts to demonstrate the existence or non-existence of the two kinds of molecules.

The most obvious lines of investigation are experiments in which molecular actions are brought into play, as in viscosity determinations and investigations of optical properties. The work of Galitzine and Wilip[1] deals with the latter subject but not in a way to give much help in the present instance. Young[2] has investigated the question of opalescence but there is not sufficient data accumulated to decide the question, although the evidence given is in favour of the classical theory. It seemed to the writer that since viscosity is essentially a molecular phenomenon and that the value of the coefficient depends on the mass of the molecules, the determination of the viscosity coefficient under proper conditions might lead to valuable information, so the following investigation was undertaken. The course of the work has been subject to annual interruptions with the beginning of the teaching session; but the apparatus and technique have been perfected gradually. Of all the methods[3] available for the determination of the viscosity coefficient that of measuring logarithmic decrement of an oscillating cylinder suspended inside a concentric cylinder seemed most practicable, and the results have justified the choice of this arrangement.

If such a suspended cylinder be set in torsional vibration, the logarithmic decrement can be determined and from the change in the decrement the changes in the viscosity and therefore in the molecular condition can be studied. In these experiments, the outer cylinder of the system is the glass tube containing the fluid, and the oscillating cylinder is described below. In choosing a substance for investigation it is necessary to select one with a moderately low critical pressure, one which is fairly easy to prepare, and one whose critical temperature is neither extremely high nor extremely low. Ethyl ether was chosen

[1] Galitzine and Wilip-. Rapports du Congrès International de Physique, de 1900, t. I, p. 675.

[2] Young, F. B. Phil. Mag. (6), 20, 793, 1901.

[3] See Brillouin, La Viscosité des Liquides et des Gaz for an excellent discussion of the different methods of determining the coefficient of viscosity and the results obtained.

as fulfilling these conditions fairly well, and it possesses the additional advantage of having been studied extensively. Ether is fairly easy to prepare, although there is nearly always some doubt as to the complete removal of dissolved gases. Young[1] has shown that this removal may be accomplished by repeated freezing in liquid air, and remelting when the gas bubbles escape as the solid ether melts. As no liquid air plant was available the freedom of the ether from gaseous impurities may be suspected; but all means possible were employed to free the substance from impurities. The method of preparation will be described further on.

APPARATUS.

The first essential is a heating apparatus which can be maintained at constant temperature indefinitely and whose temperature can be changed quickly from one point to another at will. The heater and regulator have been described elsewhere[2] and all that is necessary to repeat here is that temperatures between 30° and 300° may be maintained indefinitely within a few thousandths of a degree when desired. Its capacity is large and the temperature is regulated easily, requiring a minimum amount of attention. The constancy of temperature is observed with a platinum resistance thermometer in a Wheatstone bridge circuit, whose galvanometer is of the reflecting type, on whose scale one division represents approximately ·01 degrees. The heater is supplied with calibrated thermometers and with windows which may be covered. It is mounted on three levelling jacks so that the position may be adjusted easily.

The oscillating system consists of a 22 carat gold cylinder carefully turned and highly polished.[3] The dimensions of the cylinders are given further on. The cylinders are constructed as follows:—After they are turned down to approximate size, a hole 1 mm. in diameter is bored perpendicular to the axis at a distance from the upper end equal to one third of the length, and a soft iron plug, a little shorter than the diameter of the cylinder, is inserted . The holes at the ends of the plug are then filled with 18 carat gold solder, which is turned off and then the cylinder is polished. A small platinum wire ·4 mm. in diameter is inserted axially in the upper end and bent into a hook

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[1] Young loc. cit.

[2] Clark. Proceedings American Academy of Arts and Science, 48. No. 15, Jan. 1913.

[3] The cylinders were made by Mr. W. B. McKay of the firm of R. J. Rodger of Kingston and are most satisfactory.

for supporting the cylinder. The cylinder hangs on a fine hard drawn silver wire about 5 cm. long and ·05 mm. in diameter. The upper end of this wire is attached to a second hook which is fastened to a spring band of platinum as shown and whose elasticity holds it in place inside the tube. This entire system is placed in one leg of a thick walled glass tube made in the form of an inverted U. The apparatus will be clear from Figure 1. It will be seen that the gold cylinder is suspended concentrically within the cylindrical tube. The glass tube

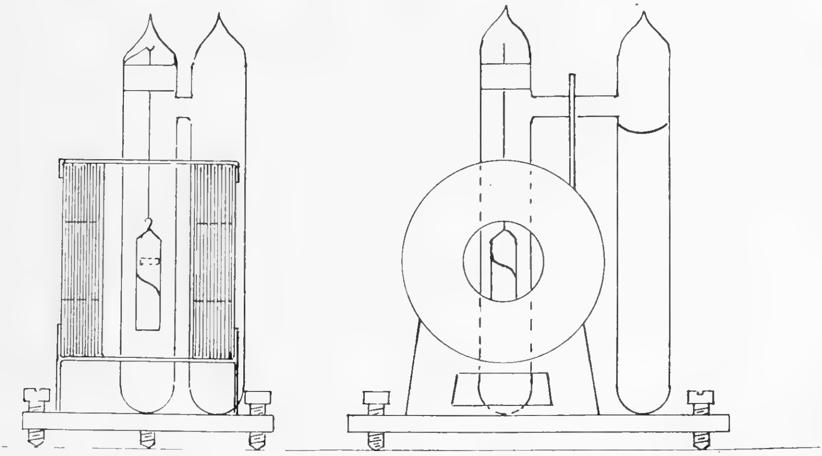

Fig. 1.

is supported in a frame made of thin sheet copper which carries in addition to the tube, two coils of copper wire whose common axis is horizontal and on a level with the iron plug in the gold cylinder. If a current is sent through the coils the iron plug sets itself along their axis and when the current is broken the cylinder oscillates under the combined effects of its inertia and the elasticity of the torsion wire, until brought to rest by the viscosity of the substance in which it hangs. The two legs of the inverted U are partly surrounded by coils of German silver wire so that the liquid in the tube may be distilled from one leg of the tube to the other. In this way observations of the decrement in either the liquid or the vapour are made possible without disturbing the apparatus. The coil on the leg containing the cylinder is open in the middle portion so that the motion of the cylinder may be followed. The four wires for these heating coils and for the directing coils pass out through the bottom of the heater in glass tubes and are connected to a storage battery through three keys. The layers of wire in the directing coil are insulated from each other by thin asbestos paper and are cemented in place with a mixture of sodium silicate and powdered talc. The frame work carrying the coils and supporting the tube is mounted on a brass plate provided with levelling screws. Thus the cylinder may be centred in the tube either by these screws or by means of the jacks which support the entire apparatus.

Various methods of observing the oscillation of the cylinder were tried. A mirror on the cylinder was found to be impracticable owing to the distortion due to irregularities in the glass tube. In fact any horizontal motion is difficult to measure accurately. Finally the following method was adopted. After the gold cylinder was completed by the jeweller it was laid on a smooth level surface and a razor blade pressed down upon it at an angle of 45° with the axis and then moved parallel to itself in a direction perpendicular to the axis of the cylinder which rolls under the blade, with the result that a sharp well-defined spiral cut is made on the cylinder. Then the cylinder is given a final polish to remove the burr caused by the cut since this would interfere with the regular reflection from the surface. When the cylinder hangs in the tube and the light from a straight filament lamp is focussed upon it, a bright vertical line crossed by the oblique cut is seen. The oscillation of the cylinder causes the cut to move up and down and for this vertical motion there is no distortion. The light used is a small 4-volt tungsten lamp with a straight filament about one cm. long and the light is transmitted through a water cell to reduce the heating effects. Except during the actual measurements the windows are covered to prevent radiation.

Originally the intention was to count the number of swings necessary to reduce the amplitude from a certain value to a definite fraction of that value; but this was found to be unreliable and was given up. Next, photography was tried but required too much light for the proper illumination of the cylinder. Finally, a transparent eyepiece scale was placed in the telescope. This scale was ruled with the regular divisions and was crossed by a vertical line through the middle of the field cutting the divisional lines at right angles. This vertical line is set on the illuminated line of the cylinder and thus gives a definite point on the scale for the crossing of the oblique cut. The scale is illuminated by a miniature electric-lamp placed in a side tube on the eyepiece of the telescope. This is necessary as the light from the cylinder is too dim to enable the observer to read the position of the spiral cut easily.

Observations of the maximum excursions on one side of the zero are made and the curve of their logarithms is perfectly straight. Figure 3 shows the logarithms of the maximum excursions for three sets of observations taken under the same circumstances. Since the slope is obtained from the slope of the line, it will be seen that the values of the decrement agree very well. For a very large amplitude the motion of the cylinder is not quite isochronous but is accurately so for the amplitudes used. The period does not change materially for a given tube under very different conditions. (See figure 3).

TUBES AND METHOD OF FILLING.

The form of the tube used is shown in Figures 1 and 2. This form was adopted in order to study the liquid and vapour regions separately and to retard rather than facilitate the mixture of the materials in the two legs of the tube. Also this form of the tube made it possible to study the viscosity without disturbing the substance in such a way as to mix the horizontal layers. Thus changes with the time can be studied.

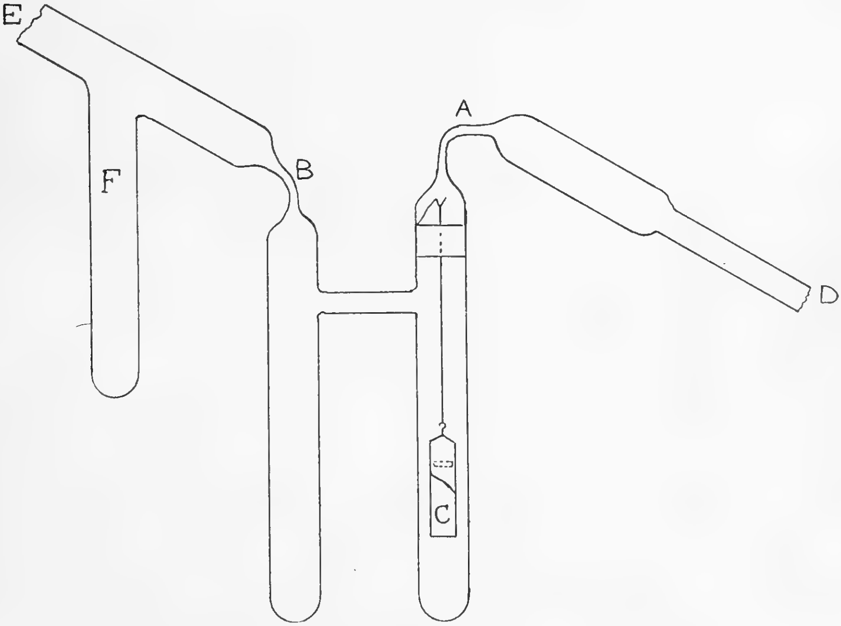

Fig. 2.

The preparation of the tube is carried out as follows:—The part A is left of full size and straight until after the insertion of the oscillating system. After the final washing, the tube is dried with a current of air and when nearly dry is heated very hot inside a coil of wire, the air current still passing. The oscillating system is inserted through A and the tube drawn down to about 1 mm. diameter and bent over. The tube D is sealed on and attached to an aspirator through a cock.

E is sealed on the still, great care being taken that the flame does not enter the tube. In order to provide for the washing out of any deposit that might be introduced while joining, the branch tube F is attached before the final washing. Next the aspirator is started and the tube heated again to insure complete removal of moisture. It will be observed that the joint at E is the only one over which the

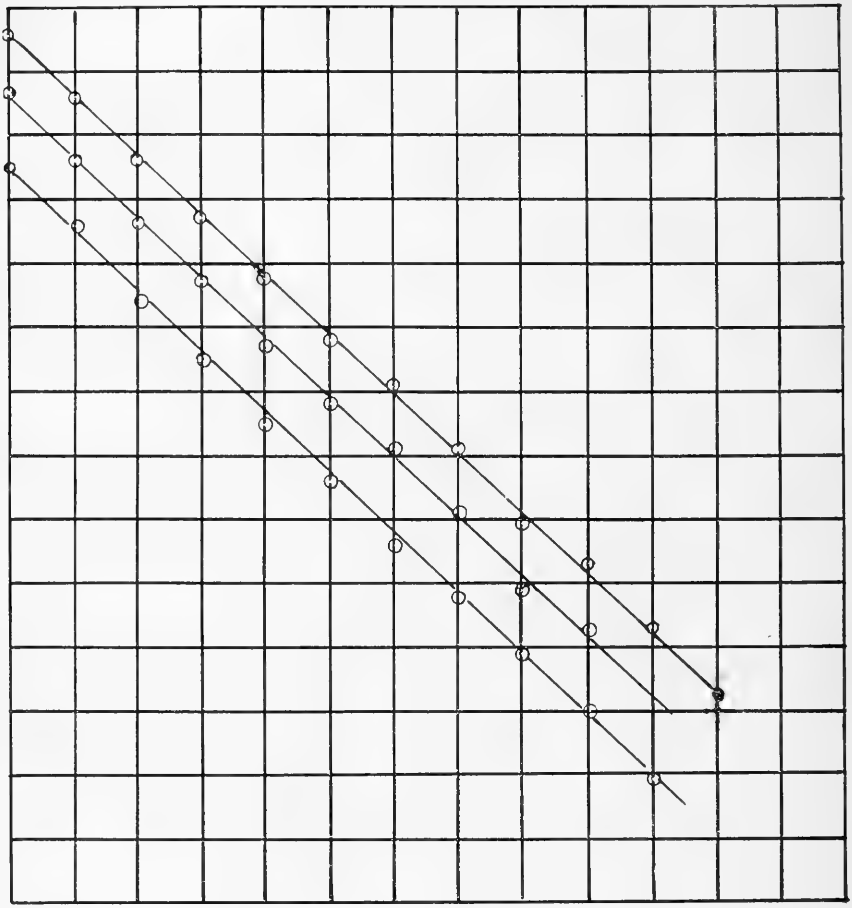

Fig. 3.

substance passes before condensation. After the tube is cooled the narrow parts at A and B are drawn down to about ·1mm. so that the final sealing off after the tube is filled is accomplished with a minimum of heat. This is possible because D is connected by a flexible tube to the aspirator and the still can be rotated in its support so that these small tubes may be drawn down easily. With the aspirator running, the liquid is heated in a water bath and by an auxiliary heating coil inside the flask and a steady stream of ether vapour is allowed to flow through the apparatus. Then the tube is cooled at E so that the first distillate runs over the joint into the tube F, washing out any deposit that may have been introduced. Then the tube is cooled below F and the liquid condenses and runs down into the experimental tube. By alternately closing and opening the aspirator cock to reduce and raise the pressure inside the tube condensation is facilitated. The distillate is boiled away and collected again repeatedly by alternately immersing the tube in beakers of warm and cold water until it is impossible to boil the ether with ebulition, showing that the air is nearly all if not quite removed,—indeed, it becomes very difficult to remove the liquid from the tube toward the end of the filling except very slowly. A slight excess over the required amount is collected in the tube and the still cock closed. Further heating removes the excess and the tube is sealed off first at B and then at A. The final sealing is accomplished under reduced pressure so there is no difficulty in accomplishing this.

The ether used was Kahlbaum's purest ether kept over sodium for several months and distilled into the tube. After the tube is complete it is placed in a testing heater and heated to about 240°. If it sustains this test without explosion it is judged good enough for use. Of course if the tube explodes the cylinder is ruined and has to be repolished if not entirely remade.

PROCEDURE.

Two lines of work were carried out, either of which supplies sufficient data for the discussion of the problem. But the two lines supplement each other and render the results more trustworthy.

I. Observations of the logarithmic decrement were made with the cylinder immersed in the liquid for a number of temperatures up to and beyond the critical temperature, and then for falling temperatures down to the critical temperature again. The same thing was done with the cylinder immersed in the vapour. If the curves for rising and falling temperatures do not coincide, comparison of these for liquid and vapour may enable us to interpret the changes in the logarithmic decrement shown by them.

II. The temperature was maintained constant within a few hundredths of a degree with the cylinder in the liquid at different temperatures near the critical temperature. The same work was carried out with the tube in the vapour. In this way changes with the time can be studied. By comparing we may be able to discover changes in the substance not accounted for by the classical theory. To avoid circumlocution the two legs of the tube will be spoken of as the liquid side and the vapour side. The liquid side is the one which is full of liquid or contains all of the liquid at ordinary temperature. The vapour side contains no liquid at ordinary temperature.

Three sets of readings are taken at any temperature or at any time and the mean of the three decrements is taken as the value for the observations. The temperatures are taken from calibrated thermometers and are probably correct within ·1°. The platinum resistance thermometer is used as a check on the steadiness of the temperature in the heater. In the first part of the work the temperatures are held constant for about half an hour before the readings of the swings of the pendulum are taken. In the constant temperature work readings are taken at intervals of about half an hour and are continued long enough to indicate the trend of the curve. In observing the swings of the pendulum it was found easier on the whole to read alternate maxima and quite as satisfactory. So this was usually done except when the decrement is very small and then every fifth and in some cases every tenth swing was observed.

RESULTS.

As has been mentioned, the earlier attempts at determination of the decrement were made by counting the number of swings of the pendulum cylinder while the amplitude decreased from a certain value to a definite fraction of that value. The method was found unreliable, particularly when the decrement is small, since it is then impossible to tell which swing takes the pendulum nearest a given position. One is very apt to get a value which accords with preconceived notions. The results will be discussed under two headings. Under the first are those where the change in the decrement with the change in the temperature is shown and under the second those in which time changes are shown. The following table gives necessary data concerning tubes and cylinders:—

Tube	Cylinder	Diam. of Bore	Diam. of Cyl.	Length of Cyl.	Mass of Cyl.	Period
I	1	·66	·475	1·72	5·335	1·18
II	2	·67	·559	1·72	7·234	1·68
III	1	·58	·475	1·72	5·335	1·28
V	1	·59	·475	1·72	5·335	1·26

I. Results obtained by raising and lowering temperature.

Only one tube was used in 1913 and the results were as shown in Figures 4 and 5. Figure 4 shows the decrement for the liquid side and Figure 5 for the vapour side. But since the method of cutting the spiral line on the cylinder had not been perfected it was deemed wiser not to publish the results until further experiments had been carried out under conditions assuring a higher degree of accuracy. In nearly all the curves, observations were begun at room temperature and carried on up to the highest point at intervals of about 10°. Then the temperature was lowered again to the critical temperature. But the values

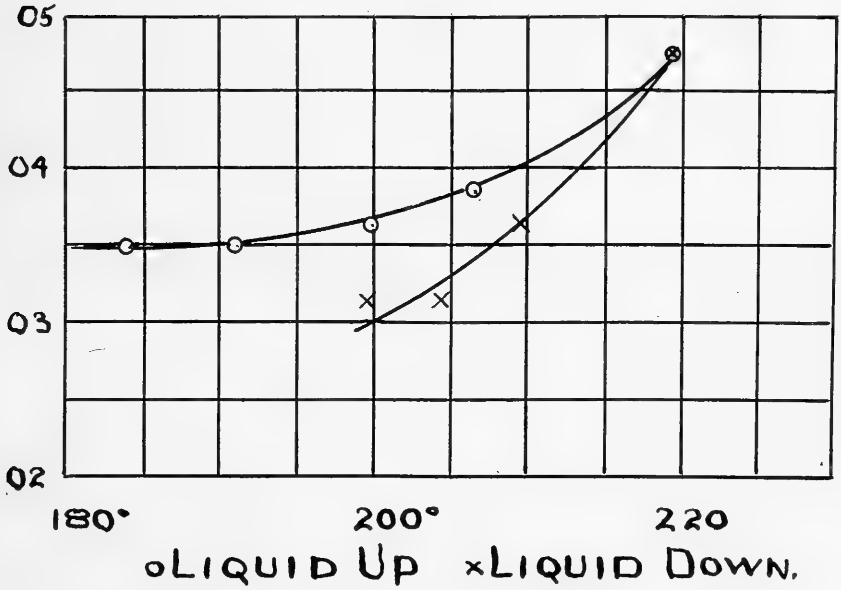

Fig. 4.

at the lower temperatures are not shown on the diagram or in the tables as the region near the critical temperature only is important.

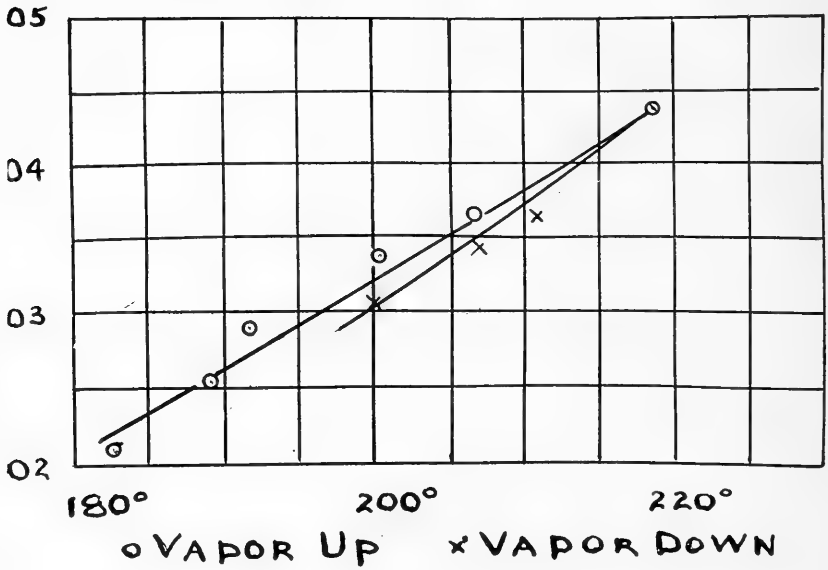

Fig. 5.

	Temp.	Dec.
	183·7	·0348
	188·7	·0380
	191·1	·0350
	199·8	·0362
	207·0	·0383
Liquid	218·9	·0475
	219·1	·0475
	209·9	·0366
	204·0	·0321
	199·6	·0322
	195·8	·0330

	Temp.	Dec.
	173·0	·0228
	182·9	·0219
	188·8	·0255
	191·3	·0280
	200·6	·0334
Vapour	206·7	·0336
	212·6	·0385
	218·3	·0447
	218·3	·0440
	211·8	·0363
	206·7	·0340
	200·0	·0303
	194·8	·0296
	194·0	·0301

The curves in Figures 4 and 5 were obtained with Tube No. 1, which was filled so that the density of the filling was nearly the critical density.

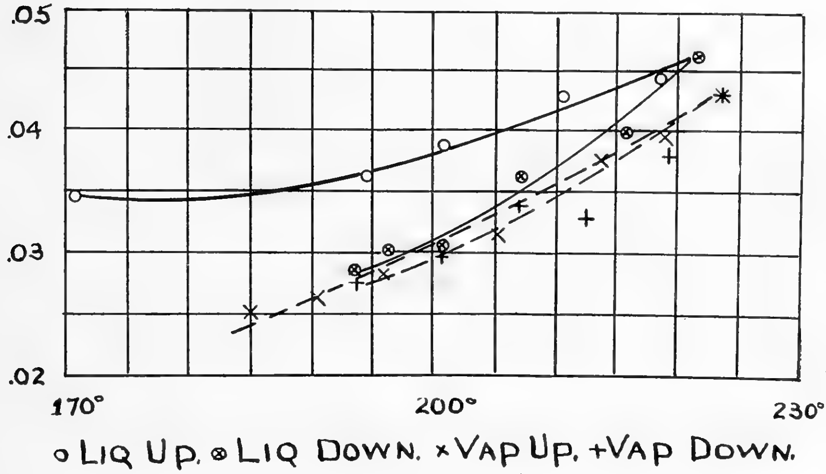

Fig. 6.

	Temp.	Dec.		Temp.	Dec.
	152·5	·0344		171·5	·0189
	170·7	·0343		185·0	·0255
	194·9	·0362		190·1	·0263
	201·6	·0380		196·1	·0284
Liquid	210·5	·0428	Vapour	205·0	·0320
	218·5	·0440		214·3	·0378
	222·6	·0454		219·4	·0393
	215·9	·0399		224·5	·0430
	207·3	·0363		224·6	·0433
	201·1	·0303		219·4	·0387
	196·1	·0301		213·3	·0325
	193·8	·0279		206·8	·0344
				200·3	·0297
				193·9	·0288

The tube of Figure 6, viz., No. 2, was filled so that the density of filling was slightly greater than the critical density. Variation in the logarithmic decrement for both the liquid and the vapour sides are shown on the same diagram.

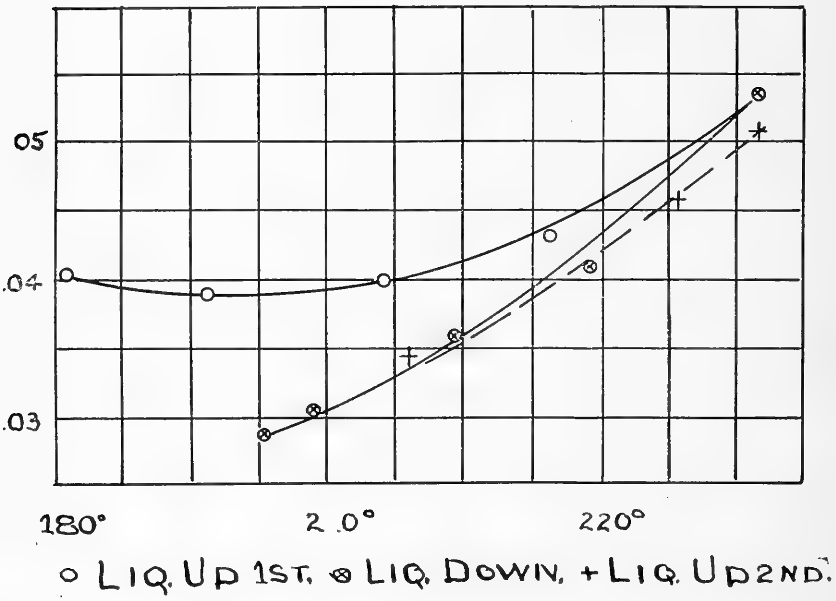

Fig. 7.

Temp.	Dec.
181·8	·0403
192·1	·0380
204·7	·0399
216·6	·0430
232·4	·0532
218·9	·0407
204·5	·0360
199·3	·0312
195·3	·0288
206·3	·0348
226·2	·0457
232·0	·0509

Figure 7 is for the same tube as for Figure 6, viz., No. 2. The curves are plotted for the liquid side alone, first for rising temperature to 232·4°, then for falling temperature down to 195·3° and up again to 232·0°.

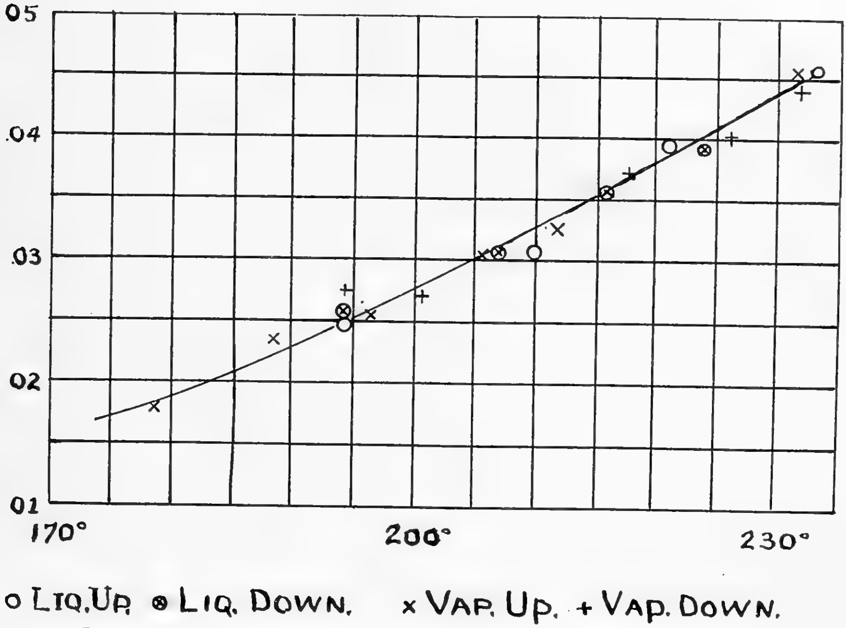

Fig. 8.

	Temp.	Dec.
	194·3	·0248
	210·0	·0308
	221·6	·0395
	233·7	·0458
	233·8	·0488
	224·1	·0383
	215·8	·0355
Liquid..............	207·0	·0305
	194·8	·0257

	Temp.	Dec.
	178·5	·0179
	188·2	·0239
	196·9	·0257
	205·6	·0304
	212·2	·0325
	222·2	·0393
	231·6	·0453
Vapour......	231·8	·0431
	225·0	·0401
	217·2	·0371
	208·4	·0306
	201·1	·0274
	194·6	·0280

Figure 8 is drawn for Tube 3 in which the density of filling is such that the meniscus vanished at the bottom of the tube. Observations were made for both liquid and vapour sides for rising and falling temperatures. One line serves equally well for all four sets of readings.

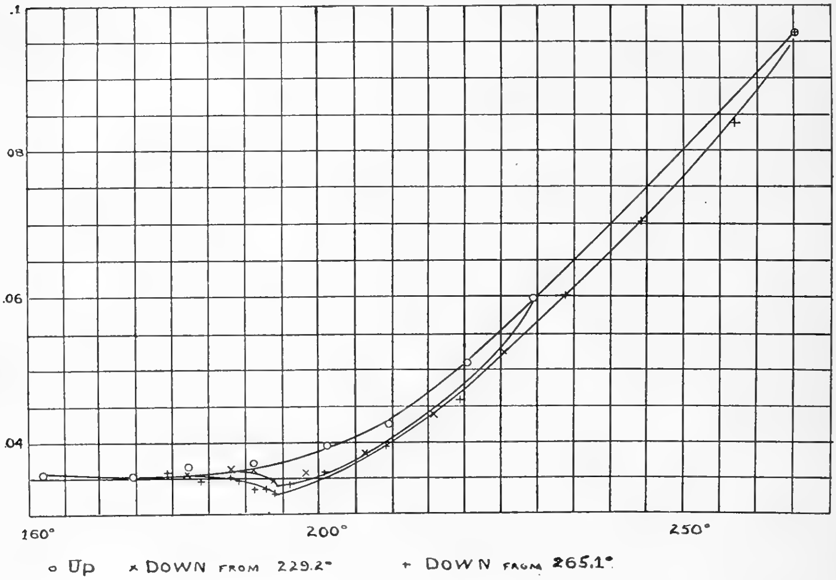

Fig. 9.

	Temp.	Dec.
	162·3	·0355
	174·2	·0353
	183·3	·0368
	190·9	·0365
	195·5	·0365
	201·8	·0395
	209·7	·0425
	220·2	·0509
Liquid 1............	229·2	·0510
	225·4	·0520
	215·4	·0440
	205·5	·0383
	197·0	·0360
	193·2	·0348
	190·5	·0365
	187·8	·0368
	182·5	·0355

	Temp.	Dec.
	265·1	·0960
	257·1	·0840
	244·3	·0704
	233·3	·0600
	219·0	·0462
	208·4	·0398
	200·3	·0362
	195·9	·0346
Liquid 2.......	193·8	·0330
	192·8	·0338
	191·7	·0338
	189·2	·0348
	187·3	·0352
	184·4	·0348
	179·7	·0357

Figure 9 was drawn from data obtained with Tube 5 in which the density of filling was so large that the tube was completely full below the critical temperature. The liquid side only was studied. In fact either side might be called the liquid side. One set of readings was begun at about 160° and carried up to about 230°. The temperature was then lowered to near the critical temperature and then observations were made for temperatures near together, and carried on until the curve ran into the curve for rising temperature. Then the next day the temperature was pushed up to about 265° and lowered again as before.

II. Constant temperature results:—

Experiments in 1912 while unreliable led to the conclusion that the logarithmic decrement of the cylinder in the liquid side of the tube decreased when the system was maintained at a constant temperature near the critical temperature and that the decrement for the vapour side at first increased and then decreased. While these results are unreliable on account of the method employed, it should be noted that the conclusions are substantiated by the later work.

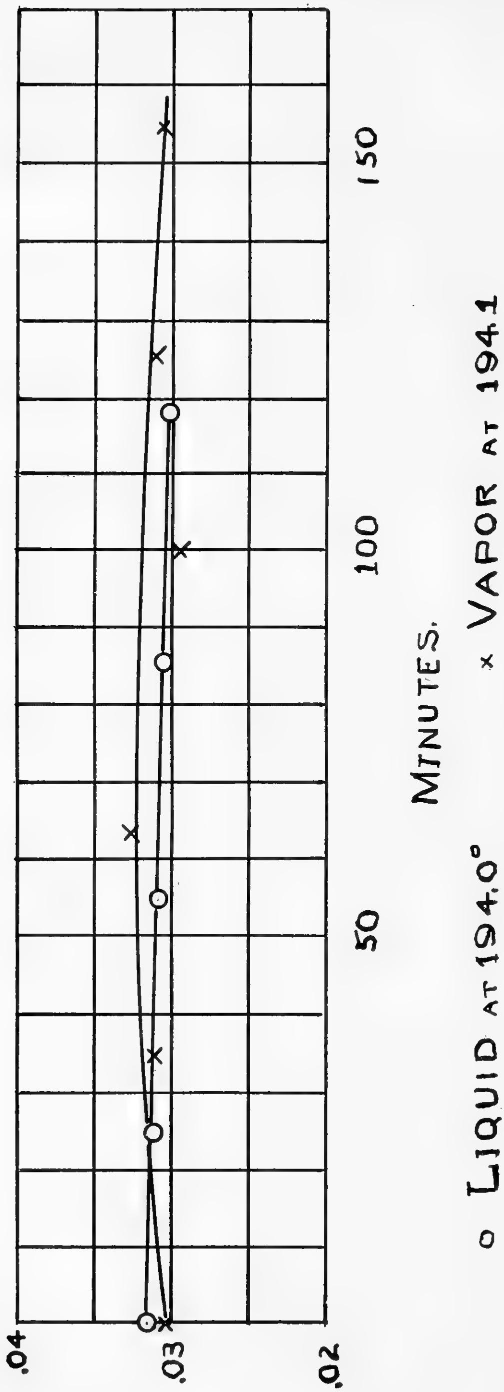

Fig. 10.

	Time	Dec.		Time	Dec.
	0.	·0313		0	·0302
Liquid at 194·0°—	25	·0309	Vapour at	36	·0316
Tube 2.	55	·0308	194·1°—Tube 2.	63	.0331
	85	·0306		100	·0295
	120	·0303		125	·0322
				155	·0315

The curves of Figure 10 show the constant temperature results of 1913. The curve for the liquid side behaved as was expected; but the curve for the vapour side showed that the decrement increased at first and then decreased. This is an extremely important point and it was for this reason that additional results with other tubes were thought necessary. The time is in minutes.

The following tables show the same phenomena as Figure 10.

	I.			II.	
	Time	Dec.		Time.	Dec
	0	·0345		0.	·0325
	25	·0339		20	·0310
Liquid at 195·9	60	·0337	Liquid at 193·6	45	·0287
Tube 5.	90	·0335	Tube 2.	75	·0290
	125	·0330		115	·0280
	160	·0328		145	·0269
	190	·0328		180	·0285
	215	·0328			
	240	·0328			

	III.			IV.	
	Time	Dec.		Time	Dec.
	0	·0303		0	·0272
Vapour at 195·4	40	·0307	Vapour at 193·3	25	·0277
Tube 2.	60	·0310	Tube 2.	80	·0255
	90	·0301		140	·0268
	135	·0295		175	·0259
	170	·0295		205	·0253
	215	·0298		250	·0266
	230	·0298		280	·0261
				315	·0259

In the foregoing tables the values of the decrement in Table I were obtained for the liquid side at 195·9° on the rising part of the curve. The temperature was raised to 240° and lowered as quickly as possible to 196·2° and the readings for Table V were made. The temperature was then lowered to 194·9° and the readings for Table VI taken. The temperature was then lowered to 194·1° and the observations for Table VII were taken.

V.

	Time	Dec.
Liquid at 196·2	0	·0324
Tube 5.	40	·0328
	80	·0328
	105	·0328
	135	·0328
	165	·0328

VI.

	Time	Dec.
Liquid at 194·9	0	·0323
Tube 5.	35	·0332
	70	·0329
	100	·0326
	230	·0327
	255	·0327

VII

	Time	Dec.
	0	·0316
Liquid at	25	·0325
194·1	50	·0332
Tube 5	80	·0329
	100	·0328

Tables II, IV and VII are for temperatures below the critical point shown by the salient point on Figure 9. The following tables, VIII and IX are for still lower temperatures.

VIII

	Time	Dec.
	0	·0325
Liquid	20	·0310
at	45	·0287
192·5	70	·0290
	115	·0280
Tube 2	145	·0269
	175	·0285

IX.

Time	Dec.
0	·0272
25	·0277
80	·0255
140	·0265
170	·0261
205	·0251
250	·0266
290	·0261
325	·0259

CONCLUSIONS.

The foregoing results lead to the following conclusions:—

I. The logarithmic decrement of an oscillating cylinder suspended in the liquid side of the tube decreases with rising temperature, reaches a minimum near the critical temperature and then rises rapidly as the temperature is raised above this point. See Figure 11. For very high temperatures the increase is approximately proportional to the change in temperature.

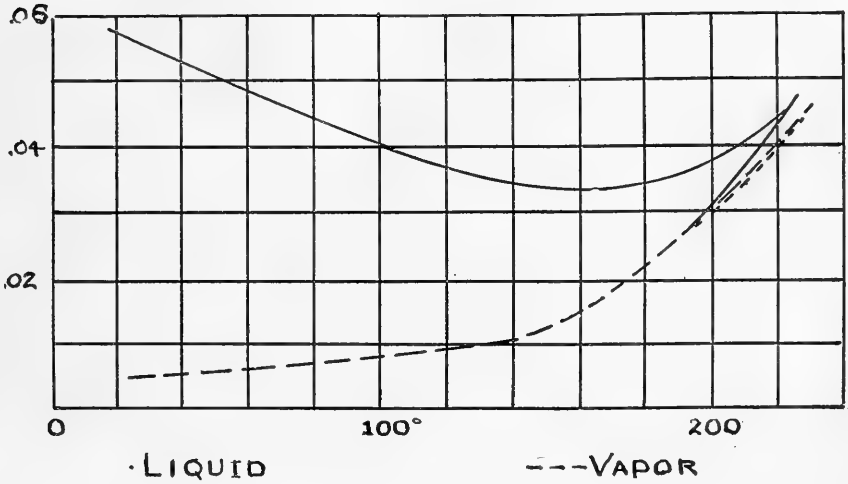

Fig. 11.

II. The decrement for the cylinder in the vapour side of the tube rises slowly as the temperature is raised above the room temperature, more rapidly as the critical temperature is approached, and still more rapidly above this point. (See Figure 11). The curves for liquid and vapour probably coincide at some temperature well above the critical temperature, which depends probably both on the amount of substance in the tube and the rapidity of the rise of temperature. This temperature has not been determined as it was not wise to run the risk of breaking the tubes.

III. Above the critical temperature the liquid side shows an increasing decrement with rising temperature and a decreasing decrement when the temperature is lowered again. The curve for falling temperature is always lower than that for rising temperature unless the meniscus vanishes at the bottom of the tube. If the tube is heated a second time from the critical temperature, the decrement is lowered again slightly. This last curve is apparently about where the curve for the vapour side of the tube would be.

IV. Above the critical temperature the vapour side of the tube shows an increase in decrement as the temperature rises and when the temperature falls again the decrement decreases. The curve for falling temperatures is slightly below that for rising temperatures. indicating a smaller decrement or a decrease due to the heating. The amount is not large *but there is certainly no increase.*

V. When the tube is maintained at constant temperature above and near the critical temperature, the liquid side shows a decrease in the logarithmic decrement. The same is true for constant temperature below the critical temperature. The limits for this change, if such exist, have not been determined.

VI. When the tube is maintained at constant temperature above and near the critical temperature the vapour side shows at first an increase in the decrement and then a decrease. Below the critical temperature the initial increase is uncertain.

VII. When the temperature is raised above the critical temperature and lowered again, the decrement for the liquid side decreases to a certain point and then the curve turns abruptly, changes its curvature and runs into the curve for rising temperature well below the critical temperature. The position of the abrupt change is at 194° as nearly as can be determined. We may call this the critical temperature.

VIII. If the temperature be raised to a higher point than in VII the curve for falling temperature is still lower and the point of abrupt change is lower and better defined but at the same temperature while the curve runs into the curve for rising temperature farther from the critical temperature.

Obviously this angle on the curve can be realized only with a tube filled so that it is completely full below the critical temperature, since in other cases when condensation takes place the cylinder will be immersed at different depths as the temperature falls. Of course this may be obviated by slightly heating one leg of the tube to cause the condensation to occur only in the leg in which the cylinder is hanging. But this would introduce great variation in the density which would not become equallized soon enough.

IX. Figure 8 seems to show that all of the above peculiarities disappear when the density of filling the tube is so small that the meniscus vanishes at the bottom of the tube at or near the critical temperature. This suggests that the changes in the decrement depend on the amount of substance in the tube. Study of Figure 5 shows that the change in the decrement on the vapour side of the tube is considerable, and Figure 9 indicates a much larger change. Here we are not dealing with the substance under exactly the same conditions, for there was liquid present in the arm of the tube under observation before the critical temperature was reached. But the liquid filled the tube at a temperature so far below the critical temperature that we may regard the tube as completely filled with a homogeneous fluid, at least homogeneous in the sense that the two branches are alike. Thus, the changes that occur in the branch of the tube under observation are the same as those occurring in all parts of the tube. This large change shown in Figure 9 indicates that the larger the amount of substance in the tube the greater is the change in the decrement produced by heatiug. In order to test this point directly, the tube of Figure 8 was opened and more liquid introduced. Unfortunately the tube exploded on heating and the cylinder was ruined.

X. When the temperature is raised to about 240° and lowered quickly to near the critical temperature and then held constant, there is an increase in the decrement when this temperature is above the critical temperature and also when it is below. The change seems to be more rapid below the critical temperature. The value which it reached after the lapse of time seems to be the same as it would reach when the tube is maintained at the same constant temperature on the initial rise.

DISCUSSION.

The effects noted in II and V may be due to diffusion of the denser part of the substance from the liquid side to the vapour side. It was pointed out by Gouy[1] and emphasized by Kuenen[2] that near the critical temperature where the isothermals on the Andrews' or pressure-volume diagram are nearly horizontal that a very slight increase in pressure causes a relatively great diminution in volume or a correspondingly great increase in density. So the weight of the overlying layers of the substance in the tube may cause abnormal density in the lower part of the tube which will not disappear except very slowly or by raising the temperature until the isothermals become steeper. Near the critical temperature then, the density on the liquid side may be abnormally great compared with that on the vapour side and heating to a much higher temperature may equalize the density so that the lower curve for falling temperatures in Figures 4, 6, 7, 8, and 9 might be explained. Also maintaining at constant temperature near the critical temperature may bring about this equalization and make an explanation of the liquid curve of Figure 10 possible. But it seems impossible that diffusion alone will account for this change, particularly when we study IV and VI.

[1] Gouy. Compt. rend. 115, 720, 1892.

[2] Kuenen loc. cit.

Here we find that there is no permanent increase in the decrement as there should be if diffusion were the only cause operating. Figure 2 shows a slight decrease in the decrement after the vapour has been heated to a high temperature and Figure 10 shows that the decrement increases at first and then decreases when the temperature is maintained constant. The initial increase in the latter case is due evidently to diffusion; but the latter decrease points to a permanent change of a different character, a change in the substance. This change may be brought about by raising the temperature or by protracted heating at constant temperature. Probably it occurs more rapidly at higher temperature.

Evidently, then, the curves for rising temperature, for the liquid side at least, are always too low, as the process above mentioned is going on all of the time during the heating. The values for falling temperatures are too high. Apparently maintaining at constant temperature on the initial rise results in a decrease in the decrement and on the fall gives an increase. Experimental results obtained thus far seem to indicate that at the same temperature the final results are the same. On the falling temperature curve we are evidently dealing with a substance which if not homogeneous is thoroughly mixed and diffusion does not obscure the result. Even below the critical temperature diffusion will not be important, as it is noticed that after raising to a high temperature condensation at the critical temperature occurs equally in both legs of the tube.

It will be evident from the foregoing that there are real changes in the nature of the substance (at least for these tubes) near the critical temperature, that these changes are slow near the critical temperature but progress as the time goes on. The change is not confined to the immediate region near the critical temperature but goes on at higher temperature. It seems that there is a sort of equilibrium for any temperature above the critical temperature, which condition is not reached instantly but after the lapse of considerable time. When the temperature is rising the decrement is constantly falling toward the equilibrium value, and when the temperature is falling the change is taking place in the reverse direction. The more the temperature is raised the lower is the value of the decrement when the temperature is falling and the farther it is from equilibrium at any temperature.

Study of the salient point on the curve for falling temperature (Figure 9) shows that there is a decided change at this temperature which we may call the critical temperature. Below this point return to equilibrium is more rapid but requires more time if the temperature was raised higher before the falling temperature readings were taken.

If we grant that the change in the decrement above the critical temperature is due in part to a change in the substance, to what shall we attribute it? The theories of Traube, de Heen, etc., seem to apply here even though their validity has been attacked by such weighty authorities. Apparently the objections raised are, that the anomalies observed by all of the experimenters whose work shows them are due either to the effects of gravity or the presence of impurities. We may grant the first for the liquid side of the tube at least; but we cannot do so for the vapour side, as there is no permanent increase in the viscosity in that side. Apparently the effect of impurities is to emphasize the effect of gravity, that is, to increase the time for the equalization of the densities. Also the value of the critical temperature would be changed. But when heated to 240° and then lowered again until condensation occurs we find the same amount of liquid in both legs of the tube, showing that we had identical substances in both legs. Also, we find a decrease in decrement occurring for the vapour side where there should have been an increase if the material had not been identical in the two legs of the tube.

If chemical change is responsible for the change in the viscosity we should expect to find it permanent and then we would have a different value if the cycle of readings around the critcial point be repeated; but we find no such difference. If chemical dissociation were the cause of the changes in viscosity observed, they should appear in Figure 8, where they are noticeably absent. Thus the objections to the classical theory seem to be sustained by the foregoing investigation, at least in its present stage. Further study is contemplated. Certainly the liquidogenique and gazogenique-theory furnishes the most reasonable explanation of all of these experimental results.

Apparently the change below the critical temperature is confined to a limited region near that temperature. Its lower limit seems to depend on the highest temperature reached before cooling, and is very near the critical temperature unless the substance has been heated well above the critical temperature. Thus we must conclude that the amount of this change at any distance from the critical temperature is very small indeed, so that at ordinary temperature the process of evaporation is not attended with this physical dissociation of the molecules.

In conclusion I have to express my thanks to the Rumford Committee of the American Academy of Arts and Sciences for financial assistance in carrying on this investigation.

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SECTION III

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On Osmosis in Soils.

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(Presented by Prof. H. T. BARNES).

(Read at May Meeting, 1915).

The results given in previous papers[1] indicate (1) that clay subsoil acts as a partial semi-permeable membrane when prepared as described below: (2) that water moves through the soil from points at which the soil solution has a low salt content to points at which it has a high salt content.

THE OBJECT OF THIS WORK.

The object of the work herein described was to apply many different tests to these phenomena in order to gain new evidence as to whether or not water does move through the soil from a weak soil solution toward a strong soil solution and whether or not this movement is due to osmosis.

Unless otherwise stated, the soil used in all these tests was prepared as follows: 30 g. of moist clay subsoil was placed in a shaker bottle with 150 c.c. of distilled water and 10 drops of strong ammonia. It was shaken for 2 hours and then boiled gently for half an hour to expel the ammonia.

This method of preparation was adopted after experiments had been made to determine (1) whether the soil should be shaken with ammonia or without; (2) the minimum effective quantity of ammonia; (3) the minimum effective time of shaking; (4) whether the soil mud should be boiled to expel ammonia.

In each experiment duplicate tubes were set up as shown in Fig. 1, and the soil solution was allowed to rise in the measuring tubes until the maximum pressures had developed.

[1] See papers listed at the end of this paper.

It was found that (1) the pressures were greater when the soil had been shaken with ammonia than when it had been shaken without ammonia; (2) the minimum effective quantity of ammonia was 10 drops with 30 g. of subsoil and 150 c.c. of water; (3) the minimum effective time of shaking was 2 hours; (4) greater pressures were obtained when the soil had been boiled to expel ammonia than when it had not been boiled.

A mechanical analysis of the clay subsoil gave the following results:

Clay......................	68·8%
Silt.......................	19·3%
Very fine sand............	11·9%
Fine sand................	0·0%
Coarse sand..............	0·0%

Part of the clay consisted of extremely fine particles which, on long standing in water, assumed a jelly-like appearance, that is, part of the clay was colloidal in nature.

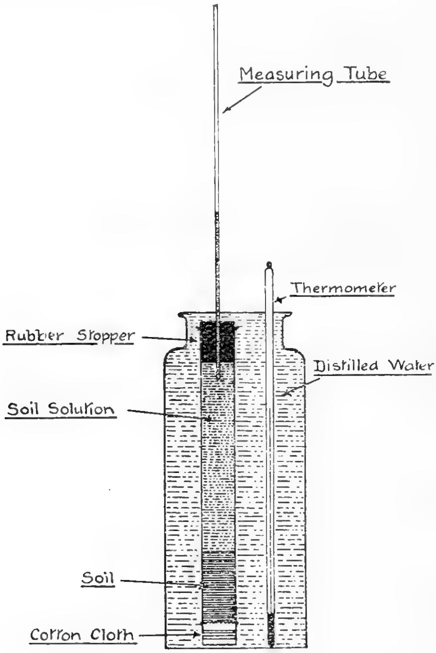


Fig. 1

HOW THE APPARATUS WAS SET UP.

The apparatus used in the first, third and fourth tests was arranged as shown in Fig. 1, that used in the remaining tests was arranged as shown in Fig. 2.

The soil mud from one shaker bottle was poured into two tubes, 1·4 cm. inside diameter and 15-20 cm. long, closed at the lower end with one layer of cotton cloth. The tubes were placed in cups of the centrifuge and the cups were filled with water to the level of the mud in the tubes. The centrifuge was run at top speed for about one-half hour to settle the soil. The liquid was decanted and more mud was added and settled. This was continued until the desired depth of soil was obtained.

The centrifuge made 1,300 revolutions per minute and the middle of the soil columns when settled was 25 cms. from the axis.

The liquid left in the tubes after the last settling was used as the soil solution. The tubes were fitted with measuring tubes, ·5–1·0 m.m. inside diameter and 45 cms. long, and were then rinsed in distilled water and placed in wide mouth bottles filled with distilled water. The water in the bottles was changed daily.

When the apparatus was arranged as in Fig. 1, the bottles were kept full to the brim, and the liquid in the measuring tubes was, at the start, made to coincide with the water level in the bottle.

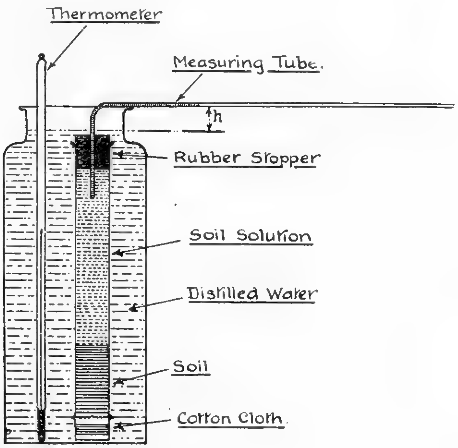


Fig 2

When the apparatus was arranged as shown in Fig. 2, the water level in the bottles was kept at all times 1·5–2 cm. below the horizontal part of the measuring tubes. This distance (marked "h" on Fig. 2) was made greater than the capillary lift of the measuring tubes. This was done to eliminate the flow which might be produced by the capillary lift of the tubes.

FIRST TEST. IS THE FINAL PRESSURE CONSTANT UNDER GIVEN CONDITIONS?

The theory on which we have been working is as follows: It is possible (1) that soils act as partial semi-permeable membranes (2) that water moves through the soil by osmosis.

If this theory is true and if we have tubes set up as in Fig. 1, the final pressure produced should be the same whether the solution in the measuring tubes is started at the water level and allowed to rise or is started at the top of the measuring tubes and allowed to fall. This, on trial, proved to be the case.

Four tubes were set up as in Fig. 1. The liquid in the four measuring tubes was started, first at zero; next at a pressure of 42·4 cms. of water and lastly again at zero. The final pressures were obtained in each case in about two weeks but the tubes were allowed to stand one week longer to make sure.

Table I.

Giving the Final Pressure in Centimetres of Water, obtained in each Tube.

	Tube 1	Tube 2	Tube 3	Tube 4	Temp.
Started at zero...............	13·2	12·1	9·7	14	15·8°C.
Started at 42·4 cm...........	13·8	13·2	9·5	15	17·2°C.
Started at zero...............	17·6	16·0	10·9	15·7	17·2°C.

Conclusion. The final pressure is approximately constant.

SECOND TEST. IS A FLOW PRODUCED?

If the soil does act as a semi-permeable membrane and if the water does move through the soil toward a solution of higher salt content, then if the apparatus is arranged as in Fig. 2, there should be a flow of the solution along the horizontal measuring tubes, and since with the apparatus arranged in this way the maximum pressure cannot be produced, the flow should continue as long as the solution in the tubes has a higher salt content than the water outside, unless the soil is altered by the passage of water through it. The results indicate that this is the case.

The four tubes used in the first test were arranged as shown in Fig. 2, the soil solutions being retained in the tubes. Daily observations of the flow were made for a period of two months. At the end of that time the flow was nearly as strong as at the beginning. The observations were discontinued because another test had been started to determine the duration of the flow (see the fifth test). Table 2 gives the average daily flow for the first five days and for the last five days of the two months.

TABLE 2.

GIVING THE DAILY FLOW, IN LINEAR CENTIMETRES, AT THE BEGINNING AND AT THE END OF TWO MONTHS.

	Tube 1	Tube 2	Tube 3	Tube 4
At the beginning..................	1·1	1·76	·88	1·62
At the end..........................	0·92	1·68	·9	1·3

Conclusion (1) A flow is produced.
(2) It promises to continue for a long time.

THIRD TEST. IS THE MOVEMENT DUE TO COLLOIDAL SWELLING?

We have tried to discover causes, other than osmosis, which might bring about this movement. It occurred to us that possibly the water does not move through the soil but that the colloidal clay absorbs soil solution, swells, and thus produces a movement.

This did not seem probable in the light of the results obtained in the first and second tests; nevertheless we decided to investigate it as follows:

Four tubes were set up in the usual way except that solid rubber stoppers were inserted in the bottoms of the tubes in place of the layer of cotton cloth. Thus no movement of water through the soil could take place. If, then, any pressure developed it could not be due to osmosis but must be due to some other cause such as colloidal swelling.

The four tubes were started with a pressure of about one-half the pressure which might be expected if the tubes were set up in the regular way. No increase in pressure occurred and, on the contrary, the liquid in the measuring tubes fell to zero in two weeks.

TABLE 3.

GIVING THE PRESSURES IN CENTIMETRES OF WATER AT THE BEGINNING AND AT THE END OF THE TEST.

	Tube 1	Tube 2	Tube 3	Tube 4
At the beginning..................	6·8	8·2	7·4	7·5
At the end........................	0·8	−0·3	−2·0	−2·0

When tubes are set up with cotton cloth in the regular way the maximum pressure remains constant for months if the water is changed daily and if the temperature remains constant.

Conclusion. Since in this test the pressure did not increase and did gradually decrease it seems clear that the cause of the usual movement is not colloidal swelling.

FOURTH TEST. CAN THE MOVEMENT BE REVERSED?

If the movement is brought about by osmosis, then it should be possible to reverse the movement by placing the stronger solution outside the tube; this, on trial, proved to be the case. Two tubes were set up as in Fig. 1, with soil solution in the tubes. The following tests were made (1) the tubes were placed in distilled water until some pressure had developed; (2) they were then placed in a soil solution stronger than the solution in the tubes, the pressures fell to zero; (3) they were again placed in distilled water.

TABLE 4.

GIVING THE PRESSURES IN CENTIMETRES OF WATER.

	Tube 1	Tube 2	Time
In distilled water...........................	4·8	3·3	5 days
In strong soil solution......................	0	0	5 days
In distilled water...........................	7·5	6·2	9 days

Electrical resistance at 20°C.; of the solution in tube 1, 1,600 ohms in tube 2, 1,700 ohms; of the strong soil solution 550 ohms; of ·02N KC1 solution 350 ohms.

Conclusion. The movement can be reversed and this indicates that it is produced by osmosis.

FIFTH TEST. HOW LONG WILL THE FLOW CONTINUE?

To determine how long the flow would continue, two tubes were set up as shown in Fig. 2, and daily observations on the flow were made. The test was started on Jan. 15, 1915, and at this date, May 15, 1915, the average daily flow is almost as great as it was at the beginning. Table 5 gives: the average daily flow for each 10 day period; the total flow to date in linear centimetres; the total flow in c.c.; the total flow in c.c. per square centimetre of soil surface.

Measurement of tube 1: depth of soil 6·5 cm.; inside diameter 1·4 cm.; area of cross section 1·54 sq. cm.; measuring tube, 1 linear centimetre = ·038 c.c.; electrical resistance of the solution 2,700 ohms at 16°C.

Measurements of tube 2: depth of soil 6·6 cm; inside diameter 1·5 cm.; area of cross-section 1·77 sq. cm.; measuring tube, 1 linear centimetre = ·0385 c.c.; electrical resistance of the solution 2,700 ohms at 16°C.

Electrical resistance of ·02N KCl with the same plates 380 ohms at 18°. Electrical resistance of distilled water 50,000 ohms.

TABLE 5.

GIVING THE DAILY FLOW IN LINEAR CENTIMETRES, THE TOTAL FLOW TO DATE, IN CM. AND C.C. AND THE TOTAL FLOW TO DATE IN C.C. PER SQ. CM.

	Tube 1	Tube 2
1st 10 days, daily flow	1·19 cm.	·94 c.m.
2nd " " " "	1·14 "	1·09 "
3rd " " " "	1·35 "	1·05 "
4th " " " "	1·21 "	1·08 "
5th " " " "	·83 "	·90 "
6th " " " "	1·04 "	·97 "
7th " " " "	1·22 "	·96 "
8th " " " "	1·17 "	·91 "
9th " " " "	1·31 "	1·13 "
10th " " " "	1·23 "	0·93 "
11th " " " "	1·11 "	0·93 "
12th " " " "	1·1 "	0·88 "
Total flow to date	139· "	117·7 "
Total flow to date	5·28 c.c.	4·53 c.c.
Total flow per sq. cm	3·43 c.c.	2·55 c.c.

Conclusion. It appears that the flow will continue for a long time.

SIXTH TEST. DOES THE FLOW VARY WITH CHANGE OF TEMPERATURE?

If the flow is an osmotic phenomenon, an increase in temperature should cause an increase in flow for the following reasons (1) the osmotic pressure of the soil solution would increase with increase of temperature; (2) the concentration of the soil solution would probably increase with increase of temperature; (3) the viscosity of the water would be decreased with increase of temperature and thus it should move through the soil more rapidly.

To determine how the flow varies with change of temperature, two tubes were set up as shown in Fig. 2, and the daily flow was measured at room temperature in the laboratory and at higher temperatures in an electric oven. The oven could be regulated to within 1 degree.

TABLE 6.

GIVING THE AVERAGE DAILY FLOW IN LINEAR CENTIMETRES AT DIFFERENT TEMPERATURES AND THE VISCOSITY OF WATER AT THESE TEMPERATURES.

Temp.	Tube 1	Tube 2	Duration	Viscosity of water
16·8°C.	3·35 cm.	2·48 cm.	16 days	·001100
35°C.	4·53 "	2·17 "	15 "	·000720
45°C.	6·95 "	3·10 "	11 "	·000597
55°C.	8·45 "	5·65 "	2½ "	·000506
17·3°C.	3·20 "	2·55 "	2½ "	

TABLE 7.

GIVING THE RATIOS OF THE DAILY FLOW AND THE RATIOS OF THE FLUIDITY OF WATER AT THESE TEMPERATURES.

Temp.	Tube 1	Tube 2	Fluidity
16·8°C.	1·	1·	1·
35°C.	1·35	0·87	1·5
45°C.	2·07	1·25	1·8
58°C.	2·52	2·27	2·17

Conclusion. (1) The rate of flow increases with increase of temperature. (2) The increase is probably proportional to the increase in fluidity of the water and to the increase in osmotic pressure.

SEVENTH TEST. HOW DOES THE FLOW VARY WITH CHANGES IN THE CONCENTRATION OF THE SOIL SOLUTION?

To determine this, two tubes were set up as in Fig. 2. The tubes were first filled with a strong soil solution and the flow was measured. The tubes were then emptied and filled with the soil solution diluted to one-half and the flow was measured. This was continued until the solution had been diluted to one sixty-fourth of its first strength. The last experiment was made with distilled water in the tubes. The electrical resistance of the solution was taken before and after each experiment. The readings are corrected for changes in temperature during the flow.

TABLE 8.

GIVING THE FLOW IN LINEAR CENTIMETRES PER DAY AND THE RESISTANCE OF THE SOIL SOLUTION AT THE BEGINNING AND END OF EACH EXPERIMENT.

Solution		Tube 1		Tube 2		Temp.
Strength	Elec. Res. beginning	Flow	Elec. Res. end	Flow	Elec. Res. end	
1	160 ohms	3·7 c.m	150 ohms	4·7 cm.	150 ohms	21·3°
1/2	295 "	2·8 "	255 "	3·0 "	260 "	22·4°
1/4	590 "	2·6 "	530 "	2·7 "	540 "	20·°
1/8	1,050 "	2·2 "	980 "	2·3 "	980 "	18·6°
1/16	1,950 "	2·3 "	1,875 "	2·25 "	1,875 "	17·2°
1/32	3,700 "	2·45 "	3,100 "	2·25 "	3,300 "	19·7°
1/64	6,200 "	2·35 "	5,700 "	2·1 "	5,500 "	18·2°
Distilled water.......	25,000 "	1·95 "	7,000 "	1·9 "	7,000 "	17·6°

Elec. res. of ·02N. KCl at 23°C. 350 ohms.

Conclusions. (1) The flow decreases with decrease in concentration of the soil solution. (2) The resistance of the soil solutions is always less at the end of an experiment than at the beginning. This indicates that the water moves through the soil towards the solution and in so doing carries soluble salts from the soil to the solution.

In this connection it must be stated that the electrical resistances were taken near the top of the tubes in all cases except when distilled water was used. In this case it was taken near the bottom of the tube. Had the other resistances been taken at this point it is probable that they would have been lower.

(3) At low concentrations the flow decreases very slowly with decreasing concentration and there is still a marked flow when distilled water is used instead of soil solution. This was investigated in the eighth test.

EIGHTH TEST. WHY IS THERE A FLOW WHEN DISTILLED WATER IS USED AS THE SOLUTION?

It seemed remarkable that a flow should take place with distilled water inside and outside the tube. The following explanation occurred to us and when tested seemed to be correct.

The explanation is as follows. That part of the distilled water in the tube which is in contact with the soil forms a soil solution and this solution on account of its density remains in contact with the soil. That part of the distilled water in the bottle which is in contact with the soil forms a solution and this solution on account of its density sinks to the bottom of the bottle and is replaced by fresh distilled water. Thus the liquid just above the soil is a soil solution and the liquid just beneath the soil is nearly pure distilled water, and the flow takes place from the water to the solution.

To test this explanation we filled the tubes, used in the seventh test, with fresh distilled water and placed them in small test tubes containing distilled water. The bottoms of the tubes were almost in contact with the bottoms of the test tubes.

Our reasoning was that if the solutions inside and outside the tube had the same concentration there would be no flow, but if they had different concentration there would be a flow in the direction of the stronger solution. In the experiment the outside solutions became more concentrated than the inside solutions and the flow was toward the outer solutions.

TABLE 9.

GIVING THE NEGATIVE FLOW IN EACH TUBE IN LINEAR CENTIMETRES PER DAY AND THE ELECTRICAL RESISTANCES OF THE SOLUTION.

	Tube 1	Tube 2
Flow in cm. per day	−0·15	−2·3
Elec. Res. of inside solution	25,000	55,000
Elec. Res. of outside solution	18,000	25,000

It will be noticed that the outer liquids had the greater concentration and that the flow was negative in each case. It will be noticed also that the inside liquids had a much higher resistance in this test than they had when distilled water was used in the seventh test. This indicates that in the seventh test the water moved up and carried salts for the soil to the inside solutions; but in this test the water moved down through the soil and the soluble salts were carried from the soil to the outer solutions.

NINTH TEST. DOES CLAY SUBSOIL IN ITS NATURAL CONDITION ACT AS A SEMI-PERMEABLE MEMBRANE?

In the former tests the subsoil was settled in an artificial manner, the following experiments were made with the subsoil in a more natural condition.

The moist clay subsoil was broken into small lumps and was rammed into the bottom of tubes similar to those used above until the depth of soil was about 2·5 cm.

Four such tubes were set up as in Fig. 2. Tube (1) was filled with a strong sugar solution (100 g. granulated sugar in 100 c.c. of water) ; tube (2) was filled with a saturated K_2SO_4 solution; tube (3) was filled with a medium strong soil solution; and tube (4) was filled with distilled water.

In tube (1) (sugar solution) a flow started at once and still continues (9 days). In tube (2) (K_2SO_4) a negative flow took place for 4 days and since then the flow has been positive (5 days). In tube (3) (soil solution) a negative flow occurred for 6 days and since then the flow has been positive (3 days). In tube (4) (distilled water) a very strong negative flow occurred at first and it still continues but it is gradually decreasing.

We believe that the negative flow was caused by absorption and we expect the distilled water tube to give a positive flow when the soil has become saturated. Whether it will do so remains to be seen.

Two tubes were prepared in the same way and filled with the strong sugar solution. They were then fitted with open arm mercury manometers and placed in distilled water. Strong pressures have developed in each case.

TABLE 10.

GIVING THE PRESSURES IN CENTIMETRES OF MERCURY AND THE DURATION OF THE EXPERIMENTS, TO DATE.

	Cms. Hg.	Duration
Tube 1	18·3	7 days
Tube 2	7·7	4 days

GENERAL CONCLUSION.

The results obtained in these nine tests show that, whatever the cause may be, water does move through the soil from a weak soil solution toward a strong soil solution.

The results agree with the theory that this movement is caused by osmosis.

1. C. J. LYNDE. On Osmosis in Soils. Soils act as Semi-Permeable Membranes. Journal of Physical Chemistry, Vol. 16, No. 9, page 750, December (1912), and Proceedings of the American Society of Agronomy, Vol 4, 1912.

C. J. LYNDE and F. W. BATES. On Osmosis in Soils. Journal of Physical Chemistry, Vol. 16, No. 9, page 766, December (1912), and Proceedings of the American Society of Agronomy, Vol. 4, p. 108, 1912.

C. J. LYNDE and H. A. DUPRÉ. On Osmosis in Soils. Transactions of the Royal Society of Canada, Vol. VII, Third Series (1913) and Journal of the American Society of Agronomy, Vol. 5, No. 2, p. 102 (1913).

C. J. LYNDE and J. V. DUPRÉ. On Osmosis in Soils. Transactions of the Royal Society of Canada, Third Series, Vol. VIII (1914), and Journal of the American Society of Agronomy Vol. 7, No. 1, p. 15, 1915.

The Preparation of Metallic Vanadium.

By R. EDSON and D. McINTOSH, F.R.S.C.

(Read May Meeting, 1915).

The element vanadium, although known in the combined state since 1801, is extremely difficult to isolate. Roscoe obtained the pure metal in 1867, and proved that the material thought by Berzelius to be metal, was actually the nitride. In the last few years, due to its importance as a constituent of various alloys, large amounts of impure vanadium have been made. In the electric furnace, reduction of the pentoxide gives an alloy high in carbon; made by the Goldchmidt process, the regulus contains appreciable quantities of aluminium and the dioxide; better results are obtained by substituting "mischmetall"—a mixture of the rare earth metals—for aluminium; but even here the metal is impure. Electro-chemical methods, although attempted, yield but indifferent results.

Roscoe reduced the dichloride of vanadium to the metal by heating in a stream of hydrogen. This process, while it appears simple, presents many difficulties. Vanadium at a red heat combines with oxygen or nitrogen with the greatest ease; hence the utmost precaution must be taken to exclude all air and moisture, while the dichloride is unstable and difficult to obtain in any quantity. Moreover, the process is a long one, requiring 80 hours to produce a gram of metal. Vanadium prepared in this way is a crystalline powder with a silver-white lustre.

De Lodyguine, in U.S. patents 575,002 and 575,668, has shown that tungsten, chromium, etc., may be deposited from a volatile salt on a "fillet" of platinum or carbon heated by the electric current. Dr. F. M. G. Johnson and one of us have investigated this method, and have found it most satisfactory for the preparation of the metals mentioned by de Lodyguine, and for boron. Metallic boron—so carefully investigated by Dr. Weintraub—can easily be deposited on a platinum or tungsten wire, and its distinctive property, the change in electrical resistance with temperature, easily demonstrated. We have applied this method to the preparation of vanadium.

The first problem was the preparation of a salt of vanadium which would be fairly volatile and could be easily made in quantity. The compound finally found most satisfactory was vanadyl trichloride, $VOCl_3$. This salt is readily prepared by heating a mixture of the pentoxide and charcoal in a stream of chlorine, and is usually reddish, due to small quantities of the tetrachloride. This impurity may be removed by rectification with sodium in a current of carbon dioxide, but for our purpose this was not essential. Pure vanadyl chloride is bright lemon-yellow coloured liquid boiling at 126°C. On exposure to moist air it decomposes quickly.

In depositing the metal, a convenient amount of the chloride is placed in the flask E, shown in Figure 1, with a stopper carrying two

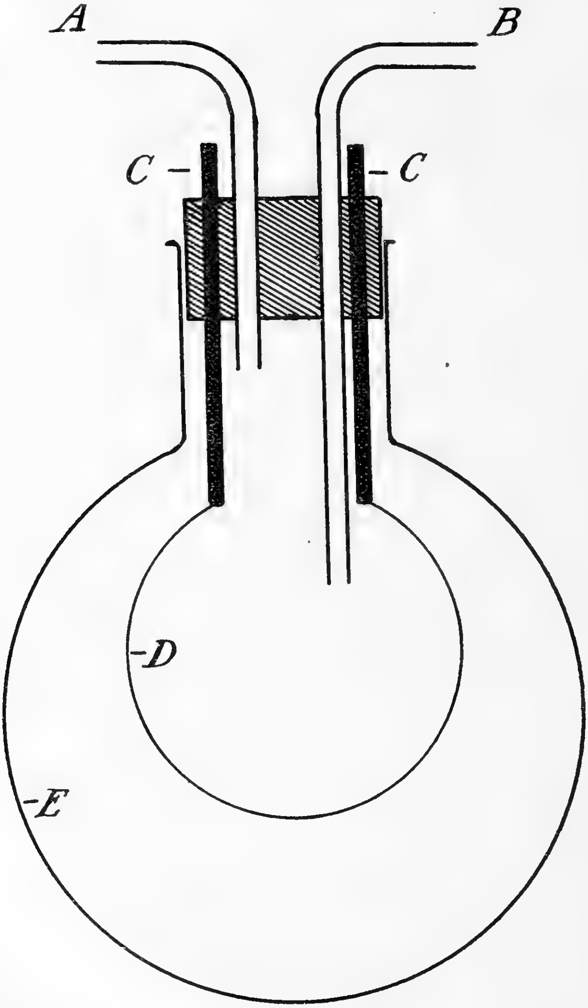


Fig. 1.

tubes A and B, and two heavy copper leads holding the platinum "fillet" D. An air pump is connected to A, and dry hydrogen is admitted slowly through B. The "fillet" is made to glow by passing a current controlled by resistance through it. The vanadium deposits smoothly on the platinum as a silvery-grey coating. The wire before and after an experiment is shown in Fig. 2.

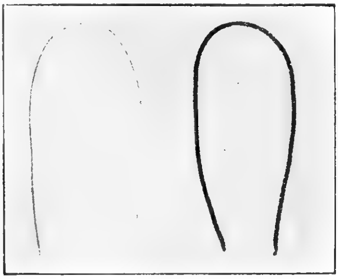


Fig. 2.

The experiment may be carried out either in vacuo or in an atmosphere of hydrogen at low pressure. As soon as the filament reaches a white heat the deposition begins and can be continued until the wire burns out. The vanadyl chloride passing through A can be condensed in a tube cooled by solid carbon dioxide and ether.

This method, while inapplicable for the preparation of vanadium on a large scale, may be used with advantage in the laboratory, or for demonstration in the lecture room.

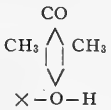
McGill University, May 1915.

Bromocamphorsulphonic Acid and Oxonium Compounds.

By D. McINTOSH, F.R.S.C.

(Read May Meeting, 1915.)

It has been shown that the halogen hydrides unite with organic bodies containing oxygen, such as ethyl ether, to give compounds of the type $C_4H_{10}O.HX$. While the constitutions of the complexes are not fixed with certainty, it seems probable that the oxygen functions as a tetravalent element, and that the compound has the formula $C_4H_{10}O<\begin{smallmatrix}H\\X\end{smallmatrix}$. Methyl ethyl ether gives the analogous compound $\begin{smallmatrix}CH_3\\C_2H_5\end{smallmatrix}>O<\begin{smallmatrix}H\\X\end{smallmatrix}$. Here the oxygen is asymmetric, and it should be possible to split the compound into its right and left optically active isomers. Unfortunately the well known methods for accomplishing such a separation are not applicable, as the compound melts at a low temperature and is decomposed by water. I have attempted to separate the isomers by introducing a single crystal into a supercooled solution of the ether at low temperature. An examination of the separated crystals in solution in the ether at low temperature in a polariscope did not show rotation.

Oxonium compounds were made by Collie and Tickle from dimethyl pyrone and the halogen acids and have been examined by many chemists. These compounds are more stable than those previously mentioned and are not completely decomposed by water. The formula given to them is , and complexes may be made with two or four molecules of acid. I regard these compounds as molecular aggregations i.e., salts with acid of crystallization, although Kendall and others deduce evidence for atomic combination.

In the hopes of obtaining more stable compounds with an asymmetric oxygen atom, I have attempted to produce oxonium compounds with a solid acid; and to facilitate the separation of the isomers, an optically active acid was used.

The substance most suitable for this purpose seems to be bromocamphorsulphonic acid; for Walden has shown it to be a strong acid in aqueous or alcoholic solutions.

When crystallized from water bromocamphorsulphonic acid contains one molecule of water. This was removed by keeping the acid in a vacuum of 0·01 mm. for several days, and this material, shown by analysis to be anhydrous, was used in the experiments.

Unfortunately there are no compounds with the alcohols or ethers analogous to those formed by the halogen hydrides. The acid is but sparingly soluble in ether and crystallizes without ether of combination. It is very soluble in alcohol, but shows no evidence of combination.

McGill University,
Montreal, April, 1915.

Crushing Strength of Ice.

BY PROFESSORS H. T. BARNES, F.R.S.C., AND H. M. MACKAY.

(Read May Meeting, 1915.)

In a paper which one of the authors (H. T. B.) had the honour to present before Section 3 of the Royal Society last year, the crushing strength of ice was given as 363 lbs. per square inch. Efforts were made to determine any difference in the crushing strength when the pressure was applied both parallel and at right angles to the main axis of the block. Comparatively small blocks were used in these tests of approximately 6 inches, but no important difference could be determined in the ultimate failure of the blocks, when yielding in these two directions.

It was stated that the blocks were heard to yield to the pressure at approximately one-half the final crushing strength.

In order to study the strength of larger ice blocks, one of the authors (H.M.M.) placed the facilities of the McGill Testing Laboratory at our disposal. In this laboratory, a large Emery testing machine gave us ample opportunity of testing blocks up to 14 inches square.

Through the kindness of Mr. Meldrum, President, and Mr. Becket, General Manager of the City Ice Company, some great blocks of clear St. Lawrence River ice were specially cut and supplied for the tests.

It was hoped to determine the effect of temperature on the strength of the ice, and the blocks were placed in storage when the air temperature was around —20°F.; but owing to the change in weather conditions, which came shortly after, it was impossible to do anything in that direction. It is hoped that further tests can be made in this important matter, under more favourable circumstances.

We think it worth while to record the results of our winter tests, although we were able to examine only three of the large blocks,

The details of these tests are given at the end of this paper.

It will be seen that two of these blocks yielded at pressures much under those of last year. This is probably due to faults in the blocks; for it is exceedingly difficult to obtain such large blocks free from them. The third block behaved much better, and ultimately burst at 378 pounds, which is in very good agreement with the tests made last year.

CONCLUSIONS.

It appears to us in consideration of all the tests, that the crushing strength of ice shows considerable variation depending on the physical condition of the ice. In the larger blocks the strength is likely to be less owing to the greater probability of the existence of faults. Very small blocks will probably show much greater pressures.

Results as high as 1,000 pounds per square inch have been given by some observers; but we believe such large pressures are obtained only on small blocks from ½ to 2 inches.

In computing the value of the crushing strength for use as a factor in engineering construction, we see no reason at present to change the figure already accepted by many Engineers, i.e., 400 lbs. per square inch.

Ice Crushing Tests, March 5th, 1915.

Block No. 1. Dimensions as in Fig. 1.

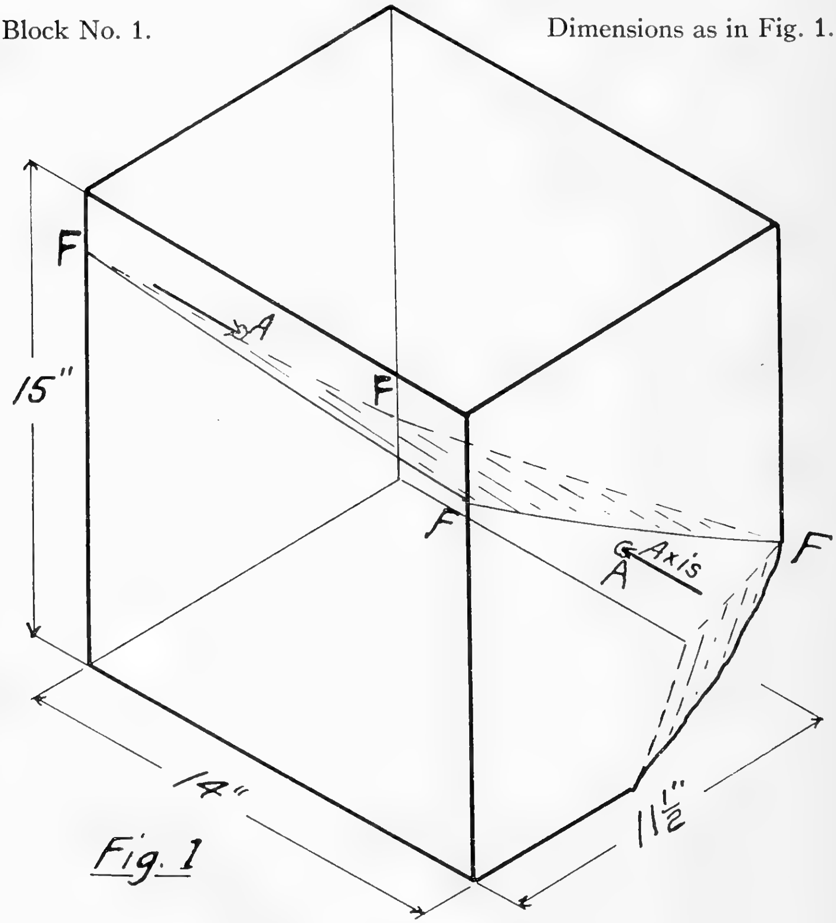


Fig. 1

Axis of Block A A—horizontal.

Axis of Load, vertical.

A fault extended across the block as shown by the slightly warped surface F F F F. The bearing plates were chilled before the block was placed in the testing machine.

Log of Test.

2,400 lbs. slight cracking.
3,200 lbs. continued cracking.
12,000 lbs. vertical crack top to bottom.
25,000 lbs. ultimate load.

$$\text{Ultimate strength} = \frac{25{,}000}{14 \times 11\cdot5} = 161 \text{ lbs. per sq. inch.}$$

Block No. 1 splits into prisms and wedges as shown in Fig. 2.

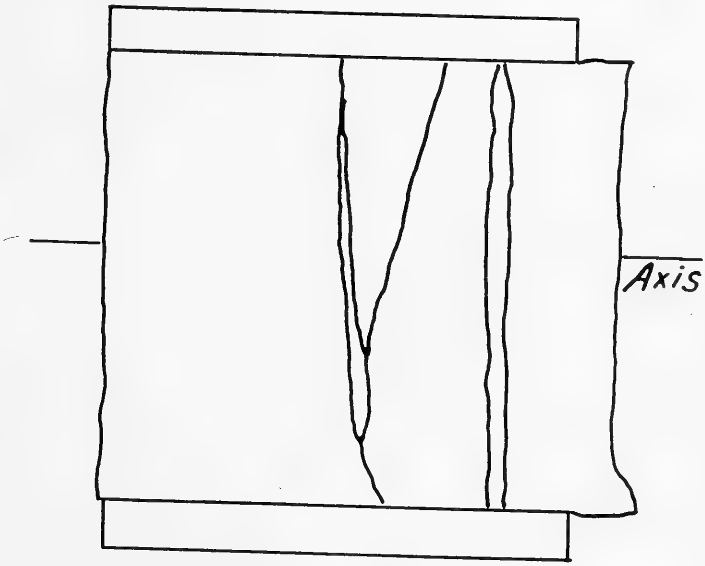


Fig. 2.

Block No. 2.

Dimensions as shown in Fig. 3

Block tested with axis vertical. This block had a fault as indicated by surface F F F F.

Log of Test.

5,000 lbs. Slight crack.
9,700 lbs. Vertical crack—top to bottom.
13,200 lbs. Block rotation about vertical axis; the load was released, and plates were readjusted.
19,400 lbs. Ultimate load. Block failed by splitting up vertically.

Ultimate strength $\frac{19{,}400}{12 \times 15} = 108$ lbs. per sq. inch.

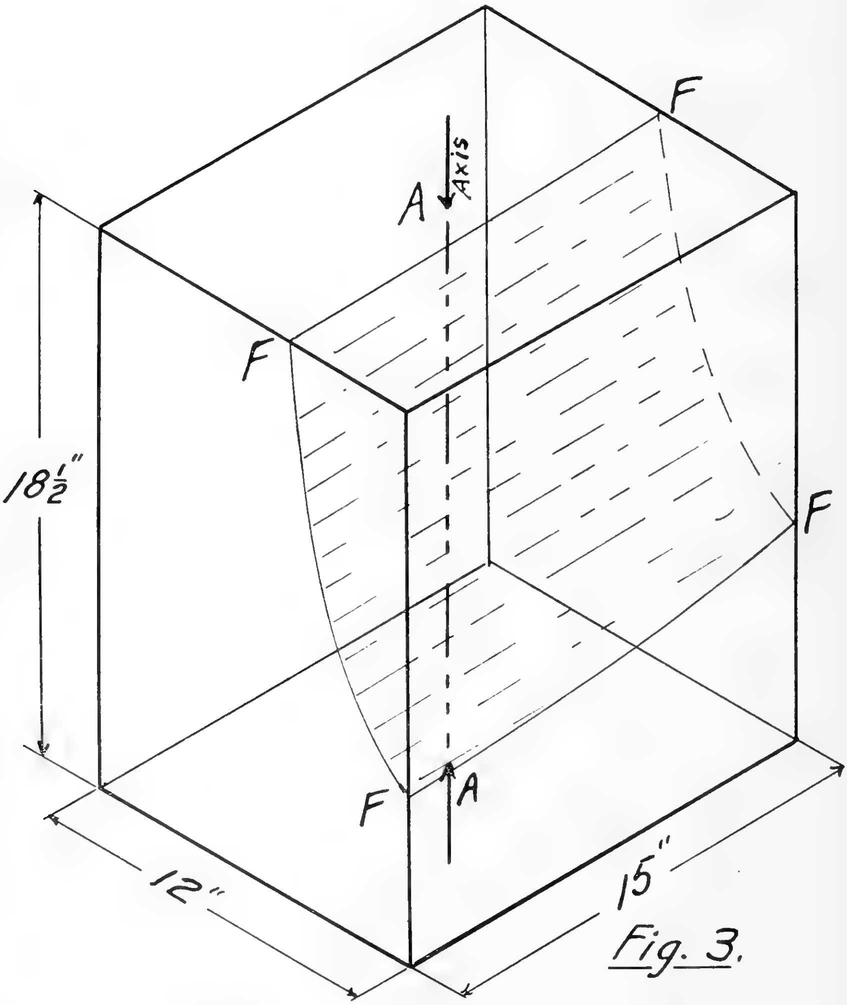


Fig. 3.

Block No. 3.

Dimensions as shown in Fig 4.

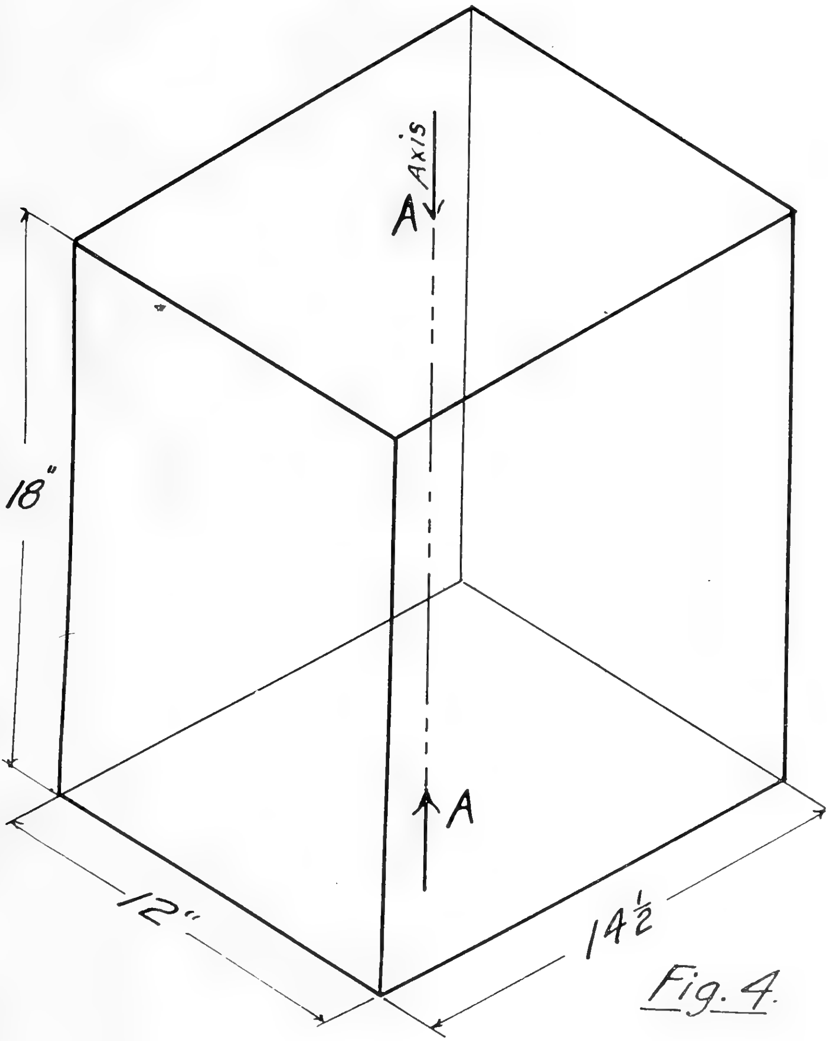


Fig. 4.

This block was perfect and without faults. Tested with axis A A. vertical.

6,000 lbs. First crack—at edge of bearing plate, where ice projected beyond plate.

9,000 lbs. Straight vertical lines showing.
15,400 lbs. First significant vertical crack.
65,500 lbs. Ultimate load.

$$\text{Ultimate strength} = \frac{65{,}500}{12 \times 14{\cdot}5} = 376 \text{ lbs. per sq. inch.}$$

Before breaking, a considerable distortion in shape was apparent, as shown in Fig. 5.

N.B. Temp. of storage —2°C.
Temp. of Laboratory 20°C. (approx.).

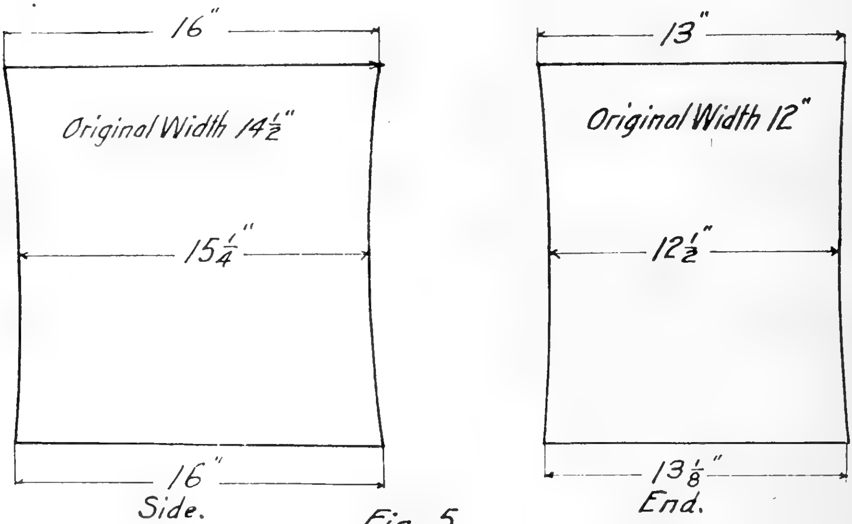


Fig. 5

On the Separation and Determination of Nickel and Cobalt.

By T. L. WALKER, University of Toronto.

Presented by PROF. W. H. ELLIS, F.R.S.C.

(Read May Meeting, 1915).

I. THE RED LEAD SEPARATION.

In the analysis of ores and metallurgical products containing nickel, the separation of this metal from iron has always constituted one of the most tedious operations. In general the iron has been separated by means of sodium acetate but much experience is necessary to secure a quick filtering precipitate which can be easily washed. In 1890 when engaged as chemist with Messrs. H. H. Vivian & Co., at the Murray Mine, Sudbury, Ontario, I was advised by Alfred Merry, one of the directors of the company to separate the iron by means of red lead—Pb_3O_4. In his opinion this method should be employed only for such analyses as did not require the highest degree of accuracy. It had been long employed in the laboratories of this company in Swansea and was communicated to me as a secret method devised by Mr. Merry himself and used in their works alone. Some years later at my request Mr. Merry gave me permission to make this method generally known.

So far as I am aware this method of separating iron from nickel and cobalt has never been published and it appeared to me desirable to determine its accuracy and the best conditions for operation with a view to giving it wider publicity. The results incorporated in this paper have been obtained from a series of experiments carried on during the past winter.

To a hot solution containing iron, nickel, cobalt, copper and lead as chlorides, add a few drops of hydrogen peroxide to change all the iron to the ferric condition. Nearly neutralise by carefully adding sodic carbonate and then gradually red lead while boiling in a flask. It is necessary to continuously agitate the flask. Chlorine is evolved with the precipitation of lead peroxide and ferric hydroxide. The red lead should be added to excess as shewn by the distinct red colour of the heavy precipitate. The separation of the iron is complete in a few minutes. The precipitate is heavy and granular. Filter and wash by decantation and finally bring the major part on to the filter, washing with hot water. From the filtrate the lead and other metals of that group may be separated by sulphuretted hydrogen, after which the filtrate is concentrated to 100c.c by boiling. Finally add three cubic centimetres of strong sulphuric acid and 30c.c of strong ammonia and deposit the nickel and cobalt by electrolysis, using a revolving cathode with a current of 5 amperes and 5 volts. The precipitation is complete in half an hour.

Details.

I.

Separation of Iron and Nickel Chlorides by Pb_3O_4.

Ni Present	Fe Present	Ni Found	Yield
·0958 gms.	·0506 gms.	·0956 gms.	99·79%
·0958 gms.	·5060 gms.	·0953 gms.	99·47%
·0958 gms.	·5060 gms.	·0952 gms.	99·37%

II.

Separation of Iron and Cobalt Chlorides I and II by Pb_3O_4; III by PbO.

	Co Present	Fe Present	Co Found	Yield
I	·1286 gms.	·1012 gms.	·1149 gms.	89·35%
II	·1286 gms	·1012 gms.	·1153 gms.	89·65%
III	·1286 gms.	·1012 gms.	·1189 gms.	92·47%

From the above results it is apparent that:

1. Nickel and Iron as chlorides can be satisfactorily separated by adding Pb_3O_4 to the nearly neutral solution and boiling.
2. Under similar treatment there is a loss of about ten per cent when this method of separation is applied to chlorides of Cobalt and Iron.
3. The separation of Cobalt and Iron by means of litharge is scarcely more complete than that obtained by using red lead.

The separation of nickel from iron by means of litharge was first suggested by Field.[1] It appears from the above experiments that litharge is as unsatisfactory as red lead for the cobalt iron separation. The chief advantage of red lead as against litharge consists

[1]Chemical News Vol. I, page 5, 1859.

in the fact that with the former oxide the precipitate obtained is much heavier so that more speed can be attained in filtering and washing.

II. NEUMANN'S SEPARATION.

Neumann has suggested[1] that the nickel in steel and matte may be satisfactorily determined by precipitating the iron as ferric hydroxide by means of ammonia, boiling, diluting to a definite volume and filtering off from this solution a definite proportion from which to plate out the nickel content. Following his conditions I have made a number of experiments which prove that the results are very variable and always too low to have any scientific value. I have obtained similar results by using other reagents to precipitate the iron; but in all cases it was found that the nickel results were low.

DETAILS.

III.

Precipitation of Iron from Sulphates.

Reagent	Ni Present	Fe Present	Ni Found	Yield
NH_4OH	·0589 gms.	·0506 gms.	·0522 gms.	88·63%
NH_4OH	·0589 gms.	·0506 gms.	·0529 gms.	89·82%
NH_4OH	·0589 gms.	·0506 gms.	·0519 gms.	88·10%
$NH_4C_2H_3O_2$	·0589 gms.	·0506 gms.	·0559 gms.	94·91%

DETAILS.

IV

Precipitation of Iron from Chlorides.

Reagent	Ni Present	Fe Present	Ni Found	Yield
$NH_4C_2H_3O_2$	·0958 gms.	·484 gms.	·0884 gms.	92·27%
$NH_4C_2H_3O_2$	·0958 gms.	·0484 gms.	·0864 gms.	90·10%
$NaC_2H_3O_2$	·0958 gms.	·0484 gms.	·0806 gms.	84·13%
$NaC_2H_3O_2$	·0958 gms.	·0484 gms.	·0904 gms.	94·36%
$NaC_2H_3O_2$	·0479 gms.	·0968 gms.	·0404 gms.	84·34%
KCN	·0958 gms.	·0484 gms.	·0867 gms.	90·50%
KCN	·0958 gms.	·0484 gms.	·0655 gms.	68·37%

[1] Chemiker Zeitung XXV, p. 731.

From the experiments of the author it does not seem that the method of Neumann can be used for quantitative work. Sodium acetate, ammonium acetate or potassium cyanide when used in a corresponding way do not yield useful results.

III. ELECTROLYSIS OF NICKEL AND COBALT CHLORIDES.

The electrolytic deposition of nickel from ammoniacal chloride solutions is generally regarded as less satisfactory than that from the ammoniacal sulphate. Oettel has shewn the conditions under which satisfactory results could be obtained. The writer has found that equally satisfactory results are obtained for cobalt chloride by the addition of a small amount of sulphuric acid to the electrolyte.

Experiment I. To a solution of cobalt chloride was added three cubic centimetres of strong sulphuric acid, 30c.c. of strong ammonia and water sufficient to increase the volume to 150c.c. By using a revolving gauze cathode at 4 amperes and 5 volts the deposition was complete in 20 minutes. The deposit was dark but quite adherent.

Experiment II. To an equal amount of cobalt chloride was added three cubic centimetres of strong sulphuric acid. The solution was evaporated till fumes of sulphuric acid were freely evolved, when the solution was rendered ammoniacal as before and diluted to 150c.c. From this solution of ammoniacal sulphate of cobalt the metal was deposited under conditions employed in the previous experiment. The separation was complete in half an hour. The results of these experiments are as follows:

Experiment I. Cobalt deposited ·1294 gms.
Experiment II. Cobalt deposited ·1293 gms.

From these and other experiments it therefore appears that cobalt chloride may be employed for electrolytic determination provided the same amount of sulphates be present as is required for the satisfactory plating from sulphate of cobalt.

III. THE DIMETHYLGLYOXIME METHOD.

In 1905 Tschugaeff[1] pointed out the value of dimethylglyoxime as precipitant of nickel and suggested its usefulness in the separation of nickel from cobalt. Later a series of experiments conducted by Brunck[2] made it plain that this separation was quantitative and

[1] Berichte XXXVIII, p, 2520.
[2] Zeitschrift für Angew Chemie XIX, p. 1793 and XX, p. 834 and p. 1844.

could be used for the separation of nickel from most of the elements ordinarily met with in the course of chemical analysis. This method was still further developed by Prettner, who compares its accuracy with other methods for the separation and determination of nickel.[1]

As developed by these investigators the precipitation occurs in a hot ammoniacal solution. In case iron be present the addition of tartaric acid is necessary to prevent its precipitation along with the nickel. Most of the nickel separates in a few minutes; but to secure the best results the solution must stand for 24 hours. Not more than 99% of the nickel separates in the first hour. By allowing an interval of 24 hours the error usually does not exceed one half of one per cent of the nickel present. The accuracy of this method is therefore about the same as that of the red lead method. The time necessary for an analysis of the same degree of accuracy is greater in the case of the dimethylglyoxime method.

University of Toronto.
June 3rd, 1915.

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[1] Chemiker Zeitung XXXIII, p. 396 and p. 411.

On the Density of Molecules in Interstellar Space.

By LOUIS VESSOT KING, M.A. (Cantab.), D.Sc. (McGill), F.R.S.C.
Associate Professor of Physics, McGill University, Montreal.

(Read May Meeting, 1915).

In recent years evidence has been brought forward by several investigators[1] indicating that light from distant stars suffers a slight attenuation in travelling through interstellar space. In particular a recent investigation by Jones[2] assigns definite numerical values to coefficients of attenuation corresponding to "photographic" and "visual" light from stars of known proper motions and spectral types whose magnitudes had been carefully measured by Parkhurst[3] for light of these wave-lengths. If, as seems reasonable, this extinction is assumed to be due to attenuation by scattering in travelling through a "residual" gas occupying interstellar space, we are enabled to estimate the average density of molecules in the intervening regions, following a method due originally to Larmor[4] for assigning an upper limit to the density of matter in comets' tails.

If we denote by K the coefficient of attenuation corresponding to wave-length λ, radiation of this wave-length originally of intensity E_0 is $E=E_0\, e^{-Kx}$ reduced, after travelling a distance x, to the value given by $E=E_0\, e^{-Kx}$. According to Rayleigh's Law of molecular scattering K is given in terms of the refractive index μ and the molecular density of the medium n by the relation $K=\frac{8}{3}\pi^3\,(\mu^2-1)^2\lambda^{-4}/n$. The ability of Rayleigh's Law to account almost completely for the attenuation of solar radiation in travelling through the earth's atmosphere was first pointed out by Schuster[5]: a later investigation by the writer[6] based on the results of the Smithsonian Astrophysical Observatory indicated that formulæ based on this law were competent to explain atmospheric extinction as well as to account quantitatively

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[1] Kapteyn, J. C., *Astrophysical Journal*, 29 (1909), pp. 46-54: 30 (1909), pp. 284–317 and correction p. 398. Turner, H. H., *Monthly Notices Roy. Ast. Soc.*, 69 (1908), p. 61– . King, E. S., *Harvard Annals*, 59, No. VI., p. 179, April, 1911: *Harvard Annals*, 76, No. I., pp. 1–10, 1913. Brown, F. S., *Monthly Notices*, 72 (1912), p. 195– also p. 718.

[2] Jones, H. S., *Monthly Notices Roy. Ast. Soc.*, 75 (1914), pp. 4-16.

[3] Parkhurst, J. A., "Yerkes Actinometry," *Astrophysical J.;* 36, (1912), p. 169-.

[4] Larmor, Sir J., Lectures, Cambridge, 1908.

[5] Schuster, A., "*Nature*," July 22, 1909: "Optics," 2nd Ed., 1909, p. 329.

[6] King, L. V., *Phil. Trans. Roy. Soc.*, 212A (1912), pp. 375-433.

and qualitatively for the intensity and distribution of sky-radiation as far as the observations available at that time could be tested. As a final test the Smithsonian results were reduced with a view to obtaining a value for the number of molecules per cm.^{3} of a gas at standard temperature and pressure: the result obtained by the writer,[7] $n_0 = (2 \cdot 78 \pm 0 \cdot 01) \times 10^{19}$, and a later independent determination by Fowle,[8] $n_0 = (2 \cdot 70 \pm 0 \cdot 02) \times 10^{19}$, indicate that we may rely with confidence on Rayleigh's Law in dealing with molecular extinction for wave-lengths not too close to regions of selective absorption.

In dealing with attenuation in a stellar distance $x = \Delta$, the term $K\Delta$ is so small that we may write to sufficient degree of approximation $K\Delta = (E_0 - E)/E_0$, i.e. $K\Delta$ is the proportional loss of intensity in travelling a distance Δ. Denoting by $K_1\Delta$ and $K_2\Delta$ the proportional losses of intensities corresponding to "photographic" and "visual" light of average wave-lengths λ_1 and λ_2 respectively, we derive on reducing to intensities the result obtained by Jones,[9] [(photographic)—(visual)] losses $= +0 \cdot 00473 \pm 0 \cdot 00035$ magnitude, the relation $(K_1 - K_2)\Delta = 0 \cdot 00435 \pm 0 \cdot 00032$, the distance Δ being 10 parsecs. (1 parsec = distance corresponding to a stellar parallax of $1'' = 3 \cdot 26$ light-years $= 3 \cdot 08 \times 10^{19}$cm.). If it is assumed that the extinction is brought about solely by molecular scattering, we also have the additional equation $K_1/K_2 = (\lambda_2/\lambda_1)^4$.

Unfortunately it is somewhat difficult to assign with accuracy the average wave-lengths corresponding to "photographic" and "visual" light. A rough estimate by the writer from Parkhurst's curves of spectral intensities corresponding to the plates and filters employed in the photographic and visual determinations yielded the values $\lambda_1 = 0 \cdot 446\mu$ and $\lambda_2 = 0 \cdot 533\mu$, so that we obtain $K_1/K_2 = 2 \cdot 08$, giving $K_1\Delta = 0 \cdot 0083_8$ and $K_2\Delta = 0 \cdot 0040_3$.[10] In order to realize more vividly the extremely small attenuation which these numbers represent, it is easily verified that in order to lose one-tenth of its original intensity radiation of these wave-lengths must travel for about $4 \cdot 1$ and $8 \cdot 5$ centuries respectively.

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[7] King, L. V., "*Nature*," 93 (July 30, 1914), pp. 557-559.

[8] Fowle, F. E., *Astrophysical J.*, 40 (Dec., 1914), pp. 435–442.

[9] Jones' determination is in fair agreement with Kapteyn's final result, (*Astrophysical J.*, 30, p. 398) [(photographic)—(visual)[losses $= +0^m \cdot 0031 \pm 0 \cdot 0006$. The corresponding determintions by King (E. S.) of the coefficients of attenuation for photographic and visual light give values about five times that of the text.

[10] The losses $+0^m \cdot 0080$ and $+0^m \cdot 0033$ estimated by Jones for "photographic" and "visual" light lead to the values $K^1\Delta = 0 \cdot 0073$ and $K_2\Delta = 0 \cdot 0030$ (wave-lengths not stated). Kapetyn's (corrected) estimate for wave-length $\lambda_1 = 0 \cdot 431\mu$ is $K_1\Delta = 0 \cdot 0050_7$, leading to the value $n = 0 \cdot 68 \times 10^5$ hydrogen molecules per cm^3., which is of the same order of magnitude as the determination already made. E. S. King's results (footnote 1) increases the estimate of the text about five-fold.

For the purposes of the present discussion we assume hydrogen to be the constituent of interstellar space (until we know more about the physical properties of "coronium," "nebulium," or other primordial gases which might possibly occupy these regions). Taking $\mu_0 - 1 = 0 \cdot 000140$, $n_0 = 2 \cdot 78 \times 10^{19}$, $\lambda = 4 \cdot 46 \times 10^{-5}$ cm., we easily derive for the coefficient of attenuation in hydrogen at standard temperature and pressure the value $K_0 = 5 \cdot 89 \times 10^{-8}$ cm.$^{-1}$. For this wave-length in interstellar space we have $K = 2 \cdot 72 \times 10^{-22}$ cm.$^{-1}$, so that $n/n_0 = K/K_0 = 4 \cdot 62 \times 10^{-15}$, giving finally for the molecular density in interstellar space the estimate $n = 1 \cdot 28 \times 10^5$ Hydrogen molecules per cm.^{3}. [10]

Associated with the problem of attenuation by scattering is that of calculating the amount of star-light scattered by the molecules of interstellar gas.[11] In this way might be explained the extremely faint luminosity which several observers believe to exist ovcr the background of the sky. This scattered light might also account for discrepancies which have been found to exist between calculated and observed distributions of total starlight from different regions of the night sky.[12] The estimation of the amount of solar radiation scattered to the earth by a distribution of interstellar gas constitutes a definite problem the complete statement of which (including the effect of self-illumination) is expressed as a particular case by a general integral equation already given by the writer.[13] The theoretical discussion applicable to the problem under discussion the writer hopes to undertake elsewhere: from the observational point of view it would seem that the difficult but perhaps not impossible task of estimating the luminosity of the sky in regions void of stars affords the only hope of bringing additional direct evidence to bear on some of the questions raised below.

In a gas of the extreme degree of tenuity which we have just estimated, molecular collisions will be extremely infrequent; an estimate of the free path according to the usual ideas of the kinetic theory is impossible without a knowledge of the average molecular velocity or temperature of the gas. As has already been pointed out by the writer[14] it is difficult to see how molecular velocities can be directly affected by radiation travelling through a gaseous medium. It is probable that gravitation and radiation-pressure are the controlling forces in ultimately determining molecular velocities by an

[11] Note a discussion on this point by H. C. Plummer in a paper by Turner, H. H., *oc. cit.* (footnote 1).

[12] Abbot, C. G., *Astronomical, J.* 27, (1911), p. 20–: "Annals of the Smithsonian Astrophysical Observatory," Vol. III. (1913), pp. 203-210.

[13] King, L. V., footnote (6), p. 379, equation (14).

[14] King, L. V., footnote (7).

extremely slow process of equipartition of energy with that of molecules escaping from planetary and stellar atmospheres.

As the above estimate of molecular density gives a total amount of matter of the order $1/38\times$ earth's mass in a sphere having a radius equal to that of Neptune's orbit it is improbable that the residual gas we are considering could have a noticeable effect on planetary motions. It might, however, be identified with the slightly resisting medium whose existence has been thought necessary by some astronomers to account for the secular acceleration of Encke's comet,[15] and which is considered by See[16] to have played an important role in planetary and stellar evolution.

The molecular density estimated above is very much less than that conjectured to exist in some of the nebulae, 10^9 molecules per cm.^{3} being about the order of magnitude in this case.[17] While the degree of rarefaction which we have derived is very much greater than it is possible to produce by any known physical means,[18] the total amount of matter contained in regions of space of astronomical dimensions is formidable: thus we find for the number of molecules in a cubic parsec the estimate $N=3\cdot75\times10^{60}$ Hydrogen molecules per parsec^3. Taking the density of Hydrogen at standard temperature and pressure to be $0\cdot0899$ grammes per litre (containing $2\cdot78\times10^{22}$ molecules), we obtain for the density of matter in interstellar space the estimate $1\cdot21\times10^{37}$ grammes per parsec^3: as the sun's mass is approximately $1\cdot96\times10^{33}$ grammes we have finally for the density of interstellar residual gas the estimate $6\cdot3\times10^3$ sun's mass per parsec^3. According to Eddington[19] a reasonable estimate of the density of visible stars in the neighbourhood of the solar system is $10\times$sun's mass in a sphere of 5 parsecs radius (525 parsec^3): i.e., $0\cdot019\times$sun's mass per parsec^3. It follows that the density of "uncondensed" or "residual" matter existing in interstellar space is of the order 10^5 that of "condensed" stellar matter. Even if, as there is some reason to believe, the number of "dark" stars is very much greater than the number of bright

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[15] On the recent history of this comet see a paper by Backland, "Encke's Comet, 1895-1908," *Monthly Notices*, 70 (1910), pp. 429-442.

[16] See, T. J. J., "Researches on the Evolution of the Stellar System," 1910, Vol. II.; pp. 134-158.

[17] Henkel, F. W.; in an article "Nébuleuses et Essaims," "Scientia," Vol. 15, (1914), pp. 294-307.

[18] The total number of molecoles per cm.^{3} corresponding to the vapour-pressure of mercury at the temperature of liquid air is estimated at 3×10^7 (Dunoyer, M. L., "Les Gaz ultra-raréfiés," in the collection "Les Idées Modernes sur la Constitution de la Matière," Gauthier-Villars, Paris, 1913, p. 216).

[19] Eddington, A. S., "Stellar Movements and the Structure of the Universe," Macmillan and Co., 1914, p. 255.

ones (Lindemann's estimate is 4,000),[20] the ratio referred to is still very large.

It is evident that unless this "residual" or "primordial" gas is exempt from mutual gravitation[21] it must give rise to a gravitational field very much greater than that of the whole sidereal universe and should therefore be taken into account in existing theories of stellar dynamics. Although the dynamics of such a system would probably have to be modified to a considerable extent to take into account radiation pressure, we should still expect an enormously high density near its mass-centre, unless the whole be endowed with a small angular velocity as is surmised to be the case with the Milky Way.

It follows from this brief discussion that we are either obliged to accept the existence of a wide-spread distribution of enormous quantities of interstellar gas of molecular density of the order 10^5 molecules per cm.[3] and take into account its influence in stellar dynamics, or conclude that the attenuation of light by scattering is very much less than is indicated by existing estimates of the absorption of stellar radiation in space.

McGill University, Montreal.

[20] Lindemann, F. A., "Note on the Number of Dark Stars," *Monthly Notices*, 75 (1915).

[21] On this point note a remark by Eddington, *loc. cit.*, p. 258.

On the Residual Ionisation in Air Enclosed in a Vessel of Ice.

By Professor J. C. McLENNAN, F.R.S., and Mr. H .G. MURRAY, B.A.

(Read May Meeting, 1915).

I. INTRODUCTION.

In the course of a series of experiments on the ice of Toronto bay, Lake Ontario, McLennan and Wright[1] found that the ionisation in air confined in a vessel of the purest zinc obtainable was about 4·4 ions per cubic centimetre per second. In this case the capacity of the vessel was about 30 litres. Later on in the course of their voyage to the South Pole, Simpson and Wright[2] found a value of 4·1 ions per c.c. per second for the ionisation in air enclosed in a vessel of about the same size and made of the same metal. Still later, McLennan and McLeod[3] when working with a zinc Wolff Electrometer of 2 litres capacity found the ionisation in air to be 4·33 ions per c.c. per second on the Atlantic Ocean, 4·93 ions per c.c. per second on the surface of Lake Ontario and 4·77 ions per c.c. per second, eight metres under the surface of Lake Ontario where the water was 20 metres deep.

Further, McLennan and McLe d[4] have shown that on the land at Toronto, at Bowland, Scotland, at Cambridge, England, and at Braunschweig, Germany, the conductivity of air enclosed in a zinc Wolff Electrometer was represented by the generation of about 8·5 ions per c.c. per second. Moreover Simpson and Wright[5] have shown that Joly's numbers for the amount of radium in sea water make it clear that over the sea the total number of ions which can be generated per c.c. per second in air confined in a zinc vessel by the total penetrating radiation from terrestrial sources including air, land and water must be less than 0·1. As the conductivity of the air in a zinc vessel on and in the waters of Lake Ontario was practically the same as it was on the ocean it follows that conductivity of about 4 ions per c.c. per second must be accounted for in air confined in a zinc vessel by (1) ionisation by the collision of air molecules in thermal agitation

[1] McLennan. Phys. Rev. No. 6, Vol. XXVI, June, 1908. Wright. Phil. Mag. 17, p. 295, 1909.

[2] Simpson and Wright. Proc. Roy. Soc. No. 85, p. 175, 1911.

[3] McLennan and McLeod. Phil. Mag. p. 740, Oct., 1913.

[4] McLennan and McLeod, *loc. cit.*

[5] Simpson and Wright. Proc. Roy. Soc. No. 85, p. 197, 1911.

or (2) ionisation occurring spontaneously in these molecules or (3) ionisation produced by a radiation from the walls of the zinc containing vessel or (4) ionisation produced by some type of radiation far more penetrating than any hitherto observed.

With a view to testing the third of these hypotheses some experiments were undertaken during the past winter by the writers on the electrical conductivity of air confined in a vessel of ice. It is known that the water of Lake Ontario contains only an extremely small trace of radium and it was thought that if the residual ionisation in air confined in a vessel of zinc was due to a radiation from the zinc then the conductivity of air enclosed in a vessel of ice would probably turn out to be less. This conjecture has been found to be correct, for in the experiments referred to the value of 2·6 ions per c.c. per second was obtained for the residual ionisation in the air.

II. APPARATUS AND EXPERIMENTS.

In these experiments two types of measuring instruments were used, namely, the C.T.R. Wilson compensating condenser gold leaf electrometer and the Wolff bifilar quartz thread instrument. These are illustrated diagrammatically in Figs. 1 and 2. As the theory

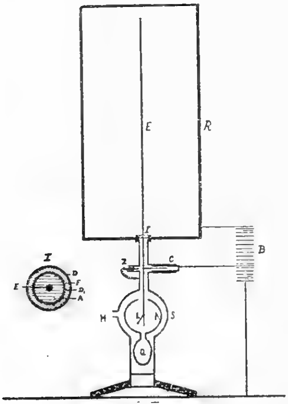

Fig 1.

of the former has been given by Wright[1] in a paper "On variations in the conductivity of air enclosed in metallic receivers" and that of the latter in a paper by McLennan and McLeod[1] on "Measurements on the earth's penetrating radiation with a Wolff electrometer." There is no need of repeating them in this place. In the experiments the

[1]Wright. Phil. Mag. No. 17, p. 295, 1909.

conductivity of air was measured at three stations, the one being on the ice on Toronto bay, where the water was about 20 feet deep, the second in the Library of the Physics Building and the third in a brick house free from radio-active contamination on land at a point

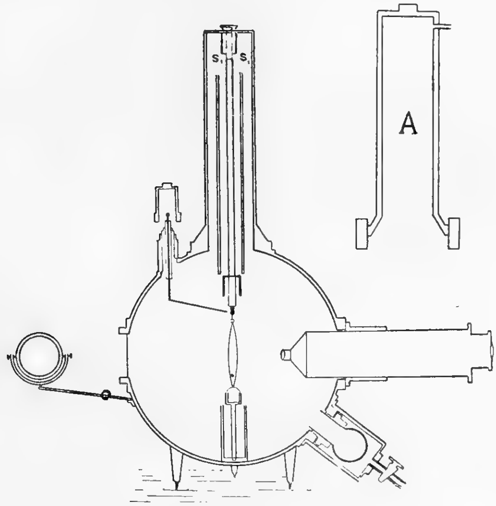

Fig. 2.

about 2 miles from the shore of Lake Ontario. Three different types of measurements were made. In the one the air was confined in a vessel of clean zinc of about 30 litres capacity, in the second it was enclosed in an air-tight zinc Wolff electrometer of about two litres capacity and in the third it was confined in a vessel of ice whose capacity was about 30 litres. Three distinct ice vessels were used two being made from ordinary tap water drawn from Lake Ontario and the other from water distilled in a large still in the Chemical Laboratory of the University of Toronto. In making these ice vessels a number of galvanized iron trays were made which were annular in form. The water was poured into these and the trays were placed out in the open until the water was frozen solid.

The ice was then taken out of these trays, carefully scraped and a cylinder was built up by placing these ice rings one upon the other and frozen together. The solidified ice cylinder was then placed on a thick plate of ice and frozen to it and finally the top of the cylinder was closed with a second plate of ice. Before the ice cylinders were used all chinks and cracks were carefully filled with water when the temperature was about

[1] McLennan and McLeod, *loc. cit.*

10°C. below zero, so that the ice cylinders prepared in this way were, when finished, one piece of ice and were air-tight apart from any porosity which the ice possessed. The appearance which the Wolff Electrometer and the cylinders of zinc and ice when mounted on the Wilson electrometer presented is shown in Figs. 3, 4 and 5. It should

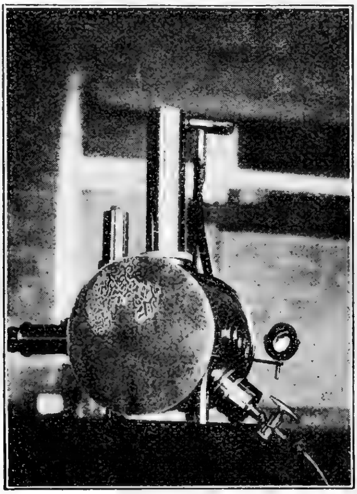

Fig 3.

be mentioned that the measurements with the ice receivers were made when the temperature ranged from 1°C. below zero to 10°C. below zero.

III. RESULTS AND THEIR DISCUSSION.

Numerous sets of readings were taken at the three stations and a summary of the final results compiled from these is given in Table I.

TABLE I.
IONISATION OF AIR.
Summary.

	Ions per c.c. per second	Capacity c.c.
Zinc receiver in Library	7·76	29,465
Wolff Electrometer in Library	7·94	2,000
Zinc receiver at House	7·11	29,465
Wolff Electrometer at House	7·66	2,000
Zinc receiver on Bay	4·65	29,465
Wolff Electrometer on Bay	4·38	2,000
Tap water ice receiver at House	4·37	35,327
Tap water ice receiver on Bay	2·60	31,416
Distilled water ice receiver on Bay	5·5	28,875

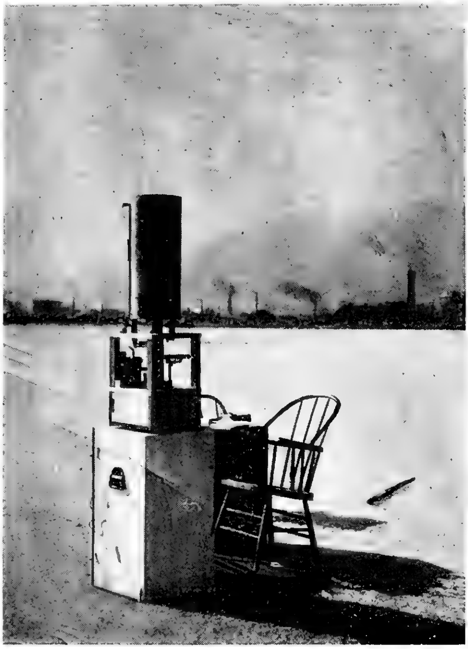

Fig. 4

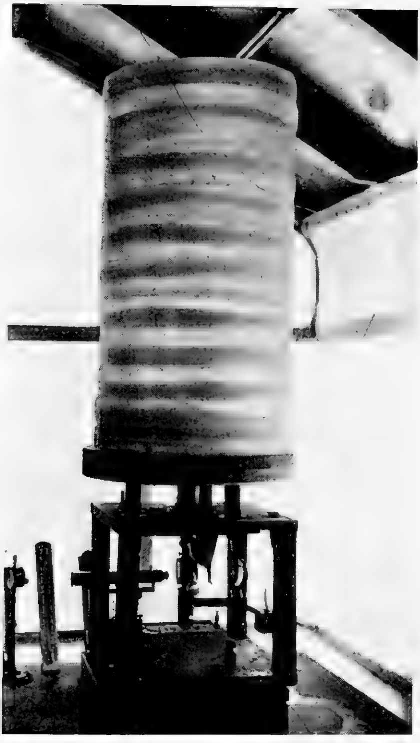

Fig 5

As the numbers show, the readings obtained for the conductivity with the Wolff Electrometer in the Library of the Physics Building and at the house mentioned above were slightly greater than those obtained at the same stations with the Wilson instrument. On the ice of the bay on the other hand the reading obtained with the Wolff Electrometer was a little less than that given by the Wilson Electrometer. The reading obtained with the ice receiver at the house on the land, viz., 4·3 ions per c.c. per second was much less than the mean reading, 7·39 ions per c.c. per second, obtained at the same place with the Wolff and Wilson instruments when the receivers were of zinc. This may have been due in part to differences in the absorption of the earth's penetrating radiation by the walls, for the zinc vessels were only from 1 to 3 mm. thick while the walls of the ice receiver were a little more than 5 cm. in thickness.

The low value obtained for the ionisation in air with the ice receiver at the land station cannot be entirely accounted for by the absorbing power of the walls for it is known from experiments made by McLennan[1] and Wright[2] that it requires from 2 to 3 metres of water to entirely cut off the gamma rays from radium and it is probable, therefore, that it would be necessary to use a screen of water or ice of the same thickness to entirely absorb the penetrating radiation present at the surface of the earth. Besides it will be noted that the reading 4·37 ions obtained with the ice receiver on the land is as low if not lower than the ionisation obtained for air in the zinc vessels on the ice of the lake where it is known that the intensity of the earth's penetrating radiation is practically negligible. It seems rather that the difference in the readings obtained with the ice and the zinc receiver must have been due to the existence of an ionising radiation emitted by the zinc walls which was not emitted by the ice. Moreover the low reading obtained with the ice receiver on the bay confirms this view, for it will be seen from the table that under these conditions the ionisation in air was found to be represented by the generation of but 2·6 ions per c.c. per second. This it will be recalled is the lowest value ever obtained for the electrical conductivity of air.

After having obtained this striking decrease in the conductivity of air by enclosing it in an ice receiver it was but natural to seek for an explanation of this final residual conductivity and the explanation which most readily offered itself was that it was due to a feeble radioactivity possessed by the ice. Part of it at least must have been due to this cause for it is known that although the water of Lake Ontario contains very little radium still traces of it in the water have been

[1] McLennan. Phys. Rev. Vol. XXVI. No. 6. June, 1908, p. 526.
[2] Wright. Phil. Mag. No. 17. p, 295, 1909.

detected. In an attempt to see how much of the final residual ionisation was traceable to this cause a cylinder of ice was prepared from distilled water obtained from the Chemical Laboratory of the University of Toronto, through the kindness of the Director and those associated with him. Readings were made on the bay upon the conductivity of air enclosed in this receiver and to our surprise the mean of the readings, as Table 1 shows, was $5 \cdot 5$ ions per c.c. per second. This it will be seen is larger, even, than the value obtained with the tap water ice cylinder on the land so that the high value must have been due to a radio-active contamination of the distilled water from which the cylinder was made. The still from which the water was obtained is one of large capacity and it has been in use for a number of years for furnishing the distilled water used in the chemical laboratory. It is not surprising therefore that the water contained radio-active impurities. It would have been interesting to measure the conductivity of air contained in a cylinder of ice made from water distilled with a newly constructed still but experiments such as those described in this paper have to be done at Toronto within a period of two or three weeks commencing about the middle of February. The experiments described in the paper represent all that it was found possible to carry out during the past winter and though they may be extended at another time enough has been done to show that the residual conductivity of air confined in a vessel of ice when measured on the surface of a large body of water such as Lake Ontario can probably be entirely accounted for by radiations from traces of radio-active material in the walls of the ice receiver and in the ice and water of the Lake.

IV. SUMMARY OF RESULTS.

1. The mean value found at land stations near Toronto for the electrical conductivity of air confined in zinc vessels of the highest available purity is represented by the generation of $7 \cdot 62$ ions c.c. per second.

2. The mean value found for the conductivity of air enclosed in the same zinc vessels has been shown to be represented by the generation of about $4 \cdot 5$ ions per c.c. per second when the experiments were made on the ice of Toronto bay, Lake Ontario.

3. With air confined in a vessel of ice made from the water of Lake Ontario the conductivity of air when measured on the surface of that lake has been found to be represented by $2 \cdot 6$ ions per c.c. per second which is the lowest conductivity hitherto observed for air.

4. Reasons have been adduced which support the view that air has no electrical conductivity apart from that impressed upon it by

radiations traversing it which are emitted by the walls of the containing vessel, and by the land, the atmosphere, and the water in the neighbourhood of the enclosed air whose conductivity is being measured.

We desire here to acknowledge the services of Mr. P. Blackman, Mr. T. Plaskett and other members of the mechanical staff in the Physical Laboratory for assistance in carrying out the investigation under rather trying circumstances.

The Physical Laboratory,
University of Toronto.
May 1st, 1915.

Residual Ionisation in Gases.

By Prof. J. C. McLENNAN, F.R.S., and Mr. C. L. TRELEAVEN, M.A.,
University of Toronto.

(Read May Meeting, 1915.)

I. INTRODUCTION.

From observations made by Simpson and Wright,[1] McLennan and McLeod[2] and others it is now known that the ionisation in air confined in air-tight clean zinc vessels is about 8 or 9 ions per c.c. per second when the observations are made on land where the soil contains only such minute traces of radio-active substances as are found in ordinary clays or loams. It is also known that when the observations are made on the Atlantic, the Indian, or the Antarctic Ocean or on the surface of large bodies of water such as Lake Ontario the ionisation in air confined in the manner indicated above drops to approximately 4 ions per c.c. per second. Moreover this reduction in the electrical conductivity of air has been shewn to be due to the absence of a penetrating radiation over the waters of oceans and lakes which is known to be present at the surface of the earth on land made up of rocks or of ordinary soils. Since this residual conductivity in air of 4 ions per c.c. per second is found to persist when all known external radiations are cut off from the vessel containing the air the question naturally arises—to what is the residual conductivity due?

To this question there appear to be but four possible answers. It may be due one may suppose either:—

(i) to an extremely penetrating radiation present on the surface of the earth; or

(ii) to ionisation arising from molecular thermal agitation or

(iii) to a real spontaneous ionisation such as one would have with exploding atoms or molecules; or

(iv) to a feeble radiation from the material forming the walls of the containing vessel.

The hypothesis of an extremely penetrating radiation being present at the surface of the earth however does not appear to be

[1] Simpson and Wright, Proc. Roy. Soc. Ser. A vol. LXXXV, p. 175, 1911.

[2] McLennan and McLeod, Phil. Mag. Oct., 1913 p. 740

tenable. For in some experiments by McLennan and McLeod[1] it has been shewn when working with clean air contained in an air-tight Wolff Electrometer of zinc placed in a water-tight box of aluminium-bronze that a value of 4·81 ions per c.c. per second was obtained for the conductivity of the air at the surface of Lake Ontario, while a value of 4·77 ions per c.c. per second was obtained when the box containing the electrometer was immersed to a depth of 8 metres, this would go to shew that the conductivity of the air was practically the same in the two positions, which would indicate that air and water had the same coefficient of absorption for this hypothetical extremely penetrating radiation. Since from two to three metres[2] of water will entirely cut off all known gamma radiations emitted by radium, the penetrating powers of this radiation would have to be so extraordinarily great, that in the absence of any collateral corroborative evidence one hesitates to believe in the reality of its existence. In considering the hypothesis of ionisation by collisions due to thermal agitation Langevin and Rey[3] have shewn from theoretical considerations on the basis of exceptional collisions that the ionisation in air should increase very rapidly with a rise in temperature. Patterson[4], however, has shewn experimentally that the conductivity of air remains practically the same from 0°C. to 180°C. Again on the basis of tangential collisions Wolfke[5] has shewn that if the conductivity of air be taken to be 4 ions per c.c. per second, at room temperatures it should be represented by 2 ions per c.c. per second at 130°C. and by about 6 ions per c.c. per second at −20°C. As this result is also in contradiction to the measurements of Patterson, it would appear that the residual ionisation in air cannot be explained on any theory of collisions as yet brought forward. There remains, therefore, the possibility of the ionisation being brought about by a spontaneous breaking up of the atoms or through the agency of a radiation from the walls of the containing vessel.

With a view to examining the validity of these two hypotheses some measurements were made on the residual ionisation in a number of gases including air and the following paper contains an account of these experiments. The investigation was begun by one of us in the summer of 1913 (see *Nature*, Dec. 11, 1913), but had to be discontinued through an accident to the electrometer. The apparatus having been repaired the investigation was resumed last autumn and from

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[1] McLennan and McLeod. Phil. Mag. Oct., 1913, p. 749.
[2] McLennan. Phys, Rev. Vol. XXVI, No. 6. June, 1908, p. 530.
[3] Langevin and Rey. Le Radium. April, 1913, p. 142.
[4] Patterson. Phil. Mag. 6. p, 231, 1903.
[5] Wolfke. Le Radium. Aug. 1913, p. 265.

the results which are given below it will be seen that while evidence has been obtained which points to the existence of a spontaneous ionisation in acetylene, there is no direct evidence of such an ionisation in air, carbon dioxide, hydrogen, ethylene, or nitrous oxide. With the last mentioned gases, however, the results point to the residual ionisation being due to a feeble radiation from the walls of the zinc electrometer consisting of alpha and beta and, possibly, gamma rays.

II. APPARATUS.

The Wolff electrometer used in this investigation is shewn in Fig. 1, and a diagrammatic sketch of its electrical system is given in Fig. 2. The instrument consisted of a cylindrical vessel of zinc

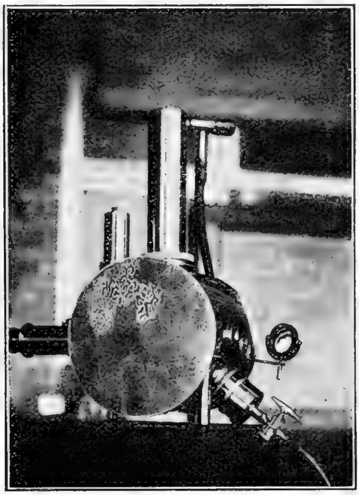


Fig 1

provided with plane sides and having a capacity of about two litres. The electrical system consisted of two conducting silvered fused quartz fibres attached at their upper ends to an insulating amber support and at their lower ends to an non-conducting cross fibre also of fused quartz and under tension. This cross fibre was attached to an insulating support of amber as shewn on the sketch. The instrument was provided with a sliding tube S_1S_1 which could be lowered so as to enclose the electrical system, and so reduce to a minimum the volume from which ions could be drawn. With the tube S_1S_1 raised the effective volume of the chamber was $2021 \cdot 1$ c.c. and with it lowered $31 \cdot 5$ c.c. The fibres were illuminated by light reflected into the instrument by a mirror through a glass window in the back of the instrument. The separation of the fibres when charged was measured by means of a microscope provided with a scale. The electrical system was calibrated in the ordinary way with a set of storage cells, and by means of a calibration curve the changes in the separation of the fibres were transcribed into potential falls. In practice the fibres were charged

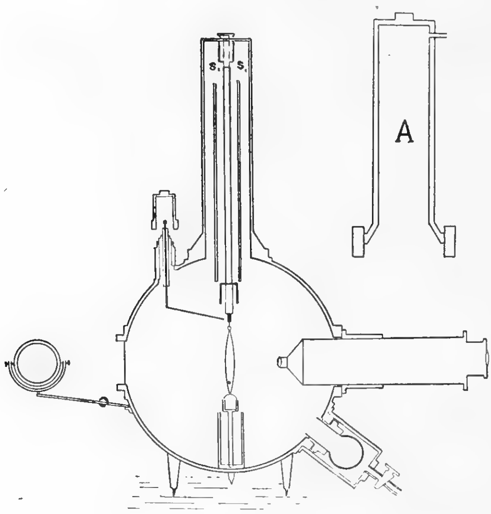


Fig. 2

by means of a Zamboni pile through the intermediary of an insulated sound passing through the walls of the vessel as shewn by the diagram, which could be turned when desired so as to come into contact with a metal piece connecting the fibres to their upper insulating support. All contacts, except in the case of the covering tube, A, were either soldered or made by fluted joints provided with leather washers. The lower end of the covering tube, A, had a ground conical surface and was held hermetically connected to the body of the instrument by means of a threaded shoulder piece. All the joints were carefully examined before each experiment and found to be air-tight before measurements were undertaken. All the gases used were carefully dried before being admitted into the instrument. The latter, however, was provided with a small drying chamber opening directly into its interior and a small glass vessel in this chamber was always kept filled with metallic sodium.

In all experiments made with air it was found that the ionisation was the same whether the sodium was present or not.

The theory of the Wolff elcetrometer has been given already in the paper by McLennan and McLeod referred to above and it will suffice here to give only the final formula:

$$N = 1\cdot03\,(\triangle V - \triangle V_1)\ldots\ldots\ldots\ldots\ldots\ldots\ldots(1)$$

for determining the number of ions generated within the air in the electrometer per cubic centimetre per second. In this formula $\triangle V$ is the loss in the voltage per hour of the electrical system with the tube S_1S_1 up and the ions coming to the system from the gas in the whole of the chamber and $\triangle V_1$ the loss in voltage per hour with the tube S_1S_1 down and the ions coming to the system from the volume of gas enclosed by the tube, i.e., 31·5 c.c.

III. FIRST INVESTIGATION.

In the first set of experiments the gases used were air, hydrogen and acetylene. The observations were made in the open at Bowland, Scotland, in a hotel in London, England, on the Atlantic Ocean in S,S, Megantic and in the Convocation Hall of the University of Toronto, the last mentioned building being a new structure and one into which no radium or other radio-active substance had been brought hitherto:

TABLE I.

IONISATION OF GASES.

Gas	q = No. of ions generated per c.c. per second			
	Bowland	London	Toronto	Atlantic Ocean
Air	8·62	8·73	8·8	4·65
Hydrogen	3·18	—	2·0	1·8
Acetylene	24·57	—	—	—
Methyl Iodide and air	14·81	—	—	—

The readings taken at these various stations in the different gases are recorded in Table I. Those at Bowland with hydrogen, acetylene, and the mixture of methyl iodide and air were taken in a hurry as the time available was short. The acetylene used was taken from a private house supply and was carefully dried before being used, the hydrogen was generated in an improvised piece of apparatus from dilute sulphuric acid acting on granulated zinc. It, too, was carefully dried but it is probable that it contained some air, The methyl iodide was introduced by evaporation into the electrometer by placing a small bottle of it with cork removed in the small chamber attached to the instrument which usually contained the metallic sodium. The instrument was filled with air when this was done and the pressure of the methyl iodide vapour was probably about one half a centimetre of mercury.

These readings served to bring out the fact that the ionisation in air on the ocean was about one half what it was on land, that with methyl vapour in air the ionisation in the latter was nearly doubled, that the ionisation in hydrogen was very low and was about the same on land as on water, and that the so-called natural ionisation of acetylene was extremely high. With the tube S_1S_1 down the loss of charge from the charged electrical system was about the same with acetylene as with air which shewed that the high value obtained for "q" with acetylene was not due to any loss of charge over the supports arising from any action of the gas on the pieces of amber which carried the fibres.

IV. SECOND INVESTIGATION.

In the second investigation the readings were taken with a number of different gases, first, in a room free from radio-active contamination in the Physical Laboratory at Toronto and then out on the ice on Lake Ontario at a point about half a mile from the shore where the water was about 20 feet deep. The temperature in the laboratory when the readings were made was about 21°C. and the temperature on the Lake from 0°C. to −10°C. The manner in which the electrometer behaved is illustrated by the diagram shewn in Fig. 3 which represents the readings in volts taken with air on a particular day from about 9 o'clock a.m. until after 6 o'clock in the evening.

After this portion of the investigation had been completed a set of readings was taken in the Laboratory with each of the gases under natural ionisation and then with them traversed consecutively by streams of alpha, beta and gamma rays of moderate intensity. Measurements with the beta rays were made by placing in the chamber which usually contained the metallic sodium a small capsule containing some uranium oxide. The back and walls of this capsule were made of thick zinc and the face consisted of a sheet of aluminium thick enough to cut off all alpha radiation.

The arrangement is shewn in Fig. 4 and from the diagram it will be seen that the effect of the rays on the gas in the electrometer was the same as it would have been if the radiation had been emitted from a portion of the walls of the instrument. In taking the readings with alpha rays the arrangement used is that shewn in Fig. 5. A very small piece of copper coated with polonium was placed on the end of a brass rod which was attached to a brass plate and inserted in the drying chamber mentioned above in a manner shewn by the diagram. In this case as in the experiments with the beta radiation the readings were taken with the gases first under natural conditions and afterwards with them traversed by the alpha radiation.

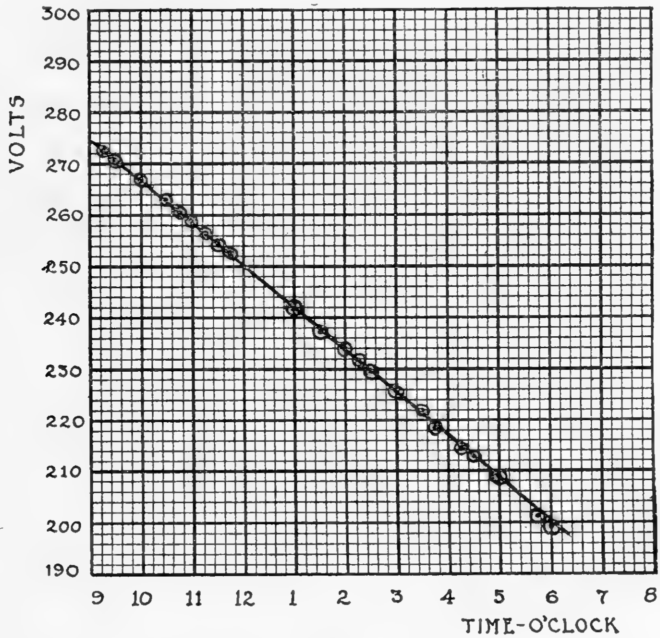


Fig. 3.

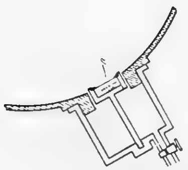


Fig 4.

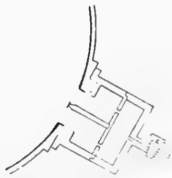


Fig 5.

In the experiments with gamma radiation a small quantity of radium bromide was sealed up in a glass tube. This tube was then placed in the cylinder of zinc with walls about 2 cm. thick which was held in position, Figs. 6 and 7, against one of the plane sides of the ioionisatn chamber of the electrometer. In this set of experiments the natural ionisation was again measured with each of the gases and then the ionisation when the gases were traversed by the gamma rays from the source just mentioned.

In all these experiments care was taken to dry and filter all the gases thoroughly before passing them into the ionisation chamber.

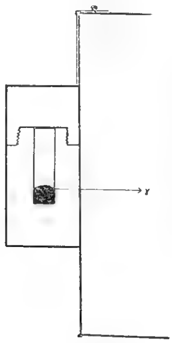


Fig 6.

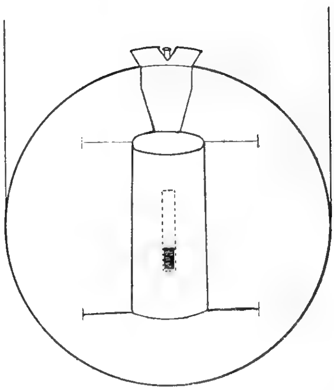


Fig. 7.

The hydrogen was prepared by allowing dilute sulphuric acid to act on granulated zinc in a Kipp apparatus. The carbon dioxide was taken from a cylinder of the product usually sold commercially. The nitrous oxide was also taken from a cylinder of the gas prepared commercially for the use of anaesthetists. The ethylene used was prepared by gently heating in a flask a quantity of pure white anhydrous phosphorus pentoxide to which a small quantity of absolute alcohol had been added and the acetylene was prepared in the usual way by allowing water to act on calcium carbide.

Readings were repeatedly taken during the past winter with all the gases under the various conditions described and the final results compiled from all of these readings are recorded in Table II.

TABLE II.

q = the number of ions generated per c.c. per second.

Gas	Column 1	Column 2	Column 3	Column 4	Column 5	Column 6
	Alpha Rays	Beta Rays	Gamma Rays	Natural Ionisation in Laboratory	Residual Ionisation on ice of Lake	Drop in Ionisation
Air.........	260·4	347·8	207·0	8·66	4·38	4·28
Carbon-dioxide....	209·4	541·8	325·0	9·90	4·83	5·07
Hydrogen ..	146·0	55·3	32·7	1·96	1·11	·85
Ethylene....	296·1	518·4	306·0	12·10	6·32	5·78
Nitrous oxide......	202·1	523·5	320·4	10·70	5·02	5·68
Acetylene...	304·6	453·0	277·8	27·9	27·00	·90

TABLE III.

IONISATION RATIOS.

On basis of air = 100.

Gas	Column 1	Column 2	Column 3	Column 4	Column 5	Column 6
	Alpha Rays	Beta Rays	Gamma Rays	Natural Ionisation in Laboratory	Residual Ionsiation on ice of Lake	Drop in Ionisation
Air.........	100·0	100·0	100·0	100·0	100·0	100·0
Carbon dioxide...	80·4	156·0	157·0	114·3	110·3	118·0
Hydrogen...	56·0	15·9	15·8	22·6	25·3	20·0
Ethylene....	113·3	149·5	148·0	139·7	144·3	135·0
Nitrous oxide	77·6	150·5	154·8	123·6	114·6	132·7
Acetylene...	116·9	130·2	134·2	322·1	616·4	21·0

The values recorded represent the number of ions generated per c.c. per second in the ionisation chamber of the electrometer under the different conditions mentioned assuming the ionic charge to be $4 \cdot 65 \times 10^{-10}$ e.s.u. Under the heading of "alpha rays" "beta rays" and "gamma rays" the numbers represent the increases in the value of q for the different gases when traversed by the respective types of rays.

The final column headed "Drop in Ionisation" contains numbers representing the differences in the values obtained for "q" under natural ionisation in the Laboratory and on the ice of the Lake. In Table III the ionisation in the various gases under the different conditions are expressed on the basis of 100 for air.

From this table it will be seen that the numbers representing the ionisation for all the gases are about the same for beta as for gamma rays. For alpha rays the relative ionisation in hydrogen was much greater than it was for either beta or gamma rays while in carbon dioxide, ethylene, nitrous oxide and acetylene, it was considerably less. Under the heading natural ionisation it will be seen that the readings for acetylene were very high namely 27·9 on land and 27·0 on the ice. The reading 27·9 was the mean of a number of readings all about the same taken with acetylene in the laboratory but the reading "q" = 27 for acetylene on the ice was the only one taken This reading was taken in a hurry and it was the intention of the writers to repeat it but the opportunity for doing so did not come before the ice on the lake had melted in the spring. The difference in the two readings it will be seen is only 0·9 ions per c.c. per second which is only about one fourth or one fifth of what one should have expected to get judging by the results obtained with the other gases.

The numbers given in the fifth column of Tables II and III represent the residual ionisation in the different gases on the ice. With the exception of that for acetylene, the numbers approximate to those given in the sixth column for the respective gases, i.e., the drops in ionisation and the residual ionisation for these gases are about in the same ratio. As the drops in ionisation are due to the absence of the earth's penetrating radiation which is probably of the gamma type one should have expected the numbers in column 6 to be approximately the same as those in Column 3 (or Column 2 since the ionisation under gamma rays is very probably due to secondary beta rays emitted by the walls of the electrometer). The differences, however, are considerable which would point to the probability of the earth's penetrating radiation being somewhat different in quality from the gamma rays used in obtaining the numbers given in Column 3.

The natural ionisations with the exception of that for acetylene given in Column 5, it will be seen, approximate to the numbers expressing the relative ionisations under beta or gamma rays rather than to those obtained with alpha rays. As materials such as zinc ordinarily classed as non-radio-active are not known to emit a gamma radiation, it would seem therefore that the residual ionisation observed with the different gases with the exception of acetylene could be ascribed to a beta radiation probably emitted by the walls of the zinc electrometer.

It will be noted however that in the case of each gas where the number expressing the residual ionisation is larger than the number expressing the beta ionisation the number expressing the alpha ionisation is also larger. Also when the number expressing the residual ionisation is smaller than the number expressing the beta ionisation then the number expressing the alpha ionisation is also smaller than the number expressing the beta ionisation. This indicates that though the greater part of the residual ionisation in the various gases may be due to beta rays a considerable part of it could be ascribed to a radiation of the alpha type. If, for example, we suppose the residual ionisation to be due to alpha and beta rays emitted by the zinc walls of the electrometer and suppose X% of the ionisation to be due to alpha rays we have for carbon dioxide the relation.

$$X \cdot 80 \cdot 4 + (100 - X)156 = 100 \times 110 \cdot 3$$

which gives $X = 60 \cdot 4$.

Applying this to the other gases we find the values for X which are given in Table IV.

TABLE IV.

Gas	X = percentage ionisation due to alpha rays.
Carbon dioxide..........	60·4%
Hydrogen................	23·4%
Ethylene................	14·4%
Nitrous oxide............	49·2% mean = 36·9%

The values of X vary considerably and give a mean of about 37%. It will be seen therefore that although the method of attacking the problem of seeking for an explanation of the residual ionisation in gases cannot at all be considered an exact one still it appears to be one of the very few methods available and from the results obtained it goes to shew that the residual ionisation observed in the gases tested with the exception of acetylene was probably due to a radiation emitted by the zinc walls of the electrometer which was partly of the alpha, partly of the beta and possibly partly of the gamma type with roughly about 37% of the ionisation due to alpha rays.

Considering the case of acetylene we see that in the second investigation as in the first an exceedingly high value was obtained for both the natural and the residual ionisation in this gas. From Table III it will be seen that under alpha and beta rays it was ionised to about the same extent as ethylene, and as the residual ionisation in ethylene was 6·32 ions per c.c. per second while in acetylene it was 27 ions per c.c. per second. it is clear that the high residual ionisation in the latter gas cannot be accounted for by an alpha and beta radiation from the walls of the electrometer.

It would look rather as if the ionisation in this case was either really spontaneous or else that it was due to some chemical action set up in the electrometer owing to the presence of some gaseous impurity.

To test the latter hypothesis an experiment was made with hydrogen prepared by adding water to commercial calcium hydride. The manner in which the hydrogen is produced in this case is very similar to that in which acetylene is obtained from calcium carbide, and it was though that if a gaseous impurity were present in the acetylene the same impurity might be expected to be present in the hydrogen as well. The natural ionisation in the laboratory in hydrogen prepared in this manner however was 1·8 ions per c.c. per second which is very close to 1·96 ions per c.c. per second the value found with hydrogen prepared by the action of sulphuric acid on zinc. It would seem therefore that in acetylene we have an ionisation where the atoms or molecules of the gas are being broken up into portions oppositely charged and that this process goes on naturally without the assistance of an agency such as alpha, beta or gamma rays. It should be added that although the argument presented in this paper, precludes the possibility of the residual ionisation in air being due to collisions between moleculer in thermal agitation, it does not exclude this agency in the case of acetylene. The ionisation in acetylene may then be due either to molecular collisions or a to spontaneous breaking up of the atoms or molecules of the gas, but to decide between these two additional experiments will have to be made.

I. Summary of results.

(1) From experiments made on the ice on Lake Ontario it would appear that the residual ionisation observed in air, carbon dioxide, hydrogen, nitrous oxide, and ethylene is not

spontaneous, even in part, but is due to a radiation emitted by the zinc walls of the electrometer which consists of rays of the alpha and beta and possibly of the gamma type.

(2) The residual ionisation in acetylene has been shewn to be exceptionally high 27 ions per c.c. per second, and evidence has been adduced which goes to shew that this ionisation cannot be wholly due to a radiation of the alpha, beta, or gamma type but that it must to a considerable extent be due either to molecular collisions or to a spontaneous disruption of the atoms or molecules which constitute the gas.

May 1st, 1915.
The Physical Laboratory,
University of Toronto.

Transactions of The Royal Society of Canada
SECTION III

SERIES III DECEMBER 1915 VOL. IX

On the Mobilities of Ions in Air at High Pressures.

BY PROFESSOR J. C. MCLENNAN, F.R.S. AND DAVID A. KEYS, B.A., UNIVERSITY OF TORONTO.

(Read May Meeting, 1915.)

I. INTRODUCTION.

In a paper by the writers, "On the electrical conductivity imparted to Liquid Air by alpha rays," attention was called to the exceedingly high insulating properties possessed by liquid air. The paper also included some measurements on the saturation currents in liquid air and in air at high pressures, when these were ionised by alpha rays. In the discussion of some phenomena connected with these currents, attention was drawn to the necessity of making measurements on the mobilities of ions both in liquid air and in air at very high pressures. Since the publication of that paper we have on several occasions made attempts to measure the mobilities of ions produced in liquid air; but up to the present have not succeeded in getting any trustworthy results. Convection currents due to the motion of air bubbles formed in the liquid air and the contamination of the liquid air by ice crystals formed from condensed atmospheric water vapour, have been two disturbing factors which we have not as yet been able to satisfactorily eliminate. It has been difficult, too, to reduce the size of the ionisation chamber of the measuring apparatus to dimensions small enough to permit of its use in a mass of liquid air small enough to be jacketted and kept at a low temperature by an outside vessel of liquid air maintained at a low temperature by rapid evaporation.

With regard to measurements on the mobilities of ions in air at high pressures, however, it has been quite different, for it has been found easy to make measurements on the mobilities at all pressures up to as high as approximately one hundred and ninety atmospheres, for such high pressures were obtained quite readily by the use of a liquid air compressor.

The only experiments which have been made hitherto on the mobilities of ions in air at high pressures appear to be the ones made by Dempster[1] and those made by Kovarik[2].

In his work Dempster used pressures to as high as 100 atmospheres and he found that over the range from one atmosphere to this limit the mobility of the positive ion made in air by alpha rays varied inversely as the pressure. He found, however, that the mobility of the negative ion at the higher part of the range did not appear to vary inversely as the pressure; but it decreased less rapidly with the pressure than it should have done if the inverse pressure law had been valid. Kovarik in his experiments, on the other hand, worked with pressures from 13·3 to 74·6 atmospheres and over the whole of this range he found that the mobilities of both positive and negative ions made in air by alpha rays followed the inverse pressure law.

In the present investigation the mobilities of the two kinds of ions were measured in air over a range of pressures commencing at 66·86 atmospheres and extending to 181·5 atmospheres. At the lower pressures of this range the mobilities obtained agreed with the results of Kovarik; but at the higher pressures it was found that the mobilities of the two kinds of ions began to approach each other in value and both decreased less rapidly with increases in pressure than they should according to the inverse pressure law.

II. Apparatus.

In making the measurements the apparatus shown in Fig. 1. was used. AB was a thick circular plate of brass about 8 cms. in diameter, into which a polonium-coated copper plate CD was inserted. GH was a circular plate of brass 2 cm. in diameter and EFKL was a circular guard plate surrounding GH. The plate GH was held firmly in position with ebonite supports, with its lower face flush with that of the guard plate EL. The upper face of CD, which was the one coated with polonium, was also flush with the upper face of the plate AB, into which it was inserted. The plate CD was square and has an area of 16 sq. cm. The plates GH and EL were kept at a distance of 1 cm. from the upper face of AB by means of ebonite supports. The clearance between GH and the guard plate EL was less than one-half a millimetre.

When this ionisation chamber was in use, it was placed in a strong steel cylinder which had a capacity of about 1·5 litres. The guard plate was electrically connected to the steel chamber, which was itself kept joined to earth. One terminal of a battery of small cells

[1]Dempster. Phys. Review, Vol. XXIV. No. 1. Jan. 1912, p. 53.
[2]Kovarik. Proc. Roy. Soc. A. Vol. 86, 1912. p. 154.

was joined to earth and the other terminal was joined by a wire, which passed through an insulating plug of ebonite in the walls of the steel cylinder, to the plate AB. An insulated wire PR also passed out

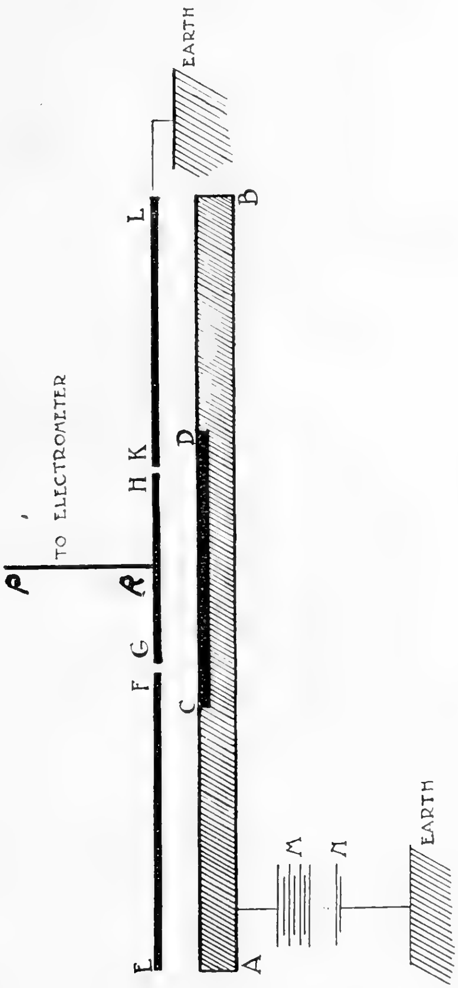


Fig. 1.

through the walls of the steel cylinder and was joined up to a pair of quadrants of a Dolazalek electrometer. With this arrangement any desired uniform electric field, positive or negative, could be established and maintained between the polonium-coated copper plate CD and the electrode EH. As the range of the alpha rays from polonium is only about 3·8 cm. in air at atmospheric pressure, it will be seen that at a pressure of about 70 atmospheres and higher the ionized portion of the air between GH and CD was confined to a very thin layer close to the latter plate.

The experiment consisted in measuring the current between CD and GH with various positive and negative voltages applied to AB at the different pressures. The formula for determining the mobilities which is applicable to the present case is that given by Rutherford[1] and Child.[2]

Expressed in electrostatic units the mobility of an ion is given by:

$$K=\frac{32.\pi.d^3.i}{9V^2} \text{ cm. a second per 300 volts a cm} \qquad (1)$$

where i is the current between CD and GH in e.s.u. per square cm. cross section, d the distance in cm. between GH and CD and V the potential difference between them in electrostatic units.

Expressed in practical electromagnetic units:

$$K=\frac{3200.\pi.d^3.i}{3V^2} \text{ cm. a second per volt a cm} \qquad (2)$$

where d is in cm., V is in volts, and i is in electrostatic units and is the current per square cm. cross-section between CD and GH.

As d was 1 cm. in the apparatus used by us the relation (2) reduces to:

$$K=\frac{3200.\pi.i}{3V^2} \qquad (3)$$

From equation (3) it will be seen that for a selected pressure the current i should be proportional to V^2.

Table I.
Air
Pressure = 145·35 atmospheres.

P.D. in Volts, V.	Square of P.D.	Current in e.s.u. per cm.^{2}
Positive		
4·11	16·89	$4{\cdot}51 \times 10^{-5}$
6·16	37·95	11·51
8·21	67·3	21·51
10·26	105·27	33·87
12·3	150·69	48·71
14·35	206·27	67·24
16·4	268·0	84·89
Negative		
4·1	16·8	$7{\cdot}09 \times 10^{-5}$
6·16	37·95	16·42
8·2	67·0	29·83
10·26	105·27	45·32
12·3	150·69	66·25
14·36	206·2	91·56
16·4	268·0	122·9

[1]Rutherford, Phys. Rev., Vol. XIII (6), p. 321, 1901.
[2]Child, Phys. Rev., Vol. XII (3) p. 137, 1901.

Table II.

Mobilities of ions at various pressures in air.

Pressure in Atmospheres	Mobility in cm /sec per volt /cm.		Mobility × Pressure		Ratio of mobilities k_2/k_1
	Positive = k_1	Negative = k_2	Positive	Negative	
Experimental Results.					
66·86	$19{\cdot}70\times10^{-3}$	$28{\cdot}30\times10^{-3}$	1·32	1·89	1·43
87·21	16·13	21·37	1·41	1·86	1·33
96·9	14·92	19·46	1·46	1·89	1·30
108·53	13·65	18·83	1·48	2·04	1·38
116·28	12·87	17·83	1·50	2·07	1·39
123·1	12·31	16·69	1·52	2·05	1·36
132·75	12·03	15·36	1·60	2·04	1·28
145·35	10·98	15·20	1·60	2·21	1·38
155·04	10·82	14·24	1·68	2·21	1·32
164·73	10·36	14·08	1·71	2·32	1·36
175·4	9·19	12·46	1·61	2·19	1·36
181·5	9·11	11·97	1·65	2·17	1·31
Calculated on basis of $p\times k$ = constant.					
20	$67{\cdot}3\times10^{-3}$	$94{\cdot}5\times10^{-3}$	1·34	1·89	1·41
30	44·9	63·0	"	"	"
40	33·5	47·3	"	"	"
60	22·4	31·5	"	"	"
80	16·8	23·6	"	"	"
100	13·4	18·9	"	"	"
120	11·2	15·8	"	"	"
140	9·6	13·5	"	"	"
160	8·4	11·8	"	"	"
180	7·5	10·5	"	"	"
200	6·7	9·5	"	"	"

At all the pressures used this law of proportionality between i and V^2 was tested by giving different values to V and in all cases it was found to hold. One of the different sets of readings obtained at a pressure of 145·35 atmospheres will serve to illustrate this point. The voltages applied, together with their squares and the corresponding currents per square cm. cross section, are given in Table I. They are represented graphically in Fig. 2 and it is clear from the diagram that the relation between i and V^2 is a linear one.

III. Results.

Diagrams similar to that in Fig. 2 were plotted from the readings taken with different voltages at all the pressures selected. From them values for i/V^2 were calculated for each of the pressures and on substituting these values in the relation given by the equation (3) the mobilities for both positive and negative ions were deduced for the corresponding pressures. These mobilities are all collected in Table II and they are plotted in Fig. 3 against the pressures as abscissae.

Mobilities calculated according to the inverse pressure law on the basis of the mobilities for positive and negative ions at atmospheric pressure being respectively 1·34 and 1·89 cm. a second per volt a cm. are also given in Table II. The dotted curves represent the calculated mobilities and the smooth curves the mobilities determined in the present investigation. As both the table and the figure show, the mobilities did not decrease as the pressure rose so rapidly as was demanded by the inverse pressure law. Moreover, it will also be seen from the table and the diagram that the mobility of the positive ion approached that of the negative ion as the higher pressures were reached, the ratio of the mobility of the negative ion to the positive ion dropping from 1·43 at 66·86 atmospheres to 1·31 at 181·5 atmospheres. The departure from the inverse pressure law, however, was not very great.

It will be recalled that Greinacher[1], in his experiments on the ionisation of paraffin oil and of petrol ether by alpha rays, found that the mobilities of the positive and negative ions produced in these liquids were practically identical. In this connection it is interesting to see that our results indicate that very probably the same equality would apply to the mobilities of positive and negative ions in liquid air. Measurements on the mobilities of ions in air at pressures still higher than those used in this investigation would be required, however, to show whether this surmise were correct or not.

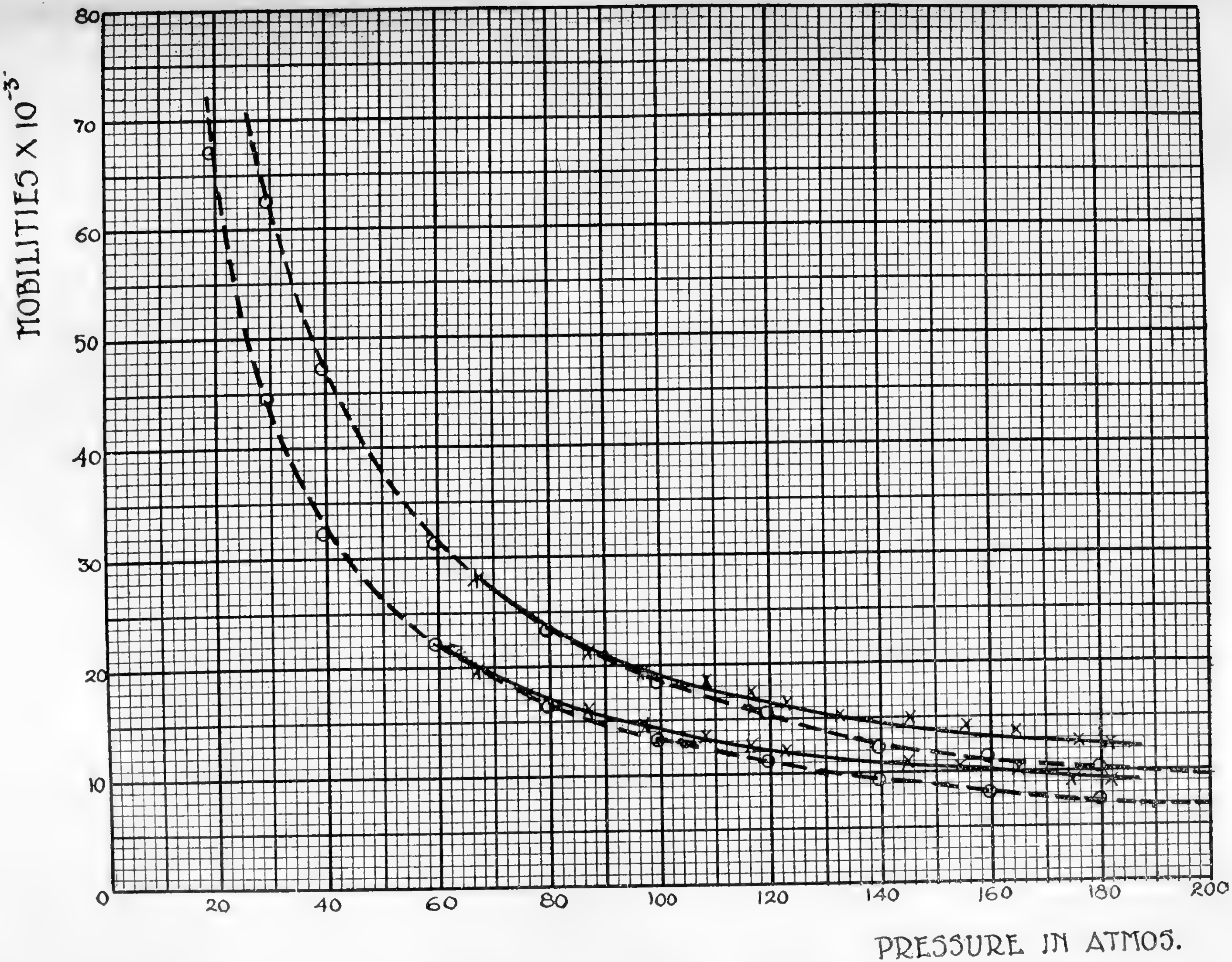
In closing we desire to express our appreciation of the services of Mr. P. Blackman, who assisted us in taking many of the readings in this investigation.

The Physical Laboratory,
University of Toronto,
May 1st, 1915.

[1]Greinacher. Phys. Zeit., 10 Jahr., No. 25, p. 986.


CURRENT IN E.S.U. X 10^-5
120
100
80
60
40
20
0
30
60
90
120
150
180
210
240
270
300
VOLTAGES SQUARED = V^2

Fig. 2.



MOBILITIES X 10^-3
80
70
60
50
40
30
20
10
0
20
40
60
80
100
120
140
160
180
200
PRESSURE IN ATMOS.

Fig. 3.

Measurement of Surface Tension by Means of a Vertical Jet.

By OTTO MAASS.

Presented by Dr. D. McINTOSH.

(Read May Meeting, 1915.)

During the past few years the worth of the absolute values of surface tension as obtained by different methods, especially by those which involve the continual formation of fresh surface of the liquid, has been a subject of some discussion.[1] In the following paper a new form of the dynamic measurement of surface tension is described. It is based on the phenomenon that an obstacle placed in the path of a jet of liquid flowing vertically downwards causes waves to travel upwards. Under the proper conditions these waves appear to be stationary and must therefore travel upwards with the same velocity with which the liquid falls. By determining this velocity and the length of the waves, the surface tension of the liquid is measured on a freshly formed surface.

A wave moving horizontally along the surface of a liquid is propelled onwards by two forces—gravity and surface tension. The velocity with which such a wave is propagated is approximately given by

$$v = \sqrt{\frac{\lambda}{2\pi}\left\{g + \frac{4\pi^2 T}{\rho\lambda^2}\right\}} \tag{1}$$

where v is the velocity, λ the wave-length, g the constant of gravity, T the surface tension and ρ the specific gravity. Now when a wave travels upwards the force due to gravity is parallel to the surface of the liquid, and plays no part in the propagation of the wave. In this case formula (1) becomes:—

$$T/\rho = \frac{v^2\lambda}{2\pi} \tag{2}$$

Formulæ (1) and (2) are derived with the assumption that the waves travel along a plane surface and that the curvature of the waves is in the form of a trochoid. The dynamics of a cylinder of liquid has however been rigorously worked out and the details of the calculation are to be found in Lamb's Textbook of Hydrodynamics.[2]

[1]Lenard Sitz. der Heidelberger Akad. d. Wiss. 1910. Bohr. Proc. Roy. Soc. p. 395 A 1911.

[2]Lamb's Hydrodynamics p. 450.

The result arrived at is

$$T/_{\rho} = v^2 \frac{2\pi r^2}{\lambda} \cdot \frac{I_0\left(\frac{2\pi r}{\lambda}\right)}{I_1\left(\frac{2\pi r}{\lambda}\right)} \left\{ \frac{1}{\left(\frac{2\pi r}{\lambda}\right)^2 - 1} \right\} \qquad (3)$$

where r is the radius of the cylinder and $I_0(x)$, $I_1(x)$ are Besel's functions.[1]

$$I_0(x) = \left\{ 1 + \frac{x^2}{2\cdot 2} + \frac{x^4}{2\cdot 4\cdot 2\cdot 4} + \cdots\cdots \right\}$$

$$I_1(x) = \frac{x}{2}\left\{ 1 + \frac{x^2}{2\cdot 4} + \frac{x^4}{2\cdot 4\cdot 2\cdot 2\cdot 2\cdot 4} + \cdots \right\}$$

As will be seen later, the values obtained for r and λ are such that I_1 does not differ much from I_0 and $\left(\frac{2\pi r}{\lambda}\right)^2$ is large compared with unity. Under this condition formula (3) tends to coincide with formula (2).

Before discussing the experimental details of determining the three unknowns λ^1, r, and v of formula (3), it may be interesting to notice the photographs of a falling stream of water when the latter is illuminated indirectly. (Figs. 1 and 2).

The stream is allowed to flow into a basin of water, waves travelling upwards from the point where the jet strikes the surface. In each case the source of light illuminating the stream was placed in a position such that the stream was illuminated from the side. The hollows of the waves are clearly shown at the side of the stream farthest away from the source of illumination. There are also curious light effects shown along the centre of each jet. These are due to the waves, each hollow and each crest acting as a lens. This effect enables one to measure the wave-lengths very accurately by placing the source of light directly behind the stream; the light passing through each wave hollow and each wave crest is thus focussed to a point, the rest of the stream appearing to be dark. (Fig. 3.)

The hollows focus the light to very fine points (see also Fig. 5.), and the wave-length can be very accurately determined by measuring the distance between two such points. It is plainly shown in Fig. 3 how the surface of the water rises to meet the stream. The dark band above the water line is due to the meniscus against the side of the glass box containing the water into which the stream is falling.

With a view to utilizing the wave lenses, described above, the apparatus was designed as shown in Fig. 4.

[1]Numerical tables of these functions may be found in Brit. Assoc. Reports 1889, 1893, 1896.

The figure is not drawn to scale, the size of the stream and the tube from which it flows being exaggerated as compared with the other objects. The flow of the stream was kept constant by allowing more

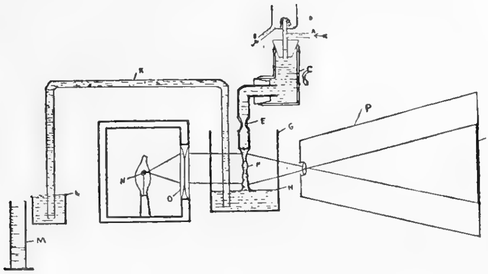


Fig. 4.

water to enter at A than would pass through the constriction at E. The excess water was drawn off at B, a constant head being thus maintained. The size of the stream would be fixed for different experiments by varying the constriction in the outflow tube at E. The stream fell into a square glass box G, partly filled with water, the latter being kept at a constant level H by means of the syphon K. After equilibrium had set in, the outflow per second was measured in graduated jar M. From the surface of the water, waves travel up the stream F, and these waves were stationary if the surface of the water which the stream strikes was steady. This was best obtained by using a wide syphon to draw off the outflow, as by this means the surface H could be kept absolutely still.

By means of the condensor O, a beam of parallel light is thrown through the jet which is then photographed. Exposures of from $\frac{1}{5}$ to $\frac{1}{10}$ second were employed.

Parallel to the stream and close beside it was placed a glass plate with co-ordinate lines (not shown in Fig. 4). These lines were photographed with the jet. By measuring the distances on the negative and the original between two lines the magnification is found. Figures 5, 6 and 7 show three photographs obtained in this way.

In Fig. 7 the stream was allowed to strike the convex surface of a watch glass. It was found that the water did not run off continuously and the waves were not absolutely steady. This method can, however, be employed to measure the surface tension of liquids which cannot be obtained in large quantities.

After the stream has been photographed the wave-lengths are measured. In each stream there are three or four waves which admit of accurate measurement; thus in Fig. 5 there are four such waves. The measurement is made by placing the negative under a microscope fitted with a cross-hair which may be moved across the range of view by means of a micrometer screw. The spots focussed by the hollow of each wave are very sharp indeed, so that the centre of each spot can be determined and the distance from one centre to the next measured.

The velocity and radius of the stream vary slightly throughout the length of the jet, hence the mean radius and the mean velocity were measured for each separate wave, and the surface tension calculated according to formula (3). In this manner the surface tension was determined for each wave in the jet.

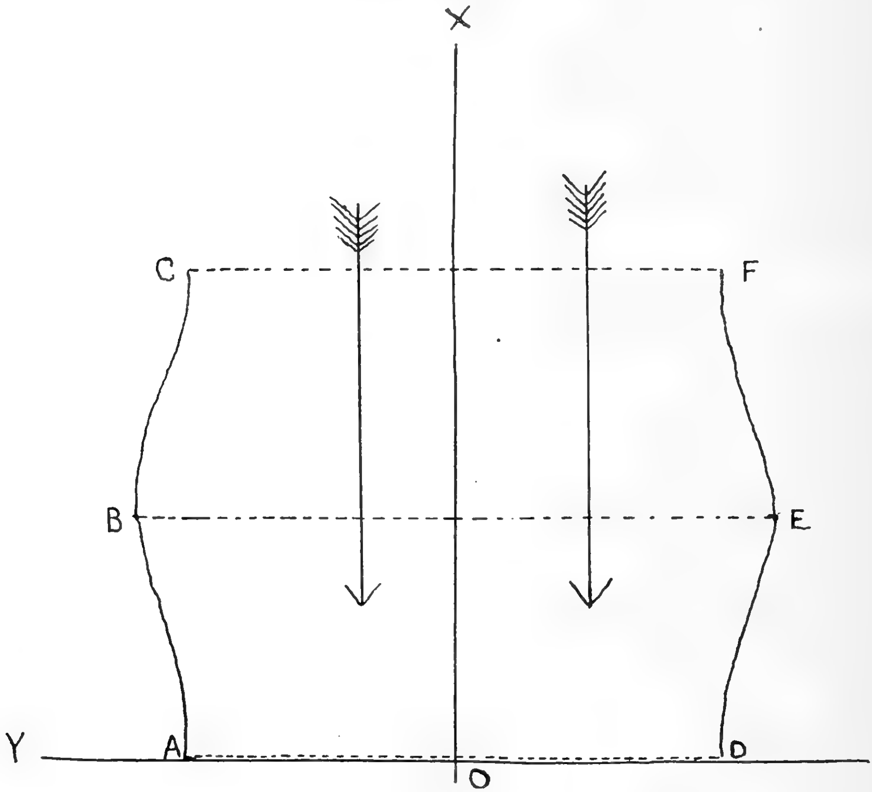


Fig. 8.

Let Fig. 8 represent a wave from one hollow to the next one. If the arrows represent the direction in which the stream is flowing then the diameter CF will be greater than AD; but since this difference is extremely small the mean of the two (D) is taken and the curve ABC may be considered to have the form of a sine curve. Waves on the surface of a liquid have the form of a trochoid; but the latter coincides with a sine curve in the limit: amplitude tending to zero. Since the amplitude was very small in all the experiments, curve ABC may be written

$$y = \frac{1}{2}\left[\frac{D}{2} + \frac{d}{2}\right] + \frac{1}{2}\left[\frac{D}{2} - \frac{d}{2}\right]\sin\left(\frac{2\pi}{\lambda}x - \frac{\pi}{2}\right) = r + \alpha \sin\left(\frac{2\pi}{\lambda}x - \frac{\pi}{2}\right) \qquad (4)$$

Where D is the diameter BE of the wave crest and therefore r the mean radius of the wave, and α the amplitude.

To measure the velocity of a wave we must know its mean cross-section. The latter is equal to

$$\frac{1}{\lambda}\int_{0}^{\lambda} \pi\, y^2\, dx$$

Substituting (4) for y and integrating, we get as the mean cross section

$$\pi\left(r^2 - \tfrac{1}{2}\,\alpha^2\right) \qquad (5)$$

Now, in all measurements, α was very small compared with r, so that α^2 may be neglected when compared with r^2. Hence the mean velocity is given by

$$v = \frac{W}{\pi r^2} \qquad (6)$$

where W stands for the number of cc. flowing through the stream per second.

D and d were measured on the negative plate in a manner similar to that by which the wave-length was measured; the cross-hair being placed tangent to each wave crest or wave hollow and the distance to the corresponding wave crest or wave hollow being measured.

The temperature of the liquid was measured in the outflow.

Figures 9, 10 and 11 show enlarged photographs of streams for which results are given.

Stream	Wave	r in cm.	λ in cm.	W in c.c. per sec	V in cm. per sec	t°	T in dynes	Mean value of T for stream
Fig. IX	1	·08824	·1084	1·481	60·54	20°	73·40	73·22
	2	·08915	·1120		59·30		73·18	
	3	·09035	·1174		57·78		73·33	
	4	·09181	·1235		55·94		72·97	
Fig. X	1	·1137	·1226	2·350	58·02	15°	74·45	74·35
	2	·1154	·1295		56·18		74·25	
Fig. XI	1	·09535	·1393	1·501	52·57	16°	74·15	73·98
	2	·09766	·1505		50·10		73·80	

The last column gives the mean value of T for each stream; when the three values are reduced to 12°C these become 74·40, 74·80, 74·56. Hence the mean value of the surface tension of water at 12° is found to be 74·6 dynes.

The stream in which the waves have the largest amplitude is shown in Fig. 11. In the first wave r and D/2 have values ·09535 and ·1002 respectively. This makes r^2 equal to ·00909 and α^2, ·000023. Hence $\frac{1}{2}\alpha^2$ in formula (5) may be neglected and v calculated by means of formula (6).

The results obtained for water are somewhat higher than those found by Bohr, who, using the vibrations of a horizontal jet, determined the value of the surface tension of water at 12° to be 73·23. The value 73·22 (obtained at 20°) agrees within 1% with the most recent static determination[1] of the surface tension of water at 20°.

The method of using the vertical jet is very simple and requires little apparatus. It may be employed for solutions and liquids other than water. The greatest error occurs in the determination of the velocity, i.e., in the measurement of the radius of the jet. The precision with which this measurement can be made depends on the accuracy of the micrometer screw of the microscope.

In conclusion, I wish to acknowledge my indebtedness to Mr. Werner for his aid in the photographic part of the work.

Department of Chemistry,
McGill University, Montreal.

[1]T. W. Richards, Journ. Amer. Chem. Soc., p. 1656, 1915.

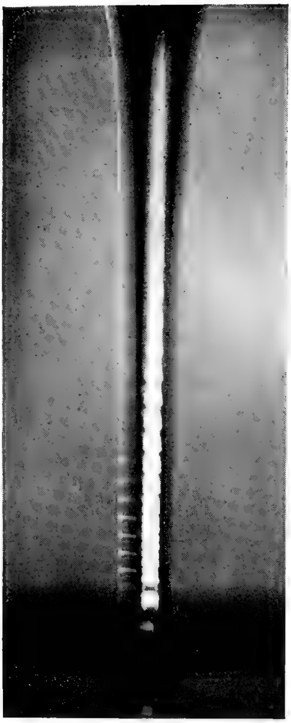


Fig. 1.

Fig. 2.

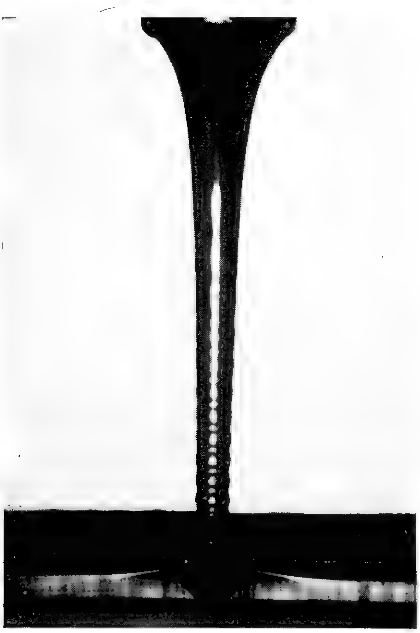


Fig. 3.

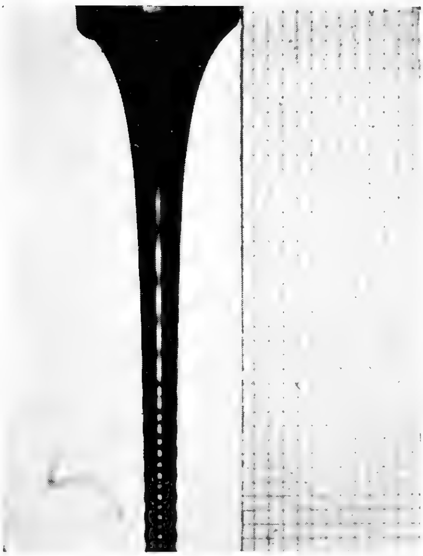


Fig. 5.

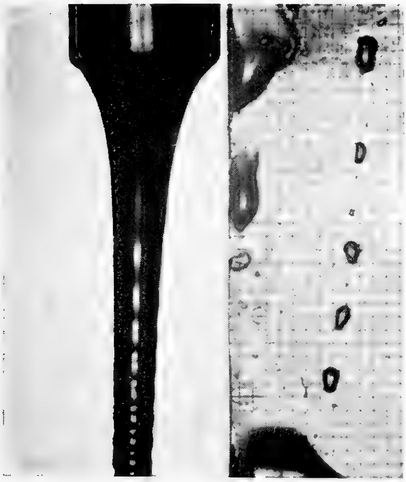


Fig. 6.

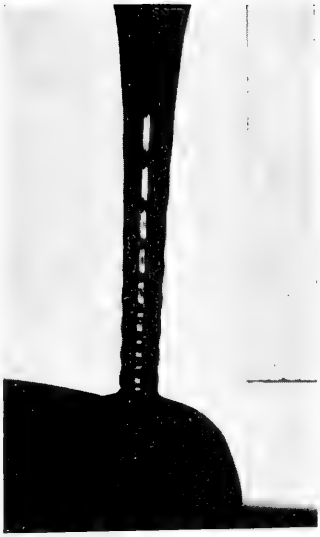


Fig. 7.

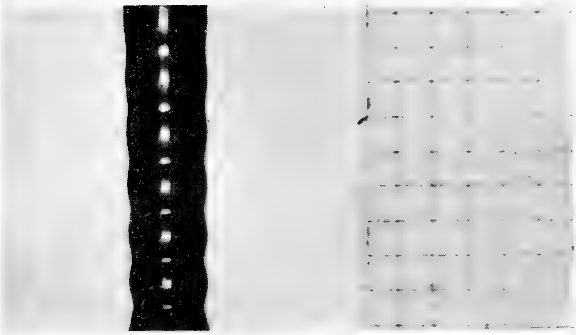


Fig. 9.

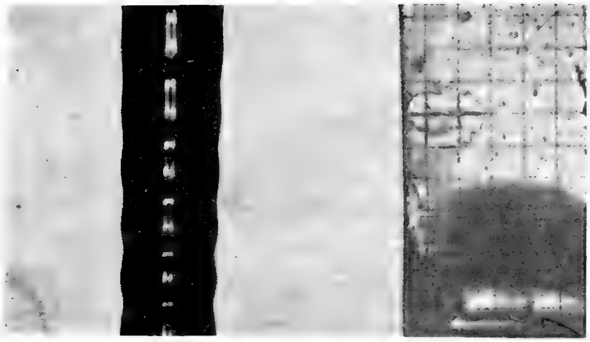


Fig. 10.

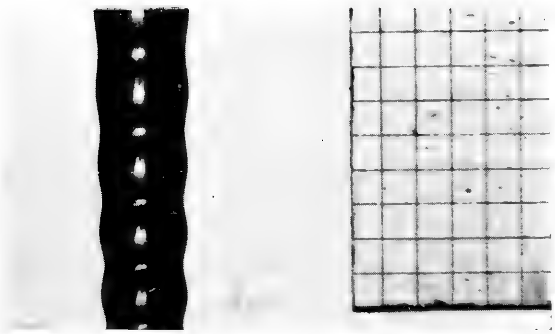


Fig. 11.

A Physical Test on a Natural (Methane) Gas Well.

By R. W. BOYLE AND H. M. TORY, F.R.S.C.

(Read May Meeting, 1915.)

During a test on a newly discovered natural gas well at Viking, Alberta, the writers had occasion to refer to available records of tests carried out on such gas wells in Canada and the United States. It appears that data on the physical behaviour of a newly discovered well, for a continuous period of three weeks or a month after discovery, are not frequently published. Accordingly it was thought advisable to publish here the record of the behaviour of the well just referred to. Although the tests here described could not go beyond the limits of the terms of a certain agreement, it is thought that the results might be of interest to some geologists and geo-physicists.

A complete log of the well, taken while drilling operations were in progress, was not obtainable; but the following details concerning the discovery of gas were obtained from an incomplete log which was kept and from personal conversations with some of the persons in charge.

The first sign of gas, with a little water, was encountered at a depth of 403 feet. As boring proceeded, small amounts of salt water were encountered at depths of 690 and 740 feet, and at a depth of 2,180 feet a small flow of gas was struck. The first measurement on this flow was carried out by the Pitot tube method, when the drilling had proceeded to a depth of 2,202 feet. The flow was then found to be delivering at the rate of, approximately, 67,000 cubic feet per day. More and more gas came into this flow as the drilling proceeded, until a much larger flow was struck at a depth of 2,300 feet. This larger strike of gas occurred at 3.00 a.m. on Wednesday, November 4th, 1914. The drilling was continued to a total depth of 2,340 feet.

At the time the tests were made there were two separate outlets of gas from the well. The larger flow of gas last mentioned came from the bottom of the well through a pipe, 6 inches in diameter, extending to a depth of 2,311 feet. Around the 6-inch pipe was another pipe, 8 inch diameter, extending from the surface of the ground to a depth of 1,444 feet. Most of the smaller flow of gas, referred to above, escaped through the space between the 6″ and surrounding 8″ pipe, and was drawn off at the surface through pipes separate from those conducting the larger flow.

It is also useful to insert the following information concerning the periods during which the well was open, from the time of its discovery to the commencement of the test which will be described.

The larger flow was blowing into the open atmosphere from the time of its discovery at 3.00 a.m., Wednesday, November 4th, until it was capped at 4.00 p.m., Saturday, November 7th. At 6.00 p.m. on this date the well was opened and blown down to a pressure of 200 pounds per square inch at the outlet valve and the gas was lighted for a period of three hours. After this the well remained closed until 3.00 p.m. Wednesday, November 11th, when it was opened for a period of three hours. It was again opened at 8.00 a.m. on Thursday, November 12th, until 4.00 p.m., November 13th. Thus the well had been open for various periods which totalled approximately five days from November 4th to November 14th, on which date our tests began.

It might be mentioned also, with reference to the smaller flow of gas, that it had been used practically continuously, for the purpose of heating the boilers of the drilling machinery and for burning as a light for the premises.

A chemical examination of samples of the gas from both smaller and larger flows showed the composition of the gas to be approximately as follows:

[1]Paraffin hydrocarbons (almost completely methane)	94%
Nitrogen	5%
Oxygen	0·4%
Carbon dioxide	0·6%

The physical tests here described were carried out on the larger flow of gas.

In order to find whether this flow came from a small isolated gas pocket, which might be quickly depleted, or whether it gave promise of a more extensive gas field, the well was blown into the open atmosphere, with no restrictions to the flow of gas, for a period of seven days. Daily measurements of the rate of flow were taken by means of Pitot tube.

It may be well to recall that this instrument is merely a simple manometer, of U-shape, containing a mobile liquid in each limb. If the manometer is connected by a tube with the flow of gas, in the manner indicated in Fig. 1, there will be a difference of level, h, of the liquid in the limbs of the manometer. The difference of level will be proportional to the square of the velocity, V, of the flowing gas.

[1]The writer is indebted to Mr. Kelso, of the University Industrial Laboratories, for this analysis.

The exact relation is given by $V = K\sqrt{2gH}$, where g is the acceleration due to gravity, and H is the height of a column of the gas in question which is equivalent to the difference of level, h, of the liquid

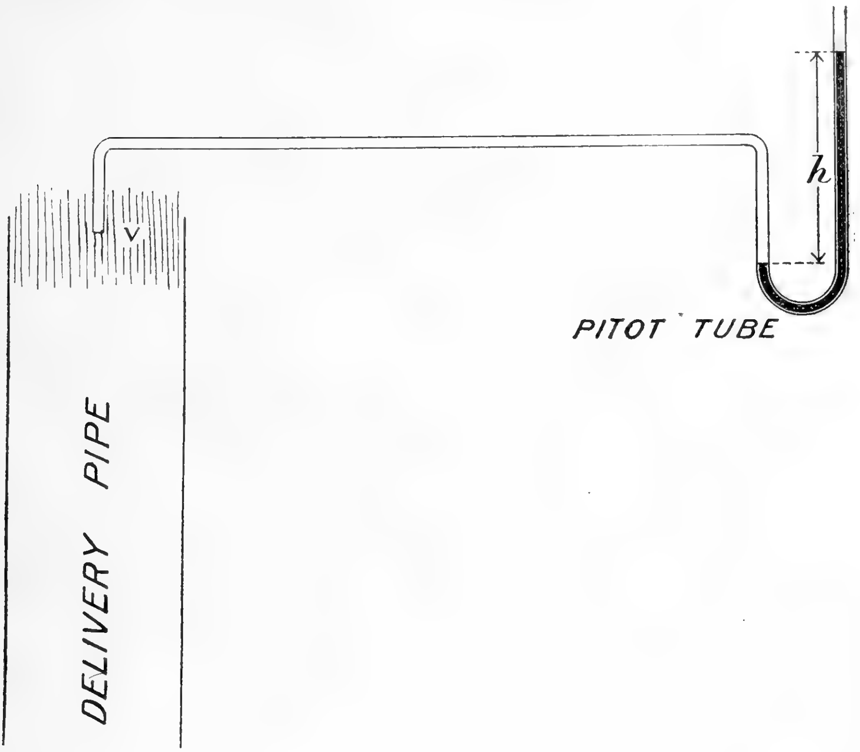


Fig. 1.

columns in the manometer, when the temperature and pressure of the gas are the same as that of the flowing gas at the point of measurement. K is a constant, usually nearly equal to 1, which is of the nature of a velocity correction for the position of the Pitot tube tip in the delivery tube. The volume of flow of gas per unit time is the product of the velocity of flow and the area of the delivery tube.

The liquids used in the Pitot tube were mercury, water, or oil, as the magnitude of the flow or the temperature of the air required. For larger flows mercury gave sufficient difference of level, but for the smaller the head was increased by using water. When the air temperature was below the freezing point of water it was necessary to use oil.

Determinations of the specific gravity of the gas from the well, compared with that of air at the same temperature and pressure, resulted in a value of 0·62. These determinations were made from comparative measurements of the rates of effusion through a small orifice of the gas and air under the same conditions of temperature and pressure.

The results for the seven days' blow-off test are given in Table I below. They are computed for a temperature of 40°F (4·4°C), which was the average temperature of the flowing gas, and an atmospheric pressure of 13·5 pounds per square inch (70 cms. Hg.) The rates of flow per 24 hours are computed to the third significant figure.

Table I.

Date	Time of Observation	Cub. Ft. Per Min.	Cub. Ft. Per 24 hrs
Nov. 14th,	4.30 p.m.	3,000	4,320,000
" 15th,	4.15 p.m.	2,430	3,500,000
" 16th,	4.00 p.m.	2,160	3,120,000
" 17th,	2.00 p.m.	1,940	2,790,000
" 18th,	4.00 p.m.	1,790	2,580,000
" 19th,	4.00 p.m.	1,630	2,350,000
" 20th,	4.00 p.m.	1,390	2,000,000
" 21st,	1.45 p.m.	1,340	1,930,000

The above rates of flow are represented in the form of a curve in Figure 2. The curve shows at a glance the rate of decrease in the delivery of the well. The end portion of the curve gives an indication that after flowing for seven days the well was gradually approaching the state of a steady rate of flow.

It was noticed during the seven days' blow-off test, that, after the well had been flowing for about a day, salt water was delivered with the gas. The occurrence of salt water in natural gas wells is not at all exceptional, and the quantity in the present case was never very considerable.

To obtain some information on the rate at which the gas could accumulate at the well on its being closed, the well, after blowing for seven days, was kept shut for the following 14 days, with the exception of a few minutes at the end of each successive 24 hours in order to allow measurements to be taken on the rate of flow. Also the accumulated rock, or closed, pressure at the end of each 24 hours was measured.

The results of this series of measurements are given in Table II, where the flows again are referred to a temperature of 40°F. and pressure of 13·5 pounds per square inch. To obtain these rates of flow the well was opened at a regular time for ten minutes each day. During these periods there were slight, unsystematic, variations of flow; the results given here are the average of all the measurements taken within the ten-minute periods.

Table II.

Date	Closed Pressure before opening well.	Rate of Flow	
		Cu. Ft. per Min.	Cu. Ft. per 24 hrs.
Nov. 21st, 2.00 p.m.	— lbs. per sq. in.	1,340	1,930,000
" 22nd,	342 " " " "	1,480	2,130,000
" 23rd,	333 " " " "	1,680	2,420,000
" 24th,	313 " " " "	1,800	2,590,000
" 25th,	313 " " " "	1,870	2,690,000
" 26th,	318 " " " "	1,970	2,830,000
" 27th,	327 " " " "	2,110	3,030,000
" 28th,	332 " " " "	2,210	3,190,000
" 29th,	337 " " " "	2,280	3,280,000
" 30th,	344 " " " "	2,360	3,390,000
Dec. 1st,	352 " " " "	2,410	3,470,000
" 2nd,	355 " " " "	2,470	3,550,000
" 3rd,	360 " " " "	2,560	3,690,000
" 4th,	367 " " " "	2,610	3,760,000
" 5th,	373 " " " "	2,660	3,830,000

The rates of flow and maximum pressures given in Table II are plotted in curves and shown in Figure 3. Both pressure and flow curves show that after fourteen days, gas was still slowly accumulating at the well, and there is not much indication that this process was at all nearing completion.

The fall and subsequent rise shown in the pressure curve are matters of interest. It is reasonably explained by the presence of water at the bottom of the well, the water having been brought there, from the gas and water-bearing sands, by the flow of gas in the seven days blow-off test. The closed pressure fell during the two and one-half days following the seven days' blow-off, and the total drop of pressure was 30 pounds per square inch. Since the specific gravity of this salt water was 1·064 there must have been, if this explanation is correct, a rise of water in the well of at least 66 feet. This was relatively not a great quantity, when it is remembered that the total depth of the well was 2,340 feet, and the gas had been flowing for seven days without interruption. It is worth noticing that the rate of flow of gas increased during the time the pressure was falling.

During the fourteen days' accumulation test, opportunity was taken to observe the rise of pressure on closing the valves after the ten-minute open flow. Readings of pressure and time were taken, and from these readings pressure-time curves have been plotted. A few of these observations are given in Table III, and some of the pressure-time curves are shown in Fig. 4.

Table III.

Rise of Pressure on closing well after 10 min. open flow.

Date.	Press. after 5 min.	Press. after 10 min.	Press. after 30 min.	Press. after 24 hrs.
Nov. 21st,	115 pounds per sq. in.	177 pounds per sq. in.	229 pounds per sq. in.	342 pounds per sq. in.
" 22nd,	120 " "	206 " "	287 " "	333 " "
" 23rd,	143 " "	231 " "	300 " "	313 " "
" 24th,	164 " "	253 " "		313 " "
" 25th,	168 " "	262 " "	313 " "	318 " "
" 26th,	172 " "	270 " "		327 " "
" 27th,	178 " "	280 " "	322 " "	332 " "
" 28th,	187 " "	292 " "	331 " "	337 " "
" 29th,	195 " "	301 " "	337 " "	344 " "
" 30th,	199 " "	307 " "		352 " "
Dec. 1st,	203 " "	312 " "		355 " "
" 2nd,	210 " "	319 " "		360 " "
" 3rd,	217 " "	326 " "		367 " "
" 4th,	222 " "	333 " "	360 " "	373 " "

These curves and figures indicate how quickly the well, after being open, will recover its pressure. It will be noticed that the rate of recovery was lowest immediately after the seven day blow-off, but from that on the rate of recovery became quicker from day to day. Immediately after the seven day blow-off the pressure took 7·6 mins. to rise to 150 pounds per square inch; on the fourteenth day it took only 3 mins. for the pressure to rise to the same figure.

At the end of the fourteen days' accumulation test just described, the well was put on open flow for three hours. At the beginning of this period the rate of delivery was 3,830,000 cubic feet per day and at the end 3,190,000 cubic feet per day, a decrease of 16·7 per cent in three hours. This fact indicates that the well on being opened quickly delivers the gas which had accumulated at the bottom. It does not necessarily imply that the gas supply of the surrounding field is small, though this may be a possible conclusion. The gas which had accumulated at the well had already forced its way through the porous sandstone to the hole of the well, where it could be quickly released. After its release the rate of flow of the well will depend on the *quantity* and *pressure* of the gas supply connected through the pores and capillaries of the sandstone with the well, and on the *porosity of the sandstone.* A large supply under considerable pressure may produce relatively a small flow of gas if the porosity of the sandstone is low.

To obtain some information on the behaviour of the well under conditions as nearly as could be made to approximate to those of actual service, the well was made to flow against a pressure at the outlet valve of about 200 pounds per square inch. Unfortunately, a period of only 20 hours' duration could be given to this test. At the end of this period of flow, against the pressure mentioned, the well maintained for one and one-half hour a continuous flow of 1,020,000 cubic feet per 24 hours, at a temperature of 29°F. The temperature of the gas was lower in the present case than that of the open flow on account of the greater expansion of the gas on reaching the open atmosphere. After this flow against a pressure the well was again put on open flow for a few minutes, and was found to be delivering at the rate of 2,200,000 cubic feet per 24 hours. These figures illustrate the approximate, empirical rule, sometimes quoted by well drillers, viz., if a well is put to flow against a pressure equal to about one-half its closed pressure, the flow will be at about one-half the rate of its open flow.

There was no sign of water being delivered with the gas when it was flowing against a pressure. The water came only after an open flow had proceeded for some time. Except in the case of the seven days' blow-off test referred to above, the gas was always able to clear itself of water on being allowed to flow a little while.

NOTE:—An experiment was performed on a sample of the gas to find if it showed any signs of radioactivity or not. The liquid, and gases from the liquid, of natural hot springs and of petroleum wells, are often radioactive on account of the presence of small quantities of radium emanation; but very often we know nothing about the depth from which these liquids come, and knowledge on the point is desirable for many problems. In the case of the present gas well we know approximately the depth from which the gas was produced, viz., about 2,300 feet, and it was of interest to find out if the gas were radioactive or not. The experiment showed, however, no trace whatever of any radioactive matter in the gas.

University of Alberta, Edmonton,
March, 1915.

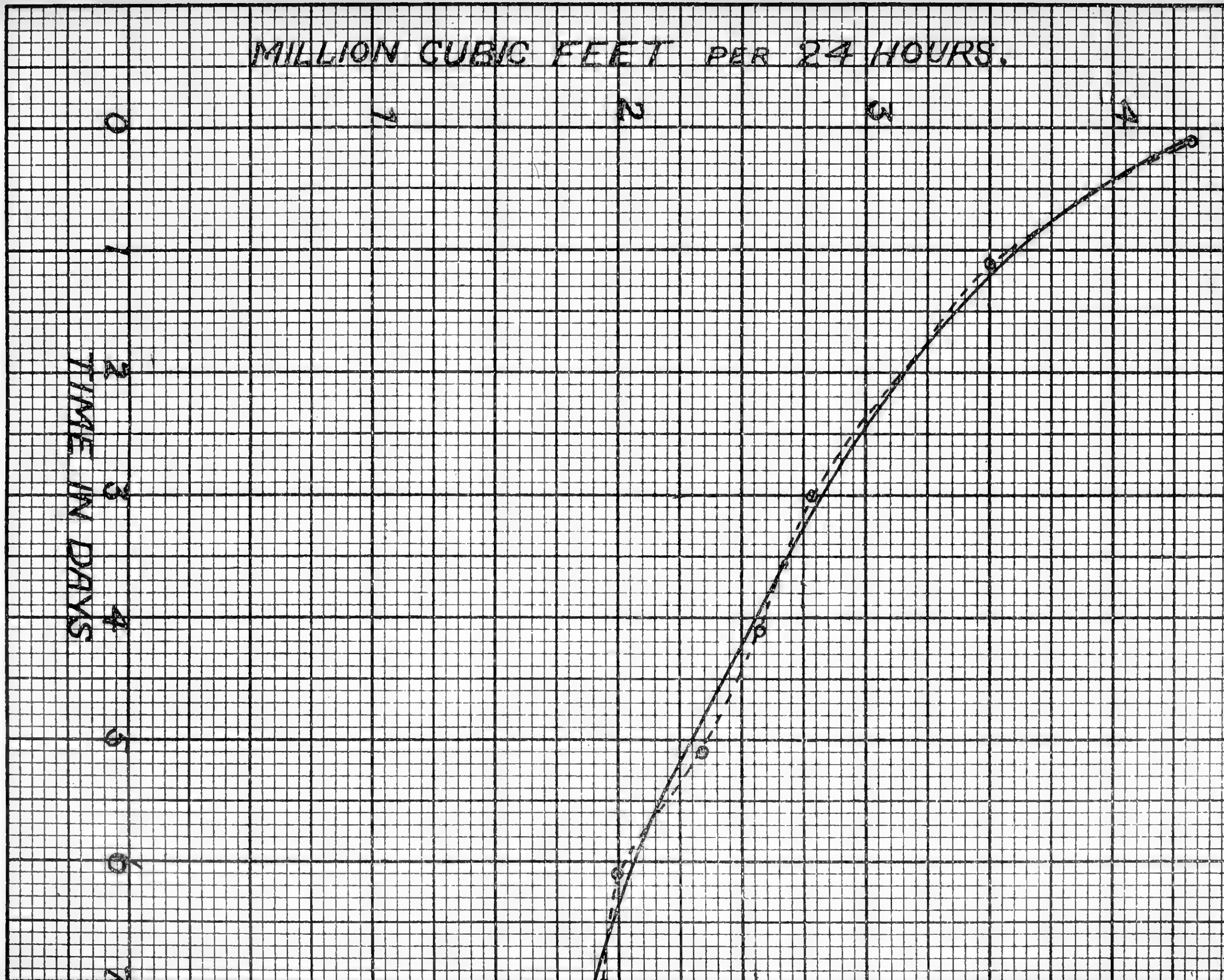


Fig. 2.

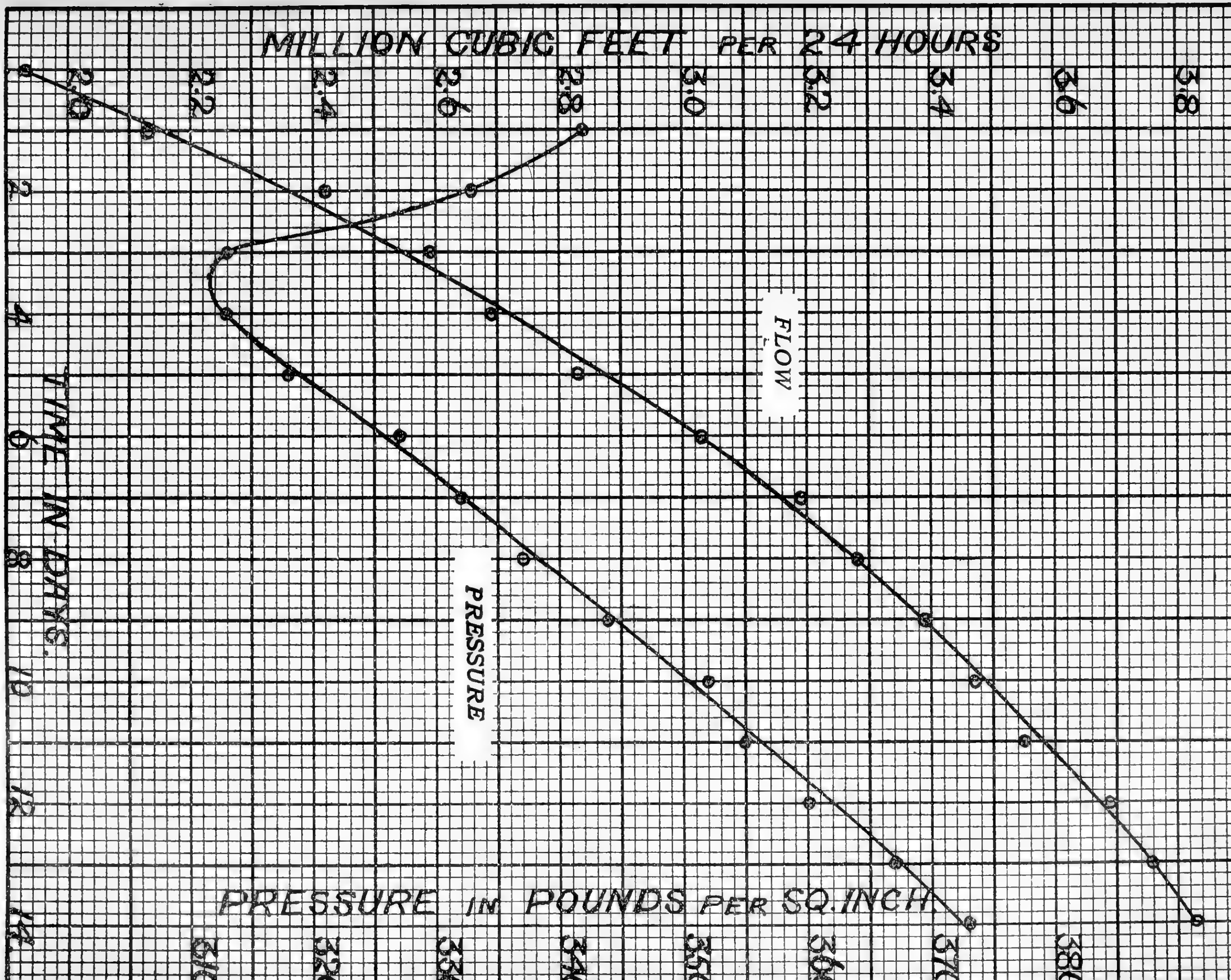
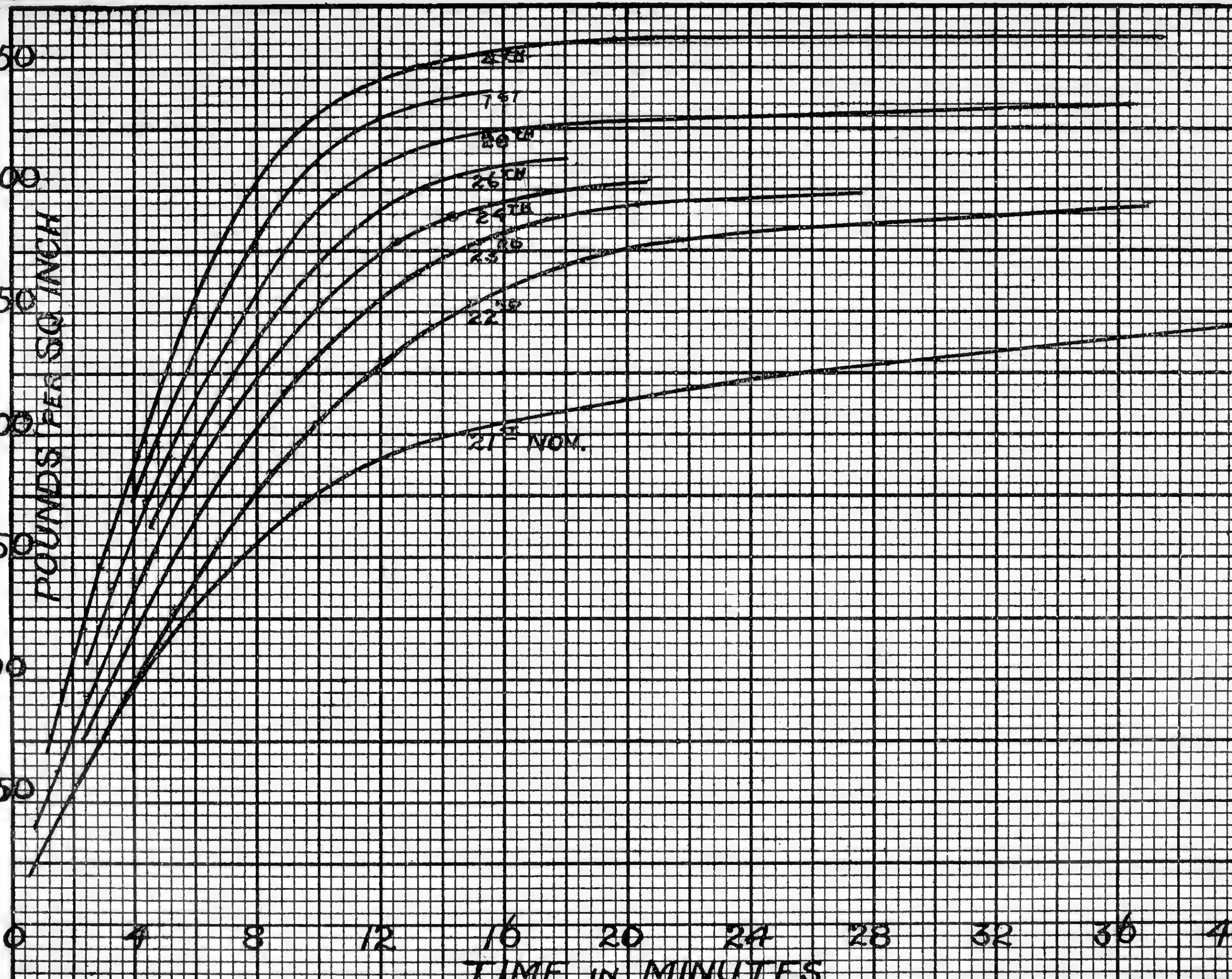

MILLION CUBIC FEET PER 24 HOURS
2.0
2.2
2.4
2.6
2.8
3.0
3.2
3.4
3.6
3.8
FLOW
PRESSURE
TIME IN DAYS.
2
4
6
8
10
12
14
PRESSURE IN POUNDS PER SQ. INCH.
310
320
330
340
350
360
370
380

Fig. 3.


350
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POUNDS PER SQ. INCH
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8
12
16
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TIME IN MINUTES.
7st
26th
24th
23rd
22nd
21st NOV.

Fig. 4.

Effect of Strain on the Coefficient of Expansion of Quartz.

By PROFESSOR H. T. BARNES, F.R.S.C.

(Read May Meeting, 1915.)

In a paper which I had the honour to present for Mr. C. B. James last year before Section III of the Royal Society, on the "Coefficient of Expansion of Mercury," it was shown that a large discrepancy exists between the coefficient as measured by the dilatometer and by the method of balancing columns.

At present no satisfactory explanation of this error has been found. Many suggestions have been made as to the possible cause and one of these which occurred to me was the effect of strain on the expansion of the quartz dilatometer. The difference between the coefficient measured by the two methods disappears, if we calculate the coefficient by the dilatometer method, neglecting the coefficient of expansion of the quartz.

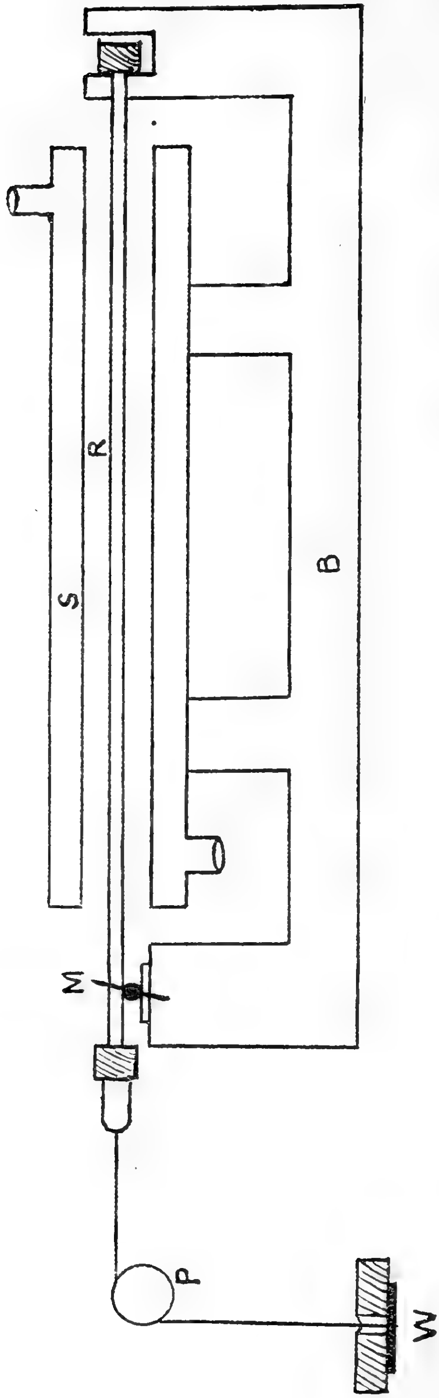
No data are available on the effect of strain on the coefficient of expansion of materials, except what we know in regard to the effect of strain on certain colloids, such as india-rubber and gelatine. Here we find that the coefficient is changed from a positive to a negative value, when the colloid is stretched slightly.

The exact composition of fused silica is not definitely known. It is probably part crystalline and partly colloidal in structure. If colloidal, it is conceivable that the strain under which a dilatometer bulb is placed when filled with so heavy a substance as mercury might have some influence on the coefficient of expansion. The expansion of quartz is small and somewhat irregular at different temperatures[1], and it is not altogether clear or proven what effect strain would have on the coefficient.

EXPERIMENTAL.

To test this point, a quartz tube was taken, approximately 80 cms. long, 5·4 mms. outside diameter and 3 mm. inside diameter. This rod was soldered into brass rings at each end, and placed in a steam jacket S, Fig. 1. One end of the tube, R, was fastened to a rigid support, and the other end connected with a fine steel wire passing over a pully P, and carrying a weight W. The expansion of the tube was observed by a telescope and scale reflected from a mirror M, which

[1]Compare N. E. Wheeler, Trans. Roy. Soc., Can. 8, 139, 1914.


R
S
B
M
P
W

rotates with a steel roller supporting the quartz tube. The steel roller is held on plate glass resting on a portion of the supporting base B.

Since the object of the experiments was to compare the expansion of the tube when under different tensions, and to find out whether any effect was present, no effort was made to determine the coefficient of expansion in absolute measure.

Had an effect existed, more refined measurements would have been undertaken. The temperature interval was taken between the temperature of the room and that of steam supplied by an ordinary boiler. Different weights were used on the scale pan up to the breaking strength of the quartz tube.

The following table contains the result of the tests. The deflection represents the change in scale reading observed in the telescope which was placed about two meters away from the mirror.

Air Temp.	Steam.	Weight.	Deflection.
20·5°C	100°C	1 kilo	7·65 Cms.
20·5	100	2 kilos	7·19
20·5	100	7·2 kilos	7·17
20·5	100	8 kilos	7·00
20·8	100	1 kilo	7·65
20·8	100	1 kilo	7·13

Above 8 kilos tube failed.

An approximate calculation of the coefficient of expansion represented by a movement of the quartz tube necessary to give a deflection of 7 centimetres on the scale, gave a result in very good agreement with the best values for this temperature interval *i.e.*, $0{\cdot}4\times10^{-6}$ cm.

It is evident that no effect of strain is observable in these experiments greater than the probable error of observation. It will be necessary to seek the cause of the discrepancy elsewhere.

A Certain Projective Configuration and the Integration of its Normal Equations.

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PRESENTED BY J. HARKNESS, F.R.S.C.

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INTRODUCTION

The investigation of geometrical problems frequently leads to the solution of differential equations of the utmost importance in other branches of pure and applied mathematics. Unfortunately, however, many of these important formulae become known only to those acquainted with highly specialized methods of geometrical analysis. It is primarily with a view to emphasizing certain results arising from geometrical considerations that this investigation has been undertaken.

In a recent paper* based on Wilczynski's Projective Theory of Curved Surfaces† and devoted to a study of surfaces whose asymptotic curves belong to linear complexes, the writer has shewn that these surfaces are organically related to a certain quadric, called the Directrix Quadric. When the Directrix Quadric consists of two coincident planes the Normal System of differential equations of the surfaces reduces to a form which has since been integrated by Wilczynski (Directrix Curves, Math. Annalen, Dec., 1914). But the geometrical basis of Wilczynski's investigation and the idea of a Directrix Quadric are points of view entirely unrelated. It therefore seems that the integration of the Normal Equations from this latter point of view is of sufficient interest to merit a separate discussion.

The integration of the Normal System can be effected by a more direct analytical method than that employed here,‡ but the present treatment is essential to a complete analysis of the geometrical configurations involved. Moreover, it enables us to utilize Wilczynski's formulae for the resolution of the general solution into a fundamental set of solutions.

*Transactions of the American Mathematical Society, Vol. 15 (1914). References to this paper will be made under the symbol S.

†The projective theory of curved surfaces has been developed by E. J. Wilczynski, in a series of five memoirs published in the Transactions of the American Mathematical Society, Vols. (8-10), (1907-1909). These memoirs will be cited as M_1, M_2, etc. We shall also have occasion to refer to Wilczynski's memoir on One-parameter Families and Nets of Curves (Trans. Am. Math. Soc., Vol. 12 (1911)); we shall hereafter refer to this memoir under the symbol N.

‡From purely analytical considerations the form

$$\theta = c_1 \int\int \frac{du\, dv}{\phi\,(u, v)} + U_1(u) + V_1(v) + c_2$$

of the general integral of the Normal System has been known for some time to the writer.

In this paper certain new metrical properties of the linear complexes involved are also placed in evidence. These properties may be stated as follows:

If $C'(v)$ and $C''(u)$ be the linear complexes determined by the asymptotic curves (v=const. and u=const. respectively) of a surface whose Directrix Quadric consists of two coincident planes, the loci of the axes of $C'(v)$ and $C''(u)$ are two cylinders with parallel generators; and the principal parameters of $C'(v)$ and $C''(u)$ have the same constant numerical value.

Analytical basis of the projective differential geometry of non-developable curved surfaces.

The projective theory of non-developable curved surfaces, as developed by Wilczynski, is based on a discussion of a system of partial differential equations which can be reduced to the form

$$(1)\qquad \begin{aligned} &\frac{\partial^2 y}{\partial u^2} + 2\,a(u,v)\,\frac{\partial y}{\partial u} + 2\,b(u,v)\,\frac{\partial y}{\partial v} + c\,(u,v)\,y = 0, \\ &\frac{\partial^2 y}{\partial v^2} + 2\,a'(u,v)\,\frac{\partial y}{\partial u} + 2\,b'(u,v)\,\frac{\partial y}{\partial v} + c'(u,v)\,y = 0; \end{aligned}$$

and on the theory of the Invariants and Covariants of this system of equations. To make this clear it is first necessary to outline briefly Wilczynski's procedure.

If we differentiate equations (1) with respect to u and v, we find four distinct third order derivatives; and each of these can be expressed uniquely in the form

$$\alpha\,(u,v)\,y + \beta\,(u,v)\,\frac{\partial y}{\partial u} + \gamma\,(u,v)\,\frac{\partial y}{\partial v} + \delta\,(u,v)\,\frac{\partial^2 y}{\partial u\,\partial v}\,.$$

By a further differentiation we find that each of the mixed derivatives of the fourth order can be calculated in two distinct ways. The two expressions thus obtained for each of these mixed derivatives of the fourth order must be identical; hence the coefficients of equations (1) must satisfy the following *integrability conditions*:

$$(2)\qquad \begin{aligned} &a_v = 0, \quad b'_u = 0, \\ &a'_{uu} + c'_u - 2a'a_u - 2aa'_u - (a_{vv} + 2b'a_v - 2ba'_v - 4a'b_v) = 0, \\ &b_{vv} + c_v - 2b_v\,b' - 2bb'_v - (b'_{uu} + 2ab'_u - 2a'b_u - 4a'_u\,b) = 0, \\ &c'_{uu} - 4ca'_u - 2a'c_u + 2ac'_u - (c_{vv} - 4c'b_v - 2bc'_v + 2b'c_v) = 0, \end{aligned}$$

where

$$a_u = \frac{\partial a}{\partial u}, \quad a_v = \frac{\partial a}{\partial v}, \quad a_{uu} = \frac{\partial^2 a}{\partial u^2}, \quad \text{etc.}, \ldots\ldots;$$

and when these conditions are satisfied the system (1) is *completely integrable.*

Further, it may be shewn that a system of equations of the form (1) whose coefficients are analytic functions of u and v has precisely four linearly independent analytic integrals

$$y^{(k)}=f^{(k)}(u, v) \quad (k=1, 2, 3, 4);$$

provided, of course, that the integrability conditions (2) are satisfied.

Any set of four solutions of (1) for which the determinant $[y\ y_u\ y_v\ y_{uv}|$ is different from zero is called a *fundamental set of solutions;* and the most general solution may be expressed in the form

$$(3) \qquad y=c_1 y^{(1)}+c_2 y^{(2)}+c_3 y^{(3)}+c_3 y^{(4)},$$

where the c's are constants. Thus any other fundamental set of solutions, say $\bar{y}^{(k)}(k=1, 2, 3, 4)$, will be of the form

$$\bar{y}^{(k)}=c_{k1} y^{(1)}+c_{k2} y^{(2)}+c_{k3} y^{(3)}+c_{k4} y^{(4)}, \quad (|c_{ki}|\neq 0), \quad (k=1, 2, 3, 4),$$

where the c's are constants.

If, then, $y^{(1)}$, $y^{(2)}$, $y^{(3)}$, $y^{(4)}$ be interpreted as the homogeneous coördinates of a point in three dimensional space, the locus of the point Py is a surface S; and, furthermore, this surface has the parametric curves $v=$const. and $u=$const. as asymptotic curves. We shall denote these parametric curves by Γ' and Γ'' respectively.

Conversely, if an arbitrary non-developable curved surface S be given by the equations

$$y^{(k)}=f^{(k)}(u, v) \quad (k=1, 2, 3, 4)$$

(the asymptotic curves being parametric), then a system of equations of the form (1) can be determined which has S as its integral surface.

It follows from (3) that the most general integral surface of (1) is a projective transformation of the surface S, and that the coefficients of (1) have the same significance for all such surfaces. Now the form of the coefficients of (1) depends upon the particular analytic representation used; since, if we apply to (1) the transformation

$$(4) \qquad \bar{u}=\alpha(u), \ \bar{v}=\beta(v), \ \bar{y}=\lambda(u,v)\, y,$$

where α, β, λ, are arbitrary functions of their arguments, the surface S and the parametric curves (Γ', Γ'') remain unchanged while the coefficients of (1) assume the new values ($\bar{a}'$, $\bar{b}$,... etc.,) where

$$(5) \qquad \bar{a}' = \frac{\alpha_u}{\beta^2_v}\, a', \ \bar{b} = \frac{\beta_v}{\alpha^2_u}\, b, \ \ldots. \text{ etc.}, \ \ldots..$$

Those functions of the coefficients (a, a',..., c, c') and their derivatives which remain unchanged by a transformation of the form (4) are called Invariants; and those functions of (a, a',...c, c'; y) and their derivatives unchanged by this transformation are called

Covariants. It follows, therefore, that any property of S expressible entirely in terms of the Invariants and Covariants of (1) is a purely projective differential property and inversely.*

The system (1) can be reduced to the *canonical form*

$$(6)\quad \begin{aligned} y_{uu} + 2by_v + fy &= 0, \\ y_{vv} + 2a'y_u + gy &= 0, \end{aligned}$$

by a transformation of the type (4). When equations (1) are written in this form, the integrability conditions assume the simpler form

$$(7)\quad \begin{aligned} a'_{uu} + g_u + 2ba'_v + 4a'b_v &= 0, \\ b_{vv} + f_v + 2a'b_u + 4ba'_u &= 0, \\ g_{uu} - f_{vv} - 4fa'_u - 2a'f_u + 4gb_v + 2bg_v &= 0. \end{aligned}$$

The most general transformation of the type (4) that leaves the form of the canonical system unchanged is the following:

$$(8)\quad \bar{u}=\alpha(u),\ \bar{v}=\beta(v),\ \bar{y}=c\sqrt{\alpha_u\,\beta_v}\;y,$$

where α and β are functions of u alone and v alone respectively and c is an arbitrary constant.†

The functions

$$y,\ z = y_u\ ,\ \rho = y_v\ ,\ \sigma = y_{uv}$$

are relatively invariant under transformations of the dependent variable that leave the canonical form unchanged; they are called the *fundamental semi-covariants* of the canonical system.‡ If we substitute for $y^{(k)}$ in these semi-covariants the four independent solutions $y^{(1)}$, $y^{(2)}$, $y^{(3)}$, $y^{(4)}$ of the canonical system, we obtain a set of four values for each of the four functions y, z, ρ, σ; these we shall interpret as the homogeneous coördinates of the four points P_y, P_z, P_ρ, P_σ. These four semi-covariants therefore determine a moving tetrahedron which is non-degenerate, since the determinant $|\,y\,z\,\rho\,\sigma\,|$ is different from zero. In like manner the function

$$x^{(i)} = x_1\,y^{(i)} + x_2\,z^{(i)} + x_3\,\rho^{(i)} + x_4\,\sigma^{(i)}\ (i=1,\ 2,\ 3,\ 4)$$

will determine a point P_x ; and the *unit point* of the system of coördinates determined by the tetrahedron $P_yP_zP_\rho P_\sigma$ can be so chosen that (x_1, x_2, x_3, x_4) will be the coördinates of P_x when referred to the moving system.

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*For further information concerning the calculation of Invariants and Covariants and the completeness of the system of Invariants, the reader is referred to Wilczynski's memoirs and a paper by G. M. Green, Trans. Am. Math. Soc. (Vol. 16, No. 1).

†M_1, p. 256.

‡M_1, p. 247.

The invariance of the following functions under transformations of the type (8) can be readily verified either by direct substitution or by infinitesimal transformations:

$$(9) \qquad a',\ b,$$
$$\theta' = [a'^2_u - 2a'a'_{uu} - 2^2a'(b_v + f)],$$
$$\theta'' = [b^2_v - 2b\,b_{vv} - 2^2b(a'_u + g)],$$
$$\Omega' = 4a'b - \frac{\partial^2 \log a'}{\partial u\,\partial v},\ \Omega'' = 4a'b - \frac{\partial^2 \log b}{\partial u\,\partial v}\text{*}.$$

These Invariants possess a geometrical significance of the utmost importance in the succeeding discussion.

Geometrical considerations.

Through every point P_y of the surface S two asymptotic curves Γ' and Γ'' pass; the tangents to Γ' and Γ'' at P_y are the lines $P_y\,P_z$ and $P_y\,P_\rho$ respectively. As the point P_y moves over the surface S these lines generate two congruences (G') and (G''); and both of these congruences have S as focal surface. If v remains constant and u varies, the point P_y moves along the curve Γ', the tangent $P_y\,P_z$ describes a developable of the congruence (G'), and the tangent $P_y\,P_\rho$ describes a ruled surface $R''(v)$ of the congruence (G''). In like manner the tangent $P_y\,P_\rho$ describes a developable of $(G)''$ and $P_y\,P_z$ describes a ruled surface $R'(u)$ of (G') as P_y moves along Γ''.

The lines of (G') and (G'') can be assembled into ruled surfaces according to any arbitrary law

$$\psi(u, v) = \text{Const.}$$

However, the surfaces that specially concern us in the present discussion are R' and R'' tangent to S along Γ' and Γ'' respectively.

The linear complex

$$C'(v): -\ b_v\,\omega_{34} - b\omega_{14} + b\omega_{23} = 0,$$

where ω_{ij} $(i, j = 1, 2, 3, 4)$ are the Plückerian line coördinates referred to the moving tetrahedron $P_y\,P_z\,P_\rho P_\sigma$, will contain the tangents to the curve $\Gamma'(v)$, if and only if the Invariant Ω' vanishes.† Also (in the same notation and coördinate system) the linear complex

$$c''(u): -\ a'_u\,\omega_{42} + a'\omega_{14} + a'\omega_{23} = 0$$

will contain the tangents to the curve $\Gamma''(u)$ when the Invariant Ω'' vanishes.‡

The writer has shewn (section 3 of the paper cited above) that when the Invariants Ω', Ω'' vanish, the surfaces $R'(v)$, $R''(u)$ are contained in line congruences each of which is the intersection of two

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*S, pp. 175, 180.
†S, pp. 175, 182.
‡S, pp. 175, 182.

linear complexes; and that, therefore, each of these surfaces has two straight line directrices. We shall denote these by (δ_1', δ_2') and (δ_1'', δ_2'') respectively. The directrices (δ_1', δ_2') constitute the two branches of the flecnode curve of R' (*i.e.*, the locus of points at which tangents have fourth order contact), and these two branches of the flecnode curve are coincident or distinct according as the Invariant θ' does or does not vanish.* A similar statement applies to the directrices (δ''_1, δ''_2) and the Invariant θ''.

It has also been shewn (section 4 of the paper cited above) that the loci of (δ_1', δ'_2) and (δ_1'', δ_2'') are complementary reguli of a quadric surface, called the Directrix Quadric.†

It may happen that the Directrix Quadric degenerates into two planes, distinct or coincident. From geometrical considerations it is apparent that, when the Directrix Quadric degenerates into two coincident planes, the two Invariants θ_1, θ'' must vanish. The converse of this however is not easily proved by geometrical reasoning.

In the succeeding sections we shall prove that when the Invariants θ', θ'' vanish, the Directrix Quadric consists of two coincident planes (of course, the Invariants Ω', Ω'' vanish); we shall also determine the finite equations of the surface for this case.

Normal Equations.

We shall now determine the *normal form* of system (6) when the Invariants Ω', Ω'', θ', θ'' vanish. At the outset we may exclude the case $(a)'$ or (b) equal to zero; since, if either (a') or (b) vanish, the surface S will be ruled,‡ and when the asymptotic curves of a ruled surface belong to linear complexes the surface has straight line directrices.§

From the conditions

$$\Omega' = 0, \ \Omega'' = 0$$

we deduce the equation

$$(10) \quad (\Omega' - \Omega'') \equiv \frac{\partial^2 \log \left(\dfrac{a'}{b}\right)}{\partial u \, \partial v} = 0;$$

whence (by integration)

$$\frac{a'}{b} = \frac{U}{V},$$

where U and V are functions of u alone and v alone respectively, and where $U \neq 0$, $V \neq 0$.

*Wilczynski, *Projective Differential Geometry of Curves and Surfaces*, Teubner, Leipzig, 1906, p. 130.

†S, §§3, 4, 7.

‡M_3, p. 293.

§S, p. 171.

But this relation can be reduced to a much simpler form by means of a transformation of the type (8). In short, if we apply the transformation

$$\bar{u}=\alpha(u)=\int \sqrt[3]{U}\,du,\ \bar{v}=\beta(v)=\int \sqrt[3]{V}\,dv,\ \bar{y}=c\sqrt{\alpha_u\,\beta_v}\ y$$

to system (6) and denote the coefficients of the transformed system by ($\bar{a}$, $\bar{b}$, etc.,) we shall find

$$(11)\qquad \frac{\bar{a}'}{\bar{b}}=\frac{a'}{b}\cdot\frac{\alpha^3{}_u}{\beta^3{}_v}=1.$$

The most general transformation of the type (8) that leaves this relation undisturbed is evidently

$$\bar{u}=u,\ \bar{v}=v,\ \bar{y}=cy,$$

where c is an arbitrary constant.

Let us assume that the relation (11) has already been effected; so that the conditions

$$\Omega'=0,\ \ \Omega''=0$$

become

$$a'=b=\phi(u,\,v),$$

where $\phi(u, v)$ is a solution of the equation

$$(12)\qquad \frac{\partial^2 \log\phi}{\partial u\,\partial v}=4\phi^2.$$

Now this equation can readily be transformed into one of the Liouville type, from which the general solution of (12) is found to be*

$$(12)^1\qquad \phi=\tfrac{1}{2}\,\frac{\sqrt{U'\,V'}}{(U+V)},$$

where U and V are functions of u alone and v alone respectively, and where $U\neq 0$, $V'\neq 0$.

On taking account of equations (9), (11) and (12), the conditions

$$\theta'=0,\ \theta''=0$$

lead to the following expressions for f and g in terms of the function ϕ:

$$(13)\qquad \begin{aligned} f&=-\phi_v-\tfrac{1}{2}\,\frac{\partial^2\log\phi}{\partial u^2}-\left(\frac{\partial\log\sqrt{\phi}}{\partial u}\right)^2,\\ g&=-\phi_u-\tfrac{1}{2}\,\frac{\partial^2\log\phi}{\partial v^2}-\left(\frac{\partial\log\sqrt{\phi}}{\partial v}\right)^2. \end{aligned}$$

We must now determine whether or not the integrability conditions (7) impose any further restrictions on the function ϕ. The first two integrability conditions become (in virtue of (11))

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*S, p. 176.

$$(7)^1 \quad \begin{aligned} 6\phi\phi_v - \tfrac{1}{2}\left(\frac{\partial^3 \log\phi}{\partial u\,\partial v^2} + \frac{\partial \log\phi}{\partial v} \cdot \frac{\partial^2 \log\phi}{\partial u\,\partial v}\right) &= 0, \\ 6\phi\phi_u - \tfrac{1}{2}\left(\frac{\partial^3 \log\phi}{\partial u^2\,\partial v} + \frac{\partial \log\phi}{\partial u} \cdot \frac{\partial^2 \log\phi}{\partial u\,\partial v}\right) &= 0. \end{aligned}$$

On taking account of equation (12), it is readily seen that these equations are satisfied identically.

Equations (12) and (13) give rise to the following relations:

$$g_u = -(\phi_{uu} + 6\phi\phi_v), \; f_v = -(\phi_{vv} + 6\phi\phi_u),$$

$$g_v = -\tfrac{1}{2}\frac{\partial^3 \log\phi}{\partial v^3} - \tfrac{1}{2}\frac{\partial \log\phi}{\partial v} \cdot \frac{\partial^2 \log\phi}{\partial v^2} - \frac{\partial \log\phi}{\partial u} \cdot \frac{\partial \log\phi}{\partial v} - 4\phi^3,$$

$$f_u = -\tfrac{1}{2}\frac{\partial^3 \log\phi}{\partial u^3} - \tfrac{1}{2}\frac{\partial \log\phi}{\partial u} \cdot \frac{\partial^2 \log\phi}{\partial u^2} - \frac{\partial \log\phi}{\partial u} \cdot \frac{\partial \log\phi}{\partial v} - 4\phi^3,$$

$$\frac{g_{uu} - f_{vv}}{\phi} = -\left(\frac{\phi_{uuu} - \phi_{vvv}}{\phi}\right) + \frac{1}{2\phi}\left[\frac{\partial \log\phi}{\partial u} \cdot \frac{\partial^3 \log\phi}{\partial u\,\partial v^2} - \frac{\partial \log\phi}{\partial v} \cdot \frac{\partial^2 \log\phi}{\partial u^2\,\partial v}\right],$$

$$2(g_v - f_u) = \left[\frac{\partial^3 \log\phi}{\partial u^3} - \frac{\partial^3 \log\phi}{\partial v^3}\right] + \left[\frac{\partial \log\phi}{\partial u} \cdot \frac{\partial^2 \log\phi}{\partial u^2} - \frac{\partial \log\phi}{\partial v} \cdot \frac{\partial^2 \log\phi}{\partial v^2}\right],$$

$$4\frac{gb_v - fa'_u}{\phi} = 2\left[\frac{\partial \log\phi}{\partial u} \cdot \frac{\partial^2 \log\phi}{\partial u^2} - \frac{\partial \log\phi}{\partial v} \cdot \frac{\partial^2 \log\phi}{\partial v^2}\right] + \left[\left(\frac{\partial \log\phi}{\partial u}\right)^3 - \left(\frac{\partial \log\phi}{\partial v}\right)^3\right].$$

The third integrability condition can therefore be reduced to the form

$$(7)'' \qquad \frac{\partial \log\phi}{\partial u} \cdot \frac{\partial^3 \log\phi}{\partial u\,\partial v^2} - \frac{\partial \log\phi}{\partial v} \cdot \frac{\partial^3 \log\phi}{\partial u^2\,\partial v} = 0.$$

But this condition is satisfied identically on account of equation (12). Thus the canonical system whose coefficients are given by equations (11), (12) and (13) is completely integrable.

Any system of equations obtained from a completely integrable system by a transformation of the dependent variable will also be completely integrable. In particular, the system of equations

$$(6)' \quad \begin{aligned} \frac{\partial^2 y}{\partial u^2} + \frac{\partial \log\phi}{\partial u} \cdot \frac{\partial y}{\partial u} + 2\phi\frac{\partial y}{\partial v} &= 0, \\ \frac{\partial^2 y}{\partial v^2} + 2\phi\frac{\partial y}{\partial u} + \frac{\partial \log\phi}{\partial v} \cdot \frac{\partial y}{\partial v} &= 0, \end{aligned}$$

obtained from (6) by the substitution

$$\bar{y} = \frac{1}{\lambda(u, v)}\,y$$

where $\lambda(u, v)$ is a solution of (6), is also completely integrable. We shall call (6)′ the Normal System.

Equations of the directrix plane and associated formulae, integrals of the Normal System, etc.

It can be shewn that, when the Invariants θ', θ'', Ω', Ω'' vanish, the equations of the double directrices δ', δ'' of the surfaces R', R'' are

$$(14)\quad \begin{aligned} &1. \quad x_1 + \frac{\partial \log \sqrt{\phi}}{\partial u} \,.\, x_2 + 2\phi^2 x_4 = 0, \\ &\qquad\qquad x_3 + \frac{\partial \log \sqrt{\phi}}{\partial u} x_4 = 0; \\ &2. \quad x_1 + \frac{\partial \log \sqrt{\phi}}{\partial v} \,.\, x_3 + 2\phi^2 x_4 = 0, \\ &\qquad\qquad x_2 + \frac{\partial \log \sqrt{\phi}}{\partial v} x_4 = 0, \end{aligned}$$

the moving tetrahedron $Py\,Pz\,P\rho\,P\sigma$ being the system of reference.* These equations shew that δ' and δ'' intersect in the point

$$x_1 : x_2 : x_3 : x_4 = \left(\frac{\partial \log \sqrt{\phi}}{\partial u} \,.\, \frac{\partial \log \sqrt{\phi}}{\partial v} - 2\phi^2\right) : \frac{\partial \log \frac{1}{\sqrt{\phi}}}{\partial v} : \frac{\partial \log \frac{1}{\sqrt{\phi}}}{\partial u} : 1;$$

that is, in the point†

$$(15)\quad \pi = \left(\frac{\partial \log \sqrt{\phi}}{\partial u} \,.\, \frac{\partial \log \sqrt{\phi}}{\partial v} - 2\phi^2\right) y + \frac{\partial \log \frac{1}{\sqrt{\phi}}}{\partial v} \,.\, z + \frac{\partial \log \frac{1}{\sqrt{\phi}}}{\partial u} \,.\, \rho + \sigma$$

To prove that this point is fixed in space, and therefore the same for all surfaces $R'(v)$, $R''(u)$, it is sufficient to shew that

$$\frac{\partial \pi}{\partial u} = \psi_1(u, v)\, \pi, \quad \frac{\partial \pi}{\partial v} = \psi_2(u, v)\, \pi.$$

In virtue of equations (6) and (12), the first derivatives of the semi-covariants can be written as follows:

$$y_u = z, \; y_v = \rho, \; z_u = -fy - 2\phi\rho, \; z_v = \sigma, \; \rho_u = \sigma, \; \rho_v = -gy - 2\phi z,$$

$$\sigma_u = \phi\left[4\phi_u + \tfrac{1}{2}\left(\frac{\partial \log \phi}{\partial v}\right)^2\right] y + 4\phi^2 z + \left[\frac{\partial^2 \log \sqrt{\phi}}{\partial u^2} + \left(\frac{\partial \log \sqrt{\phi}}{\partial u}\right)^2 - \phi_v\right] \rho,$$

$$\sigma_v = \phi\left[4\phi_v + \tfrac{1}{2}\left(\frac{\partial \log \phi}{\partial v}\right)^2\right] y + \left[\frac{\partial^2 \log \sqrt{\phi}}{\partial v^2} + \left(\frac{\partial \log \sqrt{\phi}}{dv}\right)^2 - \phi_u\right] z + 4\phi^2 \rho.$$

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*S, p. 182, Equations 28; Equations 14 can be obtained from these by putting $\theta' = \theta'' = 0$.

†Cf., S, p. 195.

From these relations and equation (12), it follows by the direct differentiation of (15) that

$$(15)' \qquad \frac{\partial \pi}{\partial u} = \pi \frac{\partial \log \frac{1}{\sqrt{\phi}}}{du}, \qquad \frac{\partial \pi}{\partial v} = \pi \frac{\partial \log \frac{1}{\sqrt{\phi}}}{dv}.$$

Thus the point π is fixed in space; and, therefore, the locus D of the directrices (δ', δ'') is either a quadric cone or a plane pencil.

Equations (14) shew that the tangent $PyPz$ to $\Gamma'(v)$ at the point Py meets the flecnode curve on R'' in the point

$$(16) \qquad \zeta = y \frac{\partial \log \frac{1}{\sqrt{\phi}}}{\partial u} + z;$$

and, in the same way, the corresponding point on R' is

$$(16)' \qquad \zeta' = y \frac{\partial \log \frac{1}{\sqrt{\phi}}}{\partial v} + \rho.$$

Equations (15) and (16) readily lead to the equations

$$(17) \qquad \begin{aligned} &\zeta_u + \frac{\partial \log \sqrt{\phi}}{\partial u} \cdot \zeta = -2\phi\zeta', \quad \zeta_v + \frac{\partial \log \frac{1}{\sqrt{\phi}}}{\partial v} \cdot \zeta = \pi, \\ &\zeta'_u + \frac{\partial \log \frac{1}{\sqrt{\phi}}}{\partial u} \zeta' = \pi, \quad \zeta'_v + \frac{\partial \log \sqrt{\phi}}{\partial v} \zeta' = -2\phi\zeta. \end{aligned}$$

Therefore the plane $P\zeta P\pi P\zeta'$ is tangent to the loci of $P\zeta$ and $P\zeta'$ at the points ζ and ζ' respectively.

We shall now prove that the plane $P\zeta P\pi P\zeta'$ is fixed in space; and that, therefore, the locus D is a plane pencil. To prove this it will be sufficient to shew that each of the functions ζ, ζ' satisfies a completely integrable system of three partial differential equations of the second order; because such a system has precisely three linearly independent solutions.* These systems will be found by differentiating (17) with respect to u and v, and eliminating in turn the variables (ζ, π) and (ζ', π) from the resulting equations. The equations satisfied by ζ are found to be

*N, pp. 474, 475.

$$\text{(18-}a\text{)}\qquad \begin{aligned} \zeta_{uu} &= a^{(\zeta)}\zeta_u + b^{(\zeta)}\zeta_v + c^{(\zeta)}\zeta, \\ \zeta_{uv} &= a_1^{(\zeta)}\zeta_u + b_1^{(\zeta)}\zeta_v + c_1^{(\zeta)}\zeta, \\ \zeta_{vv} &= a_2^{(\zeta)}\zeta_u + b_2^{(\zeta)}\zeta_v + c_2^{(\zeta)}\zeta, \end{aligned}$$

where $a^{(\zeta)} = \dfrac{\partial \log \phi}{\partial u}$, $b^{(\zeta)} = -2\phi$, $c^{(\zeta)} = -\frac{1}{2}\dfrac{\phi_{uu}}{\phi} + 5\left(\dfrac{\partial \log \sqrt{\phi}}{\partial u}\right)^2 + \phi_v$,

$$a_1^{(\zeta)} = \frac{\partial \log \sqrt{\phi}}{\partial v},\ b_1^{(\zeta)} = \frac{\partial \log \dfrac{1}{\sqrt{\phi}}}{\partial u},\ c_1^{(\zeta)} = 2\phi^2 + \frac{\partial \log \sqrt{\phi}}{\partial u} \cdot \frac{\partial \log \sqrt{\phi}}{\partial v},$$

$$a_2^{(\zeta)} = 0,\ b_2^{(\zeta)} = 0,\ c_2^{(\zeta)} = \frac{1}{2}\frac{\phi_{vv}}{\phi} - \left(\frac{\partial \log \sqrt{\phi}}{\partial v}\right)^2;$$

and the equations satisfied by ζ' turn out to be

$$\text{(18-}b\text{)}\qquad \begin{aligned} \zeta'_{uu} &= a^{(\zeta')}\zeta'_u + b^{(\zeta')}\zeta'_v + c^{(\zeta')}\zeta', \\ \zeta'_{uv} &= a_1^{(\zeta')}\zeta'_u + b_1^{(\zeta')}\zeta'_v + c_1^{(\zeta')}\zeta', \\ \zeta'_{vv} &= a_2^{(\zeta')}\zeta'_u + b_2^{(\zeta')}\zeta'_v + c_2^{(\zeta')}\zeta', \end{aligned}$$

where

$$a^{(\zeta')} = 0,\ b^{(\zeta')} = 0,\ c^{(\zeta')} = \frac{1}{2}\frac{\phi_{uu}}{\phi} - \left(\frac{\partial \log \sqrt{\phi}}{\partial u}\right),$$

$$a_1^{(\zeta')} = \frac{\partial \log \dfrac{1}{\sqrt{\phi}}}{\partial v},\ b_1^{(\zeta')} = \frac{\partial \log \sqrt{\phi}}{\partial u},\ c_1^{(\zeta')} = 2\phi^2 + \frac{\partial \log \sqrt{\phi}}{\partial u} \cdot \frac{\partial \log \sqrt{\phi}}{dv},$$

$$a_2^{(\zeta')} = -2\phi,\ b_2^{(\zeta')} = \frac{\partial \log \sqrt{\phi}}{\partial v},\ c_2^{(\zeta')} = -\frac{1}{2}\frac{\phi_{vv}}{\phi} + 5\left(\frac{\partial \log \sqrt{\phi}}{\partial v}\right)^2 + \phi_u.$$

Therefore the locus D is a plane pencil.

Four Invariants of the equations (18) are of particular importance in the present study; they will be denoted by the symbols $H^{(\zeta)}, K^{(\zeta)}$ $H^{(\zeta')}, K^{(\zeta')}$, and are indeed the Laplace-Darboux Invariants of the equations with mixed derivatives of the second order.* The values of these Invariants are

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*N, pp. 492, 495, 476.

$$H^{(\zeta)} = 0,\ K^{(\zeta)} = 4\phi^2, \tag{19}$$
$$H^{(\zeta')} = 4\phi^2,\ K^{(\zeta')} = 0.$$

The first and minus first Laplacian transformations of ζ and ζ' are*

$$L(\zeta) \equiv \zeta_v + \frac{\partial \log \frac{1}{\sqrt{\phi}}}{\partial v} \cdot \zeta,\ L_{-1}(\zeta) \equiv \zeta_u + \frac{\partial \log \sqrt{\phi}}{\partial u} \cdot \zeta,$$

$$L(\zeta') \equiv \zeta'_v + \frac{\partial \log \sqrt{\phi}}{\partial v} \cdot \zeta',\ L_{-1}(\zeta') \equiv \zeta'_u + \frac{\partial \log \frac{1}{\sqrt{\phi}}}{\partial u} \cdot \zeta'.$$

The relations (17) shew that the pencils of double directrices $P(\delta')$ and $P(\delta'')$ are transformable into each other by Laplacian transformations.

We shall now proceed to the integration of the Normal System. It follows from (17) that

$$\frac{\partial}{\partial v}\left(\frac{\zeta}{\sqrt{\phi}}\right) = \frac{\pi}{\sqrt{\phi}} = \frac{\partial}{\partial u}\left(\frac{\zeta'}{\sqrt{\phi}}\right); \tag{20}$$

and that therefore the expression $\left(\frac{\zeta\, du + \zeta' dv}{\sqrt{\phi}}\right)$ is a complete differential.

Since $H^{(\zeta)}$ and $K^{(\zeta)}$ vanish the second equation of (18-*a*) can be written

$$\frac{\frac{\partial}{\partial u}\left\{\frac{\partial \zeta}{\partial v} + \zeta \frac{\partial}{\partial v}\left(\log \frac{1}{\sqrt{\phi}}\right)\right\}}{\left\{\frac{\partial \zeta}{\partial v} + \zeta \frac{\partial}{\partial v}\left(\log \frac{1}{\sqrt{\phi}}\right)\right\}} = \frac{\partial}{\partial u}\left(\log \frac{1}{\sqrt{\phi}}\right);$$

and the second equation of (18-*b*) can be written

$$\frac{\frac{\partial}{\partial v}\left\{\frac{\partial \zeta'}{\partial u} + \zeta' \frac{\partial}{\partial u}\left(\log \frac{1}{\sqrt{\phi}}\right)\right\}}{\left\{\frac{\partial \zeta'}{\partial u} + \zeta' \frac{\partial}{\partial u}\left(\log \frac{1}{\sqrt{\phi}}\right)\right\}} = \frac{\partial}{\partial v}\left(\log \frac{1}{\sqrt{\phi}}\right).$$

On integration these equations give

$$\frac{\partial \zeta}{\partial v} + \zeta \frac{\partial}{\partial v}\left(\log \frac{1}{\sqrt{\phi}}\right) = \frac{G_1(v)}{\sqrt{\phi}}, \tag{21}$$
$$\frac{\partial \zeta'}{\partial u} + \zeta' \frac{\partial}{du}\left(\log \frac{1}{\sqrt{\phi}}\right) = \frac{G_2(u)}{\sqrt{\phi}}.$$

*N, p. 487.

But by (17)

hence
$$\frac{\partial \zeta}{\partial v} + \zeta \frac{\partial}{\partial v}\left(\log \frac{1}{\sqrt{\phi}}\right) = \frac{\partial \zeta'}{\partial u} + \zeta' \frac{\partial}{\partial u}\left(\log \frac{1}{\sqrt{\phi}}\right);$$
$$G_1(v) = G_2(u) = c_1 \text{ (a constant).}$$

The integrals of (21) are readily found to be

$$\frac{\zeta}{\sqrt{\phi}} = c_1 \int \frac{dv}{\phi} + U_1, \tag{22}$$
$$\frac{\zeta'}{\sqrt{\phi}} = c_1 \int \frac{du}{\phi} + V_1,$$

where U_1 and V_1 are such functions of u and v respectively that ζ and ζ' satisfy (17).

It follows from equations (16) that

$$\left\{\frac{\partial y}{\partial u} + y \frac{\partial \log \frac{1}{\sqrt{\phi}}}{\partial u}\right\} du + \left\{\frac{\partial y}{\partial v} + y \frac{\partial \log \frac{1}{\sqrt{\phi}}}{dv}\right\} \partial v \tag{23}$$
$$= \left(\frac{\zeta}{\sqrt{\phi}}\right) du + \left(\frac{\zeta'}{\sqrt{\phi}}\right) dv.$$

Hence

$$\frac{y}{\sqrt{\phi}} = \int \left\{\left(\frac{\zeta}{\sqrt{\phi}}\right) du + \left(\frac{\zeta'}{\sqrt{\phi}}\right) dv\right\} + c_2 \text{ (a constant),}$$

where the expression under the integral sign is an exact differential. Now substitute the values of $\frac{\zeta}{\sqrt{\phi}}$ and $\frac{\zeta'}{\sqrt{\phi}}$ found in (22) in this equation; the resulting equation

$$\frac{y}{\sqrt{\phi}} = c_1 \int\int \frac{du\, dv}{\phi} + \int U_1\, du + \int V_1\, dv + c_2 \tag{24}$$

is therefore the general integral of the Normal Equations (6′).

In order to resolve the general integral (24) into a fundamental set of solutions, it is necessary to express U_1 and V_1 in terms of the arbitrary functions U and V of equation (12). This can be effected most readily by Wilczynski's procedure,* which we now adopt. If we put

$$U_2 = \int \frac{U}{\sqrt{U'}}\, du, \quad U_3 = \int \frac{du}{\sqrt{U'}},$$
$$V_2 = \int \frac{V}{\sqrt{V'}}\, dv, \quad V_3 = \int \frac{dv}{\sqrt{V'}},$$

then,

**Directrix Curves, Math. Annalen*, Dec. 1914, p. 158.

$$\int \frac{du}{\phi} = 2(U_2 V_3' + U_3 V_2'),$$

$$\int \frac{dv}{\phi} = 2(U_2' V_3 + U_3' V_2),$$

$\left(U_2' = \dfrac{d\,U_2}{d\,u}\right.$, etc. . . .)

Thus equations (22) become

$$\frac{\zeta}{\sqrt{\phi}} = [U_1 + 2c_1(U_2' V_3 + U_3' V_2)], \tag{22'}$$

$$\frac{\zeta'}{\sqrt{\phi}} = [V_1 + 2c_1(U_2 V_3' + U_3 V_2')].$$

If these values of $\dfrac{\zeta}{\sqrt{\phi}}$ and $\dfrac{\zeta'}{\sqrt{\phi}}$ be substituted in either of the relations

$$\frac{\partial}{\partial u}(\sqrt{\phi}\,\zeta) = -2\phi^{\frac{3}{2}}\zeta',\ \frac{\partial}{\partial v}(\sqrt{\phi}\,\zeta') = -2\phi^{\frac{3}{2}}\zeta,$$

there results an equation which can be written

$$\frac{1}{\sqrt{U'}}\left[(U_1' + \tfrac{1}{2}\frac{U''}{U'}U_1)\,U - U' U_1 + 2c_1\sqrt{U'}\,U_2\right] \tag{25}$$
$$+ V_1\sqrt{V'} + 2c_1 V V_3 - 2c_1 V_2$$
$$+ \frac{1}{\sqrt{U'}}\left[U'_1 + \tfrac{1}{2}\frac{U''}{U'}U_1 + 2c_1\sqrt{U'}\,U_3\right] V_3\,;$$

i.e., in the form

$$\lambda(u) + \mu(v) + \rho(u)\,\sigma(v) = 0.$$

Hence

$$\lambda'(u) + \rho'(u)\,\sigma(v) = 0,$$
$$\mu'(v) + \rho(u)\,\sigma'(v) = 0;$$

and therefore $\rho(u)$ or $\sigma(v)$ must be a constant.

But $\sigma(v) = V$ and $V' \neq 0$; the equation (23) therefore implies that

$$\frac{1}{\sqrt{U'}}\left[U'_1 + \tfrac{1}{2}\frac{U''}{U'}U_1 + 2c_1 U_3\sqrt{U'}\right] = c_3\,,$$

$$C_3 U - U_1\sqrt{U'} + 2c_1(U_2 - U U_3) + V_1\sqrt{V'} - 2c_1(V_2 - V V_3) + c_3 V = 0,$$

where c_3 is a constant. From the second of these relations it follows that

$$c_3 U - U_1\sqrt{U'} + 2c_1(U_2 - U U_3) = -c_4,$$
$$c_3 V + V_1\sqrt{V'} - 2c_1(V_2 - V V_3) = +c_4,$$

where c_4 is a further constant.

Therefore

$$U_1 = \frac{1}{\sqrt{U'}} [2c_1(U_2 - UU_3) + c_3 U + c_4],$$

$$V_1 = \frac{1}{\sqrt{V'}} [2c_1(V_2 - VV_3) - c_3 V + c_4].$$

On introducing these values of U_1 and V_1 in (24), we find the general solution of the Normal System in the form

$$(24') \quad \left(\frac{y}{\sqrt{\phi}}\right) = 2c_1(U_2V_3 + U_3V_2) + 2c_1 \int \frac{U_2 - UU_3}{\sqrt{U'}}\, du$$
$$+ 2c_1 \int \frac{V_2 - VV_3}{\sqrt{V'}}\, dv + c_3(U_2 - V_2) + c_4(U_3 + V_3) + c_2.$$

Thus we arrive at the following fundamental set of solutions of the Normal System:

$$x = (U_2V_3 + U_3V_2) + \int \frac{U_2 - UU_3}{\sqrt{U'}}\, du + \int \frac{V_2 - VV_3}{\sqrt{V'}}\, dv,$$
$$(26) \quad y = U_2 - V_2, \quad z = U_3 + V_3, \quad w = 1.$$

If we introduce the substitution

$$u = U_3, \; v = V_3, \quad U_2 = \bar{U}', \quad V_2 = \bar{V}',$$

the equations (26) become (on dropping the bars)

$$(27) \qquad x = 4(U+V) - 2(u-v)(U' - V'),$$
$$y = U' - V', \; z = u+v, \; w = 1.$$

It remains to find the equations of the complexes $C'(v)$ and $C''(u)$ when expressed in the Cartesian coördinates (x, y, z). We shall omit the details of the calculation involved in passing from the moving tetrahedron (y, z, ρ, σ) to the fixed trihedral (x, y, z).

The equations of the complexes $C'(v)$ and $C''(u)$ turn out to be

$$(28) \qquad C'(v): \; 2(y\delta z) - (\delta x) + 4v(\delta y) + 4V'(\delta z) = 0,$$
$$C''(u): \; 2(y\delta z) + (\delta x) + 4u(\delta y) - 4U'(\delta z) = 0.$$

The loci of the axes of $C'(v)$ and $C''(u)$ are the cylinders

$$y = V', \; z = -v$$

and

$$y = U', \; z = u$$

respectively. We shall say that the complexes of a family are attached to a cylinder C when the axes of the complexes are generators of C. The principal parameters of $C'(v)$ and $C''(u)$ are $+\frac{1}{4}$ and $-\frac{1}{4}$ respectively.

The results established above may be recapitulated in the following theorem:

THEOREM.—*If the Directrix Quadric of a surface S consists of two coincident planes, the two families of linear complexes determined by the asymptotic curves on S are attached to two cylinders with parallel genera-*

tors; and the principal parameters of the complexes have the same constant numerical value. The integration of the Normal Equations of S involves only direct operations and quadratures; and the finite equations of S in Cartesian coördinates can be written in the form

$$x=4(U+V)-2(u-v)\ (U'-V'),\ y=U'-V',\ z=u+v,$$

where $u=const.$, $v=const.$ *are the asymptotic curves.*

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On the Absorption Spectra of Mercury, Cadmium, Zinc and Other Metallic Vapours.

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I. INTRODUCTION.

(Read May Meeting, 1915.)

In 1907 it was pointed out by R. W. Wood[1] that in the absorption spectrum of non-luminous mercury vapour there is a heavy band at $\lambda = 2536 \cdot 72$ A°.U., and a less sharply-defined one at $\lambda = 2350$ A°.U. In a later paper by Wood and Guthrie[2] dealing with the same subject, no mention is made of the absorption band at $\lambda = 2350$ A.°U.; but it is stated that with dense mercury vapour there is a fairly strong band at $\lambda = 2338$ A°.U. and another very broad one at $\lambda = 2140$ A°.U. From the work of Kirschbaum[3] and others it is known that light of wave-length $\lambda = 1849 \cdot 6$ A°.U. is strongly absorbed by mercury vapour.

The absorption band at $\lambda = 2536 \cdot 72$ A°.U. has been shown by Wood to be asymmetrical. It is sharply defined on the shorter wave-length side; but with increasing vapour density it gradually spreads out towards the red end of the spectrum. With low vapour densities it consists of two bands the one at $\lambda = 2536$ A°.U. and the other at $\lambda = 2539$ A°.U. The band at $\lambda = 2338$ A°.U., which is probably the same one as that originally given by Wood at $\lambda = 2350$ A°.U., does not appear to have been examined in detail. In regard to the band noted by Wood at $\lambda = 2140$ A°.U., especially as it was obtained with high vapour densities, it appeared to the writers that it might be connected with the absorption observed by Kirschbaum at $\lambda = 1849 \cdot 6$ A°.U. Some experiments were made by us to test this view and also to study the character of the absorption band at $\lambda = 2338$ A°.U. and these will be described in what follows.

II. ABSORPTION SPECTRUM OF MERCURY.

In the first experiments the light from a quartz mercury arc lamp was projected through an evacuated clear fused quartz tube containing

[1]R. W. Wood. Ast. Phys. Jl. Vol. XXVI, p. 41. 1907.
[2]Wood and Guthrie. Ast. Phys. Jl. Vol. XXIX. No. 1, p. 211, 1909.
[3]Kirschbaum. Electrician. Vol. 72, p. 1074, 1914.

a little mercury. The mercury was gradually heated and a series of photographs was taken with a small Hilger quartz spectrograph. A reproduction of one of these photographs is shown in Fig. 1. The upper spectrum is that of the mercury arc alone, the second is that obtained when the quartz tube was moderately heated and the third is that obtained when the mercury vapour density was considerably higher. The asymmetrical character of the absorption band at $\lambda = 2536 \cdot 72$ A°.U. is clearly brought out by the photograph.

In the second experiments a photograph was first taken of the spark spectrum of mercury in air in a manner already described in a previous communication by one of us.[1]

Photographs were also taken of the spectrum of the light from the spark between terminals of cadmium in air after it passed through the mercury vapour in the exhausted quartz tube mentioned above. These were taken with gradually increasing vapour density and are shown in Fig. 2. In this photograph the mercury spectrum is shown at the top well down into the ultra-violet and the strong lines at $\lambda = 1942 \cdot 1$ A°.U. and $\lambda = 1849 \cdot 6$ A°.U. are clear and distinct. The succeeding four spectra show that even with small vapour density the absorption was such as to cut off the light of wave-lengths in the region of $\lambda = 1942$ A°.U. and $\lambda = 1849 \cdot 6$ A°.U. In the second last spectrum, absorption at $\lambda = 2536 \cdot 72$ A°.U. can just be detected but in the last one it is well marked. The absorption band at $\lambda = 2338$ A°.U. also comes out in this spectrum and that at $\lambda = 1849$ A°.U. has widened out so that on the side of longer wave-lengths it has reached $\lambda = 2144 \cdot 0$ A°.U. From the general appearance of the photograph it will be seen that the absorption at $\lambda = 1849 \cdot 6$ A°.U. develops symmetrically with increasing vapour density. This photograph also shows that light of wave-lengths near to $\lambda = 1849 \cdot 6$ A°.U. was the most strongly absorbed by mercury vapour. That in the neighbourhood of $\lambda = 2536 \cdot 72$ A°.U. came next, while high vapour densities were required to bring out the absorption at $\lambda = 2338$ A°.U.

In the third experiment a large Hilger quartz spectrograph was used. With this instrument the arc spectrum of mercury from a quartz lamp was first taken, then the spark spectrum between aluminium terminals in water after the manner devised by Henri[2] and the the spectrum of the light from the spark between these aluminium terminals in water after it had passed through a heated clear fused quartz evacuated tube containing mercury vapour of high density. These three photographs are shown in Fig. 3. The spark from

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[1]McLennan. Proc. Roy. Soc. A. Vol. 91. p. 26, 1914.
[2]Henri. Phys. Zeit. No. 12. p. 516. June 15th, 1913.

aluminium terminals in water as will be seen from the second spectrum in the figure gives a continuous spectrum of remarkable extent. It can be obtained with ease down to λ = 2150 A°.U.

The arrangement for producing the Henri spark is shown in Fig. 4. The terminals of the induction coil AB were joined to the spark gap at CD and to the inside coatings of two one-gallon Leyden jars

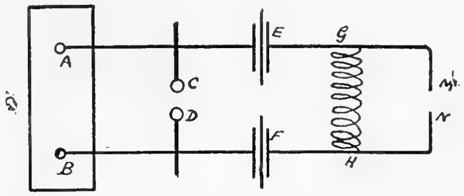

Figure 4

EF. The outside coatings of these jars were joined to two rods of aluminium MN. These rods constituted the terminals of the spark gap which was the light source and they were short circuited by a coil of small self-induction GH. The aluminium terminals MN were rods about 1 cm. in diameter. They were conically pointed and were held clamped in a vertical plane inclined at 45° to each other. The clamps in which they were held were provided with threads which enabled one to readily alter the distance between the sparking points. When the spark was in action the terminals MN were immersed to a depth of about 5 cms. in a vessel of water. The light from the spark passed through the water and out of a quartz window sealed into the side of the vessel. It was then focussed with a cylindrical quartz lens upon the slit of the spectrograph. The third spectrum in Fig. 3 is the mercury vapour absorption spectrum taken with the light from the Henri spark. In the region below λ = 2150 A°.U. it will be seen there is complete absorption. The asymmetrical nature of the absorption at λ = 2536·72 A°.U. is also brought out. At λ = 2338 A°.U. it will be seen that the absorption is complex, and consists of four bands, one extending from λ = 2313 A°.U. to λ = 2320 A°.U., one at λ = 2322 A°.U. another at λ = 2326 A°.U. and a wider one between λ = 2330 A°.U. and λ = 2338 A°.U. The absorption moreover is strong and sharply edged on the longer wave side but it weakens out and is less clearly defined on the side of the shorter waves.

It will be noted the third spectrum in Fig. 3 also shows a narrow absorption band at λ = 2288 A°.U. As cadmium vapour has an absorption band at this point its occurrence in this photograph was ascribed to the presence of a trace of cadmium in the mercury.

From these results it will be clear that between $\lambda = 6000$ A°.U. and $\lambda = 1800$ A°.U. there are but three regions of absorption in the absorption spectrum of non-luminous mercury vapour, viz., in the neighbourhood of $\lambda = 1849 \cdot 6$ A°.U. of $\lambda = 2338$ A°.U., and of $\lambda = 2536 \cdot 72$ A°.U. It should be noted that $\lambda = 1849 \cdot 6$ A°.U. is the first line in the series of the mercury arc spectrum given by n = 1.5, S—m, P and $\lambda = 2536 \cdot 72$ A°.U. is the first line in the series n = 2, p_2—m, S[1] of the same spectrum. The line $\lambda = 2338$ A°.U. has not been shown as yet to belong to any series.

III. The Absorption Spectrum of Cadmium Vapour.

In the experiments with cadmium vapour the spectrum of the light from the spark between terminals of cadmium in air was first of all photographed directly and then after it had passed through cadmium vapour of different densities contained in a heated, highly exhausted tube of clear fused quartz. A photograph taken in this way with the small quartz spectrograph is shown in Fig. 5. The upper spectrum is the spark spectrum taken directly and the lower two are absorption spectra. They show as will be seen, strong and symmetrical absorption at λ 2288 A°U. The experiments were repeated with the larger spectrograph and one of the photographs taken with the instrument is shown in Fig. 6. The second spectrum is the spark spectrum taken directly and the third is the absorption spectrum. This photograph shows a sharply defined narrow absorption band at $\lambda = 3260 \cdot 17$ A°.U. as well as a wide symmetrical band with centre at $\lambda = 2288$ A°.U. Although numerous experiments were made with vapour of varying densities, no trace of any other bands was found. This confirms the observations of Wood and Guthrie.[2]

In this connection, however, it should be noted here that in a number of the photographs of the absorption spectrum of cadmium vapour a narrow, tolerably well defined absorption band came out at $\lambda = 2536 \cdot 72$ A°.U. This was no doubt due to absorption by mercury vapour which either came back, during the process of exhaustion, from the mercury pump into the tube containing the cadmium vapour or else was present as an impurity in the metallic cadmium originally. This absorption band was clearly shown in the original photograph from which the reproduction shown in the third row of Fig. 6 was made but as will be seen it is scarcely detectable in the reproduction.

It is interesting to note that the lines at $\lambda = 2288$ A°.U. and $\lambda = 3260 \cdot 17$ A°.U. are respectively the first numbers of the series

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[1]Dunz. Inaugural Dissertation. Tubingen 1911, pp. 67 and 68.
[2]Wood and Guthrie. *loc. cit.*

in the arc spectrum of cadmium given by n = $1 \cdot 5$, S—m, P and n = 2, p_2—m, S, *i.e.*, they are analogous to the lines in the mercury arc spectrum at $\lambda = 1849 \cdot 6$ A°.U. and $\lambda = 2536 \cdot 72$ A°.U.

Some photographs were also taken of the spectrum of the cadmium arc. In taking these the form of arc used is that shown in Fig. 7.

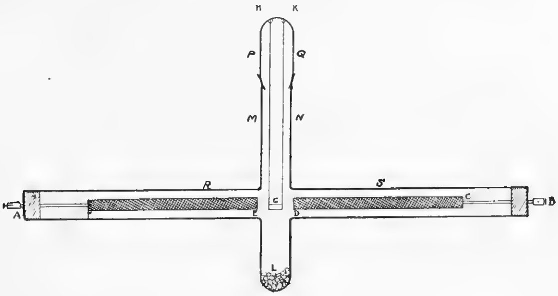

Figure 7

The apparatus consisted of a tube of fused quartz possessing three arms, R, S and MN together with a receptacle L. The metal to be used in the arc was placed in the receptacle, L, and two rods of the same metal FE and DC were attached to two wires and these latter were in turn fastened to two brass plugs A and B which were sealed into the tubes R and S with mastic wax. A small sheet of platinum was attached to two wires which constituted a heating circuit and these were sealed with platinum wire into a glass tube PQ at H and K. The open end of the glass tube was ground so as to fit exactly into the end of the quartz tube MN as shown in the diagram. The arms MN, R and S were each about 40 cms. long and it was found with this length that when the receptacle L was strongly heated with a Bunsen burner the wax joints at A and B and the ground one at the end of the tube MN remained quite cool.

In the experiments the plate G was coated with a thin layer of either calcium oxide or barium oxide. When the tube was in operation the terminals of an auxiliary heating circuit were attached at H and K, B and K were joined by a wire and the arcing voltage was applied between B and A, the latter being the positive terminal. With this arrangement G and D constituted a double cathode. The tube was highly exhausted with a Gaede mercury pump through a glass tube sealed into an opening in the brass end piece at A.

In taking the photographs the plate G was brought to incandescence by means of the auxiliary heating circuit; the metal in it was strongly heated with the flame of a Bunsen burner so as to keep the plate G surrounded with the vapour of the metal, and the collimator of the quartz spectrograph was directed at the incandescent plate G. A short tube of asbestos cloth was attached to the quartz tube directly in front of this plate so that the radiation from the arc passed through it to the slit of the spectroscope. This arrangement was found necessary to cut off the radiation from the Bunsen flame itself.

With the arrangement just described, it was found that when the direct current 110-volt circuit with suitable resistance in series was applied to the terminals A and B, and the plate G brought to incandescence strong arcs could be maintained for hours with both cadmium and zinc. With the 220-volt circuit applied the arcs of these two metals could be made most intense and could be maintained for long periods. With the 220-volt circuit it was found that when the arc was once struck it could be easily maintained for a considerable time without the continued use of the oxy-cathode G. With low voltages, however, it was always necessary to maintain the plate G at incandescence in order to keep the arc established.

A photograph of the cadmium arc spectrum taken with a lamp of this form is shown in the upper row of Fig. 6. As the illustration shows, there is a marked difference between the arc and spark spectra of cadmium, numerous lines coming out in the one which do not appear in the other. Another point of interest in connection with these spectra is that in the arc spectrum there was a reversal at $\lambda = 2288 \cdot 79$ A°.U. and also another though less clearly marked at $\lambda = 3100$ A°.U. In the arc spectrum no reversal at $\lambda = 3260 \cdot 17$ A°.U. was observed.

IV. The Absorption Spectrum of Zinc Vapour.

Although a number of observers had looked for absorption bands in the absorption spectrum of zinc vapour none was observed until a short time ago, when a well defined band was noted by one of us at $\lambda = 2139 \cdot 3$ A°.U.[1] The reason that this band had not been found before was that it was far down in the ultra-violet beyond the range examined by the other investigators. It is shown in Fig. 8. The upper spectrum is that of the zinc spark in air and the lower two are the spectra obtained when the light from the zinc spark in air was passed through zinc vapour in a heated evacuated quartz tube. It will be seen that with increasing vapour density the band developed symmetrically. Photographs of the absorption spectrum of zinc vapour were also taken with the larger spectrograph. One of these is shown in Fig. 9. The upper spectrum is that of the zinc spark in air taken directly after it had passed through zinc vapour. The absorption corresponding to $\lambda = 2139 \cdot 3$ A°.U. as will be seen is extensive and clearly defined. It will also be seen that there is a narrow band at

[1]McLennan, *Phil. Mag.*, Vol. XXVIII, Sept. 1914.

$\lambda = 3075 \cdot 99$ A°.U. In the emission spectrum of the spark taken directly there are two lines close together at $\lambda = 3075 \cdot 99$ A°.U. while in the lower photograph only one line is seen. In order to bring out the absorption at this point more clearly, a series of photographs was taken with gradually increasing vapour density. One of these is shown in Fig. 10. The upper spectrum shows the line at $\lambda = 3075 \cdot 99$ A°.U. to be double. In the second and third spectra the line is single and in the fourth and fifth spectra a narrow dark band is seen close to and to the left of the single line. An enlargement was taken of this portion of the absorption spectrum and it is shown in Fig. 11. This photograph it will be seen brings out very clearly the absorption band at $\lambda = 3075 \cdot 99$ A°.U.

If the absorption spectrum in Fig. 9 be examined it will be seen that absorption bands are also shown at $\lambda = 2288$ A°.U. and $\lambda = 2536 \cdot 72$ A°.U. These were no doubt due to the presence of mercury and cadmium vapours in the tube containing the zinc vapour. As this tube was a new one and had not been used previously it would seem that the mercury and the cadmium must have been present in the zinc as impurities. It is of interest to note this, for the zinc had been purchased as being doubly distilled and specially pure. The mercury vapour absorption band is also shown in Fig. 10 at $\lambda = 2536 \cdot 72$ A°.U.

The zinc lines at $\lambda = 2139 \cdot 3$ A°.U. and $\lambda = 3075 \cdot 99$ A°.U. are respectively the first members of the series given by $n = 1 \cdot 5$, S—m,P and $n = 2$, p_2—m, S in the spectrum of the zinc arc. There is therefore a complete analogy in so far as the first members of these two series are concerned in the absorption spectra of mercury, cadmium, and zinc vapours. In the absorption spectra of cadmium and zinc vapours no absorption was observed corresponding to that obtained with mercury at $\lambda = 2338$ A°.U. It will be remembered, however, that with mercury this absorption band required high vapour density to bring it out clearly. It may very well be that with cadmium and with zinc vapours, the densities used were not sufficiently high to produce noticeable absorption at points in their spectra corresponding to the band at $\lambda = 2338$ A°.U. in the mercury spectrum.

V. Absorption Spectra of Gold and Silver Alloys.

In the course of the experiments described above and in view of the relationships which have been established above between the absorption spectra of mercury, cadmium and zinc vapours, it was thought well to make an attempt to see if the absorption spectra of gold, silver and copper vapours revealed similar relationships. Small quantities of gold, of silver and of copper were in turn heated as highly as possible in evacuated quartz tubes, and although these tubes were heated to softening, the vapours obtained of all three metals were not very dense. Moreover, when the light from the spark in air between gold, silver, and copper terminals was sent through their respective vapours, no trace of absorption was in any case obtained.

Through the kindness of Mr. C. D. Heycock our attention was drawn to some alloys of gold and of silver which have low melting points. One of these which contained 96·2% gold and 3·8% aluminium had its melting point at 526·5°C and another which has the composition represented by Ag_3Cu_2 contained 28% of copper and 72% of silver and had its melting point at 777·3°C. The light from the Henri spark was projected in turn through evacuated quartz tubes containing these alloys and though the tubes were heated as highly as was practicable, no absorption was detected in the region between λ = 6000 A°.U. and λ = 1800 A°.U.

VI. On the Structure of Fine Lines in the Mercury, Cadmium and Zinc Arc Spectra.

When working with the particular form of metallic arc lamp described above, it was found that when the 220-volt circuit was applied, cadmium and zinc arcs of extraordinary brilliancy could be obtained. This made it possible to make a close examination of the structure of some of the finest lines in the arc spectra of these metals. Two of them in particular were carefully studied, viz., the cadmium red line λ = 6439·3 A°.U. and the red zinc line λ = 6364 A°U. Light of the former wave-length it will be remembered was used by Michelson[1] in his determination of the length of the metre. In studying its structure with his own type of interferometer, it was found by him to be simple and not to possess any satellites. This was confirmed by Janicki[2] who, at a later time, investigated it with an echelon grating. In our investigation with a Lummer plate interferometer it was also found to be simple and a reproduction of one of the Lummer plate patterns of it is shown in Fig. 12.

The zinc line λ = 6364 A°.U. is also given by Janicki[3] as a simple line without satellites. In our study of it with the Lummer plate this line appeared visually at times to be accompaned by two faint satellites. These came out only when high currents were passing in the arc; but although numerous attempts were made to obtain photographs of them they did not appear on any of the plates. We are not

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[1]Michelson. Phil. Mag. 34 pp. 280—299, 1892.
[2]Janicki. Ann. der. Phys. (4) 29, p. 833, 1909.
[3]Janicki. loc. cit.

able, therefore, to decide whether the satellites have a real existence or not. The Lummer plate pattern of this line showing just the one simple component is reproduced in Fig. 13. For purposes of comparison the Lummer plate pattern of the mercury green line $\lambda = 5461$ A°.U. taken by one of us with the same Lummer plate interferometer is shown in Fig. 14. The structure of this line has been discussed elsewhere by McLennan and McLeod.[1] In so far as this photograph goes it shows the line to consist of a wide main component accompanied by five satellites.

V. The Ultra-violet Spark Spectrum of Cadmium.

While the experiments which have been described above were in progress, a spectroscope provided with a fluorite train, made for us by the Adam Hilger Co., was added to the equipment of the Physical Laboratory at Toronto. With this instrument some preliminary photographs were taken of the spark spectrum of cadmium in air in the region below 2100 A°.U. As the plates showed a number of lines in addition to those given by Eder and Valenta the experiments were carefully repeated. Rods of the purest cadmium obtainable were used as terminals for the spark gap. Photographs of the spark spectra of zinc and aluminium were taken on the same plates and in measuring up the wave-lengths of the lines in the cadmium spectra the following well-known lines were used as standards.

Zinc lines[2]	Aluminium lines[3]
$\lambda = 2138 \cdot 66$ A°.U.	$\lambda = 1990 \cdot 57$
$02 \cdot 35$	$35 \cdot 9$
$00 \cdot 06$	$31 \cdot 15$
$2064 \cdot 32$	$1862 \cdot 81$
$62 \cdot 08$	$58 \cdot 2$
$25 \cdot 51$	$54 \cdot 8$

From the measurements it was easy to identify certain lines on our spectra with those given by Eder and Valenta which appear to be the only ones recorded for the spark spectrum of cadmium in the region investigated by us. The wave-lengths of the lines found by us were determined on the assumption that those given by Eder and Valenta were correct. All the lines found by us together with their

[1]McLennan and McLeod. Proc. Roy. Soc., A. Vol. 90, p. 243, 1913.
[2]Eder and Valenta. Atlas Typischer spectren, Wien.
[3]Handke. Inaugural Dissertation, Berlin, 1909, p. 18.

relative intensities are given in Table I. The lines found by Eder and Valenta[1] with their relative intensities are also given in the same table.

Table I.

Ultra-violet spark spectrum of cadmium			
McLennan and Edwards		Eder and Valenta.	
Wave-lengths in A°. U.	Intensity	Wave-lengths in A°. U.	Intensity
2096·1	1	2096·1	3
76·3	1	—	—
64·5	3	64·5	1
62·1	4	62·06	5
55·4	4	55·4	3
47·6	1	—	—
41·3	2	—	—
25·5	7	2025·53	5
21·2	1	—	—
19·4	5	2019·4	1
07·7	3	07·7	2
04·3	7	04·3	5
1995·1	5	1995·1	3
89·2	1	—	—
79·8	1	—	—
77·1	4	1977·1	2
70·4	1	—	—
65·4	4	1965·4	1
45·6	1	—	—
42·9	6	1942·9	2
39·2	4	39·2	4
21·9	4	1921·9	3
19·6	3	—	—
01·1	6	1901·1	1
1899·2	2	—	—
83·1	2	—	—
77·8	1	—	—
73·8	6	1873·8	5
56·4	6	56·4	4
54·8	6	—	—
50·6	7	—	—
44·1	7	—	—

VI. Summary of Results.

I. In the absorption spectrum of non-luminous mercury vapour there has been shown to be a strong symmetrically spaced band at $\lambda = 1849\cdot6$ A°.U., a diffuse complex band at $\lambda = 2338$ A°.U., and an asymmetrical band at $\lambda = 2536\cdot72$ A°.U. The complex band at $\lambda = 2338$ A°.U. consists of a band extending from $\lambda = 2313$ A°.U. to $\lambda = 2320$ A°.U. one at $\lambda = 2322$ A°.U. another at $\lambda = 2326$ A°.U. and a wider one between $\lambda = 2330$ A°.U. and $\lambda = 2338$ A°.U.

[1]Kayser's Handbook of Spectroscopy. Vol. V, p. 283.

II. In the absorption spectrum of non-luminous cadmium vapour there is a strong symmetrically spaced absorption band at $\lambda = 2288$ A°.U. and a narrow sharply defined one at $\lambda = 3260 \cdot 17$ A°.U.

III. In the absorption spectrum of non-luminous zinc vapour there is a strong symmetrically spaced absorption band at $= \lambda\ 2139 \cdot 3$ A°.U. and a very narrow, sharply defined one at $\lambda = 3075 \cdot 99$ A°.U.

IV. With the exception of the absorption band at $\lambda = 2338$ A°.U. all the absorption bands found for the vapours of the three metals are the first members of either the series represented by $n = 1 \cdot 5$, S—m, P or that represented by $n = 2$, p_2—m, S.

V. No absorption bands were found in the absorption spectra of gold, silver and copper vapours and in those of the vapours of alloys of these metals.

VI. A new form of metallic vapour arc lamp has been devised which gives arcs of exceptional brilliancy.

VII. In the arc spectrum of cadmium, reversals were found at $\lambda = 2288 \cdot 79$ A°.U. and $\lambda = 3100$ A°.U.

VIII. An examination of the cadmium arc line $\lambda = 6439 \cdot 3$ A°.U. with a Lummer plate interferometer showed it to be simple and without satellites. The zinc line $\lambda = 6364$ A°.U. photographically was found to be a simple one but visually it appeared at times to be accompanied by two faint satellites.

IX. A number of new lines have been found in the spark spectrum of cadmium between $\lambda = 2100$ A°.U. and $\lambda = 1840$ A°.U. These were brought out by the use of a fluorite spectroscope.

We desire to acknowledge our indebtedness to Mr. P. Blackman for assisting us in taking the photographs.

The Physical Laboratory,
University of Toronto,
May 1st, 1915.

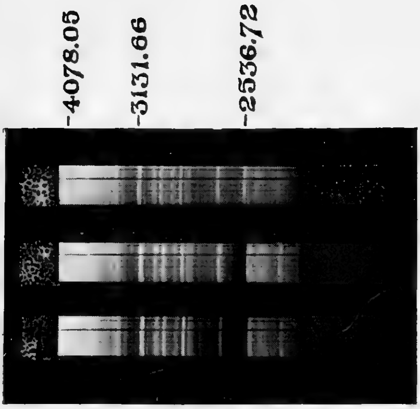


Fig. 1.

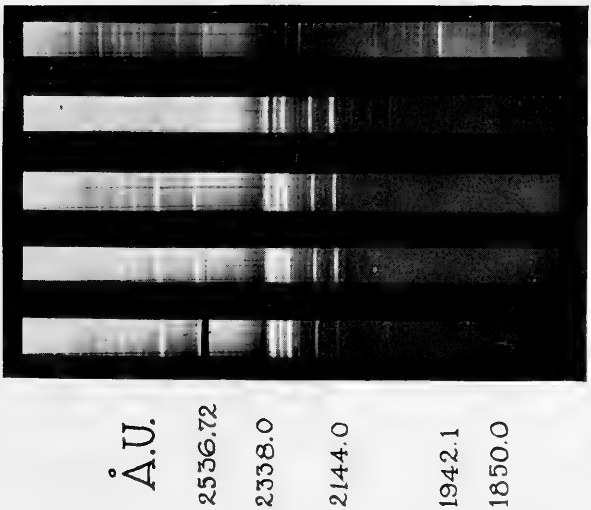


Fig. 2.

PLATE II.

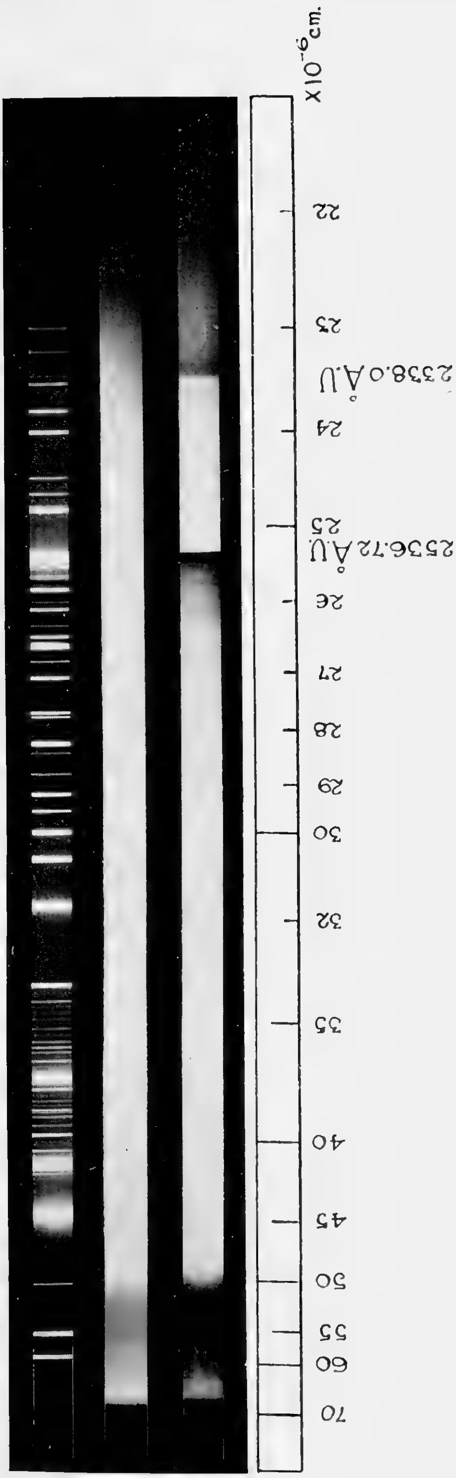


Fig. 3.

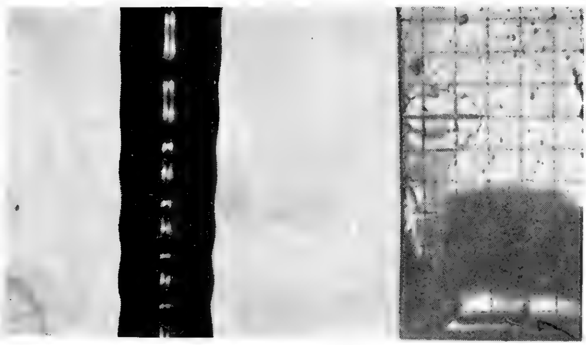


Fig. 10.

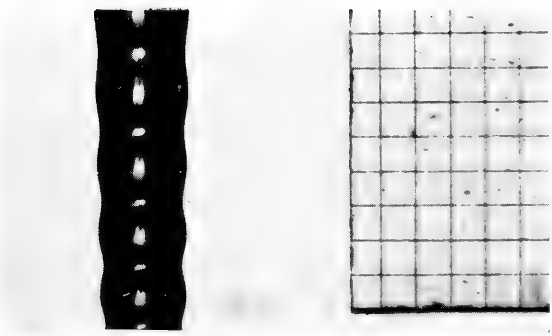


Fig. 11.

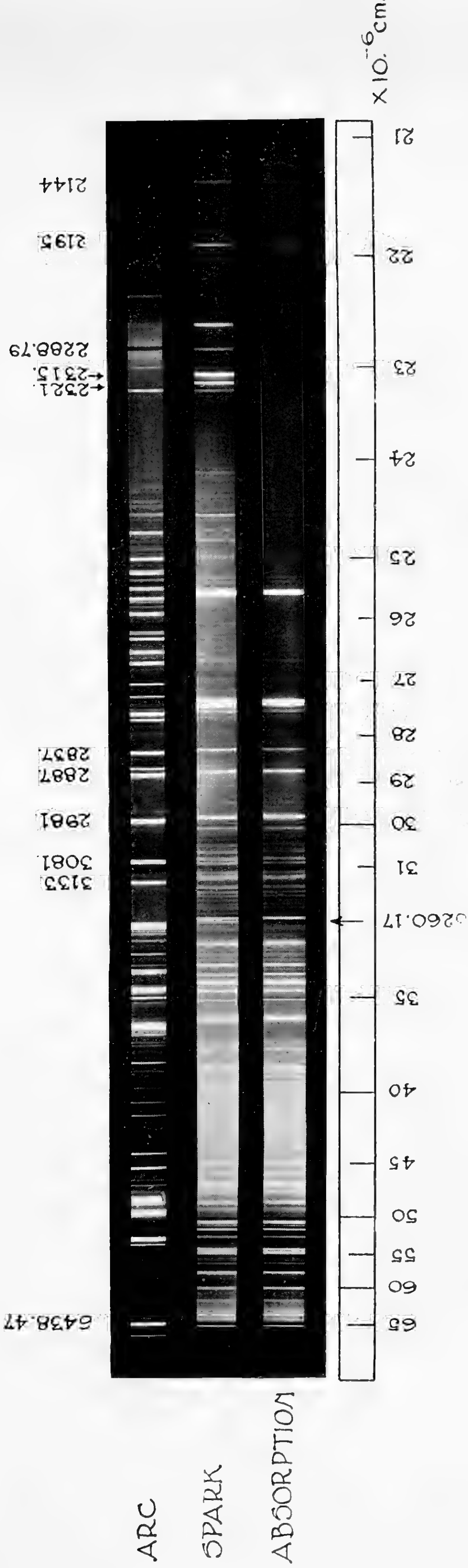
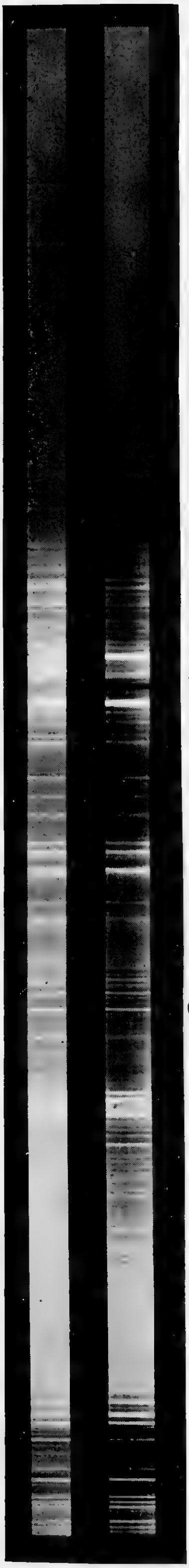

ARC
SPARK
ABSORPTION
2144
2195
2288.79
2315
2321
2837
2887
2981
3081
3133
3260.17
6438.47
21
22
23
24
25
26
27
28
29
30
31
35
40
45
50
55
60
65
$\times 10^{-6}$ cm.

Fig. 6.



2139.3

2288.79

2536.72

3075.99

Fig. 9.

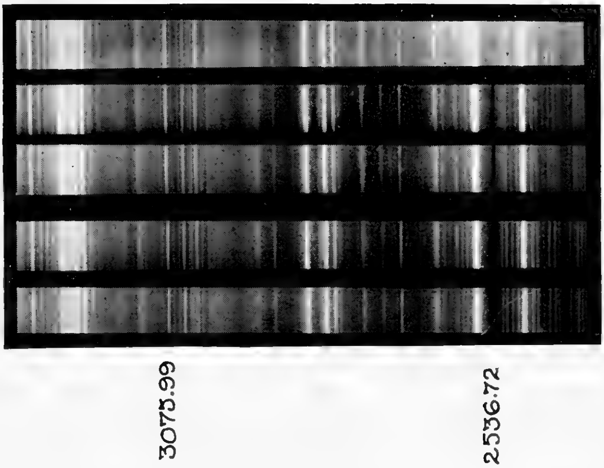


Fig. 10.

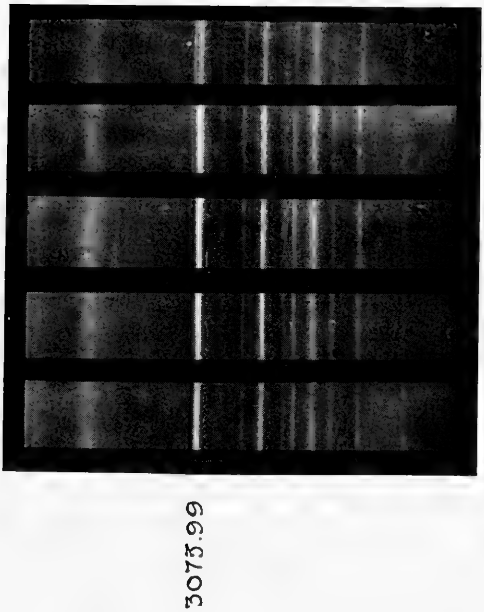


Fig. 11.

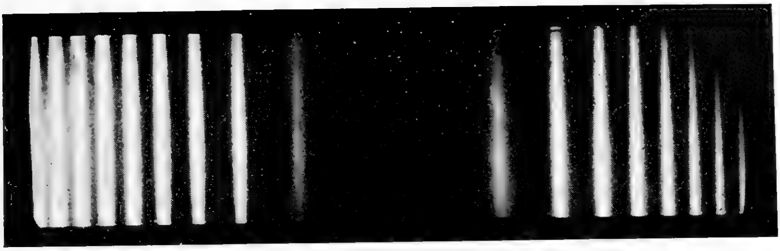


Fig. 12.

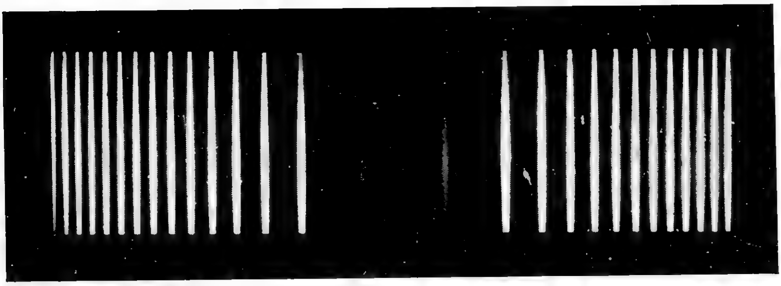


Fig. 13.

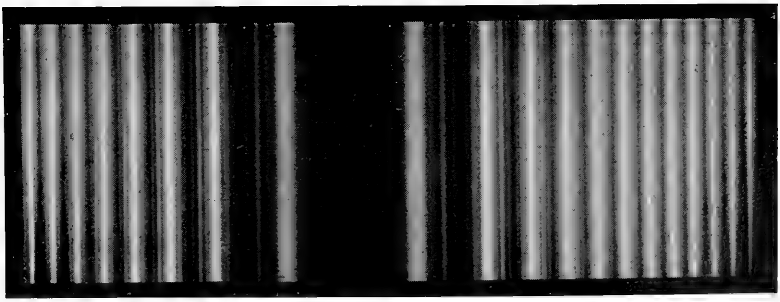


Fig. 14.

On the Infra-Red Emission Spectrum of the Mercury Arc.

BY PROFESSOR J. C. MCLENNAN, F.R.S., AND RAYMOND C. DEARLE, M.A.

(Read May Meeting, 1915.)

I. INTRODUCTION.

At the present time, when efforts are being directed towards the establishment of relationships between the atomic structure of an element and special features of its spectra, it is desirable to ascertain as fully as possible the frequencies which are associated with the atoms of the element in definite and determinate physical states. The frequencies associated with mercury atoms in the neutral, or supposed neutral state, have been carefully investigated by R. W. Wood[1], McLennan and Edwards[2] and others in the region between $\lambda = 6{,}000$ A°.U. and $\lambda = 1{,}800$ A°.U. In the experiments in which this was done, it has been found that if light of wave-lengths lying within the limits mentioned be passed through non-luminous mercury vapour there is a strong symmetrical absorption band at $\lambda = 1{,}849$ A°.U., a moderately strong non-symmetrical one at $\lambda = 2{,}536 \cdot 72$ A°.U. and one still less marked and consisting of three narrow bands at $\lambda = 2{,}338$ A°.U.

From this it has been concluded that within the limits mentioned there are three groups of frequencies which characterise the atoms or groups of atoms present in the vapour of mercury in the non-luminous state. It is desirable, however, that a wider range of frequencies should be investigated, especially on the side of the infra-red, where but little work on absorption appears to have been done as yet.

With a view to proceeding in this direction some preliminary work has been done by the writers in that region on the emission lines in the spectrum of the mercury arc. It is evident that a knowledge of the lines which characterise this spectrum in the infra-red region as well as of their exact wave-lengths would be of great assistance in deciding where to look for absorption by mercury vapour.

It was found on examining the work of those who have already investigated the emission spectrum of the mercury arc in the infra-red

[1] R. W. Wood. Physical Optics, p. 431.

[2] McLennan and Edwards, Proc. Roy. Soc. of Canada, 1915.

region, that considerable divergence exists in their results. The first recorded investigations were somewhat cursory attempts by Snow and by Drew and it was not until 1903 that we have any results in which confidence can be placed.

These are due to Coblentz and Geer[1] who worked with a rock salt prism spectrometer and a radiometer and found three definite lines between $0 \cdot 97\mu$ and $1 \cdot 285\mu$. In addition to these they were able to identify six lines in the neighbourhood of $5 \cdot 0\mu$ and possibly one other near $3 \cdot 0\mu$. Coblentz[2] repeated this work a couple of years later and announced that there are no important lines beyond $1 \cdot 3\mu$ except those near $5 \cdot 0\mu$. W. J. H. Moll[3] somewhat later using a rock salt spectrometer and thermopile in connection with an automatic recording device identified five lines between $1 \cdot 0\mu$ and $1 \cdot 7\mu$. In direct opposition to the results of Coblentz and Geer, Moll states that there is no measurable emission above $1 \cdot 7\mu$. Probably the most accurate measurements on the infra-red spectrum of the mercury arc are those made by Paschen[4] with a concave grating and a Rubens thermopile. By means of the better definition and the higher dispersion afforded by the grating, Paschen was able to separate maxima which had previously been recorded as single lines. In all he identified fourteen lines between $1 \cdot 0\mu$ and $1 \cdot 7\mu$ and he confirmed the statement by Moll that there are no lines beyond $1 \cdot 7\mu$. He[5] subsequently repeated his measurements and found a maximum at $4 \cdot 0\mu$; but inasmuch as this maximum came out in the arc spectrum of a number of the elements he concluded that it was due to the presence of hydrogen. In these later measurements a bolometer was used in combination with a grating. More recently still H. Rubens and O. von Baeyer[6] have succeeded in showing that the mercury arc emits a radiation of wavelength about 313μ. They succeeded in isolating this radiation by the method of focal separation previously used by Rubens and Wood[7] and in measuring its wave-length by means of a Fabry and Perot interferometer of a special type in combination with a Rubens microradiometer. Subsequent measurements[8] by them on this radiation

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[1]W. Coblentz and W. C. Geer, Phys. Rev., 16 pp. 279-286, 1903.

[2]Coblentz, Phys. Rev., 20 pp. 122-124, 1905.

[3]Moll. Kon. Akad. Wet. Amsterdam. Proc. 9 pp. 544-548, 1907.

[4]Paschen, Ann. der Phys. 27, 3, pp. 537-570, 1907.

[5]Paschen, Ann. der. Phys. 33, 4, pp 717-738, 1910.

[6]H. Rubens and O. von Baeyer, Phil. Mag., 21 pp. 689-695, 1911.

[7]H. Rubens and R. W. Wood, Preuss. Akad. Wiss. Berlin, Sitz. Ber. 52. pp. 1122-1137, 1910.

[8]H. Rubens and O. von Baeyer, Preuss. Akad. Wiss. Berlin, Sitz. Ber. 30 pp. 666-667, 1911.

showed that it consisted of two wave-lengths, the one at about 218μ and the other in the neighbourhood of 343μ.

The only noteworthy measurements by photographic methods in the infra-red spectrum of the mercury arc were made in 1912 by H. Lehmann.[1] He used the phosphoro-photographic method of Bergmann[2] and found four lines corresponding to those of Paschen and in addition a new line at 1·46μ.

In the present investigation a careful survey was made of the infra-red spectrum of the mercury arc in the region beyond 1·0μ with the object of confirming, if possible, the existence of the lines identified by Paschen and of seeing whether the lines found by Coblentz and Geer in the neighbourhood of 3μ, had a real existence. In this examination a number of the lines noted by Paschen were identified, the existence of a line near 3·0μ was confirmed and in addition a number of new lines were observed.

II. Apparatus.

In this work a number of different forms of mercury arc lamps were used as sources of the radiation; but a quartz mercury lamp, constructed by W. C. Heraeus, was found to be the most satisfactory. This lamp gave a very powerful and quite concentrated arc. When in operation it was driven with a direct current of from 3·0 to 3·2 amperes, with a striking potential of 110 volts. A suitable resistance was of course inserted in series with the lamp. It was found that even with this lamp the current through it steadily decreased for the first ten minutes after the arc was struck. This was brought about by an increase which took place in the resistance of the mercury vapour when the temperature of the lamp was rising. The following table and the curve in Fig. 1. show the variation of the current with the elapse of time in a typical case:

Time	Current
0 min.	6·4 amps
0 min. 50 secs.	6·1 "
1 " 35 "	5·9 "
2 " 20 "	5·7 "
3 " 10 "	5·45 "
3 " 45 "	5·1 "
4 " 45 "	4·75 "
5 " 40 "	4·4 "
6 " 35 "	4·13 "
7 " 50 "	4·00 "
9 " 10 "	3·75 "
10 " 10 "	3·72 "
11 " —	3·7 "

[1]H. Lehmann. Ann. der. Phys. 39, 1, pp. 76-77, 1912.

[2]Bergmann, Zeitschr. Wiss. Phot. 6 pp. 113-130 and pp. 145-169, 1908.

In all experiments care was taken to see that the lamp was in the steady state before measurements were made on the intensity of the radiation.

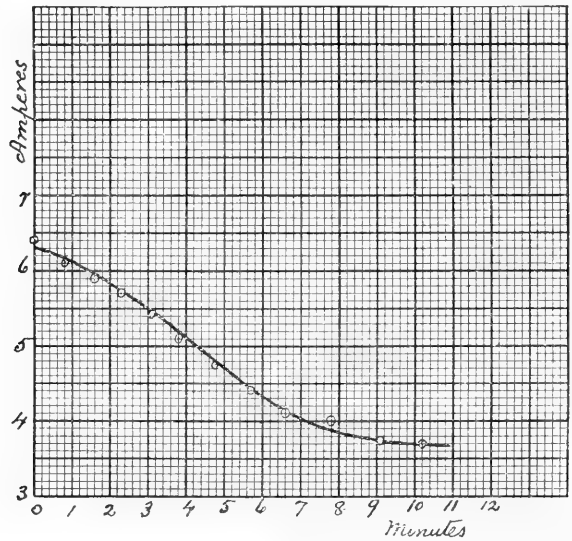

Fig. 1.

The form of spectrometer used was one designed and constructed by the Adam Hilger Co. It is shown in Fig. 2 and in diagram in

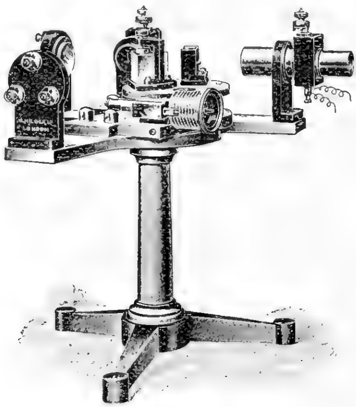

Fig. 2.

Fig. 3. The energy measurements were made with a senstitive Rubens thermopile shown in Fig. 4 in conjunction with a very delicate Paschen galvanometer made by the Cambridge Scientific Instrument

Company. The radiation from the lamp was allowed to fall upon a large concave mirror having a diameter of 19 cms and a focal length of 30 cms which brought it to a focus on the slit S_1. From this slit the

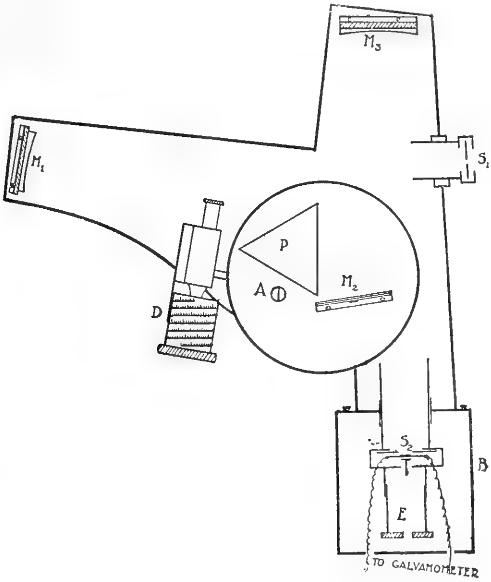

Fig. 3.

rays passed to the nickel-steel concave mirror M_1 thence through the rock salt prism P to the plane nickel steel mirror M_2. From this they were reflected to the concave nickel-steel mirror M_3 and by it they were brought to a focus on the linear junctions of the thermopile at T, which was placed immediately behind the slit S_2. The prism and plane mirror were mounted on a table which rotated about the point A. By turning this table through a small angle, any desired part of the spectrum could be brought to a focus at S_2. The rotation was produced by the motion of a helical drum attached at D, which was calibrated in wave-lengths up to 10μ from data on the dispersion of rock salt as given by Paschen[1] and others.

An eye-piece E was attachable behind the slit S_2 for the purpose of focussing lines in the visible part of the spectrum on the thermopile and of adjusting the prism so that the radiation brought to a focus at S_3 was in agreement with the reading on the drum. The prism had faces $3 \cdot 2$ cms by $4 \cdot 2$ cms and was ground to an angle of approximately 55°. Judging by the visible spectrum, there was very little curvature in the spectral lines produced by this prism.

[1]Paschen, Ann. d. Phys. 26. 1. pp. 120-138; 5 pp. 1029-1030, 1908.

The thermopile, Fig. 4, consisted of 10 junctions of bismuth-silver joined by silver solder and flattened out into rectangular plates at the exposed junctions which were blackened. The sensitive area

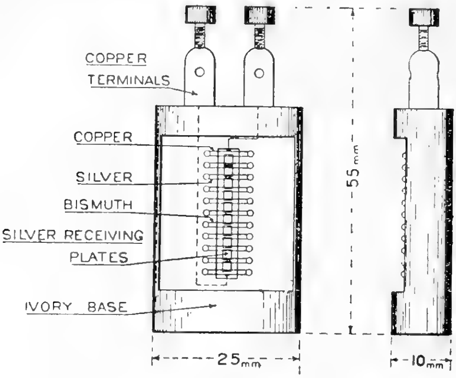

Fig. 4.

was 20 mm. long and 1·5 mm. wide or a total of 30 sq. mm. As the slit width used in all the experiments was only 1 mm., the effective area of the exposed junctions was only 20 sq. mm.

The galvanometer used was a modified form of the Thomson galvanometer and was specially designed by Paschen[1] for radiometry measurements. The magnet system consisted of two groups of thirteen magnets arranged alternately on opposite sides of a fine glass stem and supported by a fine quartz fibre. The coils were elliptical in shape and were wound with six different sizes of wire with the object of producing a maximum field for a given resistance of copper. The period could be controlled by means of a magnet and it was adjusted to have a full period of 5 secs. It was found that while a longer period did not materially increase the sensibility, it made the zero drift considerably greater. The resistance of the thermopile was 2·93 ohms and that of the galvanometer, with the coils connected in multiple series which was the arrangement always adopted, was 3·0 ohms. The sensitiveness of the instrument was such that a deflection of 1 mm. on a scale at a distance of one metre was produced by a current of ·00025 micro ampères.

One of the greatest difficulties met with in the work was the variation produced by temperature changes and by stray air currents. To overcome these the thermopile and slit were enclosed in a nickelled box, shown at B in Fig. 3, which was both packed inside and surrounded outside with cotton waste. The whole spectrometer was enclosed in a

[1]Paschen, Ann. der. Phys. 27, 3. pp., 537-570, 1908.

wooden box lined with absorbent cotton and all the free space between the spectrometer stand and the box was also filled with cotton waste. The box had a window at S_1, covered by a shutter and a second window as well through which to read the wave-lengths on the drum. As an additional precaution an asbestos screen was always placed between the lamp and the spectrometer. The lamp itself gave rise to certain errors due to variations in the current and to the occasional deposit of a drop of mercury on the face of the tube from which the radiation was taken. These latter errors were sufficient at times to produce false maxima of considerable magnitude. In taking all readings the drum was set at the desired wave-lengths and the shutter was opened until the galvanometer reached its maximum deflection, when it was again closed. This was repeated from six to ten times and the mean value of the deflection was taken as a measure of the energy in the particular wave-length selected. Zero drift was always considerable, on some days amounting to as much as 140 mm. in readings extending over the space of an hour. To eliminate the effect ot this drift the amount of deflection on opening the shutter was read and also the distance which the spot of light returned on closing the shutter. The mean of these two was then taken as the correct reading. When every imaginable precaution was taken it was still found that maxima appeared in the energy curves which apparently did not represent spectral lines. However, it was possible by repeating the readings over any given portion of the spectrum on different days to differentiate between true and false maxima and so to identify the spectral lines. In taking the measurements, it was necessary to distinguish between the energy which was contributed by a special line and that which was contributed by the continuous spectrum due to the radiation from the heated quartz of the lamp itself. To do this a circuit breaker was connected in series with the lamp, the drum was adjusted to give the wave-length of the desired line and the shutter was opened immediately after the circuit was broken. The ensuing deflection was read and the time noted on a stop-watch. The shutter was again closed and after an interval re-opened. The deflection produced and the time corresponding to it were again noted. In this way several readings were taken and a cooling curve was plotted from them. This curve was then extended backwards to zero time and from the point where it cut the ordinate axis the energy conrtibuted by the radiation from the hot quartz of the wave-length under investigation was ascertained. This reading was subtracted from the reading taken when the lamp was in operation and the difference gave the energy contributed by the spectral line. A cooling curve of the type just mentioned is shown in Fig. 5.

The intensity of the radiation of any particular wave-length as measured by the spectrometer was found to vary with small displacements of the lamp or scale and so all measurements were com-

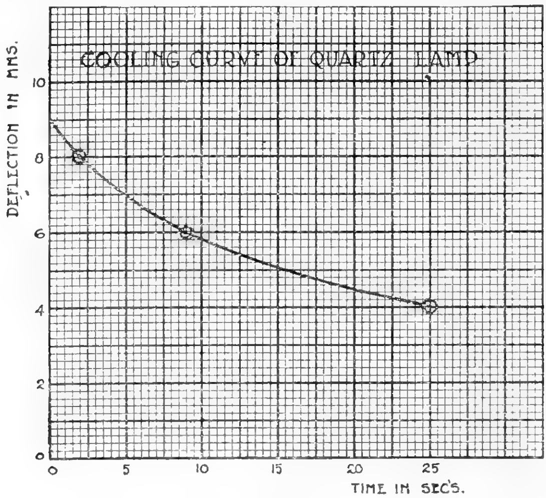

Fig. 5.

pared with the deflection produced by the radiation from the green line $\lambda = 5{,}461$ A°.U. This line which was of strong intensity possessed the advantage of being practically outside the region of the hot quartz radiation.

III. Accuracy of Measurements.

In work on infra-red spectra the means generally employed to produce the spectrum are the prism and the grating. The latter has the great advantage that it absorbs but little radiation and that it affords good definition in all parts of the spectrum. Against this, however, is the fact that the energy is divided up into several orders, that these orders often overlap in the infra-red, and that the distribution of energy in any one order does not always correspond with the true distribution in the spectrum. The prism, on the other hand, gives but one order, so that a maximum of energy is found in each and every wave-length. It limits the measurements, however, to the region where the radiation is transmitted without absorption. With prisms of rock salt the radiation is transmitted up to wave-lengths of 60,000 A°.U.; but it is difficult to secure good definition in the longer wave-lengths. This difficulty, moreover, is enhanced by the fact that in order to secure sufficient energy in the weaker lines it is necessary to work with a fairly wide slit. On this account one cannot expect in working with a rock salt prism to reach the precision of wave-length measurement attainable with a grating spectroscope or to differentiate between lines very close together with the same facility as with a grating. The prism, however, enables one to obtain a reliable register of the maxima in the energy spectrum and these can be used as a guide for finer measurements with an instrument such as a grating. The following table shows the width of spectrum covered in the different ranges by the thermopile slit for a slit width of 1 mm.

Wave-length	Width of spectrum.
0·54 μ	0·02 μ
0·58 "	0·03 "
0·82 "	0·08 "
1·50 "	0·28 "
2·00 "	0·62 "
3·00 "	0·76 "
4·00 "	0·68 "
5·00 "	0·54 "
6·00 "	0·46 "
7·00 "	0·40 "
8·00 "	0·36 "
10·00 "	0·32 "

These results are also shown graphically in Fig. 6. Although from this table there seems to be a considerable width of spectrum

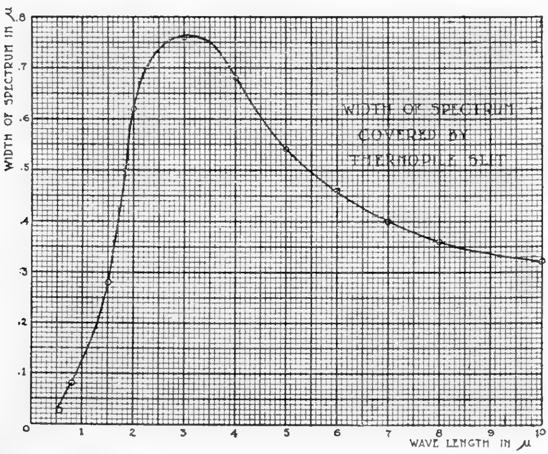

Fig. 6.

covered by the slit, still it must be remembered that since in all our measurements readings were taken at intervals of $0 \cdot 1\mu$, the energy curves could be filled in between these readings and the wave-lengths could be assigned to the various lines with an accuracy of probably $\pm 0 \cdot 01\mu$.

IV. Observations.

After the apparatus was carefully set up and found to be in good working order a set of readings was taken on the energy spectrum of an Arons[1] amalgam lamp. The amalgam in this lamp consisted of about 60% Hg, 20% Pb, 20% Bi, ½% Zn and ½% Cd., the lamp was run on the 110 volt direct current circuit with a suitable resistance in series. The energy curve is shown in Fig. 7. Thirty-six distinct

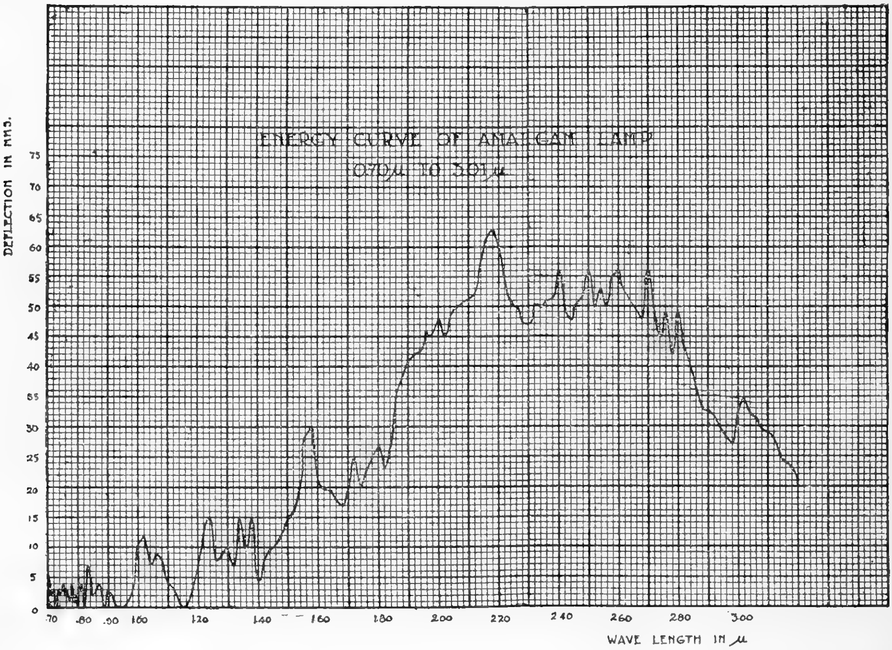

Fig. 7.

maxima were observed in all between wave-lengths $0 \cdot 70\mu$ and $3 \cdot 0\mu$. Possibly as many more could have been distinguished by repeated observations; but as there was no way of distinguishing which were mercury lines and which were lines of the other metals further work with this lamp was abandoned.

Readings were then taken, as stated above, with a lamp containing only pure mercury. The maxima from a large number of sets of readings were compared and the regions which contained constantly recurring maxima were carefully examined so as to establish the exact

[1]Arons, Ann. d. Phys. Band 23, 1906.

position of each maximum as closely as possible. In the same region as that investigated by Paschen,[1] the positions of nine lines were determined and these accorded fairly well with the wave-lengths given by him. As was expected, in regions where the latter gives two or three lines in close proximity, only one maximum, corresponding to the mean wave-length was recorded in our measurements. Corresponding to the new line observed by H. Lehmann[2] at $1 \cdot 464\mu$, a maximum was found which appeared to vary slightly from $1 \cdot 46\mu$ to $1 \cdot 50\mu$. The mean wave-length of all the readings taken on this line was $1 \cdot 483\mu$. In addition to these, four other lines were recorded, two of which had already been located by W. Coblentz and W. C. Geer with slightly higher values for the wave-lengths. In their work a line is given at $1 \cdot 045\mu$ while in ours it was found to be at $1 \cdot 038\mu$. Close to the line we also found two others at $1 \cdot 067\mu$ and $1 \cdot 090\mu$ respectively. The presence of these lines was evidently suspected by Coblentz and Geer[3] since they state that certain observations were repeated "to learn whether another line exists between $1 \cdot 06\mu$ and $1 \cdot 12\mu$ where the curve is very asymmetrical." Their instruments, however, were not sufficiently sensitive to detect these lines. Beyond $1 \cdot 7\mu$ only one line was found which was at $3 \cdot 2\mu$. This confirmed the doubtful indications recorded by the above-named pair of investigators. This part of the spectrum was not as thoroughly examined as might be desired and it is just possible that a closer examination might have revealed other maxima, particularly in the region of $3 \cdot 7\mu$ where indications, as will be shown below, point to the possible existence of a new line.

In Table I., the wave-lengths of the lines isolated in the present investigation are given in the first column and their relative intensities in the second. Accompanying these are given in order the wave-lengths of the lines determined by other investigators, namely, Paschen, Lehmann, Moll and Coblentz and Geer. The intensities are given for the first two, but in the case of the others no intensities are recorded in their communications. In the last column the frequencies of all the lines are given, reduced to a vacuum.

[1]Paschen, *loc. cit.*

[2]Lehmann, *loc. cit.*

[3]Coblentz and Geer. Phys. Rev. 16 p. 284, 1903.

Table I.

Authors	I	Paschen	I	Lehmann	I	Moll	Coblentz and Geer.	Frequency in vacua
μ							μ	
3·02	6	—	—	—	—	—	—	3310·3
—	—	—	—	—	—	—	3·00 (?)	3332·4
1·72	5	—	—	—	—	—	—	5812·4
—	—	1·711	4	—	—	—	—	5843·1
—	—	1·707	5	—	—	—	—	5856·9
—	—	—	—	—	—	1·70	—	5880·8
—	—	1·694	2·8	—	—	—	—	5900·8
—	—	1·692	4·6	—	—	—	—	5908·6
—	—	1·529	9	—	—	—	—	6514·4
—	—	—	—	—	—	1·52	—	6577·1
1·483	3	—	—	—	—	—	—	6668·3
—	—	—	—	1·464	4	—	—	6828·5
—	—	1·395	6·5	—	—	—	—	7166·0
1·377	8	—	—	—	—	—	—	7260·6
—	—	—	—	1·369	2	—	—	7300·2
—	—	1·367	17	—	—	—	—	7311·3
—	—	—	—	1·359	2	—	—	7352·2
—	—	1·357	12	—	—	—	—	7366·7
1·329	6	—	—	—	—	—	—	7522·4
—	—	—	—	—	—	—	1·285	7778·4
1·270	4	—	—	—	—	—	—	7871·8
—	—	1·207	2·6	—	—	—	—	8282·2
1·205	2	—	—	—	—	—	—	8286·6
—	—	1·202	2·4	—	—	—	—	8316·4
—	—	1·188	2·6	—	—	—	—	8410·3
1·170	7	—	—	—	—	—	—	8544·9
—	—	1·129	31	—	—	—	—	8826·5
1·128	9	—	—	1·128	3	—	—	8863·0
1·090	5	—	—	—	—	—	—	9171·7
1·067	7	—	—	—	—	—	—	9369·7
—	—	—	—	—	—	—	1·045	9567·2
1·038	6	—	—	—	—	—	—	9631·4
—	—	—	—	1·015	1	—	—	9851·2
1·014	30	1·014	71	—	—	—	—	9863·5

V. Discussion of Results.

If the measurements made by the writers be compared with the others given in Table I., it will be seen that the line observed by us at $3 \cdot 02\mu$ is probably the same as that given by Coblentz and Geer at $3 \cdot 00\mu$ and the maximum at $1 \cdot 72\mu$ doubtless corresponds to the group of four lines given by Paschen between $1 \cdot 692\mu$ and $1 \cdot 711\mu$. There is no line given by the others near 1·483 unless it be that given by Paschen at $1 \cdot 529\mu$ and the one given by Moll at $1 \cdot 52\mu$. The maximum noted at $1 \cdot 377\mu$ represents probably a combination of Paschen's two lines at $1 \cdot 395\mu$ and $1 \cdot 367\mu$ and the lines nearest to $1 \cdot 329\mu$ are that noted by Paschen at $1 \cdot 3517\mu$ and that given by Coblentz and Geer at 1·285. The line at $1 \cdot 270\mu$ appears to be a new one, unless it be the same as that given by Coblentz and Geer at $1 \cdot 285\mu$. That at $1 \cdot 205\mu$ very likely represents a combination of the lines given by Paschen at $1 \cdot 207\mu$ and $1 \cdot 202\mu$. The line at $1 \cdot 170\mu$ probably represents the same one as Paschen's at $1 \cdot 188\mu$. The maximum observed at $1 \cdot 128\mu$ was also found by Paschen and Lehmann but the maxima at $1 \cdot 090\mu$ and $1 \cdot 067\mu$ are new. As mentioned before, the maxima at $1 \cdot 038\mu$ and $1 \cdot 045\mu$ probably refer to the same line. The line at $1 \cdot 01\mu$ was also observed by Paschen and by Lehmann at $1 \cdot 015\mu$.

An energy curve showing the maximum at $3 \cdot 02\mu$ is given in Fig. 8 and others showing the new lines at $1 \cdot 27\mu$, $1 \cdot 090\mu$, and $1 \cdot 067\mu$ are

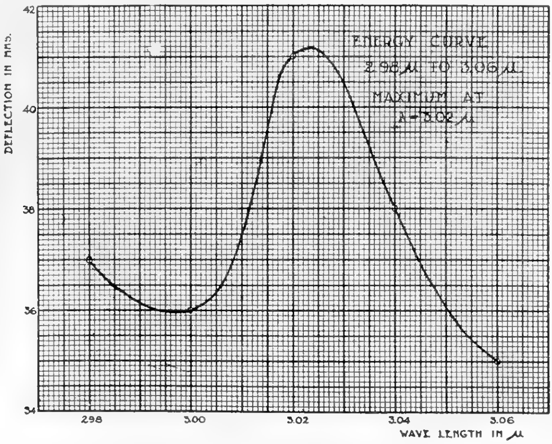

Fig. 8.

given in Figs. 9 and 10. It will be noted that the maxima at $1 \cdot 27\mu$ and $3 \cdot 02\mu$ are fairly sharp while those shown in Fig. 10 are somewhat broader.

A comparison of the intensities assigned to the various lines by the different investigators affords an interesting study. Paschen says in his paper that he found the line at $1 \cdot 014\mu$ was the most intense in the whole mercury spectrum and that on the same relative scale, as that recorded in Table I., he found the mercury green line at $\lambda = 5461$ A°U. was represented by an intensity of 42, i.e., rather more than one-half of the intensity of the line $1 \cdot 014\mu$. In the measurements of the writers it was found that if the energy in the line at $1 \cdot 014\mu$ be represented by 30 that in the line at $\lambda = 5461$ A°U. was found to be represented by 40, or one-third more than that of the line $1 \cdot 014\mu$. On looking at Lehmann's results it will be seen that though there is no value given for the intensity of the green line that of the line $1 \cdot 015\mu$ is given by him as the weakest in the infra-red spectrum. This was probably due to the method of registering the spectrum used by

Lehmann, for it will be remembered that by it the lines were recorded by their inverting action on a phosphorescent screen. It is quite possible that the line $1 \cdot 015\mu$ being nearer to the wave-lengths of the

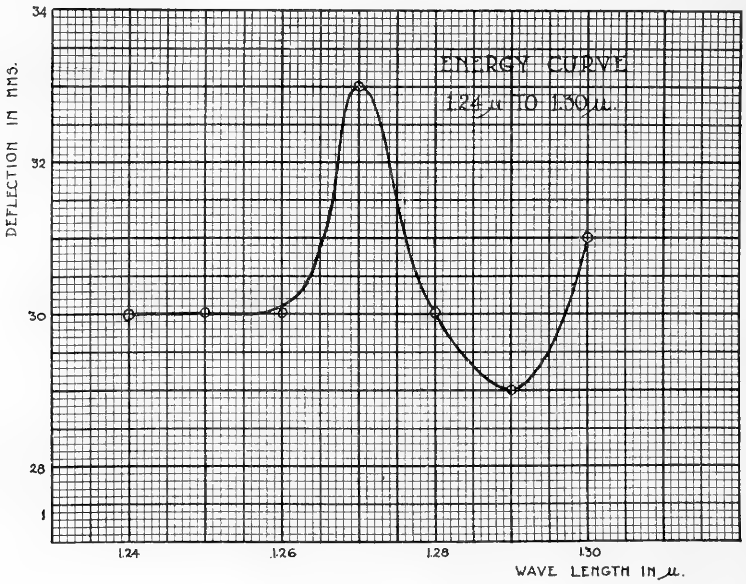

Fig. 9.

visible spectrum than any of the others recorded, would not have as strong an effect as waves of longer length. As regards the relative intensities of the lines $1 \cdot 014\mu$ and 5461 A°U., it was noted by

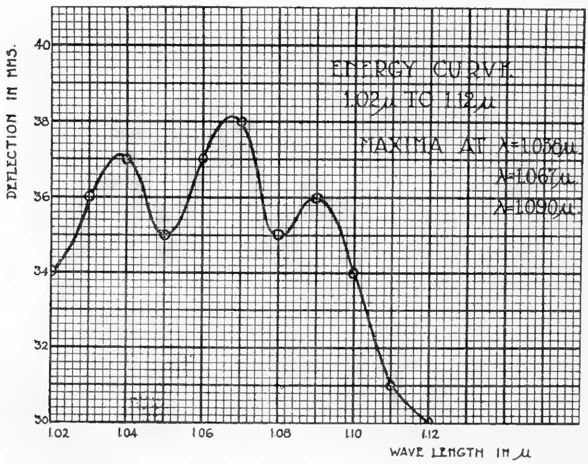

Fig. 10.

Paschen[1] that if the vapour pressure in his lamp was increased, the relative intensity of the line $1 \cdot 014\mu$ came out still higher, while with a low vapour-pressure the intensity of the two lines was about equal. This may explain the values of the intensities found for these lines in the present investigation.

Table II.

Wave-length.	Frequency	Difference.
First subordinate triplet series.		
r = 2, p—m, d. m = 3.		
3663·05 A°. U.	27292·06	4630·92
3131·66 " "	31922·98	1767·36
2967·37 " "	33690·34	
Second subordinate triplet series.		
= 2, p—m, s. m = 1·5.		
5460·97 A°. U.	18306·73	4631·31
4358·66 " "	22937·04	1767·19
4046·78 " "	24707·23	
Triplet $1 \cdot 038\mu$ $1 \cdot 270\mu$ $3 \cdot 02\mu$.		
30200 A°.U.	3310·3	4561·5
12700 " "	7871·8	1759·6
10380 " "	9631·4	
Suggested triplet $1 \cdot 09\mu$ $1 \cdot 367\mu$ $3 \cdot 70\mu$		
37000 A°. U.	2702·7	4608·6
13670 " "	7311·3	1860·4
10900 " "	9171·7	

In looking for series relationships among the lines given in the first column of Table I., it was seen that the frequency differences for the lines $1 \cdot 038\mu$, $1 \cdot 27\mu$ and $3 \cdot 02\mu$ are practically the same as those which characterise the subordinate series triplets in the mercury spectrum given by γ = 2, p—m, d and γ = 2, p—m, s. This will be evident from the numbers given in Table II. It will be noted, too, that the frequency difference between the line given in our list at $1 \cdot 09\mu$ and the one given by Paschen at 1·367 is equal to 1860·4, which approximates, as the table shows, to the frequency difference between the second and third numbers of the triplets of the two subordinate series mentioned above. If these two lines should turn out to be the second and third numbers of a triplet similar to the one

[1]Paschen, Ann. d. Phys. 27. 13. p. 559, 1908.

already noted, there would need to be a line at about $3 \cdot 70\mu$. A line in this position, however, was not observed in our investigation; but as already mentioned this portion of the infra-red spectrum was not examined as closely as the region of somewhat shorter wave-lengths.

VI. Summary of Results.

I. Thirteen lines have been recorded in the infra-red spectrum of the mercury arc between the wave-lengths $1 \cdot 00\mu$ and $3 \cdot 02\mu$.

II. The existence of the line near $1 \cdot 04\mu$ which was shown to exist by Coblentz and Geer but which was not found by later investigators, was confirmed by the finding of a line at $1 \cdot 038\mu$.

III. The existence of at least one line with a wave-length longer than $1 \cdot 70\mu$ was proved by the discovery of a line at $3 \cdot 02\mu$, which was also in confirmation of the work by Coblentz and Geer.

IV. Three new lines were discovered in the infra-red spectrum at $1 \cdot 067\mu$, $1 \cdot 090\mu$ and $1 \cdot 270\mu$.

V. It has been pointed out that the frequency differences for the lines $1 \cdot 038\mu$, $1 \cdot 270\mu$ and $3 \cdot 02\mu$ are the same as those which characterise the triplets in the subordinate series for the mercury arc spectrum given by $\gamma = 2$, p—m, d and $\gamma = 2$, p—m, s. It has also been suggested that possibly the lines at $1 \cdot 09\mu$ and $1 \cdot 367\mu$ are the third and second numbers of a similar triplet with its first number in the neighbourhood of $3 \cdot 70\mu$.

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SECTION III

SERIES III — MARCH 1916 — VOL. IX

An application of the "Calculus of Finite Differences" to correct an experimental curve, and thus obtain, by a graphical method, an accurate representation of the integral of this curve.

By S. DOUGLAS KILLAM.

Presented by H. M. TORY, F.R.S.C.

(Read May Meeting, 1915).

Let us suppose that as the result of an experiment we obtain n values of a function corresponding to n values at equal intervals of an independent variable x. In the example used to make the problem more concrete I have taken n equal to 6, and have the following table of values:

x	f (x)
0	3
1	4
2	5
3	5
4	4
5	5
..	..

Our problem is to obtain a graphical representation of the function $f(x)$, a polynomial of the fifth degree passing through these six points in an x y-plane, and from that a graphical representation of the function $\int_0^x f(x)dx$.

If we solve this problem analytically we obtain a polynomial of the fifth degree passing through the six given points, by Lagrange's interpolation formula

$$f(x)=\frac{(x-x_2)\ (x-x_3)\ (x-x_4)\ (x-x_5)\ (x-x_6)}{(x_1-x_2)\ (x_1-x_3)\ (x_1-x_4)\ (x_1-x_5)\ (x_1-x_6)}\,f(x_1)+\cdots\cdots+\cdots\cdots$$

$$+\cdots\cdots+\cdots\cdots+\frac{(x-x_1)\ (x-x_2)\ (x-x_3)\ (x-x_4)\ (x-x_5)}{(x_6-x_1)\ (x_6-x_2)\ (x_6-x_3)\ (x_6-x_4)\ (x_6-x_5)}\,f(x_6)$$

where (x_1, y_1); $(x_2, y_2)\ldots.(x_6\ y_6)$, are the co-ordinates of the six points.

The polynomial of the 5th degree through the six points (0, 3), (1, 4)..........(5, 5) obtained by Lagrange's method is

$$f(x) = \frac{1}{120}\left\{2x^5 - 15x^4 + 20x^3 + 15x^2 + 98x + 360\right\} \quad\ldots\ldots\ldots\ldots\ldots\ldots(1)$$

We can integrate this function analytically and have

$$\int f(x)dx = \frac{1}{120}\left\{\frac{x_6}{3} - 3x^5 + 5x^4 + 5x^3 + 49x^2 + 360x\right\}\ldots\ldots\ldots\ldots(2)$$

$$\text{where} \int f(x)dx = o \text{ when } x = o.$$

This last function can be represented graphically in an $x\ y$-plane; but in obtaining it we have resorted to an intermediate analytical step involving the use of Lagrange's formula, which is a long, tedious piece of work in which the probability of error is very great.

The alternative method is purely graphical and passes directly from the given data by a graphical construction to a graphical representation of the integral curve $\int_0^x f(x)dx$. The accuracy of the graphical method is great enough for most problems in applied mathematics; that is, the error is less than the width of the narrowest construction lines possible to use.

We begin (Fig. 1) by drawing a smooth curve through the six given points a, b, c, d, e and f; and assume this to be a polynomial of the fifth degree. If we compare this freehand curve with equation (1) we find a slight error between e and f. If we knew the equation of the curve $f(x)$ we could easily plot other points and correct our curve; but my object is to avoid the labor of finding this equation. The method of extrapolation by finite differences is most useful for my purpose. As $f(x)$ is a polynomial of the fifth degree the fifth column of differences is constant, and in my example equal to 2. (See Table I).

TABLE I.

x	$f(x)$	$\Delta\ f(x)$	$\Delta^2 f(x)$	$\Delta^3 f(x)$	$\Delta^4 f(x)$	$\Delta^5 f(x)$
-2	-2	4	-3	3	-3	2
-1	2	1	0	0	-1	2
0	3	1	0	-1	1	2
1	4	1	-1	0	3	2
2	5	0	-1	3	5	
3	5	-1	2	8		
4	4	1	10			
5	5	11				
6	16					

By starting with the fifth column of differences we can work backwards and find the values of $f\ (x)$ corresponding to $x = -2$; $x = -1$; and $x = 6$. In my example it is only necessary to locate the points (6, 16), and ($-$ 1, 2) in order to draw a smooth curve through the eight points r, a, b, c, d, e, f and g; so that between a and f this curve is an exact graphical representation of the function $f(x)$. In Figure 1 the dotted curve shows the correct shape of our function between e and f. The part es′f was obtained before we found the point g and is incorrect by the amount shown in the figure. The same thing applies to that part of our curve between a and b, only in the example taken the error is almost negligible.

Now that we have a correct graphical representation of the function $f(x)$ we wish a graphical representation of the function $\int_0^x f(x)dx$. The method of graphical integration first suggested by Massau[1] is the shortest and most accurate for our purpose. We replace the curve $f(x)$ which is to be integrated (Figure 2) by a step-curve such that the area under the step-curve equals the area under $f(x)$. We then integrate the step-curve graphically, which is very simple when we notice that the step-curve is made up of lines parallel to the x-axis. [For literature on this method see Runge "Graphical Methods" § 13 Columbia Univ. Press; or von Sanden "Praktische Analysis"

[1] Massau, "Mémoire sur l'intégration graphique et ses applications."

Teubner.] Our integral curve $\int_0^x f(x)dx$ obtained in this way is shown with its graphical construction in Figure 2. If our graphical work is correct the curve o b′ c′ d′ e′ f′ is an accurate graphical representation of the polynomial

$$\int_0^x f(x)dx = \frac{1}{120}\left\{\frac{x^6}{3} - 3x^5 + 5x^4 + 5x^3 + 49x^2 + 360x\right\}.$$

If we plot this curve, it coincides exactly with our graphically found curve. The dotted curve between e' and k shows the error in our integral curve when we drew a smooth curve through the six points a, b, c, d, e and f, as representing $f(x)$ without extrapolating the points r and g. The error in my example is very small; but would have been much greater if there had been a correction to $f(x)$ between a and b. Instead of the above used graphical method of integration we might have integrated our curve $f(x)$ by the "integraph" of Coradi; but I have found by long practice that the graphical method is more accurate and solves the problem in less time.

The graphically found curve $\int_0^x f(x)dx$ is within the accuracy of graphical methods, and can be found without the long process of applying Lagrange's interpolation formula, and of plotting the integral curve after integrating analytically. In short, we proceed by a graphical method or construction directly from our experimental curve to the desired function $\int_0^x f(x)dx$.

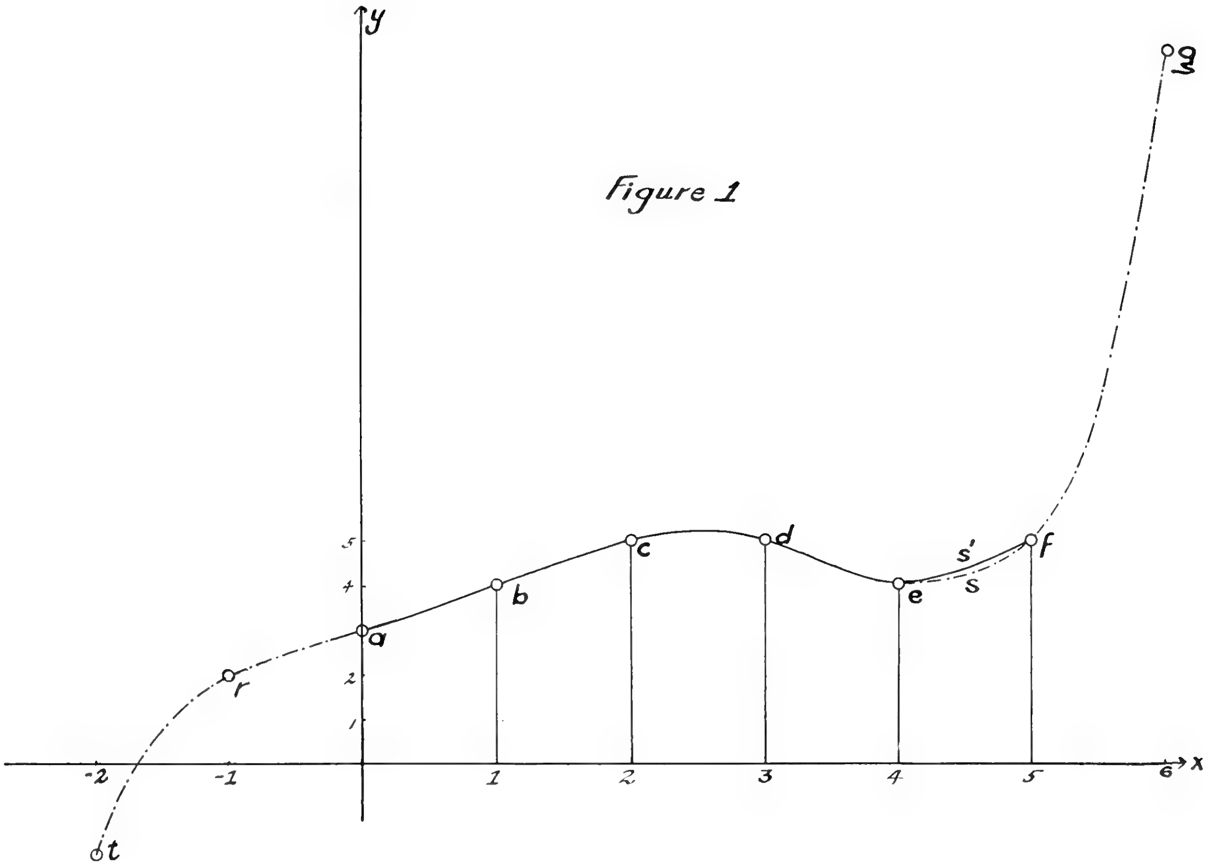


Figure 1

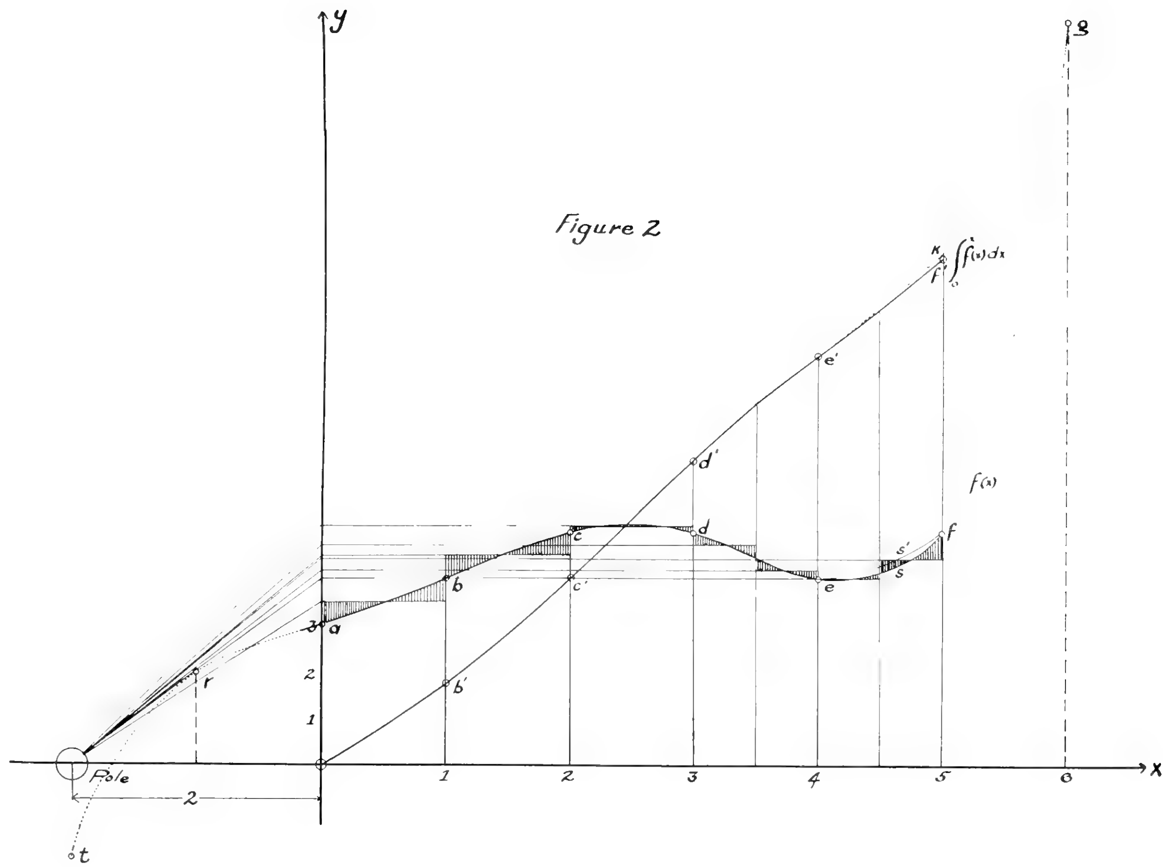


Figure 2
y
x
Pole
2
1
2
3
a
b
b'
c
c'
d
d'
e
e'
f
f'
K
s
s'
r
t
g
f(x)
$\int_0^x f(x)\,dx$
1
2
3
4
5
6

Certain sets of orders of coincidence associated with an algebraic equation.

BY J C. FIELDS, PH.D., F.R.S.

(Read May Meeting, 1915.)

Consider an equation

1. $$f(z, u) = u^n + f_{n-1} u^{n-1} + \ldots + f_o = 0$$

where the coefficients f_s are rational functions of z. In the neighborhood of any value $z = a$ we have a factorization of the form

2. $$f(z, u) = (u - P_1) \ldots (u - P_n)$$

where $P_1, \ldots, P_n$ are series in powers of $z - a$. In the neighborhood of $z = \infty$ the element $z - a$ is replaced by $1/z$. Any rational function of (z, u) can be written in the form

3. $$H(z, u) = h_{n-1} u^{n-1} + \ldots + h_o$$

where $h_{n-1}, \ldots, h_o$ are rational functions of z. In the neighborhood of $z = a$ it can also be represented in the form

4. $$H(z, u) = \theta_1 Q_1(z, u) + \ldots + \theta_n Q_n(z, u)$$

where $\theta_1, \ldots, \theta_n$ are series in powers of $z - a$ and where the functions $Q_s(z, u)$ are defined by the identities

5. $$f(z, u) = (u - P_s) Q_s(z, u), \quad s = 1, \ldots, n.$$

On dividing $f(z, u)$ by $u - P_s$ we evidently have

6. $$Q_s(z, u) = \sum_{\sigma = o}^{n-1} (f_n P_s^{n-\sigma-1} + \ldots + f_{\sigma+2} P_s + f_{\sigma+1}) u^\sigma.$$

The representation (4) of $H(z, u)$ will then take the form

7. $$H(z, u) = \sum_{\sigma = o}^{n-1} \sum_{s=1}^{n} \theta_s (f_n P_s^{n-\sigma-1} + \ldots + f_{\sigma+2} P_s + f_{\sigma+1}) u^\sigma.$$

We know that the set of orders of coincidence which so condition the general rational function of (z, u) that its principal coefficient must be integral relatively to the element $z - a$ is the set of adjoint orders of coincidence corresponding to the value $z = a$. We here propose to determine the set of orders of coincidence which so condition the general rational function $H(z, u)$ that the coefficient of u^σ is integral with regard to the element $z - a$. The coefficients $h_{n-1}, h_{n-2}, \ldots, h_o$ in the expression for $H(z, u)$ in (3) we shall call the first, second, ... nth coefficients of the function. The residue relative to the value $z = a$ in the coefficient h_{n-s} we shall call the *sth residue* of the rational function $H(z, u)$ relative to the value $z = a$. The expressions *first residue* and *principal residue* then have the same signification.

8. Writing

$F_\sigma(z, u) = f_n u^{n-\sigma-1} + f_{n-1} u^{n-\sigma-2} + \ldots + f_{\sigma+2} u + f_{\sigma+1}, \ \sigma = 0, 1, \ldots$

formula (7) takes the form

9. $$H(z, u) = \sum_{\sigma=0}^{n-1} \sum_{s=1}^{n} \theta_s F_\sigma(z, P_s) u^\sigma.$$

In $H(z, u)$ then the coefficient of u^σ is

10. $$\sum_{s=1}^{n} \theta_s F_\sigma(z, P_s).$$

Suppose now that the orders of coincidence of the function $F_\sigma(z, u)$ with the branches of the r cycles corresponding to the value $z=a$ are designated by the symbols $\mu_{\sigma,1}, \mu_{\sigma,2}, \ldots, \mu_{\sigma,r}$ respectively. If in the sum (10) the portion corresponding to the cycle of order ν_1 is given by the sum

11. $$\sum_{s=1}^{\nu_1} \theta_s F_\sigma(z, P_s)$$

we see that the lowest exponent in the ν_1 conjugate series $\theta_1, \ldots, \theta_{\nu_1}$ consistent with this expression being integral relatively to the element $z-a$ is $-\mu_{\sigma,1} - 1 + 1/\nu_1$. When however this is the lowest exponent in the series $\theta_1, \ldots, \theta_{\nu_1}$ we see from (4) that the order of coincidence of the function $H(z, u)$ with the branches of the cycle of order ν_1 is $\mu_1 - \mu_{\sigma,1} - 1 + 1/\nu_1$ where μ_1 is the order of coincidence of the functions $Q_1(z, u), \ldots, Q_{\nu_1}(z, u)$ with the respective branches $u - P_1 = 0, \ldots, u - P_{\nu_1} = 0$. We see then that the orders of coincidence of a rational function $H(z, u)$ with the branches of the r cycles corresponding to the value $z=a$ which insure that the coefficient h_σ of u^σ in the function is integral with regard to the element $z-a$ are respectively the numbers

12. $$\mu_1 - \mu_{\sigma,1} - 1 + 1/\nu_1, \ldots, \mu_r - \mu_{\sigma,r} - 1 + 1/\nu_r.$$

These are evidently the orders of coincidence furnished for the value $z=a$ by the function

13. $$\frac{A(z, u)}{F_\sigma(z, u)}$$

where the numerator represents the general adjoint function. The form (13) is independent of the particular value $z=a$ under consideration and the argument holds also for the value $z=\infty$, the element $z-a$ being here replaced by $1/z$. In the particular case where $\sigma = n-1$ we have $F_{n-1}(z, u) = f_n = 1$ and consequently $\mu_{\sigma,1} = \mu_{\sigma,2} = \ldots = \mu_{\sigma,r} = 0$. The numbers in (12) here become the numbers defining adjointness for the value of the variable z in question and the quotient (13) becomes the general adjoint function, all of which accords with what we already know in this particular case.

In the set of numbers (12) we evidently have just that set of orders of coincidence relative to the finite value $z=a$ which insures that the

$(n-\sigma)th$ residue is 0 in any rational function conditioned by these orders of coincidence. If the numbers (12) are supposed to have reference to the value $z=\infty$ we obtain, on adding 2 to each of them, a set of numbers

$$14. \qquad \mu_1 - \mu_{\sigma,1} + 1 + 1/\nu_1, \ldots, \mu_r - \mu_{\sigma,r} + 1 + 1/\nu_r$$

such that any rational function possessing these as orders of coincidence relative to the value $z=\infty$ evidently has 0 as its $(n-\sigma)th$ residue relative to this value of z. We conclude then that the sets of orders of coincidence corresponding to any specified value of z, the value $z=\infty$ included, which insure the vanishing of the 1st, 2nd, ...nth residues respectively for the value of the variable z in question, are furnished by the functions

$$15. \qquad \frac{\phi(z,u)}{F_{n-1}(z,u)}, \quad \frac{\phi(z,u)}{F_{n-2}(z,u)}, \ldots, \frac{\phi(z,u)}{F_o(z,u)}$$

where $\phi(z,u)$ is the general ϕ-function. From the form of $F_\sigma(z,u)$ in (8) we see that we have

$$16. \qquad u^{\sigma+1}F_\sigma(z,u)+f_\sigma u^\sigma+\ldots+f_o=0$$

so that instead of the functions $F\sigma(z,u)$ appearing in the denominators of the expressions in (13) and (15) we might employ the forms

$$17. \qquad -u^{-\sigma-1}(f_\sigma u^\sigma+\ldots+f_o).$$

The orders of coincidence defined by the general functions $A(z,u)/F_\sigma(z,u)$ we shall call *quasi adjoint orders of coincidence* and the bases of coincidences on which these functions are built we shall call *quasi* adjoint bases. For the value $\sigma=n-1$ then the quasi adjoint basis coincides with the adjoint basis. In the reduced form of the quasi adjoint function

$$18. \qquad A(z,u)/F_\sigma(z,u)=h^{(\sigma)}_{n-1}u^{n-1}+\ldots+h^{(\sigma)}_o$$

we see that $h^{(\sigma)}_\sigma$, the coefficient of u^σ, must be a constant for the orders of coincidence defining the function require that the coefficient of u^σ be integral with regard to every element $z-a$ and also with regard to the element $1/z$. The function $A(z,u)$, and therefore also the function $A(z,u)/F_\sigma(z,u)$, involves* $p+2n-\rho$ arbitrary constants where ρ is the number of the irreducible equations involved in the fundamental equation (1). If in the general function (18) we add 1 to each of the orders of coincidence corresponding to some one specific value of z we impose n conditions on its constant coefficients. Among these n conditions is evidently included the vanishing of the constant coefficient of u^σ.

Suppose $\tau_1, \ldots, \tau_r$ and $\bar{\tau}_1, \ldots, \bar{\tau}_r$ to be two sets of orders of coincidence relative to the finite value $z=a$ which are connected by the relations

* Theory of the Algebraic Functions of a Complex Variable, p. 150, Mayer & Müller, 1906.

19. $$\tau_s \bar{\tau}_s = \mu_s - \mu_{\sigma, s} - 1 + 1/\nu_s\,,\quad s = 1, \ldots, r.$$

On designating by $H(z, u)$ the general rational function conditioned by the set of orders of coincidence $\tau_1, \ldots, \tau_r$, it is easily seen that the conditions imposed on a rational function $\bar{H}(z, u)$ by the set of orders of coincidence $\bar{\tau}_1, \ldots, \bar{\tau}_r$ are obtained on equating to 0 the $(n-\sigma)th$ residue relative to the value $z = a$ in the product $H(z, u)\,\bar{H}(z, u)$. The statement holds good for the value $z = \infty$ when one replaces the numbers $\mu_s - \mu_{\sigma, s} - 1 + 1/\nu_s$ in (19) by the numbers $\mu_s - \mu_{\sigma, s} + 1 + 1/\nu_s$.

Instead of following the course of procedure indicated in what precedes we might have started out arbitrarily with the function $F_\sigma(z, u)$ as defined in (8). Employing, as convenient, either this form or the form given in (17) consider any two rational functions $A(z, u)$ and $H(z, u)$ connected by the relation

20. $$A(z, u) = A_{n-1} u^{n-1} + \ldots + A_o = F_\sigma(z, u) H(z, u).$$

This relation we can write in the form

21. $$A(z, u) = -(f_\sigma u^\sigma + \ldots + f_o)\,(h_{n-1} u^{n-\sigma-2} + \ldots + h_{\sigma+1}) + (f_n u^{n-\sigma-1} + \ldots + f_{\sigma+1})\,(h_\sigma u^\sigma + \ldots + h_o)$$

for $\sigma < n-1$. For $\sigma = n-1$ the identity (20) becomes $A(z, u) = H(z, u)$. Both in this case and in the cases included under (20) we see, on identifying coefficients of u^{n-1} on the two sides of the identity, that we have $A_{n-1} = f_n h_\sigma = h_\sigma$. The coefficient A_{n-1} of u^{n-1} in any reduced rational function $A(z, u)$ is then the same as the coefficient of u^σ in the reduced form of the quotient $A(z, u)/F_\sigma(z, u)$.

The adjoint orders of coincidence corresponding to a value $z = a$ are those which determine that the principal coefficient in a function $A(z, u)$ shall be integral relatively to the element $z - a$. The adjoint orders of coincidence then determine that the principal coefficient in the product $F_\sigma(z, u) H(z, u)$ shall be integral with regard to this element. But the principal coefficient in this product, being the coefficient of u^σ in the function $H(z, u)$, the orders of coincidence of this function which determine that its coefficient h_σ shall be integral with regard to the element $z - a$ are obtained on subtracting from the adjoint orders of coincidence in question the corresponding orders of coincidence of the function $F_\sigma(z, u)$. The orders of coincidence of a rational function $H(z, u)$ for the value $z = a$ which insure that the coefficient h_σ of u^σ in the function is integral with regard to the element $z - a$ are therefore those given in (12).

Liquid Chlorine as a Solvent: Cryoscopic Determinations at Low Temperature.

By P. WAENTIG and D. MCINTOSH, F.R.S.C.

(Read May Meeting, 1915).

During the last few years many investigations of the basic properties of oxygen and of its tetravalence have been made. It has been shown that the halogen hydrides unite with organic substances containing oxygen—such as ether—yielding compounds of the general type $C_4H_{10}O$, HX. To bring these results in agreement with our views on valence, tetravalent oxygen has been assumed, and for the compounds the formulae $=O<^{H}_{X}$ and $=O=XH$ have been suggested.

Physico-chemical studies show that the former is to be preferred, since in solution the oxygen compound moves to the cathode under an electrical stress, i.e., it must be part of the positively charged ion. The conductivity measurements prove, however, that in a solution of a halogen acid these compounds are much more complex than the formula given above would indicate.

Somewhat similar combinations made with the halogens and alcohol, ethers and ethereal salts show compounds of the types, $C\ H_4\ O, X$, $C_4H_{10}\ O, X_2$, and $CH_3\ COOC_2H_5, X_3$, so that a hydroxyl atom is balanced by one, an ethereal or ketonic oxygen by two, and the three oxygen atoms of an ester by three halogen atoms. The constitutions of the compounds are as doubtful as those with the halogen acids. Some chemists give to them the simple formula $C_4H_{10}O, X_2$ in the case of the ether combination. With the alcohol complexes the formula must be doubled, and with ethyl alcohol the most probable constittion is $C_2H_6O=Cl\text{-}Cl\ =\ O\ C_2H_6$.

With all the oxonium compounds the constitutions are far from satisfactorily explained. The chlorine compounds dissolved in liquefied chlorine must be simpler than the corresponding compounds with the halogen acids since the former show no electrical conductivity, and therefore no ionization. Mr. Maass[1] and one of us have attempted to add to our knowledge by investigating the freezing point curves of a number of these systems. The slopes of the curves showed that all types were largely broken down in solution. In the hope of gaining some further knowledge of these complexes, cryoscopic determinations

[1] Jour. Am. Chem. Soc. 33, p. 71, 1911; 34, p. 1273, 1912.

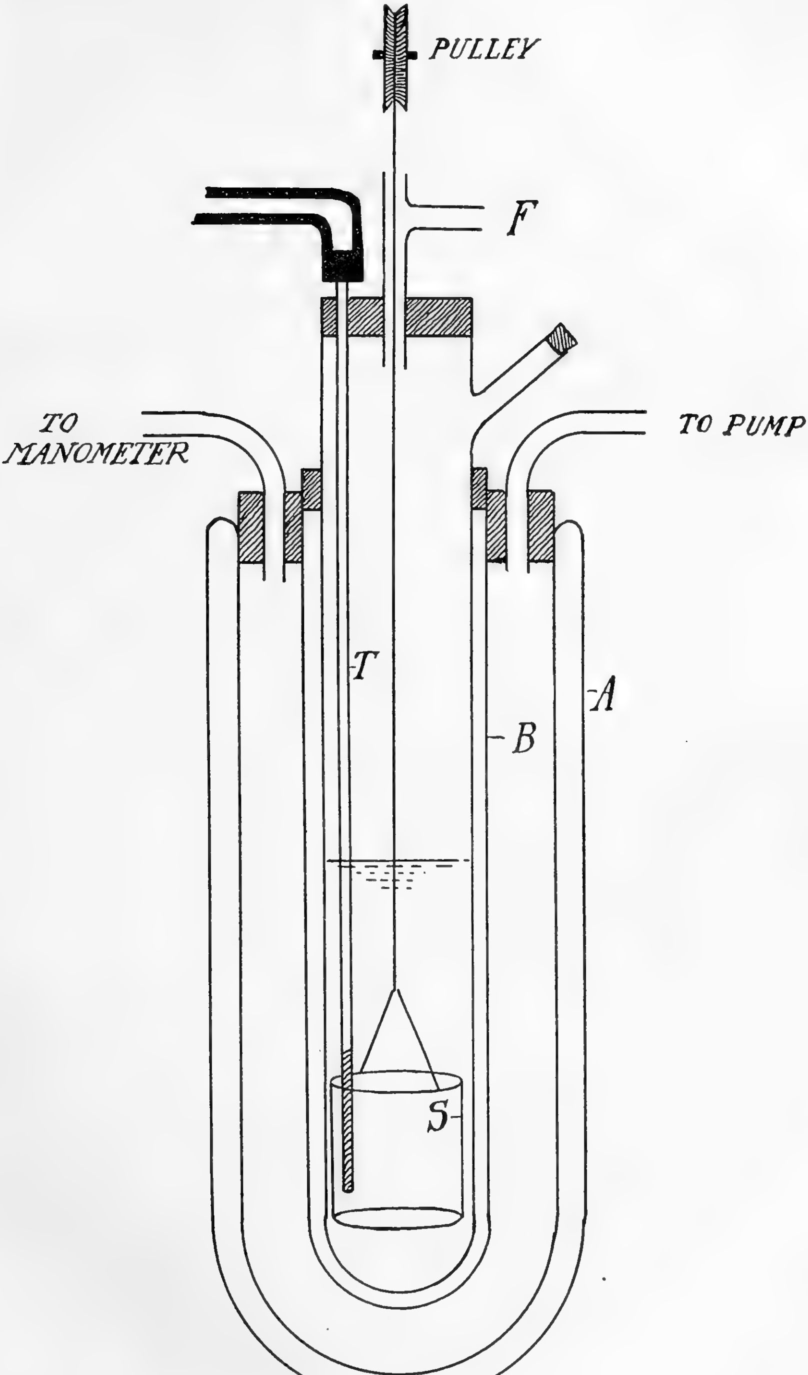
have been made in liquid chlorine and hydrogen bromide. The results of the first investigation form the subject of this paper.

The apparatus for the measurement of the temperatures was a Carey-Foster bridge of the kind used by Beckmann[1] and one of us. It consisted of a metre bridge wire of 14·42 ohms resistance, in series with two coils of 3,000 ohms. The thermometer was of the Heraeus platinum type wound on quartz, with a resistance of 25.015 ohms at 0°. The balancing resistances were Post Office boxes, and these were calibrated by a standard Wheatstone bridge. A Broca galvanometer proved most satisfactory, and at the temperature of freezing chlorine (—101·5°) one millimetre on the bridge wire equalled 0·00143°C. The apparatus was sensitive to 0·0005° but the other errors were naturally much greater.

The cryoscopic apparatus is shown in the diagram. A is a 3-inch silvered Dewar flask into which is fitted a rubber stopper carrying a test tube B, which serves as an air chamber for the freezing point tube. T is the platinum thermometer with heavy copper leads making contact with the bridge through two large mercury cups, so that the tube could be easily removed. The stirrer S, is of platinum and is moved by a platinum wire which passes over the pulley to an excentric on the shaft of a small motor. Dry air is forced through F to prevent the entrance of moisture. The evaporation of chlorine at its F.P. (9·2 mm pressure) is very slight. The Dewar flask contained solid carbon dioxide and ether boiling under reduced pressure. A May-Nelson pump and a manometer with a system of taps enabled the pressure, and consequently the temperature, to be maintained with sufficient accuracy. (−105°−108°C).

In making an experiment, a convenient quantity of chlorine, usually about 50 grams, was condensed in the freezing point tube and weighed, the weight of the boiling tube with stirrer, thermometer, etc., having been previously determined under identical conditions. (With a little practice this can be done to 0·1 per cent.). The resistances of the boxes were adjusted until the slider was at a convenient point on the bridge and its position was noted at the freezing point of the chlorine. The tube was removed, the chlorine melted and the solute added from a pyknometer, through the side tube. The freezing point was again determined and this procedure repeated till five or six measurements had been made. The primary source of error and one difficult to avoid was in the addition of the solute. Variations in the results were generally traceable to a portion of the solute remaining on the walls of the tube or on the stirrer, and precautions were taken to avoid this error as far as possible.

[1] Zeit. anorg. Chem. 67, p. 17, 1910.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All the materials were purified by the well known methods. The toluol and ether were distilled from sodium; the chloroform was shaken repeatedly with water and dried over strong sulphuric acid, etc.

The results are given in Tables 1-9. g represents the amount of solute employed, mm. the total change in the position of the slider, D the lowering of the freezing point, K_1 and K the constants for the total amount of solute and for the individual experiments respectively.

TABLE I.

Toluol, M.W. 92 Chlorine 56·5 grams.

g.	g. in 100 g. C1.	m.m.	D.	K.	K_1
0·200	0·354	88	0·126	32·7	32·7
0·382	0·676	162	0·232	30·3	31·6
0·568	1·005	235	0·336	29·1	30·8
0·755	1·336	313	0·448	31·7	30·8
0·953	1·687	385	0·551	27·0	30·0
1·149	2·034	464	0·664	30·0	30·0
			Mean	29·6	

TABLE II.

Chloroform, M.W. 119·5 Chlorine 53·0 grams.

g.	g. in 100g C1	m.m.	D.	K.	K_1
0·160	0·302	46	0·066	26·1	26·1
0·366	0·691	140	0·200	41·2 ?	34·6 ?
0·663	1·251	235	0·366	29·0	32·1
1·282	2·419	430	0·615	28·5	30·4
1·457	2·749	481	0·688	26·4	29·9
1·639	3·093	537	0·768	27·9	29·7
1·832	3·457	601	0·859	29·9	29·7
			Mean	27·9	

TABLE III.

Carbon tetrachloride, M.W. 154. Chlorine 50·6 grams.

g.	g. in 100g C1.	m.m.	D.	K.	K_1
0·457	0·903	138	0·197	33·6	33·6
0·759	1·500	204	0·292	24·5	30·0
1·056	2·087	276	0·395	27·0	29·1
1·755	3·468	458	0·655	29·1	29·1
2·460	4·862	648	0·927	30·0	29·4
			Mean	28·8	

TABLE IV.

Tin tetrachloride, M.W. 260·5. Chlorine 51·4 grams.

g.	g. in 100g.	m.m.	D.	K.	K_1
0·188	0·366	33	0·047	33·5	33·5
0·449	0·874	74	0·106	30·3	31·7
0·637	1·239	98	0·140	24·3	29·5
0·957	1·862	144	0·206	27·5	28·9
1·451	2·822	224	0·320	31·0	29·5
1·709	3·500	271	0·388	26·2	28·9
			Mean	28·8	

TABLE V.

Ethyl ether, M.W. 74. Chlorine 53·18 grams.

g.	g. in 100 Cl	m.m.	D.	K.	K_1.
0·139	0·262	82	0·117	33·0	33·0
0·358	0·673	184	0·263	26·2	28·9
0·691	1·300	357	0·511	29·3	29·1
0·806	1·518	419	0·599	30·0	29·2
1·000	1·882	515	0·737	27·9	29·0
1·165	2·192	599	0·857	28·8	28·9
			Mean	29·1	

TABLE VI.

Acetone, M.W. 58· Chlorine 43·5 grams.

g.	g. in 100g.	m.m.	D.	K.	K_1
0·264	0·607	201	0·287	27·4	27·4
0·388	0·892	281	0·402	23·4	26·1
0·538	1·237	379	0·542	23·5	25·4
0·757	1·740	505	0·722	20·8	24·1
0·953	2·191	616	0·881	20·4	23·3

TABLE VII.

Ethyl acetate, M.W. 88· Chlorine 45·0 grams.

g.	g. in 100 g Cl.	mm.	D.	K.	K_1
0·266	0·591	128	0·183	27·2	27·2
0·558	1·240	268	0·383	27·1	27·2
0·790	1·756	378	0·541	27·0	27·1
0·950	2·111	469	0·671	32·2	28·0
1·099	2·442	543	0·777	28·1	28·0
1·224	2·720	600	0·858	25·7	27·8
			Mean	27·8	

Table VIII.

Ethyl alcohol, M.W. 46· Chlorine 49·1 grams.

g.	g. in 100 Cl.	mm.	D.	K.	K_1
0·144	0·293	40	0·057	8·95	8·95
0·417	0·849	105	0·150	7·70	8·13
0·776	1·580	166	0·237	6·34	6·90
1·222	2·489	233	0·333	4·87	6·15
1·866	3·800	357	0·511	6·25	6·18

Table IX.

Methyl alcohol, M.W. 32· Chlorine 56·4 grams.

g.	g. in 100 g. Cl.	mm.	D.	K.	K_1
0·167	0·296	28	0·040	4·3	4·3
0·388	0·688	65	0·093	4·3	4·3
0·799	1·417	120	0·172	3·5	3·9
1·107	1·963	178	0·255	4·9	4·2
1·525	2·704	220	0·315	2·6	3·7

The determinations with toluol, chloroform, carbon tetrachloride and tin tetrachloride-substances unlikely to form compounds with chlorine[1]—were made primarily with the object of fixing the freezing point constant. The mean of these results gave K, 28·8, and from this the latent heat of solid chlorine when calculated by the van't Hoff equation is 20·4 calories per gram.

The determinations with ethyl ether and ethyl acetate show normal results, i.e., these bodies exist in solution as single molecules. Acetone is polymerized in concentrated solutions, while ethyl and methyl alcohols are greatly associated in all dilutions. This is not unexpected, since bodies containing the hydroxyl group are usually polymerized, particularly at low temperatures.

Two formulæ are possible for the ether chlorine compound,

$$\underset{(1)}{C_4H_{10}O <^{Cl}_{Cl}} \qquad \text{and} \qquad \underset{(2)}{C_4H_{10}O = Cl - Cl = Cl - Cl = OC_4H_{10}}$$

Bromine, however, forms an analogous compound; so that its constitution must be that of the chlorine complex. But in addition it forms the compound $C_4H_{10}OBr_3$, which can only be represented by the straight chain type (2). We might then expect formula (2) for the chlorine compound, and a constant of 14·5 for our cryoscopic measurements instead of the normal value. Formula (1) from this point of view is to be preferred.

[1] *loc. cit.*

An examination of the freezing point curves for the complete system ether-chlorine and ether-bromine shows that the compounds are largely broken down in solution, i.e., the solute is not in combination with the solvent in solution. It is impossible to fix the constitutions of these compounds with any degree of certainty from the cryoscopic measurements, and other methods must be employed before this question can be definitely answered.

It may be added that water and iodine do not change the freezing point of chlorine, so that these substances are insoluble or very slowly soluble in liquid chlorine. Bromine readily dissolves and raises the freezing temperature.

McGill University,
Montreal, April, 1915.

On the Ionisation Tracks of Alpha Rays in Hydrogen.

By PROFESSOR J. C. McLENNAN, F.R.S. and MR. H. N. MERCER, M.A., B.Sc., University of Toronto.

(Read May Meeting, 1915).

I. INTRODUCTION.

In a paper by Marsden in the Phil. Mag. of May, 1914, experiments are described in which it was found that when alpha particles from radium are projected into hydrogen velocities are given to particles of the gas which enable them to pass through a thickness of aluminium foil capable of stopping the fastest alpha particles. These "H" particles, as Marsden designated them, have been shown by him to be capable of producing visible scintillations on a zinc sulphide screen when this is placed at a distance away from their source more than three times the distance at which the alpha particles themselves produce scintillations.

On account of the high velocities possessed by these "H" particles and for various other reasons it is believed that they are the positively charged nuclei of hydrogen atoms just as alpha particles are the charged nuclei of helium atoms and that they are expelled from the atoms of hydrogen when these are subjected to a direct impact by the alpha rays.

Moreover since these "H" particles are capable of producing scintillations in a zinc sulphide screen and since scintillations are now considered to be the results of ionisation it would appear that these "H" particles are capable of ionising the atoms in the zinc sulphide. The question, then, which naturally arises is: Are these "H" particles capable of ionising the atoms of a gas through which they may be projected? In order to throw some light on this matter it was thought well by the writers to make an experimental study of the ionisation tracks of alpha rays in hydrogen and the following paper contains an account of this investigation.

II. APPARATUS.

The method followed was precisely the same as that devised by C.T.R. Wilson[1] and used by him in obtaining his exceedingly beautiful

[1] C. T. R. Wilson, Proc. Roy. Soc. A Vol. 87, pp. 277-292, 1912.

ionisation tracks of alpha, beta and X-ray tracks in air. The apparatus which was made by the Cambridge Scientific Instrument Co. under his direction is shown in Fig. 1., and in diagram in Fig. 2. For

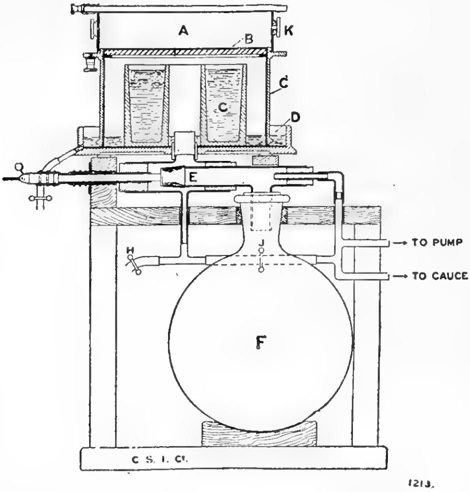

Fig. 2.

complete details of the construction and operation of this apparatus the reader is referred to C. T. R. Wilson's original paper[2] or to the descriptive catalogue of the Cambridge Scientific Instrument Co. It will suffice here to say that the cylindrical cloud chamber A. Fig. 2 was about 16·5 cms in diameter and 3·4 cms in height. The walls and roof of this cloud chamber A were coated inside with gelatine containing a trace of copper sulphate and the plate glass roof, B, of the piston or plunger, C, was coated with gelatine blackened with ink and containing 2% of copper sulphate. The expansion was effected by opening the valve E and so connecting up the air space below the plunger with the evacuated chamber F. In all the experiments the apparatus was arranged so that the ratio of the final to the initial volume V_2/V_1 of the gas in the expansion chamber above the plunger was about 1·36 : 1.

As the plunger was always at the bottom of the chamber when the expansion was completed, the value of the ratio V2/V1 depended upon the height to which the plunger was raised initially. It was raised therefore to any height desired by simply removing the stopper K from the expansion chamber and blowing into the tube H. The reading taken on the gauge depicted in Fig. 1 after expansion showed when the proper ratio for V2/V1 was secured.

[1] *loc. cit.*

In order to obtain distinct ionisation tracks it was necessary to have all ions in the cloud chamber removed before the expansion took place and this was effected by establishing an electric field between the top plate of the plunger and the roof plate of the cloud chamber. To do this the gelatine layer under the roof plate was connected by means of a ring of tinfoil cemented between the glass cylindrical wall and the roof plate to one terminal of a battery of storage cells whose other terminal was connected to the metallic base of the expansion chamber and through the brass cylindrical portion of the plunger to the roof plate of the latter.

In taking the photographs the method followed was also that adopted by C. T. R. Wilson and consisted in passing the discharge from a set of Leyden jars charged with a Holtz machine through some vapourized mercury in a set of four quartz tubes joined in series and placed close to the walls of the expansion chamber. The light from these discharge tubes was projected into the expansion chamber in beams of parallel rays by a set of four plano-convex strips of glass. The camera was directed vertically down upon the roof plate of the cloud chamber. In setting up the apparatus it was found convenient to separate the vacuum chamber somewhat from the expansion chamber and the manner in which this was done is shown in the upper part of Fig. 3. In the lower part of the figure the connections are shown

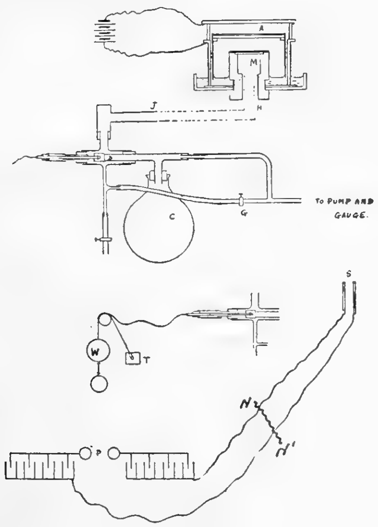

Fig. 3.

for producing the expansion and exciting the spark. The Holtz machine was joined to the insides of two sets of Leyden jars at P, NN′ was a wet string short circuiting the outsides of the jars and S represents the discharge tubes in which the secondary spark occurred. In taking the photographs the string joined to T, Fig. 3, was cut and the valve B was opened by the falling weight W. When this weight reached the limit of its fall a second weight in the form of a brass ball and supported by a slender cord broke away and fell between the terminals at P and brought on both the primary spark at P and the secondary discharge at S. The height of the brass ball from the spark gap, P, was adjusted so as to bring on the discharge at the instant desired after the expansion took place.

In the experiments carried out by us the cloud chamber above the plunger was filled either with air or hydrogen or with mixtures of air and hydrogen and the cloud tracks were formed by the condensation of either water vapour or the vapour of absolute alcohol.

The source of the alpha rays was a layer of polonium on the anterior face of a small sheet of copper of area about 1 sq. mm. This plate of copper was attached to a short stout copper wire which projected into the cloud chamber and was held in position by being fastened with wax to the stopper K, Fig. 2. When hydrogen was used the ionisation tracks in most cases extended completely across the cloud chamber. In the present investigation, however, it was the ends of the trails which were to be specially examined and so the tracks in hydrogen were cut down by covering the layer of polonium with sheets of very thin aluminium leaf. This was done in all the experiments in which the photographs of tracks in hydrogen were taken which are described in this paper. The lengths of the reduced tracks were generally about 4 cms. or less.

III. Experiments.

Although the investigation was primarily directed to obtaining if possible evidence of the production and of the ionising power of the "H" particles of hydrogen and many photographs were taken with that end in view, not one of the photographs showed any trace of cloud tracks pointing to their production or to ionisation by them. Many of the tracks shewed abrupt bends similar to those obtained by Wilson and occasionally very short spurs were obtained at these bends, but no spurs were obtained such as one should expect to get with "H" particles travelling with velocities such as those Marsden found they possessed.

This absence of "H" particle cloud tracks in our experiments cannot be taken, however, to mean that "H" particles are not produced in hydrogen or that they do not possess the power to ionise a gas but it goes to confirm, rather, what has been already surmised that when alpha rays traverse hydrogen exceedingly few of them, collide with the hydrogen atoms in such a way as to expel the "H" particles.

Although the experiments were disappointing in this regard they served to bring out some points of minor interest and a few of the photographs taken are reproduced in the present communication to illustrate these points. The photograph reproduced in Fig. 4 is one taken of water cloud-tracks of alpha rays in hydrogen and enlargements of portions of this photograph are shown in Figs. 5 and 6.

In Fig. 5 there is shown a sharp bend near the end of one of the tracks and a less abrupt one near the middle of a second track. Fig. 6 also shows a very sharp bend near the end of one track but as will be seen there is no sign of a spur of any appreciable length associated with it. The tracks shown in these photographs are typical of many which we obtained but as mentioned above none of them showed spurs such as we expected to get with expelled "H" particles. In taking the photograph shown in Fig. 4 a field of 70 volts was applied in the cloud chamber and a Zeiss Planar lens F 4·5, 5 cms focus was used. The photograph was taken on an Ilford Monarch plate.

The reproduction shown in Fig. 7 also shows a sharp bend in one of the tracks but there is no indication of any spur at the bend. It was obtained with hydrogen and condensed water vapour. The field applied to the cloud chamber was 8 volts.

Figs. 8, 9 and 10 are reproductions of enlargements of the ends of some alpha ray tracks in hydrogen the clouds of which were formed from water vapour. The field applied to the cloud chamber when they were taken was 8 volts. The interest in these photographs lies in the fact that the ends of the tracks and the curves they exhibit are somewhat more extended than those obtained by Wilson with air. In some cases it will be seen they resemble the curve at the end of a hockey stick while in others the bends are more like the ends of a shepherd's crook.

Some of the tracks shown in Fig. 8, as will be seen, appear to be double while others again are single and very distinct. The double tracks are clearly out of focus and more or less indistinct. From their general appearance the doubling would appear to be entirely an optical effect but it is just possible that it represents an electrical separation of the ions in those tracks which were produced a short time before the more distinct ones. Against this latter view, however, there is the fact that the separation shown on the photograph appears to be lateral while if it had been produced by the electrical field the displacement in all probability would have been in a vertical plane or very close to it.

The track in Fig. 11 and its enlargement in Fig. 12 was also obtained with hydrogen and water vapour the field applied being 30 volts. In this one the crook at the end is brought out very clearly as well as the abrupt bend at the middle. At this bend there is a slight protuberance or thickening on the convex side which looks something like a shortened spur but it is only just noticeable. Although photographs of many alpha tracks showing abrupt bends were taken this one represents practically the maximum indication of a spur which was obtained. This shows that if the "H" particles really do ionise a gas the kind of collision which results in the liberation of such particles is of exceedingly rare occurrence.

If the reproduction shown in Fig. 12 be closely examined it will be seen that in addition to the abrupt bend near the middle and the crook at the end there is a slight bend of double curvature between these two. Many of the tracks photographed showed this gradual change in curvature and it was thought at first that they constituted evidence opposed to the view advanced by Rutherford that the scattering of alpha particles of large amount is the result of single deflections through considerable angles and not to a cumulative effect due to a very large number of minute deviations. Continued investigation, however, showed that the bending mentioned above was mechanical in its origin and was due to a distortion impressed upon the track of ions in the gas by the irregular movement of the gas in the course of expansion after the alpha ray particle had passed but before the condensation actually took place. In some of the photographs the distortion of the alpha ray tracks was very considerable and an enlargement of one of a number which exhibited this in a very marked way is shown in Fig. 13. Here it will be seen the curvature commences practically at the beginning of the tracks and extends for a considerable distance over their length.

In this photograph the tracks were in hydrogen but the cloud was formed from the condensation of alcohol vapour. The field applied was 30 volts.

Fig. 14 exhibits another feature which characterised a number of the photographs. In this one it will be seen that a considerable space intervenes between the polonium plate and the commencement of the alpha ray tracks. In this particular photograph the ionisation was in hydrogen and the cloud was formed from alcohol vapour. Similar results were also obtained when the clouds were formed from water vapour. This absence of condensation at the beginning of the tracks was taken to mean that owing to the proximity of the copper plate carrying the polonium the gas in this region was kept sufficiently warm during the expansion to prevent condensation of the vapour.

IV. Summary of Results.

1. It has been shown that although alpha ray tracks in hydrogen are of greater length than those in air they exhibit similar characteristics to those obtained in air.

2. It has been shown that alpha ray ionisation tracks can be exhibited by the condensation of alcohol vapour equally as well as with the condensation of water vapour.

3. The photographs obtained confirm the observation of C. T. R. Wilson and support the contention of Rutherford that apart from the crooks at the ends of the alpha ray tracks the "scattering" is due to single deflections through considerable angles.

4. The experiments failed to bring out evidence in support of ionisation by the nuclei of hydrogen atoms projected from the latter when alpha particles collide with the atoms.

5. The experiments go to show that when alpha particles are projected through hydrogen exceedingly few collisions occur which result in the ejection of a hydrogen nucleus.

The Physical Laboratory,
University of Toronto,
May 1st, 1915.

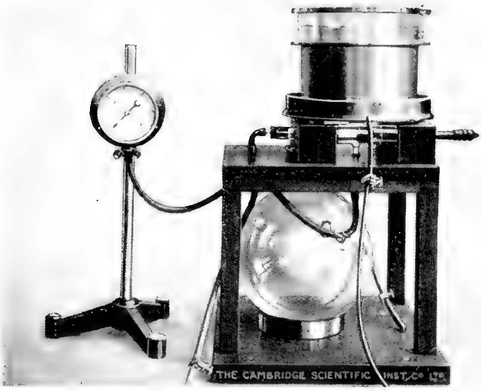

Fig. 1.

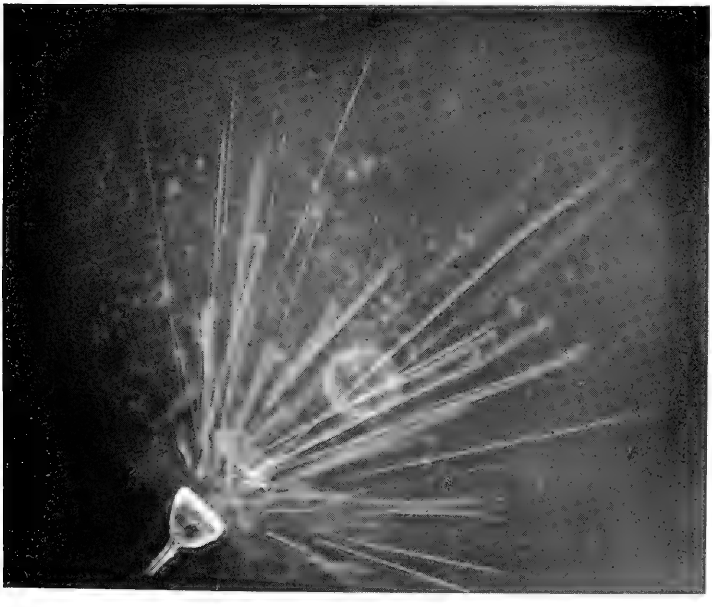

Fig. 4.

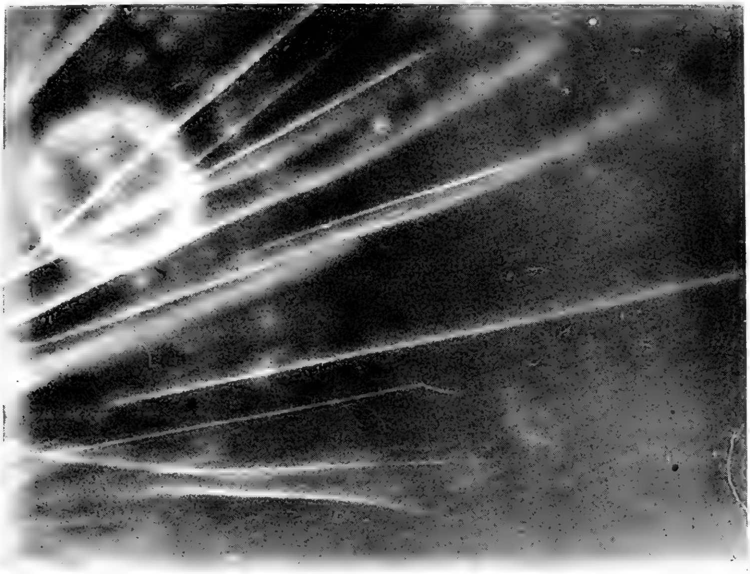

Fig. 5.

Fig. 6.

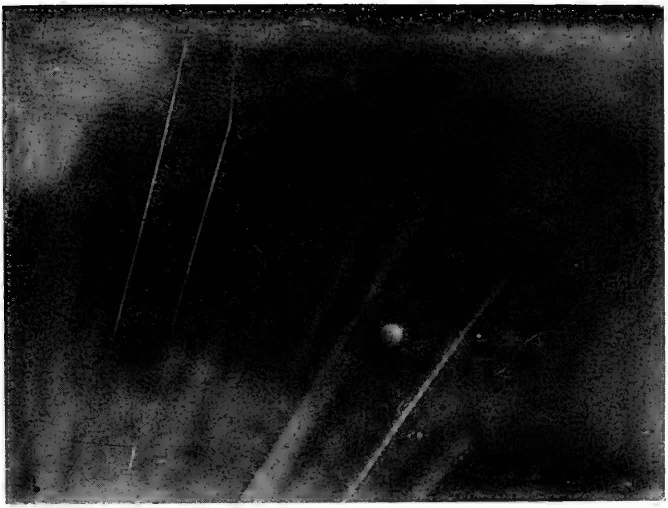

Fig. 7.

Fig. 8.

Fig. 9.

Fig. 10.

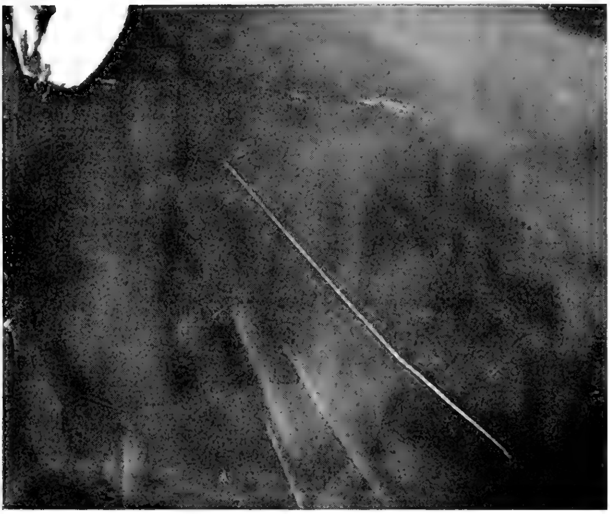

Fig. 11.

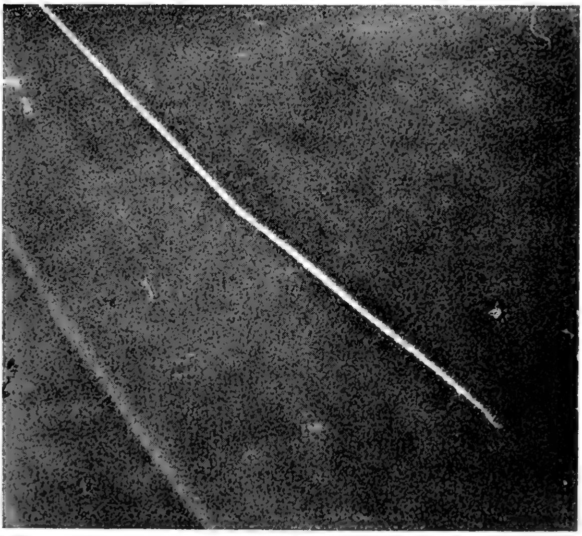

Fig. 12.

Fig. 13.

Fig. 14.

On the Delta Rays Emitted by Zinc when Bombarded by Alpha Rays.

By PROFESSOR J. C. McLENNAN, F.R.S. and C. G. FOUND, M. A.,
University of Toronto.

(Read May Meeting, 1915).

I. INTRODUCTION.

In some experiments by V. E. Pound[1] and described by him in a paper, "On the secondary rays excited by alpha rays," he found that the delta radiation emitted by carbon when bombarded by the alpha rays from polonium increased very considerably when the temperature of the carbon was lowered from room temperature to the temperature of liquid air. He also showed that this increase in the delta radiation from carbon as its temperature was lowered was due to an increase in the amount of air occluded in the surface of the carbon.

Numerous observers have also found that the amount of a gas occluded in the surface of metals determines to a very considerable extent the intensity of the photo-electric effect exhibited by such metals when stimulated by ultra-violet light. Indeed, it was shown by Küstner[2] that no photo-electric effect was exhibited by zinc even with wave-lengths as short as $\lambda = 1850$ A°.U., when the metal was scraped in a vacuum after extraordinary precautions had been taken to exclude gases, particularly the active ones. Wiedmann and Hallwachs[3] have shown, too, that the removal of occluded gases from potassium by repeated distillation in a very high vacuum caused its photo-electric effect to disappear completely with light which included wave-lengths down to $\lambda = 3{,}400$ A°. U. The results of Küstner and Wiedmann and Hallwachs have also been confirmed by Fredenhagen.[4]

In addition, Hughes[5] has shown that the contact difference of potential between zinc or bismuth both distilled in *vacuo* and platinum is exceedingly small when the surfaces of the zinc or bismuth consist of a fresh deposit of the distilled metals. If traces of air, how-

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[1] Pound. Phil. Mag. Nov. 23 and 24, 1912.
[2] Küstner. Phys. Zeit. p. 68, 1914.
[3] Wiedmann and Hallwachs. Verh. d. Deutsch. Phys. Ges. p. 107, 1914.
[4] Fredenhagen. Verh. d. Deutsch. Phys. Ges. p. 201, 1914.
[5] Hughes. Phil. Mag. Sept. 1914, p. 337.

ever, be admitted into the evacuated chamber containing the metals, a great increase takes place in the contact difference of potential between the metals.

In view of all these experiments it was thought well to investigate what the effect would be on the intensity of the delta radiation from zinc under bombardment by alpha rays when care was taken to remove as far as possible all gases from the surface of the zinc bombarded. The following paper contains an account of this investigation and from what follows it will be seen that with freshly prepared zinc surfaces the delta ray effect is exceedingly small; but that when air is permitted to be occluded in such surfaces a very great increase takes place in the magnitude of the effect.

II. Apparatus.

The apparatus used in conducting the experiments is similar to that used by Hughes[1] in his investigations on the photo-electric effect and is shown in Fig. 1. It consisted of a glass tube about 3

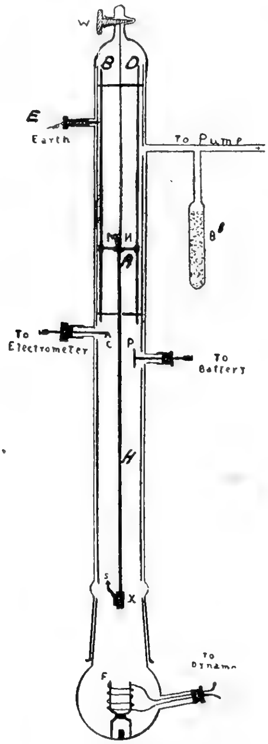

Fig. 1.

[1] Hughes. Phil. Trans. A. CCXII, p. 205, 1912.

cms in diameter and about 60 cms in length. This tube carried at its upper end a tap windlass W and at its lower end it was provided with a ground joint for fitting it into the glass heating chamber shown in the diagram. The tube was lined with a thin walled brass tube, which was kept joined to earth through a connection at E. B and D were two guiding rods of brass attached to the inner lining brass tube and M N was a strip of brass which was supported by a cord from the windlass W and had loops on its ends about the guiding rods B and D. An insulated brass rod H was rigidly attached to M N through the intermediary of a short cylinder of amber A. It carried at its lower end a small plate of zinc X with a projecting piece S which came into contact with the cup C when the rod H was raised by the windlass. A slender brass rod connected the cup C to a sensitive electrometer. P was a circular plate of copper 2 cms in diameter with a deposit of polonium on its anterior face. As shown in the figure it could be connected as desired to either terminal of a battery of small storage cells. The tube B′ was filled with coconut charcoal which was used for the purpose of improving the vacuum made with a Gaede rotary mercury pump. F was a small fused quartz furnace tube and was provided with platinum heating coils as shown. It was held in an upright position by means of a short glass rod sealed into the base of the heating chamber. When making zinc deposits on the surface of the zinc plate X the apparatus was first of all evacuated as highly as possible with the Gaede pump in conjunction with the coconut charcoal cooled with liquid air. Metallic zinc placed in F was brought to the boiling point with the heating coils and the rod H was lowered so that the zinc plate X was directly above the opening in F and immersed in the issuing vapour. With this arrangement the zinc plate could be readily coated with a fresh surface when desired. In studying the delta radiation from this plate the rod H was raised with the windlass W until the projection S was in electrical contact with the cup C. Under these conditions the zinc plate X was directly in front of the polonium coated plate P and was subjected to bombardment by the alpha rays which were emitted by the latter.

It should also be mentioned that when in operation the tube was set up with that portion about P in the field and between the poles of an electromagnet.

III. Experiments.

Experiment I. In commencing the investigation two experiments were carried out similar to those described by Logeman[1] in his paper on the emission of electrons from metals bombarded by alpha

[1] Logeman. Proc. Roy. Soc. Series A, Vol. 78, Sept. 6, 1907.

rays. In the first experiment, a heating jacket was placed about the tube containing the charcoal so as to drive the air out of the latter and the apparatus was exhausted as highly as possible with a Gaede rotary mercury pump. After this was done the heating jacket was removed from B′ and when the latter had dropped to room temperature it was surrounded with a Dewar flask and cooled with liquid air. When this was done a McLeod gauge attached to the apparatus showed that the pressure in the vessel had been reduced to considerably below ·001 mm of mercury. The zinc disc X, whose surface had been carefully scraped before it was inserted in the apparatus, was raised until contact was made between S and C. The polonium plate P was then charged to various positive potentials by means of the storage battery and the corresponding currents between P and X were measured with the Dolazaleck quadrant electrometer joined to C. The capacity of the quadrants and the attached electrical system was found to be 140 e.s.u.

The values of the applied potentials and the currents they produced are given in Table I, and a curve representing them is given in Fig. 2.

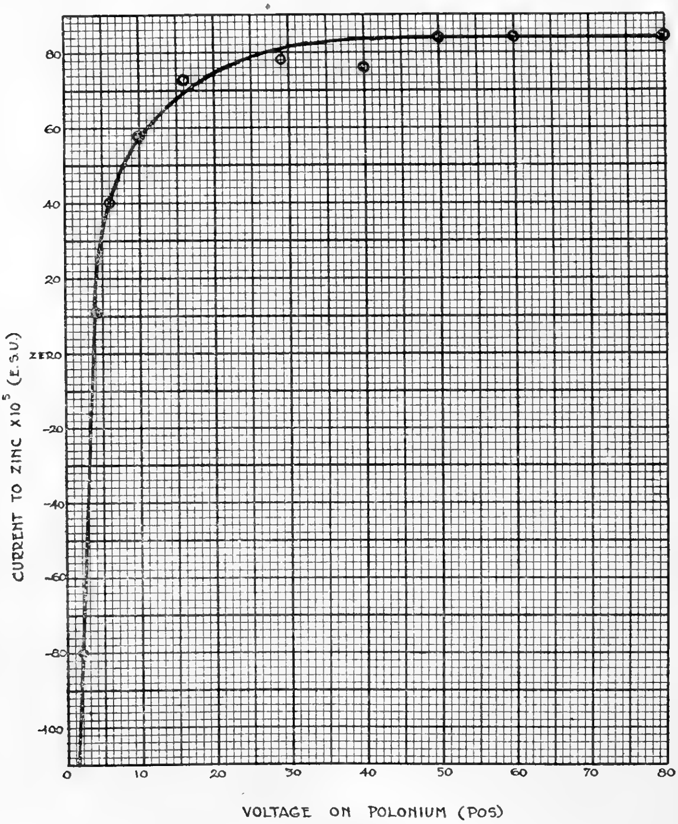

Fig. 2.

TABLE I.

Sensibility of Electrometer, S, = 220 mm. per volt.
Capacity of Electrometer, C, = 140 e.s.u.
D = deflection in mm. scale divisions per minute.
The current, i, = C. D/300. S. 60 e.s.u.

Voltage on Polonium.	Deflection in mm. per min..	Current $\times 10^5$ e.s.u.
0 Volts	− 35 mm.	− 127
+ 2 "	− 22 "	− 80
+ 4 "	+ 3 "	+ 11
+ 6 "	11 "	+ 40
+ 10 "	16 "	+ 58
+ 16 "	20 "	+ 73
+ 22 "	20 "	+ 73
+ 28 "	21·5 mm.	+ 78
+ 40 "	21 mm.	+ 76
+ 50 "	23 "	+ 84
+ 60 "	23 "	+ 84
+ 80 "	23 "	+ 84

From the numbers in the table and from the curve in Fig. 2 it will be seen that although the terminal P was always either at zero or at a positive potential relative to X, the current was initially negative and remained so until a potential of about 4 volts was reached, when it passed through zero and became positive, gradually increasing to a maximum with an applied positive potential of about 40 volts.

In this experiment it will be noted that the current between P and X consisted of: (1) a very small positive current in the residual gas due to ionisation; (2) a positive current consisting of the stream of alpha particles emitted by the polonium; (3) A positive current consisting of a stream of recoil atoms from the polonium; (4) A positive current due to electrons passing from X to P arising from the bombardment of X by the alpha particles and (5) a negative current due to electrons passing from P to X which accompanied the alpha particles and had their origin either in the polonium or in the copper surfaces on which the polonium was deposited. With zero or low positive voltages the stream of electrons mentioned in (5) it will be seen, completely masked the other four constituents of the current. As the positive applied voltages, however, were increased, this stream of electrons was more and more prevented from leaving the electrode

P and, finally, when a potential of 40 volts was reached, none escaped from P at all and the current became constant and consisted of the first four constituents mentioned above. This result was exactly in accordance with what Logeman had previously observed and it showed that the apparatus was working satisfactorily.

Experiment II. In the second experiment the polonium-coated disc, P, was kept joined to the positive terminal of the battery at a steady potential of 80 volts. This ensured that no electrons escaped from P.

The electromagnet was then excited with currents of different intensities and readings were taken on the corresponding currents through the chamber to the zinc plate X. The results in one of the experiments of this type are given in Table II and are represented graphically in Fig. 3.

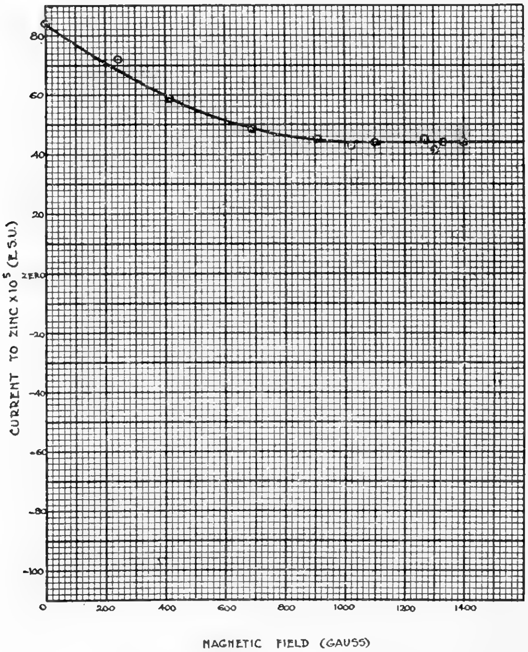

Fig. 3.

TABLE II.

Voltage on polonium plate = 80 volts, positive.

Current through the coils of the electromagnet.	Value of the magneticfield.	Electrometer deflection per min.	Current $\times 10^5$ e.s.u.
zero	zero	23·0	84
·5 amps	240 gauss	22·3	72
1·0 "	410 "	18·0	58·3
1·7 "	690 "	15·0	49
2·5 "	905 "	14·0	45
3·0 "	1,020 "	13·2	43
3·3 "	1,100 "	13·5	44
3·7 "	1,190 "	11·5	37
4·4 "	1,275 "	14·0	45
4·7 "	1,300 "	12·7	41
5·0 "	1,330 "	13·7	44
6·0 "	1,400 "	13·7	44

From these it will be seen that the current gradually fell off as the field was increased and ultimately reached a steady state with a field of approximately 1,000 gauss.

From the known properties of the ionisation currents of the alpha rays and of recoil atoms, it is clear that a field of this intensity was not sufficient to modify to any appreciable extent the current carried by them to X and it follows therefore that the decrease in the current observed was due to the action of the magnetic field in curling the electrons emitted by the zinc plate under bombardment by the alpha rays back again into that plate. This experiment, therefore, showed that a field of 1,000 gauss was sufficient, when the applied potential difference was 80 volts, to entirely cut off the stream of electrons. The problem before us, then, was to apply the procedure just described to the investigation of the intensity of the electronic stream from the zinc plate X when the surface of this plate was made to undergo various modifications.

Before leaving this experiment it may be pointed out that the results obtained go to show that approximately three electrons were emitted by the bombarded zinc plate for every alpha particle which struck it.

From the table it will be seen that the current under the electric field combined with the maximum magnetic field was approximately 44×10^{-5} e.s.u. This current consisted of (1) alpha particles; (2) recoil atoms and (3) the ionisation current. As the gas pressure in the apparatus was exceedingly low the ionisation current must have been negligible. Taking it to be so the current must have been carried by the alpha particles and the recoil atoms. If, now, we assume that as many alpha particles were shot back into the polonium plate as were projected forward from it, it follows that the number of recoil atoms taking part in the current was very closely equal to the number of alpha particles which contributed to it. Taking the charge on the alpha particle to be 2e, and that on the recoil atom to be e, we have then, since the current carried by the electrons emitted by the zinc plate must have been 40 x 10^{-5} e.s.u., the number of alpha particles striking X given by 44 x 10^{-5}/3e. Since the number of electrons emitted by the zinc plate was 40 x 10^{-5}/e it follows that 2·73 electrons were emitted by the zinc plate per alpha particle which struck it.

Experiment III. The next experiment which was performed served to illustrate the fatigue of the delta ray effect. In this case the apparatus was continuously evacuated for two days after the measurements made in Experiments I. and II were taken. At the end of this time readings were taken by applying various positive potentials up to 80 volts and when this was reached the magnetic field was turned on and readings were taken with fields up to 1,400 gauss. These are all recorded in Table III and are shown graphically in Fig. 4 together with the results of Experiments I. and II. From the results it will be seen that while the maximum current under 80 volts was 84 x 10^{-5} e.s.u. at the beginning of the experiment it was only 63 x 10^{-5} e.s.u. after two days evacuation. With an applied potential difference of 80 volts and a magnetic field of 1,400 gauss, however, the readings obtained on the two occasions were practically the same. This showed that the current carried by the alpha particles and the recoil atoms remained the same for the two days but that in the interval the electronic current from the zinc plate under bombardment by the alpha rays had dropped from 40 x 10^{-5} e.s.u. to 18 x 10^{-5} e.s.u.

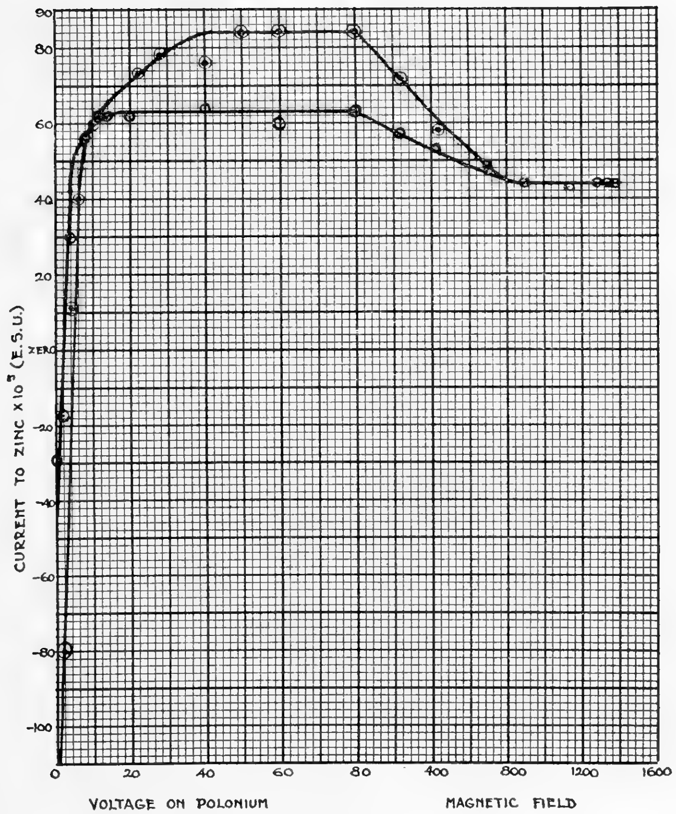
CURRENT TO ZINC X 10³ (E.S.U.)
90
80
60
40
20
ZERO
-20
-40
-60
-80
-100
0
20
40
60
80
400
800
1200
1600
VOLTAGE ON POLONIUM
MAGNETIC FIELD

Fig. 4.

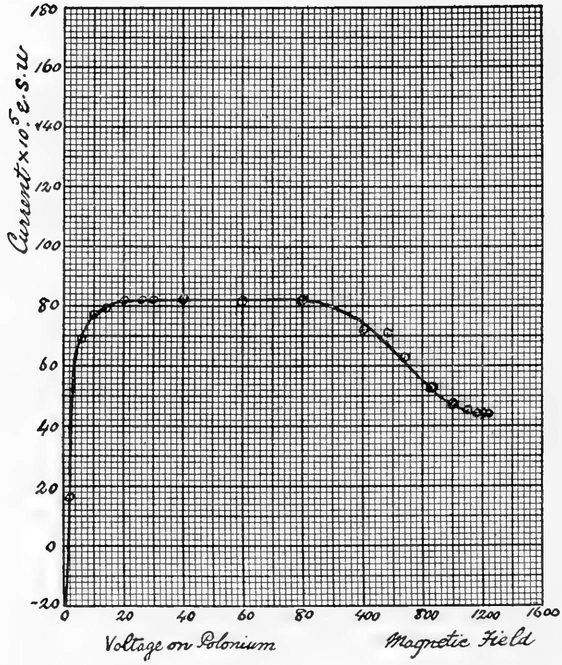
Current × 10⁵ e.s.u
180
160
140
120
100
80
60
40
20
0
-20
0
20
40
60
80
400
800
1200
1600
Voltage on Polonium
Magnetic Field

Fig. 5.

TABLE III.

Voltage on Polonium.	Current through coils.	Magnetic Field.	Deflection per min.	Current $\times 10^5$ e.s.u.
zero	zero	zero	− 10 mm.	− 29·5
2 volts	"	"	− 6	− 17·0
4	"	"	11	30
8	"	"	19	56
14	"	"	21	62
20	"	"	21	62
40	"	"	21·7	64
60	"	"	20·5	60
80	"	"	21·2	62·6
80	·8 amps	240 gauss	19·5	57·6
80	1·0 "	410 "	17·8	53
80	1·7 "	690 "	16·5	49
80	2·5 "	905 "	14·8	44
80	3·5 "	1,140 "	14·5	43
80	4·4 "	1,275 "	15	44
80	5·0 "	1,330 "	15	44
80	5·7 "	1,390 "	15	44

This result made it evident that the electronic stream from the zinc plate was determined to a considerable extent by the amount of air occluded in its surface. For it is clear that under the continuous evacuation for two days there must have been a gradual diminution in the amount of air occluded in the metal and as everything else in the experiment remained the same this diminution must have been the cause of the decrease in the stream of delta radiation.

Experiment IV. In this experiment a freshly cleaned plate of zinc was attached to the rod H at X and the apparatus was left full of air at atmospheric pressure for 6 days. It was then exhausted as highly as possible with the Gaede pump and the coconut charcoal surrounded with liquid air.

Readings were first taken with positive potentials applied to P up to 80 volts and then keeping the potential of P at 80 volts positive readings were taken with increasing magnetic fields up to 1,245 gauss. These readings are given in Table IV and the curve representing them is shown in Fig. 5.

TABLE IV.

Zinc surface first scraped clean and then exposed to air at atmospheric pressure for six days.

Voltage on Polonium	Current through Coils.	Magnetic Field	Deflection per min.	Current $\times 10^5$ e.s.u.
zero	zero	zero	− 8 mm.	−25
+ 2 volts.	"	"	5	16
6 "	"	"	22	69
10 "	"	"	24·5	77
14 "	"	"	25	79
20 "	"	"	26	82
26 "	"	"	26	82
30 "	"	"	26	82
40 "	"	"	26	82
60 "	"	"	26	82
80 "	"	"	26	82
80 "	·5 amps	240 Gauss	23	72
80 "	·95 "	405 "	23	72
80 "	1·3 "	570 "	22·5	71
80 "	1·65 "	680 "	20	63
80 "	2·3 "	860 "	17	53
80 "	2·8 "	995 "	15	47
80 "	3·3 "	1,100 "	14·5	45·6
80 "	3·6 "	1,160 "	14	44
80 "	3·9 "	1,205 "	14	44
80 "	4·2 "	1,245 "	14	44

From these it will be seen that the maximum current obtained without any magnetic field was 82 x 10^{-5} e.s.u. but that with the magnetic field applied the current fell to 44 x 10^{-5} e.s.u. and this current as was pointed out before, consisted of (1) the residual ionisation current (2) the stream of alpha particles from P and (3) the stream of recoil atoms from the same source.

After the set of readings had been taken the liquid air was taken from about the charcoal which was then allowed to rise to room temperature. The heating jacket was then placed round it and its temperature gently raised so as to drive off as much of the occluded air as possible. While this was being done the Gaede pump was kept constantly in action. Meanwhile the rod H was lowered with the windlass W until the plate X was directly over the furnace F and about 2 cms above it. When the pressure had been reduced to below ·001 mm of mercury a current of 10 amperes was passed through the platinum wire of the furnace for 15 minutes. This sufficed to vapourize the zinc in the furnace and to deposit a good coating on the surface of the zinc plate X.

The furnace current was then cut off and the rod H was raised as quickly as possible until contact was made with S at C. A positive potential of 80 volts was then applied to P and readings were taken with increasing magnetic fields at intervals of a few minutes for half an hour.

The magnetic field was then cut off and at the end of 55 minutes readings were again taken at intervals for half an hour with electric fields ranging from zero to 80 volts. At the end of 90 minutes a reading was taken with an applied field of 80 volts and a magnetic field of 1,200 gauss and at the end of 190 minutes a reading was again taken under the same conditions.

All these readings are recorded in Tables V and VI and curves drawn from them are shown in Figs. 6 and 7.

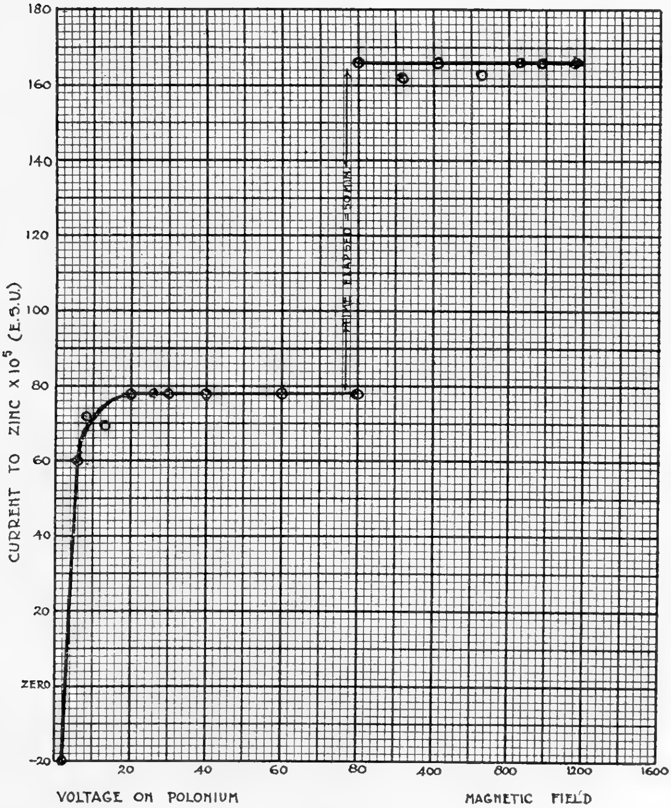

Fig. 6.

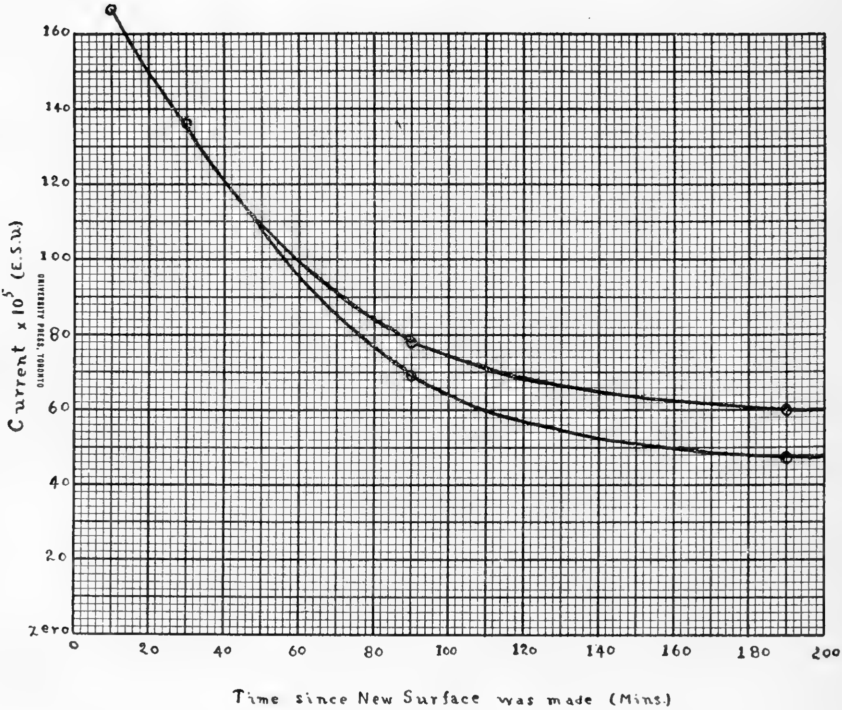
160
140
120
100
80
60
40
20
zero
0
20
40
60
80
100
120
140
160
180
200
Current x 10^5 (E.S.U.)
UNIVERSITY PRESS, TORONTO
Time since New Surface was made (Mins.)

Fig. 7.

TABLE V.

Zinc surface deposited from zinc vapour in a high vacuum.

Voltage on Polonium Volts +	Current through Coils.	Magnetic Field Gauss.	Time since surface made.	Deflection per minute.	Current $\times 10^5$e.s.u.
80	zero	zero	5 min.	53 mm.	166
80	·5 amps.	240	11 "	52 "	163
80	·95 "	405	15 "	53 "	166
80	1·65 "	680	18 "	52 "	163
80	2·3 "	880	23 "	53 "	166
80	2·8 "	995	28 "	53 "	166
80	3·6 "	1,160	30 "	53 "	166
zero	zero	zero	55 "	−21 "	−66
2	"	"	58 "	0 "	0
6	"	"	60 "	19 "	60
10	"	"	62 "	23 "	72
14	"	"	65 "	22 "	69
20	"	"	67 "	25 "	78
26	"	"	70 "	25 "	78
30	"	"	72 "	25 "	78
40	"	"	75 "	25 "	78
60	"	"	77 "	25 "	78
80	"	"	85 "	25 "	78

TABLE VI.

Zinc surface deposited from zinc vapour in a high vacuum.

Time since surface was made.	Electric field alone.		Electric and magnetic field.	
	Deflection per minute.	Saturation current.	Deflection per minute.	Saturation current.
10 min.	53 mm.	166×10^{-5} e.s.u.	53 mm.	166×10^{-5} e.s.u.
30 "	43 "	135 "	43 "	135 "
90 "	25 "	79 "	22 "	69 "
190 "	19 "	60 "	15 "	47 "

One point which is brought out very prominently by these readings is that for the first half hour the current between P and X, under a potential difference of 80 volts was the same whether a magnetic field, as high even as 1,160 gauss, was applied or not. From this it was manifest that during this interval there was practically no emission of electrons from the newly deposited zinc surface, under bombardment by the alpha rays. It will be noted, too, that during the interval the saturation current was about 165×10^{-5} e.s.u., which was about twice as great as that saturation current obtained in the previous experiment with the ordinary zinc plate without the fresh deposit. This was very probably due to the air pressure in the apparatus being somewhat higher immediately after the deposit had been than it was when the observations were made with the zinc plate in its original condition. Even with the Gaede pump in action the effect of heating the furnace and the charcoal would be to drive off considerable air from the walls of the vessel and the charcoal into the apparatus and as the volume of the apparatus was considerable it would take time to remove this air again. That this interpretation was the correct one is shown by the readings taken in the second period extending from 55 minutes after the deposit had been made up to 85 minutes after that time. These it will be seen show that with increasing positive potentials the current increased and finally reached a maximum of only 78×10^{-5} electrostatic units. This would indicate that during the first half hour the ionisation constituent of the current was very considerable, as it should have been on account of the higher air pressure, while at the end of 85 minutes after the deposit had been made it was much less on account of the removal of the air from the apparatus.

The numbers given in Table VI. and the curves in Fig. 7 are also of interest in this connection for they show not only that the current gradually diminished with the lapse of time owing to the diminution of the ionisation current constituent arising from the gradual reduction of the air pressure but also that there was a gradual increase in the electronic stream from the zinc plate with the lapse of time under the bombardment by the alpha rays.

From what has gone before it is evident that this development of a delta radiation from the zinc plate arose from the gradual occlusion of air into the surface of the zinc.

For, as the vapour was deposited on the zinc plate in a high vacuum the surface would not contain any air at first. It would not, however, in this state be in an equilibrium condition and a tendency towards absorption would exist. The result of this would be that so long as air was present in the apparatus, absorption would take place at least until an equilibrium was established between the air occluded in the surface and that within the apparatus. This gradual occlusion of the air by the zinc surface would therefore appear to account for and to be the cause of the gradual development of the electronic current.

IV. Summary of Results.

1. In the present investigation, it has been shown that when a plate of zinc, with a freshly scraped surface, is placed in a highly exhausted chamber and bombarded by alpha rays, there is an emission of slow moving electrons or delta rays from it at the rate of three electrons for each alpha particle impact.

2. It has also been shown that the emission of electrons from such a plate of zinc under bombardment by alpha rays diminished with the lapse of time from the moment when it was placed in the high vacuum.

3. It has also been shown that initially there is no emission of electrons under bombardment by alpha rays from a surface of zinc deposited from zinc vapour in a high vacuum; but that as time elapses, an electronic emission is gradually developed under the gradual absorption of air by the surface of the zinc deposit.

The Physical Laboratory,
University of Toronto.
May 1st, 1915.

On the Ultraviolet Spectrum of Elementary Silicon.

By PROFESSOR J. C. MCLENNAN, F.R.S. and MR. EVAN EDWARDS, M.A., University of Toronto.

(Read May Meeting, 1915).

In the course of some work by the writers with a fluorite spectrograph on the ultraviolet spectrum of mercury, cadmium and zinc their attention was drawn to a paper recently published by Sir William Crookes[1] on "The Spectrum of Elementary Silicon." In this paper the wave-lengths in the spark spectrum of this element are given down to $\lambda = 2{,}124 \cdot 63$ A.°U. As the only wave-length as yet published for this element, shorter than this limiting one, is one recorded by Eder and Valenta[2] at $\lambda = 1{,}929 \cdot 0$ A.°U. it was thought that it might be well to examine the spectrum in the region below $\lambda = 2{,}125$ A.°U. This has now been done and the present paper contains a list of the lines which have been observed down to $\lambda = 1{,}842 \cdot 2$ A.°U.

Sir William Crookes in his paper records that the elementary silicon of the highest purity which he was able to obtain was supplied to him by the Carborundum Company at Niagara Falls. He also records that the three samples supplied by them to him gave on analysis 99·56, 99·86 and 99·98 per cent. of silicon the impurities being titanium, iron and aluminium.

On account of these samples being so pure the writers applied to the manager of the above-mentioned company for a few small pieces and these were sent to us with the accompanying statement that they were presumably of as high purity as those with which the observations of Sir William Crookes were made.

Our experiments were made with these pieces of silicon and we desire here to acknowledge our indebtedness to the Carborundum Company for their kindness in the matter.

In making the experiments the spark was obtained from the discharge of two one gallon Leyden jars charged with a 10 inch induction coil. A great many plates were taken with different pieces of the silicon and seven of the best of these were carefully measured up to arrive at the wave-lengths of the different lines which came out.

[1] Sir William Crookes. Proc. Roy. Soc. No. A. 621. Vol. 90. Aug., 1914, p. 512.

[2] Eder and Valenta Atlas Typischer Spectren, Wien, 1911.

In taking the photographs the spark spectrum of zinc was first taken on the plate, then the spark spectrum of silicon and finally the spark spectrum of aluminium.

The prominent zinc and aluminium lines in the region examined were:

Zinc lines[1]	Aluminium lines[2]
λ = 2,138·66 A.°U.	λ = 1,990·57 A.°U.
02·35 "	35·9 "
00·06 "	31·15 "
2,064·32 "	1,862·81 "
62·08 "	58·2 "
25·51 "	54·8 "

and these were used as standards when determining the wave-lengths of the silicon lines. In measuring up a plate the distances of the various zinc, silicon, and aluminium lines from the edge of the plate were carefully measured with a Hilger comparator. The distances of the above-mentioned zinc and aluminium lines, from the edge of the plate were used for the abscissae of a calibration curve and the wave-lengths of the lines as ordinates. This calibration curve was then used to determine the wave-lengths of the silicon lines. Photographs were also taken of the spark spectra of iron and aluminium to make certain that no lines of these elements were included in those obtained with the samples of silicon but as we had no samples of titanium at hand we were not able to take the precaution of making absolutely certain that no lines of that element were included in those ascribed to silicon. However, the high purity of the silicon used, and the fact that the same spectrum came out on the plates when different pieces of the metal and different points on the same pieces were used as sparking terminals would seem to guarantee the purity of the spectrum observed.

[1] Eder and Valenta Atlas Typischer Spectren, Wien.

[2] Handke. Inaugural-Dissertation. Berlin, 1909, p. 18.

The mean values of the measurements made on the wave-lengths of all the lines observed in the spark spectrum of silicon are:

Wave-lengths in Ångström Units.	Relative Intensity. Arbitrary scale.
λ = 2,124·4	10
2,073·1	2
65·2	1
61·4	2
54·9	2
24·9	1
1,990·1	4
86·2	1
21·7	1
09·3	1
01·0	5
1,885·5	10
58·4	Faint
53·9	1
50·0	Faint
45·5	2
42·2	1

The Physical Laboratory,
University of Toronto.
May 1st, 1915.

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SECTION IV

SERIES III | JUNE 1915 | VOL. IX

Presidential Address.

By A. H. REGINALD BULLER,

Professor of Botany at the University of Manitoba.

(Read May Meeting 1915)

Micheli and The Discovery of Reproduction in Fungi.

(With Four Plates)

I have long been of the opinion that no man can have a full conception of any subject upon which he may specialize until he has studied the history of its development. Imbued with this belief, I have spent a considerable amount of time, during the past six years, in two of the most famous of the Old World libraries, perusing many ancient and modern works written by my predecessors upon those peculiar plants which are known as fungi. In the course of my reading, I have come upon a work published some two centuries ago by an Italian, Pier' Antonio Micheli, in the pages of which a new and a very bright light was thrown on fungi, the fact for the first time being made clear that fungi possess reproductive bodies which are able to bring about the propagation of the species. This important discovery made it possible for later botanists to work out the life-histories of fungi, with a consequent enrichment of the science of Botany in general, and a great advance in Plant Pathology in particular.

The discoveries of Micheli in connection with the reproduction of Fungi seem to me to be so interesting in themselves and of such historic importance, that I intend in this Address to lay them before you. Since the crucial experiments devised by Micheli were carried out in the year 1718, my remarks will perhaps serve, although they are a little previous, as a bicentenary celebration.

In order to give to Micheli's work a proper historical background, so that we may see it in its right perspective, we shall first consider the question of reproduction in fungi as it appeared to Micheli's predecessors.

The view generally held before the time of Micheli on the origin of fungi was that these plants arise by spontaneous generation. The physician and poet, Nicander (*circa* 185, B.C.), referred to a fungus as being "an evil ferment of the earth."[1] From the writings of Theophrastus, Plutarch, Martial, Pliny, and others, it is made evident that the old Greeks and Romans held the view that Truffles are produced through the action of lightning during thunder-storms.[2] Plutarch actually has a long discourse in his *Table Talk* entitled "Why Truffles are thought to be produced by Thunder" in which it is proved to the satisfaction of the talkers that Truffles owe their existence to lightning which, being mixed with heat, pierces into the earth and so alters it as to form the fungi subterraneously. The delightful argument is put forward that since, during thunder-storms, flame comes from moist vapours and deafening noises from soft clouds, there need be no surprise that, when lightning strikes the ground, Truffles should spring into existence.[3]

Phanias who was quoted by Athenæus in the Third Century, A.D., said that Fungi and Truffles are like Ferns in that "they produce neither bloom nor any trace of generation by buds or seeds."[4] That the Greeks and Romans took notice of the lamellæ of the Agaricineæ is shown by the fact that they mistook certain simple corals which have radiating calcareous plates, for fungi turned to stone;[5] but there is nothing in the classical writings to suggest that the ancients ever observed the spore-dust which the lamellæ give forth.

The Revival of Learning in the Sixteenth Century brought new life to the science of Botany. A large number of botanical works known as Herbals were printed. The first ones were simply commentaries on Dioscorides, a Greek physician, who lived in the time of Nero and Vespasian and who had described about five hundred kinds of plants in his *Materia Medica*. The Herbalists had a great respect for classical authority. One of the consequences of this was that they accepted the views of the ancients in respect to the nature and origin of fungi. Thus, in 1552 Bock,[6] in his Herbal of the plants of Germany, said: "Fungi and Truffles are neither herbs, nor roots, nor flowers, nor seeds, but merely the superfluous moisture of earth, of trees, of rotten wood, and of other rotting things. This is plain from the fact that all

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[1] Nicander, Alexipharmaca, 521-536.

[2] *Cf.* A. H. R. Buller, The Fungus Lore of the Greeks and Romans, Trans. Brit. Mycological Soc., 1915.

[3] Plutarch, Symposiaca, Book IV, Question 2.

[4] Phanias, *apud* Athenaeus, Deipnosoph., II, 56-59.

[5] Theophrastus, *apud* Athenaeus, *loc. cit.*, II, 61, f.

[6] Bock (Hieronymus Tragus), De Stirpium maxime earum quae in Germania nostra nascuntur usitatis, etc., Argent., 1552, p. 942.

fungi and truffles, especially those which are used for eating, grow most commonly in thundery and wet weather, as the poet of Aquinum says: *Et facient lautas optata tonitrua coenas.*"[1] Matthiolus, in the Prague edition of his Herbal, dated 1563, expressed the same views in almost identically the same words.[2]

The doctrine of spontaneous generation for fungi was accepted by Cesalpino, the chief exponent of Aristotelian botany in the sixteenth century, he who discussed the seat of the soul in plants and argued that it exists in the pith where the stem and root are united. In his great work, *De Plantis Libri XVI,* published in 1583, he says concerning Fungi and certain other organisms: "Some plants have no seed; these are the most imperfect, and spring from decaying substances; they therefore only have to feed themselves and grow, and are unable to produce their like; they are a sort of intermediate existences between plants and inanimate nature. In this respect Fungi resemble Zoophytes which are intermediate between plants and animals, and of the same nature are the Lemnæ, Lichens, and many plants which grow in the sea."[3]

Toward the end of the Sixteenth Century, a reaction against the views of the ancients concerning the origin of fungi set in. A Neapolitan by the name of Porta, in the year 1591, published a book called *Phytognomonica* in which he had a chapter headed: *Contrary to the Ancients All Plants are Provided with Seed.* In this chapter, he refers to fungi and says: "From fungi I have succeeded in collecting seed, very small and black, lying hidden in oblong chambers or furrows extending from the stalk to the circumference, and chiefly from those which grow on stones, where, when falling, the seed is sown and sprouts with perennial fertility. Falsely therefore has Porphyrius said that fungi, since they do not arise from seed, are the children of the gods. So also in Truffles, a black seed lies hidden. On this account, they come forth in woods where they have frequently been produced and have rotted away. And I have often seen them arising where the washings of tan or the tan itself is thrown away."[4] Porta had undoubtedly guessed aright. It is evident that he did actually set his eyes upon the reproductive bodies of fungi. The black dust, which he mentions as lying hidden in oblong chambers or furrows extending from the stalk to the circumference, was probably the dark spores which

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[1] The poet of Aquinum was Juvenal. The line cited is from Juvenal's Sat. V, in which a feast is described: "After this Truffles will be handed round, if it is Spring, *and if the longed-for thunders have produced the precious dainties.*"

[2] Matthiolus, Neu Kreüterbuch, Prag, 1563, p. 476.

[3] Andrea Cesalpino, De Plantis Libri XVI, Florence, 1583, lib. I, cap. XIV, p. 28.

[4] J. B. Porta, Phytognomonica, 1591, Francofurti, lib. VI, cap. II, p. 369.

are produced as minute particles on the hymenium which lines the interlamellar spaces of such Agarics as Panæolus and Coprinus. His Truffles may possibly have included Scleroderma which produces its spores within its cleistocarps as a black powder, whilst the fungi which he observed on tan were probably Mycetozoa such as the well-known Flowers of Tan, *Fuligo varians*, which develops its spores in the form of a dark powder surrounded by a thin and fragile covering. We must therefore acknowledge that Porta rightly recognised the spore-dust of certain fungi, as consisting of reproductive particles corresponding in function to the seeds of Higher Plants; but he had no proof to offer. He performed no cultural experiments and therefore his view could not be at all convincing to sceptics.

The seventeenth century saw the invention and improvement of the microscope, an instrument fraught with enormous possibilities for the increase of knowledge. With the employment of this new aid to research, the hitherto invisible spores of certain fungi were revealed to the curious eyes of Hooke and Malpighi; but the final discovery and correct interpretation of the reproductive bodies was left, as we shall see, to Micheli.

Robert Hooke issued his *Micrographia or some Physiological Descriptions of Minute Bodies made by Magnifying Glasses with Observations and Inquiries therefrom* in 1665. In his pioneer work in the world of the minute, he brought under his microscope a great variety of objects among which were certain fungi. He gave descriptions and illustrations of a White Mould (Mucor) which he found growing on the sheepskin cover of a book, and also of "a plant growing in the blighted or yellow specks of Damask-rose-leaves, Bramble-leaves and some other kinds of leaves."[1] He failed to discover the spores in the sporangia of the Mucor, but in the case of the second fungus which it is evident from his illustration was a Phragmidium, one of the Rust fungi, he certainly observed the teleutospores.[2] His illustration is the very first ever made of the reproductive bodies of a fungus: it shows several Phragmidium pustules with the stalked spores protruding outwards, but the multicellular nature of the latter was overlooked. Although it is quite certain that Hooke saw these spores, he failed to interpret them correctly: judging them by their external form he took them for seed-pods, and thought that they might contain seed which would be liberated like that from the follicles of the Columbine.

Hooke, notwithstanding his microscopic work, thoroughly believed in spontaneous generation. Even in the case of his Phragmidium, he supposed that the fungus arose in the first place by putrifaction

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[1] Robert Hooke, Micrographia, 1665, pp. 121-127.

[2] *Ibid.*, Fig. 2, Schema XII.

of the leaves. However, he also thought that when it had so arisen, it might produce seeds which would propagate the fungus from leaf to leaf. He regarded highly organized plants as compound, and imagined that during their decay, they break up into simpler ones. He thus accounted for the coming into existence of the Mistletoe on the Oak, the Jew's-ear Fungus on the Elder, and Lichens on the trunks of trees. "And this," he says, "we see to be very much the method of nature throughout its operations, *putrefactive Vegetables* very often producing a Vegetable of a much less compounded nature, and of a much inferior tribe."[1]

So far as Mushrooms are concerned, Hooke concluded from his observations that they are generated without seed in any part of them, "for," he says, "having considered several kinds of them, I could never find anything in them that I could with any probability guess to be the seed of it, so that it does not as yet appear (that I know of) that Mushrooms may be generated from a seed, but they rather seem to depend merely upon a convenient constitution of the matter out of which they are made, and a concurrence of either natural or artificial heat."[2] He also concluded that Moulds "may be produced at any time from any kind of putrifying Animal or Vegetable Substance, as Flesh, etc., kept moist and warm . . ." and that "they require no seminal property."[3]

Malpighi, one of the founders of vegetable histology, published his *Anatome Plantarum* under the auspices of the Royal Society of London in 1675-1679. In this work, several pages are given to fungi, which are dealt with along with Mistletoe, Lichens, Lunularia, and Mosses, under the heading *De plantis quae in aliis vegetant.*[4] The anatomy of the fungi which were investigated, is illustrated in a Plate, (Tab. XXVII) which contains twenty-three sketches of various Moulds (his Mucedo) and three of an Agaric (his Fungus). The Moulds were found on the putrescent pericarps of melons, lemons, and oranges, upon wood, and upon bread. Judging by the illustrations, the species which Malpighi observed, included a Pin Mould (*Rhizopus nigricans*)[5] a Monilia,[6] a Botrytis,[7] and a Penicillium.[8] Malpighi actually saw the spores of some of these fungi, for in several sketches he shows the spores properly attached to sterigmata which come off from a common

[1] *Ibid.*, p. 123.
[2] *Ibid.*, p. 127.
[3] *Ibid.*
[4] M. Malpighi, Anatome Plantarum, Londini, 1679, pars altera, pp. 62-67.
[5] *Ibid.*, Tab. XXVII, Fig. 108, F.
[6] *Ibid.*, Fig. 108, L.
[7] *Ibid.*, Fig. 108, C, D, K, etc.
[8] *Ibid.*, Fig. 109, V, T.

sporophore.[1] The Monilia is represented as consisting of chains of oidia. There is one drawing of a branched mycelium like that of Penicillium,[2] and another showing mycelium, sporophores, and spores, all in connection with one another.[3] The apperception of microscopic plants by the early observers was naturally influenced by a phanerogamic bias, and Malpighi, like his predecessor Hooke, failed to interpret the spores correctly: he regarded the sporangiophore with the spores as an inflorescence, and the spores themselves as florets. Malpighi also gave an account of the development of a small Agaric (his Fungus) growing on wood. From its shape and from the hairs, each crowned with a drop of fluid, the species may have been *Psathyrella disseminata* or one of the smaller Coprini. A network of hyphæ on the surface of the wood was observed and from it the fruit-body was seen to spring, but no mention is made of seeds in the text, so that it is evident that Malpighi failed to discover reproductive bodies in fungi of the Mushroom type.

In summing up the chapter to which reference has just been made, Malpighi says that it is evident that the Mistletoe is propagated by seeds and, as for the rest of the plants which grow on others, "up to the present we do not know how they are multiplied and born; especially among these are the Fungi and Mucedo. Various are the substances on which Fungi may arise; and as I have been able to see, for the most part they spring up either on wood or on pieces of it; and at their beginning there grows luxuriantly a large network of filaments from which, when they are at length united into a bundle, a stalk is produced. Wherefore either Fungi, Mucedo, and Moss have their own seed, by which their species is propagated, or they sprout from the growth of fragments of themselves as happens in other plants."[4] It is also suggested that the seeds or pieces may be blown about by the wind and thus spread from place to place. Malpighi, therefore, unlike Hooke, was not disposed to believe in the spontaneous generation of fungi but favoured the more rational seed theory.

The investigations of Hooke and Malpighi were soon followed up by Leeuwenhoek.[5] This Dutch naturalist who, like Hooke, examined a great variety of minute objects, was the first observer not only of the Hydra and Rotifers but also of the red corpuscles of the human blood,

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[1] *Ibid.*, Fig. 108, D, L, M, N, R, S.

[2] *Ibid.*, Fig. 109, T, V.

[3] *Ibid.*, Fig. 108, R, S.

[4] *Ibid.*, p. 67.

[5] Anton van Leeuwenhoek (1632-1723). For his life and work *vide* Miall, The Early Naturalists, their Lives and Work, London, 1912, pp. 200-223. Leeuwenhoek's works, translated by Samuel Hoole into English from the Dutch and Latin editions, were published in London in 1789.

of Yeast cells,[1] Volvox, Haematococcus, Polytoma, and other unicellular forms of life. He also gave the first description of spermatozoa which had been demonstrated to him by a physician named Hamm. In 1683, in a letter to the Royal Society, he announced the discovery of Bacteria which he had found when examining the white fur taken from his own teeth.[2] His microscopes were simply double-convex lenses which gave various degrees of magnification. The high powers, owing to loss of light, could only be successfully employed when the object was transparent and directly illuminated by the sun. Medium powers gave the best results. Since microscopes had become good enough to detect even the smallest kinds of living organisms, it was not the fault of instruments that the spores of Hymenomycetes, such as the Mushroom, and of fungi generally, remained unknown at this time.

Tournefort, in 1707, in his admirable account of the culture of Mushrooms in artificial beds, definitely ascribed the origin of these fungi to seeds. It is true that he failed to understand the function of the lamellæ which he called the leaves of the fungus, and was also compelled to confess that Mushrooms "possess neither flowers nor observable seeds"; but several times he intimated his belief in microscopic reproductive bodies. In one place, after describing the mycelium which he pointed out gives rise to young Mushrooms, he says: "According to appearances these white threads are nothing but developed seeds or germs of Mushrooms and all these germs may be enclosed in so small a space that one can only perceive them, however much care one may take, after they have grown out into little hairs."

Another Frenchman whose name is not recorded, showed in a report to the French Academy upon Tournefort's memoir on Mushrooms, that he had perfectly correct ideas about the invisible reproductive bodies of fungi, although, like Tournefort, he evidently considered that they had not yet been observed.[4] His scientific imagination which had been excited by the discovery with the microscope of the spores of Ferns a few years before, enabled him to see the vast hosts of fungus spores which we now know are scattered in the most wonderful profusion everywhere in

[1] Leeuwenhoek, Arcana Naturae detecta (1680), Vol. II, pp. 1-14. He discovered that the Yeast cells give off bubbles of gas in fermenting wort. Cited from Miall pp. 219-220.

[2] Leeuwenhoek, Phil. Trans. Roy. Soc., No. 159 (1684); also Arcana Naturae detecta (1683). Cited from Miall, p. 220. *Cf.* Hoole's Translation, p. 118.

[3] Tournefort, Observations sur la naissance et sur la culture des Champignons, Mém. Acad. Sci. de Paris, 1707, p. 61.

[4] An anonymous Frenchman, Sur les Champignons, Histoire de l'Acad. Roy des Sci., 1707, pp. 46-49. The writers of the Histoire all wrote anonymously.

nature. Assuming that fungi possess microscopic seeds, he gave a rational explanation of the origin of fungi in horse-dung, etc. He supported his views by analogies with seed-plants, and estimated the value of the minute size of the reproductive bodies. His belief that all fungi are reproduced from seed is expressed as follows: "We should be still less to be excused than the ancients, if we thought as they did, because for us the number of plants which have no visible seed is very much smaller. Therefore without fear, we can advance the view that all fungi have seeds, and we may rest assured that, if ever experiment should succeed in clearing up the matter, it will justify us."

The writings of Tournefort and of the anonymous Frenchman which have just been cited, show that, at the beginning of the eighteenth century, the existence of reproductive bodies was a matter rather of speculation than of exact knowledge. Nevertheless, the art of raising Mushrooms on artificial beds was at this time well known and extensively practised, more especially by the gardeners around Paris. A flood of light is thrown on the Mushroom culture of the period in the very interesting paper of Tournefort, to which a reference has already been made, called *Observations sur la naissance et sur la culture des Champignons*.[1] The technique of preparing the dung, turning it with a fork, and moistening it with water, preparing spawn, drying it for keeping, and sowing the beds with it, covering the beds with earth and regulating their temperature, had been developed; so that it is evident that gardeners, by the beginning of the eighteenth century, had already had a great deal of experience in growing Mushrooms.[2] Even such terms as *gobeter*, *lardon*, etc., which are still used by Parisian champignonists, were commonly employed. The beds were made in the open and not in caves as at present.[3] To procure spawn in the first place, manure beds were made up at the beginning of April, and it was left to chance to develop the mycelium of the Mushroom. At the be-

[1] Tournefort, *loc. cit.*

[2] The exact date when Mushrooms began to be cultivated from spawn is uncertain. In England the practice appears to have been unknown up to the middle of the seventeenth century, for writers like Francis Bacon (Sylva Sylvarum, London, 1627, pp. 140-141) and Parkinson (Theatrum Botanicum, London, 1640, pp. 1316-1324) make no mention of it; but in 1731 Miller (Gardener's Dictionary, London, art. Mushrooms) gives full details for the making of Mushroom beds, and says that Mushrooms "are annually cultivated by the Gardeners near London. . . . who cultivate them for sale."

[3] Caves were not used at Paris for Mushroom culture until the latter part of the nineteenth century. Their employment was initiated by M. Monin who died in 1905. *Cf.* Cohendy, La Culture des Champignons comestibles (Journal Mensuel), Paris, Ann. 2, 1908, p. 271.

ginning of August, the desired result was frequently obtained: the dung was found to be turning white. Masses of the infected manure about the size of one's fist were then used to spawn other beds from which Mushrooms were to be raised. It was only by using spawn or *lardons* thus specially prepared that the beds could be made financially successful. Before the discovery of the *lardon* method, attempts at Mushroom culture were too full of risks to be generally made. We do not know the name of the man who, at some time previously to the year 1700, discovered and taught the art of using spawn. He remains unknown to fame. Perhaps he was a Parisian *jardinier* with a little more originality than his fellows; but whoever he was, to him belongs a large part of the credit for making possible the modern industry of raising Mushrooms which is now extensively practised in caves and special Mushroom houses, and which gives employment to several thousands of workers.[1] At the present day, at Paris, to obtain vigorous spawn is still one of the greatest difficulties of Mushroom culture. Special searchers hunt over old manure piles in the country, and thus often come across virgin spawn. This they bring to the city in baskets and sell at a good price to the Mushroom growers who increase it in amount by special culture.[2] Also, virgin spawn is now raised from spores in pure cultures by a Company in Paris and sold in cartridge-like masses or *cartouches*;[3] whilst, in the United States of America, pure spawn has been prepared by propagating the interior hyphae of young stipes.[4] The shape of the beds two centuries ago, as shown by Tournefort's illustrations, was almost the same as that which one may now see anywhere in the caves near Paris. Experience has shown that this shape cannot be much altered without a sacrifice in economy.[5] Tournefort's Plate not only contains the first illustration of artificial Mushroom beds, but also the first representation of mycelial strands showing the mode in which they swell out to form young Mushrooms.

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[1] Fifteen hundred workers are employed in raising Mushrooms for the markets of Paris alone. The value of the Parisian industry is upwards of 6,000,000 francs per annum. Statistics collected by the Syndicat des Champignonnistes de France. *Vide* M. P. M. Biers, La Culture du Champignon de couche, Bull. de la Soc. Mycolog. de France, T. 24, 1908, p. 196.

[2] This fact I have obtained by personal enquiry of the Mushroom growers when visiting the Mushroom caves in the suburbs of Paris in 1912.

[3] I have seen the *cartouches* in use at Paris.

[4] B. M. Duggar, The Principles of Mushroom growing and Mushroom Spawn making, U. S. Dep. of Agric., Bureau of Plant Industry, Bull. No. 85, 1905.

[5] The beds in the caves of Paris are almost triangular in cross-section, the base being 40-60 cm. wide. The beds are placed in rows, side by side. The total length of all the beds together, in the caves of Paris, has been estimated at 1460 kilometres. *Vide* Biers, *loc. cit.*

The view expressed by Tournefort in 1707 that all fungi spring from seed was by no means generally accepted at that time, for shortly afterwards, in 1714, Marsigli[1] and Lancisi[2] expressed the opinion that fungi on tree-trunks are merely the diseased parts of the trees resulting from a derangement of the fibres, and that ground-fungi are the product of the oily sap left by decaying vegetation. In 1738, Jussieu joined in the controversy and opposed himself to Marsigli and Lancisi. Jussieu held that tree-fungi are independent plants quite different from the trees on which they grow, and are produced from seeds. Unlike previous writers, with the exception of Porta whose observations on the reproductive bodies of fungi in 1591 had long been forgotten, he pointed out exactly where the seeds are to be found in several different kinds of fleshy fungi. He says: "But this supposition of seeds is by no means imaginary; for they make themselves felt to the touch in Mushrooms, where the cap has leaves underneath, like meal, especially when they begin to decay; one perceives them easily with the help of a lens in those whose leaves are black at the margin; one finds them in the form of a dust in those that are called *lycoperdon;* they appear in fairly large grains on the Champignon de Malte, they are placed in chambers made to contain them in hypoxylon." He then describes the *Fungus minor allii odore* and mentions the powder on the gills.[3] These observations leave no doubt that Jussieu did actually observe spores on the gills of certain of the Agaricineæ, in Puffballs, and in the sporocarps of one of the Ascomycetes. However, Jussieu did not bring forward any experimental proof that the spores have a reproductive function.

We now come to the Florentine botanist Micheli whose discoveries in connection with the reproduction of fungi mark an epoch in mycology. This gifted observer was born in 1679. His parents were poor and took but little care with his education. It is said that they intended to make him a bookseller. However, his strong desire for natural knowledge was not to be denied. He devoted himself to Botany, taught himself Latin in which language botanical books were then written, and gradually gained a wide and intimate acquaintance with plants. The Court recognised his ability by making him botanist to Cosmo III, the Grand Duke of Tuscany, with the care of the public

[1] Marsiglius, Dissertatio de generatione Fungorum, Romae, 1714.

[2] Lancisus, De ortu et textura Fungorum, Romae, 1714.

[3] Antoine de Jussieu, De la necessité d'établir dans la methode nouvelle des plantes, une classe particulière pour les Fungus, à laquelle doivent se reporter non-seulement les champignons, les agarics, mais encore les Lichen, Mém. de l'Acad. Roy. des Sci., 1728, pp. 377-382. The *Fungus minor allii odore* was probably either *Marasmius alliaceus*, *M. scorodonius*, or *M. porreus* all of which smell of garlic.

gardens at Florence. He soon obtained a number of new plants from the more flourishing garden of Pisa, and with the co-operation of his friends, a Botanical Society was founded at Florence in the year 1717. In 1729, when he was fifty years old he published the results of his scientific observations in a great work which was printed in his native city. The cost of the plates which numbered one hundred and eight, was defrayed by a large number of patrons interested in natural history.[1]

Among them were Hans Sloane who was then President of the Royal Society, William Sherard, the Oxford botanist, and several other Englishmen. The work is usually referred to as the *Nova Plantarum Genera*, but translated from the Latin its full title is *New genera of plants, arranged after the method of Tournefort, in which 1900 plants are enumerated, of which almost 1400 have not before been observed, while others are referred to their proper places; about 550 of these which it seemed advisable to illustrate, have been represented on 108 copper plates; with additional notes and observations regarding the planting, origin, and growth of fungi, mucors, and allied plants.* It is a fine quarto volume with excellent plates which, in many copies that have come down to us, look almost as fresh as when they were issued. In order to collect new plants, Micheli was commissioned to travel in Northern Italy. In 1736, he visited the famous Mount Baldus and the Venetian Isles. Unfortunately he was attacked by pleurisy from the consequences of which he never recovered. He returned to Florence where he died in 1737 in the fifty-eighth year of his age. He was buried in the Church of Sante Croce where lie the ashes of some of the greatest men of Italy and of all time,—of Michael Angelo, Galileo, Dante, Machiavelli, and Alfieri. Well may the people of Tuscany be proud of their great forerunners. On the tablet erected to Micheli's memory there is a Latin inscription which translated reads as follows:

"Pier' Antonio Micheli lived 57 years and 22 days, happy although in moderate circumstances, an expert in natural history, a leading botanist of Tuscany, well-known everywhere for his researches and writings, and much beloved by all the worthy men of his age on account of his wisdom, sweetness of disposition, and modesty. He died on the second of January, 1737. His friends gathered contributions and erected this tablet."

Micheli was never married. His contemporaries describe him as a man of the most pleasing, modest, and liberal manners, no less ready to communicate than eager to acquire knowledge. He had good health until his last illness when, as one of his biographers relates, "he placidly

[1] At the beginning of his work Micheli gives a list of 197 patrons.

yielded to his fate, not only with Catholic ceremonies but with the feelings of a Christian."[1]

Micheli's botanical work is specially distinguished by the accurate illustration of several difficult families of plants which his predecessor Tournefort had left untouched. The genus Carex first assumed an intelligible form under his hands. He described a large number of Lichens which had previously been neglected, and he was the first to illustrate the reproductive structures in Mosses although he did not understand their significance. For the Liverworts he founded the genera Blasia, Marsilea, Jungermannia, Sphaerocarpus, Anthoceros, Targionia, etc. He also studied Sea-weeds and had numerous plates engraved which he intended to publish in a second volume of his great work; but he died before this could be accomplished. Like his contemporaries he confounded Corals and Hydrozoa with Sea-weeds, and made a genus out of the present hydroid *Sertularia* which he called *Dillenia* after the botanist Dillenius. He also made a large collection of fossils, but he never published anything concerning them. The chief products of his pen, in addition to the *Nova Plantarum Genera*, were: an account of his botanical tours in Italy, an alphabetical catalogue of all the plants in the garden at Florence, and an octavo pamphlet on Orobanche which he rightly regarded as a noxious weed which ought to be exterminated. He said that the best way to get rid of Orobanche would be to eradicate the beans or other plants to which the parasite attaches itself, in the month of April, for the parasite which is an annual plant, would thus be prevented from producing seeds upon which it is dependent for its continuance from year to year.

Notwithstanding his contributions to other branches of Botany, it is as a mycologist that Micheli has the greatest claim to remembrance by posterity. He described a large number of new species, founded a number of new genera, and arranged them in a new system which he based on his own discoveries. The genera Polyporus, Phallus, Botrytis, Aspergillus, Clathrus, Mucor, Lycogala, and Geaster all owe their names to him. Micheli was a leader in the description of the smaller fungi, particularly of the Moulds and of the Mycetozoa. He also invented the name *Puccinia* which he used to include our Gymnosporangium and Ceratiomyxa. He described several hundred species of fungi like the Mushroom, and therefore found it necessary to elabo-

[1] As a source of facts for Micheli's life and general work as a botanist, I have consulted J. E. Smith's article *Micheli* in Rees' Cyclopaedia, Vol. XXIII, London, 1819; J. E. Smith's A Sketch of a Tour on the Continent, ed. II, London, 1807, vol. I; Dawson Turner's Extracts from the Literary and Scientific Correspondence of Richard Richardson, Yarmouth, 1835; etc.; and Micheli's Nova Plantarum Genera.

rate a new system to contain them; and he set his system out in synoptical form. The only previous attempt at such a classification had been made by Vaillant and was of a very rudimentary kind. But this is not the place to enter on a full discussion of Micheli's systematic work. Our special business just now is to consider his investigations in connection with the reproduction of fungi.

Micheli's investigations upon the reproduction of fungi seem to have been guided by a desire to discover flowers and seeds in these plants so that he might bring Fungi into line with Flowering Plants, and thus make a useful contribution to systematic botany. Armed with a microscope of very simple construction, he set about the task of examining the most varied species of fungi for the expected seeds. Success soon crowned his efforts. So far as the Hymenomycetes are concerned, he found the spores (which he called seeds) on the gills of Agaricus (his Fungus), in the tubes of Boletus (his Suillus), on the spines of Hydnum (his Erinaceus,) and on the outer surface of the branches of Clavaria. In all these cases, he illustrated his remarks with drawings (Pl. I, A, C, F, I, K, etc.; Pl. II, A-F, I-K; Pl. III, F, G); but as, in describing his genus Agaricum which included such dimidiate forms as Fomes, Polyporus, *Tremella mesenterica*, *Hirneola auricula-judae*, Corticium, etc., he speaks generally of seeds as being present, he doubtless saw them in species belonging both to the Tremellineae and the Thelephoreae. Among Gastromycetes, he found spores in Lycoperdon (Pl. III, H), in the foetid liquid on the cap of Phallus, and in the peridiola of the Nidularieae, (Pl. III, I-K). Furthermore, descending in the scale, Micheli showed that his seeds are also present in the asci of certain Discomycetes (Pl. III, L), in the perithecia of Pyrenomycetes (Pl. III, M, N), in Truffles, in Lichens (Pl. III, O, P), in the sporangia of Mucor (Pl. IV, B), upon the sporophores of Aspergillus and Botrytis (Pl. IV, D, E, G), and, finally, in the sporangia of the Mycetozoa (Pl. III, A-E). A considerable amount of evidence was thus accumulated to support the general conclusion that reproductive bodies are present in all fungi.

There is nothing in Micheli's text to indicate to us the exact species of the Agaricineae which he used for his investigations, but it is not improbable that among them was a Panaeolus. He discovered that in some species of lamellate fungi, the spores can be seen on the lamellae in groups of four (Pl. I, I). In such a Panaeolus as *Panaeolus campanulatus*, if one examines a gill in face view with the low power of the microscope, the well separated groups of four black spores can be distinguished very quickly and clearly. In other fungi, Micheli found that the spores appeared not in groups of four but scattered irregularly over the gill surface. Some of these fungi were undoubtedly

Coprini as is evident from the fact that one of them was obtained from a manure heap and possessed the characteristically large cystidia (Pl. III, P-R).[1] Now, as I have shown in a special paper, the basidia of the Coprini are usually dimorphic, about one-half of them being much longer than the other half.[2] With the dimorphism is correlated a crowding of the basidia together. Owing to the crowding, the spores of the long basidia often overlap those of the short basidia. In the Coprini, on this account, it is not so easy with low magnification to distinguish the groups of four spores as it is in Panaeolus and many other non-Coprinus species of Hymenomycetes. Doubtless, it was the crowding of the spores together which led Micheli to believe that in the Coprini the spores are scattered singly over the gill surface. Since Micheli observed the spores of a Hydnum, of a Boletus, and of a Clavaria, it is clear that he did not confine his attentions to dark-spored fungi. However, of all the species which he used, none could have been more favourable for his investigations than the Coprini, for in them the gills are so extremely thin, that light easily passes through their whole thickness, throwing up the black spores into vivid relief; but even with reflected light, such as Micheli probably employed, the black spores stand out very clearly on the lighter background of the general hymenial surface.

In searching fungi for bodies equivalent to seeds, Micheli had been highly successful; but this did not satisfy him. He was also anxious to discover floral organs comparable with those of the Phanerogamia. Accordingly, on observing at the free margins of the gills of species of stiped Agaricineae (his Fungus) some peculiar threadlike-cells (Pl. I, F, I, N, K), he immediately interpreted these structures as being apetalous flowers. He says: "At the margin of the laminae are produced apetalous flowers, naked, consisting of nothing but a cylindrical filament; in some species solitary or distinct from one another; in others, however, collected into a mass or tuft."[3] The margins of the gills of many of the Agaricineae, e.g. *Hypholoma Candolleanum*, *Psilocybe foenisecii*, *Lepiota cepaestipes*, the cultivated Mushroom, etc., are known to consist of projecting hyphae of a more or less specialized kind. Doubtless in some cases, it was these sterile elements which we may term *marginal hairs*, that Micheli took for flowers; while in other cases, as some of his illustrations seem to show, it may have been the groups of four spores belonging to projecting basidia. The flowers

[1] Micheli, Nova Plantarum Genera, p. 133; *cf.* Tab. 73, fig. 1, I, Tab. 75, fig. 9, and Tab. 79, fig. 4.

[2] A. H. R. Buller, The Production and Liberation of Spores in the genus Coprinus, Trans. Brit. Mycological Soc., 1911, pp. 348-350.

[3] Micheli, *loc. cit.* p. 133. Illustrations of the supposed flowers are shown in Tab. 73 and Tab. 76.

were supposed to be restricted to the gill edge, and therefore to arise apart from the seeds which had been found scattered over the surface of the gill sides. Boletus (his Suillus) was also regarded by Micheli as containing his peculiar flowers, for, in referring to the underside of the pileus, he says: "In the mouths of the tubes and in the upper part of the stipe while the pileus is expanding, are found flowers which are apetalous, monostemonous (i.e., consisting of a single filament), sterile and naked, or in other words destitute of calyx, pistil, and stamens" (Pl.II, A, G, H).[1] To succeeding botanists, what it was that Micheli saw in the Boleti has never been clear, for anything like that which he represented at the mouth of the hymenial tubes does not exist. Possibly in his sections, he saw some of the elongated spores projecting on their sterigmata, but failed to recognise them when seen in side view as the same things which he knew from face view observations of the hymenium, and so interpreted them as flowers. In making his sketch (Pl. II, G), he evidently drew his hymenial tube about twice the natural size and then added the "flowers" at the mouth, but he seems to have given these supposed flowers the same magnification that they had when seen under the microscope. Possibly it was by intentionally combining macroscopic and microscopic features that Micheli hoped to make clear to others the relationship of the supposed flowers to the seed-bearing tubes.

In a third genus, his Agaricum, which included dimidiate Hymenomycetes of various kinds, Micheli also described flowers (Pl. I, N, O), and in exactly the same words as for Boletus.[2] Micheli therefore regarded the Hymenomycetes as simple forms of seed-plants. It is to be noted that he did not call his flowers stamens: in his genus Fungus, he simply says that they consist of nothing but a filament; whilst in Agaricum and Suillus, he says that calyx, pistil, and stamens are absent. Some subsequent writers have erroneously spoken of Micheli's *stamens* when they should have said his *flowers*.

The function of the hairs seen by Micheli at the margins of the gills, although under investigation, is still unknown. According to Knoll, in some cases at least, these hyphae are hydathodes.[3] It seems to me possible that in some species they may be useless structures which could well be done without. However, this may be, it has long been known that they cannot possibly be flowers. In giving this interpretation, Micheli made one of those errors from which the pioneer, entering a new and a strange world, can hardly escape.

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[1] *Ibid.* p. 126; also Tab. 68.

[2] *Ibid.* p. 117.

[3] F. Knoll, Untersuchungen über den Bau und die Funktion der Cystiden und verwandter Organe, Jahrb. f. Wiss. Bot., Bd. 50, pp. 453-501.

Micheli's view that the flowers of a lamellate fungus are situated on the margins of the gills, remote from the seeds which are scattered over the gill-sides, now seems very curious; but it must be remembered that, at the beginning of the eighteenth century, the functions of the different parts of true flowers were not generally understood. Camerarius (1691 and 1694) had proved by experiment that anthers are necessary for the production of embryos, but the theories of fertilization put forward by Morland (1703,) Geoffroy (1711), and Vaillant (1718), show us that no one at that time understood how pollen led to the fertilization of the ovules. It was not until 1846 that Amici and Robert Brown demonstrated that pollen-tubes which grow down the style, enter the micropyles of the ovules, and cause the egg-cells to develop into embryos.[1] There is nothing to show that Micheli in 1729 believed that fertilization is necessary for the development of the so-called seeds of fungi. It is not improbable that he thought that they could attain maturity without its help.

In studying the gills of certain Agarics which grow on manure heaps, Micheli discovered those peculiar organs of the hymenium which we now call *cystidia* (Pl. I, P Q, R). He says: "In some other species of Fungi and especially in those which arise on the dung of horses, cows, and similar animals, I have observed something that is noteworthy, to wit, that the surface of their lamellae is ornamented, not merely with seeds but also with transparent bodies which in some species are conical, K, and in others pyramidal, L."[2] The letters K and L refer to his Plate 73. Turning from the structure to the function of these bodies, he continues: "They are made by the wise device of nature so that one lamella does not touch another, to the end that the seeds produced between them should not be hindered in their development or that they should not fall except when they ought to fall." Micheli's Figure I in his Plate 73 (Pl. I, P) gives a fairly correct idea of the distribution of the cystidia over the gill surfaces of such Coprini as *Coprinus fimetarius* and *C. macrorhizus*. The conical bodies were doubtless cystidia seen in the turgid condition, whilst the pyramidal ones were cystidia which had collapsed on drying and which therefore had developed angles. The gills in all probability were examined in air, the more modern method of mounting preparations in water under a coverglass being then unknown. The cystidia of the Coprini do not fall with the spores as Micheli supposed, but their disappearance is due to autodigestion as I was able to prove in 1910.[3]

[1] For a history of the early study of the flower, *cf.* L. C. Miall, The Early Naturalists, their Lives and Works, London, 1912, pp. 337-345.

[2] Micheli, *loc. cit.* p. 133.

[3] A. H. R. Buller, The Function and Fate of the Cystidia of *Coprinus atramentarius* Ann. of Bot., Vol. XXIV, 1910, pp. 613-630.

Micheli regarded cystidia as mechanical props or stays which keep adjacent gills apart in the interests of spore-development and spore-discharge. In the case of the Coprini, this view has been strengthened by the anatomical work of Wettstein,[1] and its correctness for *Coprinus atramentarius* has been made sufficiently certain by my own researches.[2] To demonstrate the excellence of Micheli's suggestion has taken nearly two centuries.

As we have now seen, Micheli discovered three kinds of structure upon the gills of Agarics: spores in groups of four, hairs on the gill margins, and cystidia on the sides of the gills; but he failed to observe basidia, sterigmata, and paraphyses; furthermore, his investigations did not extend to the trama. These other gill elements could be brought to light only after the microscope had been considerably improved.

Micheli was not contented with merely supposing that the little grains which he had found with the microscope were the seeds of fungi, but he performed a series of highly original and carefully thought-out experiments which he called "Observations," to demonstrate that the supposed reproductive bodies are able, as a matter of fact, to give rise to plants of the same species as those which bear them. He made his tests of the seed hypothesis with Agarics, and with three of the commonest Moulds: Mucor, Botrytis, and Aspergillus, (Pl. IV). He planted the spores on a suitable culture medium—dead leaves for Agarics, freshly cut and therefore practically sterile pieces of melon, quince, and pear for the Moulds—and watched the result. The experiments with the Moulds came off with great certainty and success. A few days after sowing the spores, a mycelium was produced which in Mucor gave rise to sporangia containing spores, and in Botrytis and Aspergillus developed the characteristic conidiophores bearing spores. The new crops of spores were again sown with results similar to those obtained in the first instance. The experiments were not only repeated but varied in such a way as to afford convincing proof that the so-called seeds really are reproductive bodies. The actual germination of the spores, however, was not observed. The experiments with the Agarics were naturally more difficult to carry out. Fruit-bodies of particular species were allowed to shed their spores on certain kinds of dead leaves which had been carefully chosen. The infected leaves were then placed in the open in heaps, in shady places, where the fungi used for the experiments had never been seen. Some months afterwards the heaps of leaves were carefully examined. In a number of them apparently

[1] R. Wettstein, Zur Morphologie und Biologie der Cystiden, Sitz.-ber. Kais. Acad. Wiss. mat.-naturw. Kl., Wien, Bd. XCV. Abt. 1, 1887, pp. 10-20.

[2] A. H. R. Buller, *loc. cit.*

nothing had happened; but, in a few, a mycelium was observed in course of development. The mycelium was watched, and after a time was found to have produced fruit-bodies of the same species as those from which the spores had been taken to start the experiments. After having discussed his negative as well as his positive results, Micheli concluded: "It is sufficient for me for the present that I have sown the seeds and have seen the fungi arise from them." On account of the uncertaitny of these experiments, he advises those who want to raise fungi for profit to confine themselves to the Mushroom which he says is grown "in oblong heaps of dung which by gardeners are called by the common French name of *Couches*."

At the present day, there is no more familiar operation in the botanical laboratory than the raising of Moulds and other fungi on various culture media. Micheli's experiments are therefore historically of high interest. In order to show exactly how they were carried out a translation of the seven "Observations" will now be given.[1]

Observation I.

On the tenth of June, 1718, I collected in the country around the town, many species of fungi which I had never seen coming up in the woods of the royal pleasure gardens commonly called Boboli. This was done to obtain the seeds of different species. Then I spread on the table in my room many leaves of Ilex, Quercus, Laurus, Fraxinus, and the like, which had already fallen some time but were not spoiled or rotten, keeping each kind separate. On the different heaps of leaves, I placed either erect or lying down, several of the fungi; on some, one species, but on others, several species, simply for the purpose of allowing each fungus to deposit its seeds on the leaves. When three or four hours had passed, the leaves were turned, not merely in order that each leaf should receive seeds, but also that the seeds should not be collected in a heap in one place. When that was done and as much of the seeds as there was need of had been collected, I threw away the fungi and divided the different kinds of leaves into two parts, of which I carried the one into a thicket of the Boboli gardens and the other outside the town to a forest of Mount Olivet. I laid all these leaves in a place suitable for producing fungi, i.e., shady, among semi-rotten leaves of kinds different from those which had been covered with the seeds of the fungi, and I so placed the different heaps that they could not be mixed either with one another or with the leaves lying around.

[1] The original Latin accounts of these experiments are in the *Nova Plantarum Genera*, pp. 136-139. I am indebted to Miss Gladys Workman and Mr. W. B. Grove, M.A., for valuable assistance in making the translations.

From the twentieth of August to the fourth of Setpember, there were several wet days, so, on the twentieth of September, I went to Mount Olivet and on the following day to the Boboli gardens to see whether I could find anything in particular on the heaps of leaves. In the Boboli gardens on some of the heaps which had been noted, and especially on those consisting of the leaves of the Ilex and Laurus, I saw that many of the seeds had increased to the size of a grain of Millet, and their margin went off into very white and thin down, and all were producing capillary and somewhat hairy roots, whence I conjectured that the fungus had already begun to grow. That the fact was really so, I found out after a few days when, in some of the heaps, I saw pilei beginning to break out from the down, and in others the whole form of the fungus plainly showing itself.[1] On the eighth of October, I visited the same places, not only for the sake of noting the progress of the fungi which had come into existence, but also of understanding, if it were possible, for what reason none had yet been observed growing on the other heaps. Not being able to see the reason easily, I therefore returned frequently to watch the progress of those which had arisen, observing them only with the eyes and not touching them at all by hand. And so toward the end of October, and after several days alternately fine and wet, they had at length become bigger, and projecting above the leaves were several of the fungi which had been produced from the seeds scattered through the heaps. I repeated these observations several times at the beginning of summer and also in autumn; but since the growth of the seeds generally depends on the chance weather of nature, i.e., on the alternation of fine and wet days which does not always happen opportunely, I have observed almost innumerable cases where it befell that the fungi did not grow, or their formation was hastened or delayed, or they were brought forth in greater or less abundance. Hence it follows that on sowing the seeds, it is very difficult to determine anything with certainty, especially since I have not yet examined everything in detail; but in the meanwhile, it is sufficient for me that I have sown the seeds and have seen fungi arise from them. If anyone, however, desires a sure method of cultivating fungi in order to get profit from them, I am of the opinion that he should employ only that method which gardeners use, namely, oblong heaps of dung which by them are called by the French name of *Couches*. From these they raise meadow fungi, and indeed from the seed and not from the heating dung as they think. This seed is naturally mixed with the dung itself or with the earth or things of that kind which serve for the composition of the oblong heaps. The manner of preparing these heaps is shown by Quintinaeus in his book,

[1] *Cf.* Pl. 1, Figs. D and E.

lib. VI, pp. 292, 327, and 333, but far more exactly by Tournefort in Comm. Ac. R. Sc., An. 1707, pag. 72.

Observation II.

On the fifth of November of the same year (1718) I took a piece of Melon (Pepo oblongus, C.B.Pin., 311) about four inches long and two inches wide and thick. Next, with a very soft brush, I collected from some other place the seeds from the dark sparkling heads of Mucor.[1] I then smeared them on to the surface of the piece of melon on one side only, and put it in a place in no wise exposed to wind or sun. On the tenth of the same month, the infected part appeared everywhere white and strewn with a very thin down, like white cotton, which on the twelfth attained almost an inch in height and assumed a greyish colour; and some of the filaments of the down began to appear with white heads. On the fourteenth, the other filaments bore heads of the same kind. Finally, on the fifteenth, all the heads had become black, and after that the seeds came to maturity.

Observation III.

With the seeds which had been produced in the heads of the Mucor in the previous experiment, on the sixteenth day, I smeared another portion of the same melon on one side, and on the other side I placed the seeds of the capitate Aspergillus with glaucous heads and rounded seeds.[2] On both sides, within the same interval of time as I have mentioned above, they sprang up, grew in the same manner as before, and produced seed after their kind. When I had done this several times, always using those seeds which each new crop of plants produced in its turn, I still observed no difference in the plants which sprang up.

Observation IV.

On the sixth day of December, I took another piece of the melon of the same size and shape as before. In it I made five hollows, distinct from one another, and in them I placed a small piece of a fig infected with Mucor whose black and shining heads were already ripe. On the eighth day, many of the Mucor plants had bowed their heads;

[1] Probably *Mucor Mucedo* Linn. *Vide* Plate IV, Figs. A and B. (Micheli, Tab. 95, Fig. 1.)

[2] Probably *Aspergillus glaucus* Link. *Vide* Plate IV, Fig. D. (Micheli, Tab. 91, Fig. 1.)

others were lowered around the holes where they had deposited seeds. Then, on the twelfth day, the whole surface of the piece of melon appeared covered over by the Mucor which, on the eighteenth day of the same month, brought its seeds to maturity. On the nineteenth day of the month, on certain parts of the surface of the above mentioned piece of melon, there appeared a white down, but in other places down of an ashen hue, arising from seeds which had fallen by chance from elsewhere on the melon. On the twentieth day, these grew up and one turned into Botrytis,[1] branched, grey-coloured, with round seeds; the other into the capitate Aspergillus[2] with glaucous heads and round seeds; but the black ones produced from seeds placed there by us forthwith perished.

Observation V.

On the fourth day of November, I infected the sides of two pieces of the same melon with the seeds of the Botrytis[3] which was branched and grey with round seeds. One of these pieces, I placed in a forcing house; the other in a small room with the window open. On these two pieces, on the seventh day, and on the same two sides which had been covered by seeds, granules appeared everywhere, like those which one may observe on the skin of what we commonly call shagreen (*sagri*), or rather a piece of pear which has been cut open for some days, but more sparsely than these. On the eighth day, these grains developed into very minute and almost imperceptible down, and especially those which were observed on the piece of melon which had been placed in the forcing house. On the evening of the ninth day, on both sides of the pieces, this down had much increased, so much so that they appeared as if covered with frost, or as it were by nitre which comes out on walls. The upper part of each piece of melon which had not been inoculated with the Botrytis seed was still intact. On the thirteenth day, the down on both pieces, at the infected spots, had produced heads which changed to a glaucous colour not differing from that of the heads from which I took the seeds, while not even a tiny plant of a second species of Botrytis or of Mucor had appeared. Howbeit, on the upper part of the piece of melon not placed in the forcing house, certain masses of white down had arisen, which on the eighteenth day

[1] Probably *Botrytis umbellata*, Fr. *Vide* Plate IV, Fig. G. (Micheli, Tab. 91, Fig. 2.)

[2] Probably *Aspergillus glaucus* Link. *Vide* Plate IV, Fig. D. (Micheli, Tab. 91, Fig. 1.)

[3] Probably *Botrytis umbellata*, Fr. *Vide* Plate IV, Fig. G. (Micheli, Tab. 91, Fig. 2.)

developed into true plants, on the twentieth day came to maturity, and then Mucor was revealed with black and shining heads, no one having planted it, but the seeds having fallen there by chance.

Observation VI.

On the first day of November, I infected another piece of the melon with the seed of the capitate Aspergillus which has spherical and glaucous heads.[1] On the fourth dav I observed no change. On the evening of the eighth day, the surface of the melon had a granular appearance similar to that already mentioned for the pear and the skin of shagreen (*sagri*), so that, on account of the abundance of the flakes of the investing down, it seemed like frost. On the thirteenth day, the down had grown and come to its final perfection, for it put forth heads and turned into plants of its own kind: and on the eighteenth day it disappeared. Howbeit, on a portion of the infected melon of very small extent which had not been inoculated with the seed of Aspergillus, another kind of plant was produced which showed itself clearly on the twenty-fourth day and came to maturity. It was indeed the branched, grey Botrytis with round seeds.[2] On the twenty-seventh day, in certain places where the (capitate) Aspergillus already on the eighteenth day had come to perfect maturity, there appeared the very slender, white Aspergillus which is branched like Gramen Dactyloides, and has round seeds.[3] Both these plants had sprung from seeds which had fallen on the piece of melon by chance.

Observation VII.

On the thirtieth day of December, I took a piece of the melon and shaped it into a triangular pyramid.[4] Then, choosing a piece of a quince and also of an almost ripe pear, commonly called *Spina*, I formed them into truncated pyramids, with their apices removed, giving the piece of quince a pentagonal, and the piece of pear a hexagonal base.[5] On the individual faces of the pyramids, I sowed the seeds of Mucor, Aspergillus, and Botrytis, keeping each kind separate,

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[1] Probably *Aspergillus glaucus* Link. *Vide* Plate IV, Fig. D. (Micheli, Tab. 91, Fig. 1.)

[2] Probably *Botrytis umbellata* Fr. Illustrations *loc. cit.*

[3] Probably *Penicillium digitatum* Sacc. *Vide* Plate IV, Fig. E. (Micheli Tab. 91, Fig. 3.).

[4] *Vide* Pl. IV, Fig. J.

[5] *Vide* Pl. IV, Figs. K and L.

so that on the piece of melon I had placed three kinds, on the quince on five sides five kinds, and lastly on the pear on six sides six kinds, just as is shown in the Plate of Mucor at the letters A, B, and C.[1] All these species of seeds began to germinate from the fourth to the fifth or sixth day of the month, as I observed. They developed into plants according to their seed, of which some attained to their maturity on the tenth day, others on the twelfth, others on the thirteenth, and finally others on the fifteenth: and they produced the seeds of their kind. I kept these seeds separate, and again and again planted the seeds produced in like fashion from them; and then I always observed the same mode of growth in them, not in one trial only but however often and whenever I attempted it, without any difference whatsoever other than in the rate of growth or in the earlier or later ripening. These discrepancies could arise from various causes, perhaps from the difference in the time of the year, the place, or the structure of the substrata, or because the seeds were too ripe or immature.

At the present time, in tracing out the life-history of a fungus, we sow single spores in a sterilised nutrient medium and thus obtain pure cultures. The progress of development is then watched step by step with the microscope, so far as is necessary, until a new crop of spores is produced. In particular it was by the successful employment of this method that Brefeld and other modern investigators have taught us so much. Micheli, on the contrary, made what we may call *mass experiments.* He did not sterilize his nutrient medium, but by cutting a piece out of a fresh melon or quince or pear he obtained a substratum which was practically sterile. By sowing the spores of his Moulds in thousands, he obtained a crop of new plants which simply swamped any other weed-fungi which might have become planted by accident.

The possibility of the fall of invisible spores upon a culture medium from the air, which may germinate and produce plants, was fully realized by Micheli as his remarks in his Observations IV, V, and VI show. The way was thus prepared for the final overthrow of the theory of spontaneous generation by Pasteur one hundred and fifty years later.

The establishment of the true origin of fungi by means of the highly original and ingenious experiments recorded in his *Nova Plantarum Genera* will always entitle Micheli to a place in the front rank of the founders of mycology.

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[1] In my Pl. IV, at J, K, and L.

Explanation of Plates I, II, III and IV.

Illustrating Professor Buller's Address on Micheli and the Discovery of Reproduction in Fungi.

All the figures in the following plates are taken from Micheli's *Nova Plantarum Genera* (1729) and have been copied and arranged by A. H. R. Buller.

Plate I.

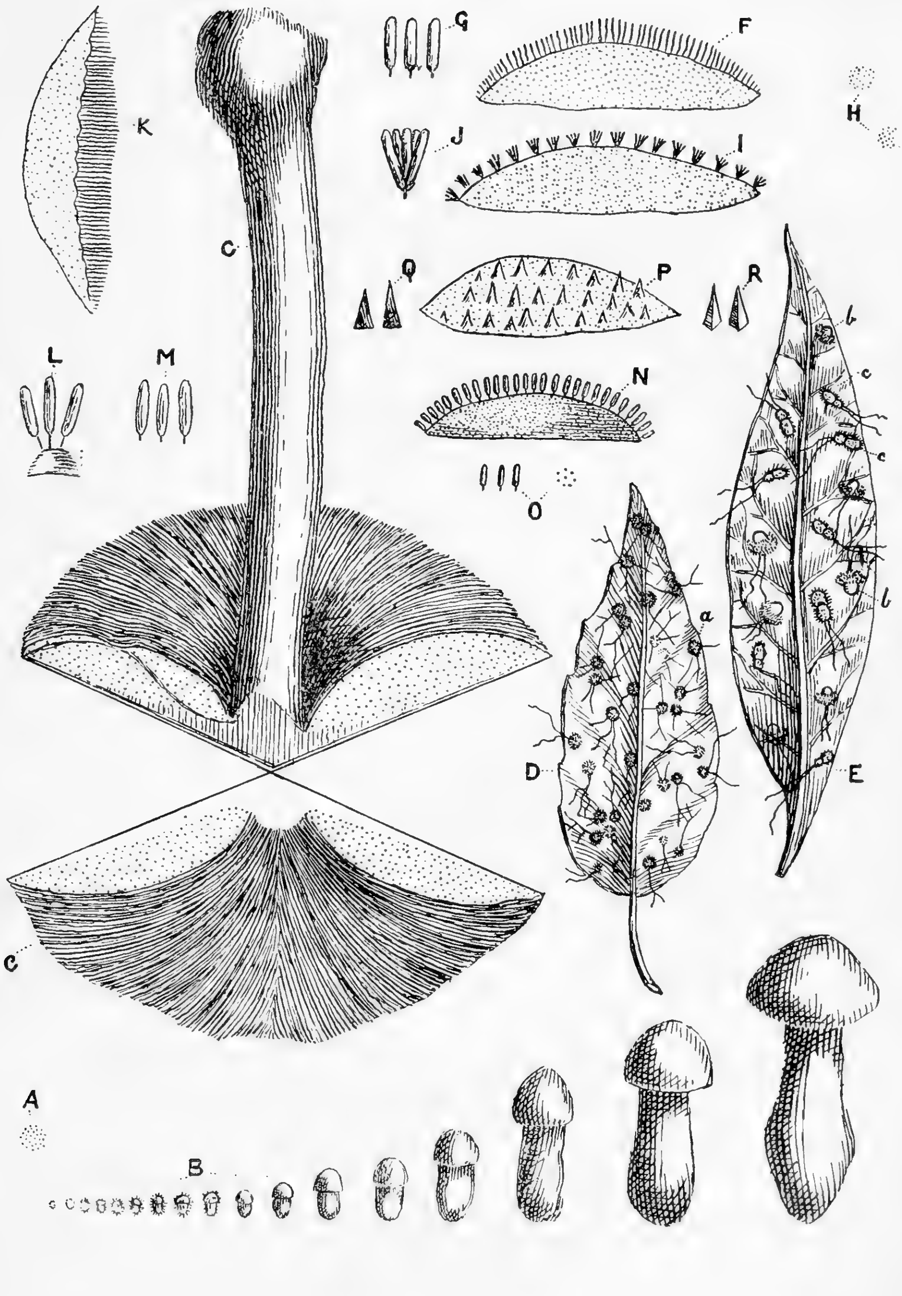
Drawings illustrating reproduction in laminated Hymenomycetes. A, isolated spores; B, seventeen developmental stages; C, a full-grown fruit-body with the pileus cut in two showing the spores (*seeds* of Micheli) on the gills; D and E, two leaves showing three stages, *a*, *b*, and *c*, in the development of a fungus. F. I, P, N, and K, isolated gills of various fruit-bodies all bearing spores: in F, P, N, and K, the spores are scattered, but in I they are in groups of four. In F, K, and N, there is a fringe of isolated "flowers" on the free gill margin, whilst in I the "flowers" are in small tufts. The "flowers" of F are shown magnified at G, those of K at L and M, those of I at J, and those of N to the left of O. The gill P is bearing cystidia (*transparent bodies* of Micheli) and spores; Q, two conical cystidia; R, two pyramidal cystidia. H, spores from the gill F; on the right of O, spores from N. A-C, F-J, P-R, from Micheli's Tab. 73; D, E, from Tab. 77; L-M, from Tab. 76: N-O from Tab. 65.

Plate II.

Drawings illustrating reproductive organs and spores in Boletus and Hydnum. A-H, Suillus (=*Boletus edulis* Fr.) A, the pileus of a fruit-body cut in two to show the structure: the layer of tubes at *b* is shown as easily separating from the flesh at *a*. B, a single tube. C, several tubes adhering together. D, a tube cut open to show the spores (*seeds* of Micheli). E, isolated spores from a tube. F, showing spores at the mouth of a tube, as seen with the microscope. G, an inverted tube showing six "flowers" at its mouth. H, isolated "flowers" consisting of a single filament, as seen with the microscope. I-K, Erinaceus (=*Hydnum repandum* Fr.). A fruit-body inverted to show the teeth. J, two teeth. K, spores from the teeth. A-H from Micheli's Tab. 68; I-K, from Tab. 72.

Plate III.

Figures illustrating various fungi with their spores. A, Mucilago (a plasmodium on a leaf). B-E, Clathroides (=*Arcyria punicea* Pers.); B, fruit-bodies natural size; C and D, the same enlarged,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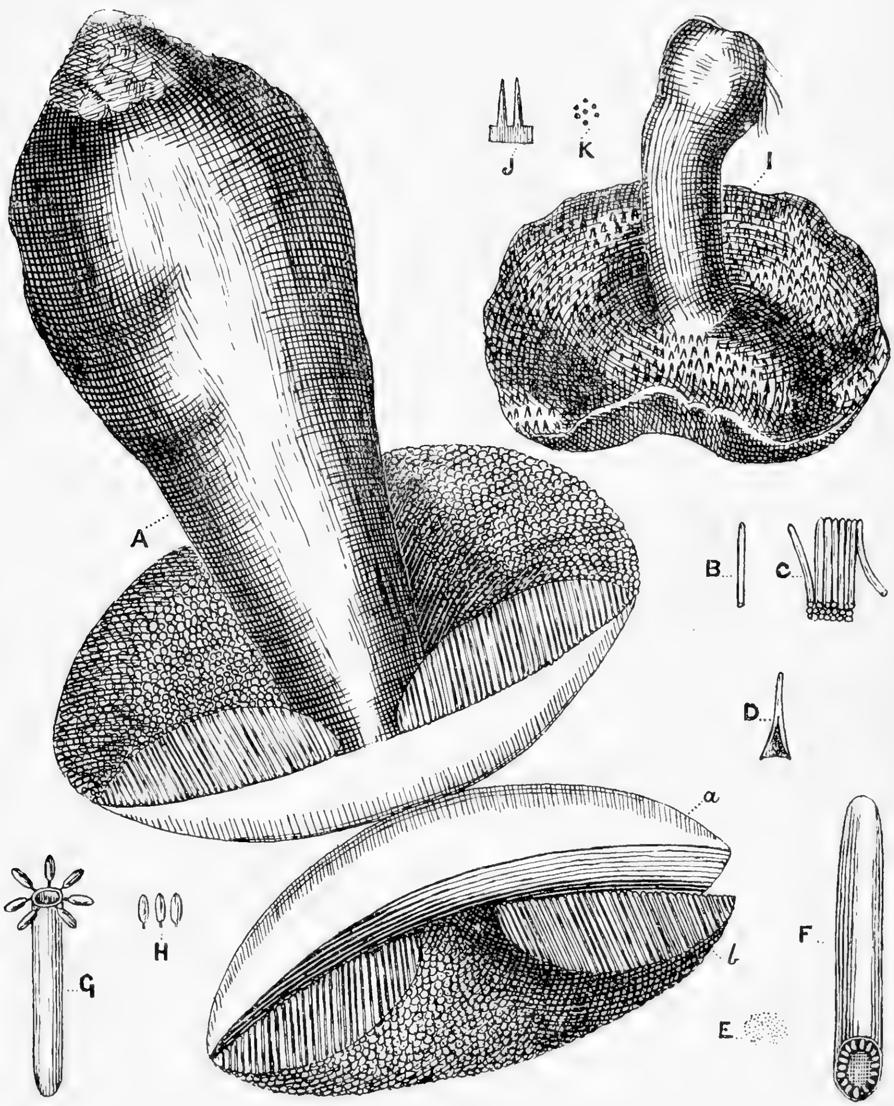
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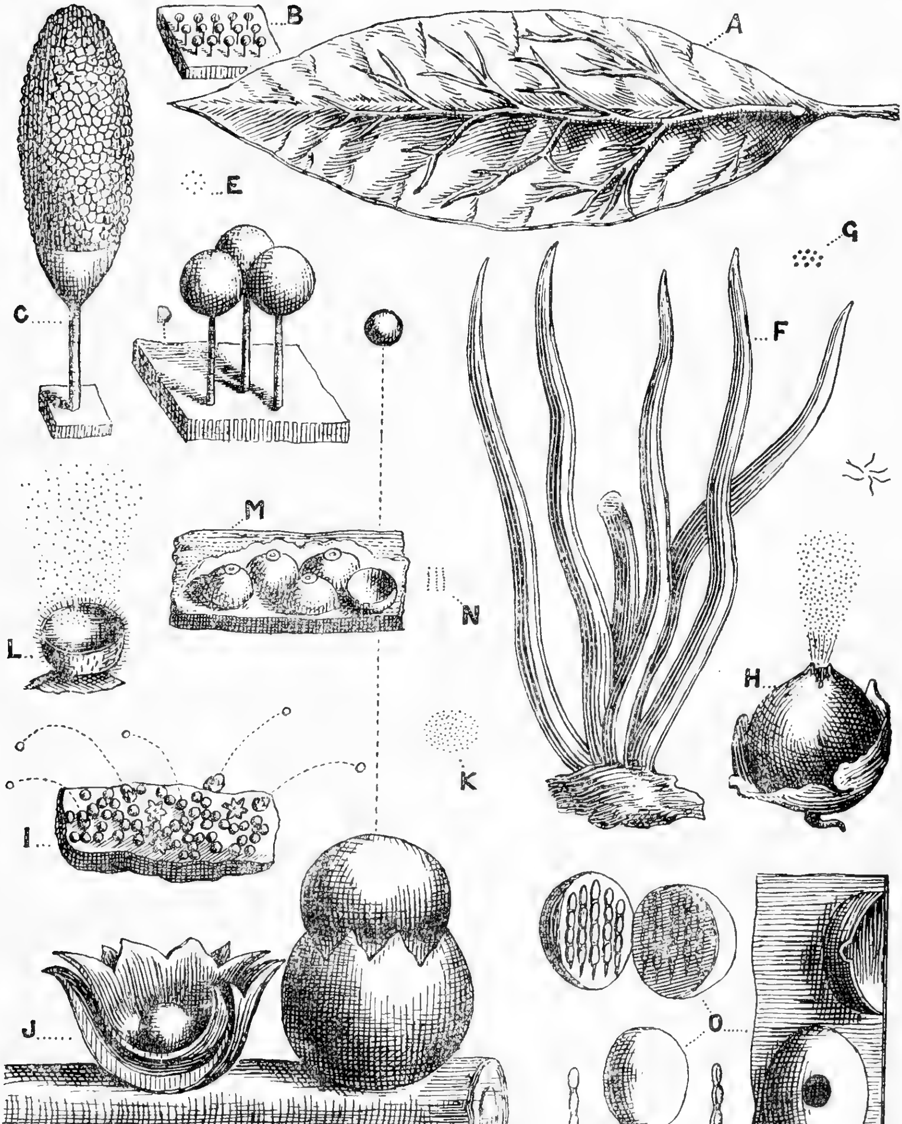
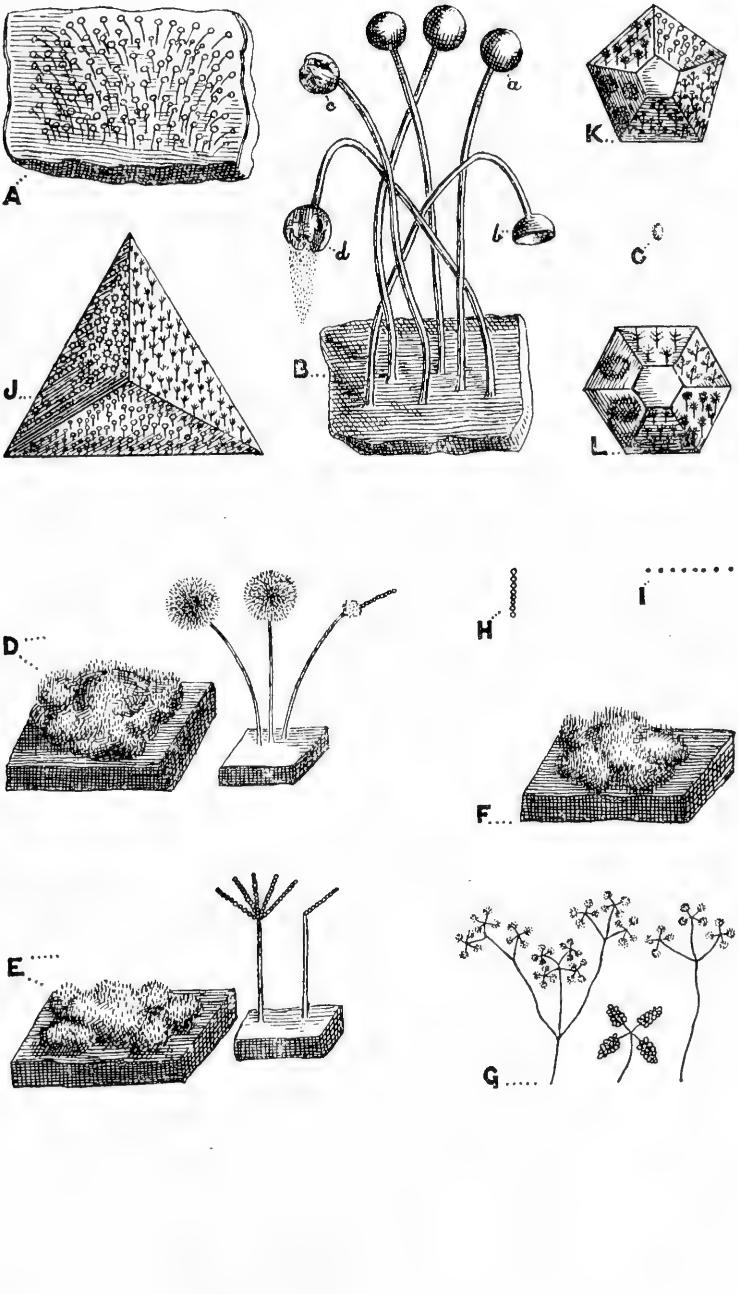
PLATE III.

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with C exhibiting the expanded capillitium network; E, some of the spores (*seeds* of Micheli). F and G, Clavaria (=*Clavaria fragilis* Fr.); F, fruit-bodies; G, spores. H, Lycoperdon (=*Lycoperdon plumbea* Fr.) with spores coming out through the stoma of the endoperidium; six capillitium fibres shown above. I-K, Carpobolus (=*Sphaerobolus stellatus* Tode); I, fruit-bodies natural size on a piece of wood, the dotted lines indicating the direction of flight of several peridiola; J, part of a drawing showing two fruit-bodies on a stick enlarged, on the left a section exhibiting the two layers of the stellate peridium containing a peridiolum before discharge, on the right a fruit-body in which the inner layer of the peridium has suddenly become inverted and has shot forth the peridiolum as indicated by the dotted line; K, spores from the interior of a peridiolum. L, Fungoides (=*Peziza* sp.) with the spores puffing out into the air. M, N, Lichen-Agaricus (=*Sphaeria* sp.?); M, five perithecia much enlarged; N, three rows of eight spores each, each row having doubtless been seen in an ascus. O, P, Lichenoides (=*Pertusaria communis*?), enlarged drawings from a lichen; O, some perithecia showing the stomata and asci; P, two isolated asci. A, from Micheli's Tab. 96; B-E, from Tab. 94; F, G, from Tab. 87; H, from Tab. 97; I-K, from Tab. 101; L, from Tab. 86; M, N, from Tab. 55; O, P, from Tab. 56.

PLATE IV.

Figures illustrating the Moulds and material which Micheli employed in his classical experiments on reproduction. Macroscopic and microscopic appearance: A and B, of *Mucor vulgaris, capitulo lucido, per maturitatem nigro, pediculo griseo* (=*Mucor Mucedo* Linn.); D, of *Aspergillus capitatus, capitulo glauco, seminibus rotundis* (=*Aspergillus glaucus* Link); E, *Aspergillus albus, tenuissimus, graminis dactyloides facie, seminibus rotundis* (=*Pencillium digitatum* Sacc.); and F, G, *Botrytis ramosa, cinerea, seminibus rotundis* (=*Botrytis umbellata* Fr.). In B: *a*, an unopened *capitulum* (=sporangium); *b* and *c* show the internal cavities, and *d* the *semina* (=spores) emerging. C, the *placenta* (=columella) of a capitulum. H, a chain of *semina* (=spores) from an Aspergillus. I, the *semina* separated. J, a piece of melon in the shape of a triangular pyramid on the faces of which three different kinds of Moulds (B, D, and G, Mucor, Aspergillus, and Botrytis) were sown and have sprung up. K, a piece of quince in the form of a truncated pentagonal pyramid, with five crops of Moulds. L, a piece of a pear in the form of a truncated hexagonal pyramid with six crops of spores. A-C, J, K, L, from Micheli's Tab. 95; D-I from Tab. 91.

The Cretaceous Sea in Alberta.

By D. B. DOWLING, B.Sc., F.R.S.C.

(Read May Meeting 1915.)

From a very early period the region embraced by the great plains was covered by the sea. In Carboniferous times land in the form of an island appeared in this sea within the limits of what is now the Interior plateau of British Columbia. It was maintained and gradually increased in area by a continental uplift and by other earth movements, the result of tangential strains which were quite pronounced during Jurassic times. This general uplift culminated in the withdrawal of the sea from the mid-continental area, as is shown by deposits of continental formation which occur in the early part of the Cretaceous period. It was not until Middle Cretaceous times that marine deposits in Alberta again appear. The re-entry of the sea was probably not due to a relaxation of the crustal strains but to the weakening of the arch between the western highlands and the old continent by unequal loading. This had been produced by the greater deposition over the submerged area which was near the newly elevated land areas or islands to the west, as compared with that from the older land surface which is now called the Canadian Shield. This unequal loading caused a deformation of the arch and with increased tangential strain, a downwarping of the extreme western area commenced. Through early Cretaceous time the trough thus formed was kept filled and maintained as a land area by the coarse material brought from the highlands to the west; but the tangential stresses to which the western part of the continent had been subjected lessened throughout the latter part of Cretaceous time and subsidences of more or less amount are found to have occurred—most noticeably in the interior of the continent. With this subsidence, mention may be made of volcanic activity in at least one area in the western part, as shown in the Crowsnest volcanics near Blairmore. We have thus the advent of the Cretaceous sea which covered a broad band stretching from the Arctic ocean to the Gulf of Mexico. The notes herewith submitted refer particularly to the western limits of this sea in the province of Alberta and to a suggestive correlation of the deposits there found.

As the sea was a mere flooding of the continental shelf it cannot be considered as having attained any great depth; but even with a shallow muddy sea the arrangement of the littoral deposits along its margin must have conformed to the general laws of distribution though the width of the zone of intermittent submergence must have been at times very great and shore deposits or near-shore deposits were projected far out with every important period of uplift which affected the depth of the sea. Attempts at correlation by means of the fossil remains have been successful to a certain extent; but the change in fauna and flora during the latter part of Cretaceous time was not very marked, so that much of this evidence in fixing the age of the various beds lacks the definiteness that is desirable. This is particularly noticeable in the brackish-water fauna of the shore deposits of the edge of the Pierre sea as found in the Belly River and Edmonton formations.

The fluctuations of the sea margin are taken to be an expression or reflection of the earth movements in the comparatively new land areas to the west and, therefore, not liable to be local in character. As the shallow water periods are well marked in the Cretaceous deposits of Alberta a scheme of correlation based mainly on the Palæogeography of the region is submitted. An exact synchronism is not claimed for all the shallow-water deposits here grouped together; but it is claimed that the shallow-water periods are the effects of earth movements which must have been of considerable magnitude and, therefore, they are of more value as time markers than the evidences of subsidences which follow, because the latter are due in a great measure to the shifting of load, the accomplishment of which may have occupied various intervals of time.

The marine Cretaceous deposits in the central part of the continent have been divided into two groups, the earlier called the Colorado and the later the Montana. Both groups are made up mainly of dark shales, showing that the sea was muddy and probably shallow. The deposits denoting deeper water, which occur frequently in the central areas, contain occasional calcareous beds, but in general the sea-water was plentifully supplied with arenaceous material.

THE COLORADO GROUP.

This series resting on the fresh-water deposits of the earlier Dakota formation is divided into two main divisions, the lower, the Benton shales, which are found very widely distributed, thus marking possibly the greatest extent of the Cretaceous sea (Plate I), and the upper, the Benton-Niobrara (Plate III). In the upper division the name Niobrara has been applied to a series of clear-water calcareous beds. These are recognized in the eastern division in Manitoba. In the sections in the middle portion of the plains there is no distinct divisional line, clear-water portions occurring all through the middle of the Colorado group and sometimes well down in what would seem to be the Benton. This is well shown in the cores obtained from the Moosejaw well. In Alberta there can be no division of the Colorado on lithological grounds.

In a discussion of the formation near the typical locality of the Benton formation, T. W. Stanton says,[1] "In the neighborhood of Fort Benton and in all the region now under investigation there is no limestone corresponding to the Niobrara, and there is no evidence of an erosion interval or unconformity; it is probably represented by shales or sandstones. The Palæontologic indications are that in this region the Niobrara is represented by dark shales not separable stratigraphically from the Benton. If this is true the Benton shales of the upper Missouri represent more than the formation known by the same name in Nebraska, in Colorado east of the Front Range, and at other places, and really include the whole of the Colorado group so that it is more appropriate to call them Colorado shales, as Weed has done in the Fort Benton folio."

In the Alberta exposures the only evidence of a possible subdivision other than by a critical study of the fauna is the occurrence of thin sandy layers about the middle of the formation, which near the mountains in many places develop into quite thick members (Plate II). In the Blairmore section the sandstone bed is used as a horizon marker and is overlain by sandy shales 150 feet thick. It is here below the middle of the formation, the upper part of which is thickened locally. Farther north, sandstones in the Benton are found on the Athabaska at the Grand rapids and a similar series on Peace river. The Peace River sandstones are observed to thin out materially toward the east and finally die out. These sands may not denote a divisional line between the beds which are elsewhere called Benton and Niobrara; but they seem rather to denote a period in this great sea when the western margin was shifted to the east for a short period, or a slight shallowing of the sea accompanied by renewed denudation of the land area to the west. This is the only indication, in the deposits, of a possible western limit to the first advance of the Cretaceous sea. The mid-Colorado sands of the Peace and Athabaska rivers are curiously suggestive of an elevation of the land area within or near which the highest peaks of the Rocky mountains are located, and suggest not so much the early building of these masses as an early lifting and formation of a land area previously covered by the unconsolidated continental deposits of the early Cretaceous and the rapid denudation and re-assortment of this loose material on the sea floor.

[1] Geology of Judith River beds. Bull. U. S. G. S. No. 257.

Other sandstones at the base of the formation may owe their marine deposition to this same reassorting action of the incoming sea on the loose material covering the consolidated rocks. Few exposures of these lower beds occur; but the evident marine character of some of the upper members of the Tar sands on the Athabaska may have been due to this action.

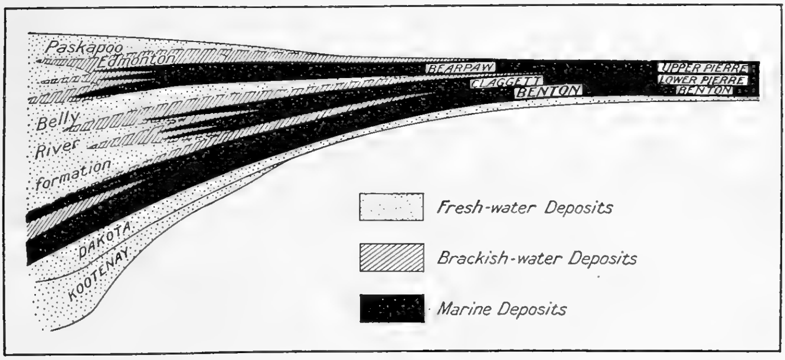
The close of the Colorado stage was marked by a change in the fauna and it has been suggested that there was also an erosion interval. This seems not to have been definitely proven; but erosion by currents may account for variable thicknesses in the thin sands at the outer edge of the covering shore deposits. The extinction of several species of marine life may also be taken as a proof of the almost complete retreat of the sea; or the change of fauna may have some connexion with the fact that the Colorado sea communicated with Arctic and subtropical waters, while during the succeeding Montana submergence it is doubtful if any northern waters were admitted.

THE MONTANA GROUP.

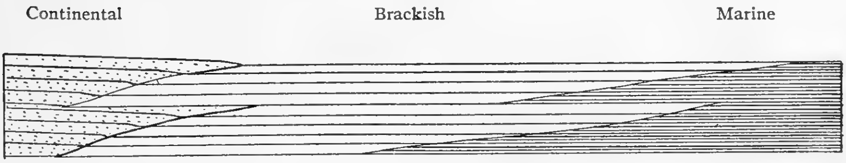
The deposits of the marine period which succeeded the Colorado stage have been classified in ascending order as the Pierre shale and the Fox Hills sandstone. The succeeding brackish water member, the Lance, owing to the inclusion in it of marine beds, is held to be of Cretaceous age. It forms in northern Dakota the latest deposits in the near vicinity of salt water and resembles the shore deposits of Alberta. As it contains a vertebrate fauna of more modern type than those of the latest brackish water beds of Alberta, the Edmonton, its position above the Montana beds, the Fox Hills sandstone, would intimate that in the absence of the Fox Hills in Alberta the top of the Montana should include at least the Edmonton.

But as there are beds beneath this latter formation which carry a Fox Hills fauna and have been correlated with it the question has arisen as to the possibility of the Edmonton beds being Laramie, as originally described in the reports for 1882-86. The name Laramie was then used in a broad sense to denote beds that formed a transition series between the Cretaceous and Tertiary. Latterly the name has been restricted to a single area and a set of beds whose position relative to the top of the Cretaceous is not firmly established. The definition Laramie for any deposits in Canada is, therefore, of little value and the only attempt at a correlation of the Edmonton with other beds will be to show its relation to the highest beds of the Cretaceous in the eastern areas such as Saskatchewan and Dakota.

Some suggestions that may help clear the point can be drawn from a study of the section of the deposits as found across the plains, which is here represented in a general diagram instead of a table of formations.



Idealized west-east section of the Cretaceous measures at the close of the marine period.



In the above diagram the vertical scale assumed is much greater than the horizontal. The representation of a succession of beds thickening westward, has emphasized the downwarping of the crust that no doubt occurred. Later, during the mountain building period, a time of folding and uplift, this movement was reversed and much of the evidence of former subsidence and deposition was removed by erosion. Sufficient exposures, however, remain to establish the general fact as well as to give an indication of the limits to which the sea extended.

GENERAL REMARKS ON CORRELATION.

Deposits of marine origin were no doubt formed at the same time as shore-wash brackish-water and even freshwater beds on the adjoining land areas. The correlation of individual members or parts would, therefore, depend altogether on whether the deposition was during the advance or retreat of the sea and on the relative speed of the two movements.

The Advance Movement.

In the two periods during which an advance of the sea is recorded the surface of the land area was probably well covered by a dense vegetation. The earlier advance at the close of the Colorado stage was not across a very wide area in Canada. In Montana a somewhat broad land area seems to have risen to sea-level. In the second advance in which the upper part of the Belly River series was covered, a wide area of this surface had been for a long time slightly above the sea and is now marked by a very important coal horizon, This material had been but lightly covered by coarse grained deposits previous to the advance of the sea. There is little trace of brackish-water beds between these coal seams and the marine shales. The surface indicates a long period of tranquillity in which a belt at least 150 miles in width settled to about sea-level. The advance of the sea across this plain with but slight further subsidence would be rapid, if not there should be some erosion or further deposition on the original surface. Evidences of this have not been observed except in the western portion of the advance, that is, in the foothills.

The Retreating Movement.

After a period of subsidence, the erosion of the land was revived by a further elevation which stimulated the shifting of the detritus seaward. This elevation seems to have been of some magnitude as it resulted in the return to shallow water conditions over a wide area in the marine basin which was at some distance from the country affected by the maximum uplift. The deposits which then covered the marine silts in both of the retreating movements of the Montana sea were distributed in brackish water. The period represented by these conditions was not of short duration. In the first retreat the brackish-water beds of the yellow portion of the Belly River formation are in places about 300 feet thick. In the second or final retreat the brackish-water beds are found at intervals throughout 700 feet of beds. It thus seems that while a vast amount of detritus was carried eastward and many coal seams were formed on the flat plains (of the Edmonton and Belly River formation,) the sea had not made much progress in its retreat, so that unlike the advance movement the retreat was very slow.

Considering now the correlation of the shore deposits with those of land or marine formations it would seem that the deposition might, on the above assumption, i. e. slow retreat and rapid advance, be illustrated by diagram somewhat as below.

On the assumption that the advance of the sea was rapid the shore deposits are to be considered as belonging, in age at least, to the shales which they appear to overlap rather than to any part of the shales which cover them.

Going back to the question involving the age of the Edmonton, if the brackish water beds shown in the upper part of the first diagram are considered, their position conforms in the western part to that of the Edmonton, the upper shale to the Bearpaw and the upper measures at the eastern end to the Fox Hills sandstone. In each case the marine sands representing the foreshore deposits vary in age of deposition from the advance to the completion of the retirement of the sea. At the eastern end the upper member only corresponds to the typical Fox Hills formation in age. In the western section marine sands with a Fox Hills fauna are found at several horizons, generally at the base of the shore formations. Thus we have Fox Hills at the base of the Lower Pierre, probably also at the base of the Upper Pierre, and also beneath the Edmonton. The use of the term Fox Hills in the nomenclature of any western marine sands would be doubtful, if not improper, except in a descriptive sense. The correlation of the western brackish water beds such as the Edmonton formation with any but the marine part of the eastern section cannot, therefore, be made without grave danger of error on account of the marine character of some of the upper members of the Edmonton. The evidence of vertebrate remains places the Edmonton well below the Lance and, therefore, it was formed at least as early as the close of the Pierre.

The inclusion of the Edmonton in the Montana is assumed and with it a probable series of freshwater beds to the west of the brackish-water deposits which must have been formed at the same time beyond the limits of the sea.

The division of the Montana group into Pierre and Fox Hills is applicable only to the eastern sections. The marine shales in Alberta containing a Pierre fauna are found in two distinct beds or formations separated in nearly all cases by shore deposits. The names in use at the present time for these portions of the Pierre are Bearpaw for the upper and Claggett for the lower. As the shore deposits, especially during the retreating stage of each of the seas here indicated, form a varying proportion of the deposits of each stage, the far western marine beds may be assumed to represent but a portion of the deposition. Similarly to the east of any trace of shore formed beds, the shales present represent a longer time interval than the sum of the Claggett and Bearpaw shales, as represented in Alberta, although the thickness of the deposits may be less. The divisions adopted here are, therefore:

Upper Pierre shore and marine deposits, i.e. Edmonton and Bearpaw.
Lower Pierre shore and marine deposits, i.e. Belly River.

Later investigation may correlate these with the Odanah and Millwood shales of Manitoba.

LOWER PIERRE.

The first advance of the Pierre sea although reaching probably farther north than in the second return did not in southern Alberta and northern Montana advance as far west. In the foothills there are areas giving sections of the shore deposits of that time in which but traces of the marine beds of the early invasion are to be found. This section, including all the lower Pierre shore deposits, is undoubtedly the group described by Dawson as the Belly River series. In the eastern exposures of the formation near Milk river the lower Pierre marine shales cut into the Belly River series and only about half of the section is exposed. The exposures of the Belly River rocks occurring on the South Saskatchewan in the vicinity of the mouth of the Bow river, contain marine types of fossils in a dark clay shale that seems to be a portion of the Lower Pierre deposit. As this is included in the Belly River formation it seems that both shore-formed beds and those of marine deposition, within certain limits, are to be considered as belonging to the Belly River formation.

Lower Pierre (Belly River) Lower Shore Deposits.

The first advance of the Pierre sea over the surface covered by the Colorado deposits may have in some places been slow enough for the denudation of some of the surface, since denudation of the upper beds of the Niobrara is recorded by Meek and Hayden.[1]

There is no mention of this erosion having been found in the western exposures and there seems to be no evidence of the time interval except perhaps the change in fauna. The advance seems to have been checked before it reached its farthest bounds or occurred at a time when much coarse-grained material was being carried to the western margin from the land area. These shore deposits where they are best developed have all the characters which point to their being deposited in a slowly receding sea and again quickly covered (see Plate IV).

[1] See p. 65, Bull. U. S. G. S. No. 257.

In Montana the widest extent of this early recession is marked by the Eagle sandstones. The lower members are of marine and brackish-water deposit. The middle is made up of sands and clays with evidence of land plants and an occasional coal seam. Sands occur again near the top covered by clays of brackish-water origin. Its continuation westward, the Virgelle sandstone, is somewhat similar, but has perhaps less evidence of fossils. In Alberta the castellated rocks of Milk river occupy this horizon. The surface exposures of the upper beds show signs of freshwater deposition. The base of the formation on Rocky Spring plateau shows a gradation of heavy sandstone beds with shale zones. These have not been carefully examined for fossils but they rest on undoubted Benton shales. The series in northern Montana possibly contain about 300 feet of beds. The Cardium sandstones of the Bow River section are thin in comparison with the shore deposits of this horizon in the vicinity of the Boundary line and are probably marine throughout. Their position according to Cairnes[1] is just above the Benton shales which here seem to constitute the whole of the Colorado group. In the foothill exposures north of the North Saskatchewan river the shore formations of this horizon form the lower part of the Brazeau formation, including probably about 200 feet of sandstones. We thus, in tracing this early shore-line northward, arrive at the sandstones on the Peace river named the Dunvegan sandstones. These show evidences of estuarine, freshwater, and terrestrial conditions throughout, and resemble in many particulars those of the Eagle and the castellated sandstones of Montana and southern Alberta although they are of greater thickness and have many more coal seams.

These several examples of the early shore or delta deposits, if the probable outline of the shore-line is considered, are found to constitute two seaward projections, the building of which required the transportation of a vast amount of material. The source of this will naturally be from points up the land slope from each and suggests two areas of recent elevation and denudation, one near the boundary line, the other north of the Athabaska river.

Lower Pierre (Belly River) Marine Deposits.

The marine shales which form the base of the Pierre in the east, here overlie the shore deposits, but do not continue far past the point probably reached by the first inrush of the sea in the south. The western extension seems to have been reached at Milk River ridge and at the southwest corner of the Porcupine hills (see Plate V).

[1] Memoir 61, G. S. C.

Farther north the shales are found in the foothills west of Calgary while indications of shore deposits intercalated in the beds in the Bighorn basin show an approach to a shore line in that area.

In the Montana section these deposits are called the Claggett shales and, although containing some sandy material, are mainly of dark grey shale with many clay-ironstone nodules. The formation is very much of the same appearance as the Pierre of the plains and is particularly rich in the smaller marine invertebrates. The thickness of the deposit varies from a maximum in the east to a minimum in the west, but it is nearly 500 feet in thickness at the longitude of Medicine Hat. The formation in the south was first described at Fort Claggett on the Missouri river and the formational name has been retained in the nomenclature of southern Alberta. In the foothills north of the North Saskatchewan river the middle part of the Brazeau formation is made up of shales and thin sandstones that suggest a near-shore marine or brackish-water deposit. The upper members are probably of freshwater deposition and as such show the probable beginning of the retirement of the sea. The shales of the Athabaska section show no division between the Colorado and Montana formations, so that the inference is that the upper part of the La Biche shales corresponds to this lower Pierre member. On Smoky river, a southern branch of Peace river, the shore deposits corresponding to the lower member of the Belly River overlie the Benton; but marine shales with a Pierre fauna are found above them. That these shales, called the Smoky River shales, belong to the lower part of the Pierre is evident in the section in the vicinity of Table mountain just south of Pine river. The shales overlying the coal-bearing Dunvegan sandstones are estimated by G. M. Dawson as being 350 feet in thickness[1] in the Smoky River section and are overlain by about 1,700 feet of beds in Table mountain. The top members of the Table Mountain section are sandstones 200 feet thick and probably are locally hardened as they have been removed from the country to the east. In the plateau country through which the Wapiti river has cut a channel just to the southeast, the Wapiti sandstones, apparently not exposed on the slopes of Table mountain below this strong sandstone, cover a large area and have been referred, on account of their coal-bearing character, to the Laramie. This correlation should be revised owing to the uncertainty of the meaning of the term; but in this connexion it should be pointed out that in the beds at the summit of Table mountain marine sandstones appear holding *Inoceramus altus* a species found in the Pierre shales of Wyoming.[2] Therefore

[1] Rep. of Progress 79-80, p. 125B.

[2] Idem. p. 117B.

it would seem that the Upper Pierre near-shore deposits were at one time present over the Wapiti sandstones. This suggests that the section in Table mountain, Pine river, consists of the following series of deposits in descending order:—

1. Marine sands (near-shore deposits of the western edge of the Upper Pierre sea).
2. Wapiti sandstones (shore deposits of the retreating stage of the Lower Pierre sea).
3. Smoky River shales (marine deposits of Lower Pierre sea).
4. Dunvegan sandstones (shore deposits of early Pierre age).

Nos. 2, 3 and 4 on this evidence may be correlated provisionally with the Belly River series of southern Alberta.

Lower Pierre (Belly River) Upper Shore Deposits.

The beds included under this head embrace not only the shore deposits during the retreat of the Lower Pierre sea, but also should include, since they are intimately associated in the same sections, those beds deposited above sea under the assorting action of freshwater streams and lakes (see Plate VI). The lower members of the formation, which on the whole is wedge-like in its transverse section, are mainly of brackish-water deposition and were referred to in the original description as generally yellowish in colour. Freshwater deposits occur in the upper or pale coloured beds although brackish-water forms are found. Coal horizons of economic importance occur at the top and also in the lower members. The estimated thickness for the two classes of deposits must vary with the locality: a maximum for the pale coloured beds may be given as 400 feet, and for the yellow beds 350 feet.[1]

These estimates cannot be added together as it is not known that the division is distinct enough to be recognized in areas remote from each other.

The upper part of the Belly River formation consisting of the shore deposits of the retreating Lower Pierre sea has been correlated by T. W. Stanton[2] with the Judith River formation of Montana. This correlation includes not only a similarity in the faunal remains but also in the character of the deposits and was finally certified by tracing in the field the connecting exposures. Similarly in western

[1] Rep. of Progress, 1882-83-84, pp. 116-117C.
[2] Bull. No. 257, U. S. Geol. Survey.

Montana the Two Medicine formation was traced to the Canadian boundary by Eugene Stebinger[1] and identified with the same beds.

In the mountains and foothills, portions of the lower members of the Belly River series are occasionally found. As these exposures are situated either near or to the west of the farthest advance of the Lower Pierre sea, there is not the same subdivision as on the prairie. In the Allison Creek sandstones of the Crowsnest pass we have apparently continental deposits representing the interval between the Benton and the Upper Pierre that is of the same time period as the Belly River series. Deposits of this nature no doubt were at one time to be found within the area now occupied by the mountains; but nearly all of this has been removed in the mountain building. Remnants remain above the Benton shales of the Crowsnest pass in the Allison Creek formation and on the head-waters of the Oldman river on the northwest branch, Oyster creek. These latter deposits have been referred to the Laramie in the early reports; but they appear to belong rather to the interval just discussed.

At the foothill section on Oldman river, the Belly River exposures are very similar to the Allison Creek rocks except perhaps in the fact that the lower part resembles the castellated sandstones on Milk river. On the Highwood river there is apparently near the base a thin section of shales that may represent the Claggett. The thicker member above may, therefore, be correlated with the shore deposits of the Pale and Yellow beds of the Belly River. Northward from Bow river the upper shore deposits are about all that is in evidence. There are also locations in which the Upper Pierre shales may not be found so that the division between the shore deposits of this horizon and of the margin of the Upper Pierre sea may not be evident. This condition is intimated in the section through the Pine River valley made by Dr. G. M. Dawson in 1879. The sandstones encountered on the eastern slope of the Rocky mountains are thus referred to:—

[2] "While there is no means of arriving at the precise age of most parts of the sandstone series of the Upper Pine river, I see no reason to doubt that it forms the coarse littoral portion of the Cretaceous rocks which spread so widely to the eastward. It seems probable, as more fully detailed elsewhere, that fine shaly materials become increasingly abundant in receding from the mountains, and that the rocks eventually resolve themselves into the subdivisions described below."

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[1] Prof. Paper 90, G. U. S. Geol. Survey.
[2] Report of Progress 1879-80, p. 114B.

One of the subdivisions, the Wapiti River sandstones, referred to above, is here correlated with the upper part of the Belly River. It is a series of sands and shales containing coal seams overlying the Smoky River shales, and is exposed in many stream channels on the plateau cut through by the Wapiti river. This formation has previously been classed as Laramie in age, indicating that it is a series of transition beds from the Cretaceous to the Tertiary. This correlation does not seem to be definite enough since as before noted there are marine deposits above it which would suggest its being nearer in date of deposit to the upper part of the Belly River. Its correlation with the Edmonton has been suggested on account of similarity of deposits. This is equally true of a comparison with the Upper Belly River beds, but the probability of marine water reaching this area decreases very fast after the time represented by the advance of the Upper Pierre sea; that is, the probability of the marine beds above the Wapiti sandstone being of the age of marine beds at the top of the Edmonton is very much less than that they are marine beds earlier than the Edmonton. Beds in the vicinity of Lesser Slave lake hitherto referred to the Laramie may also belong to the top of the Belly River.

UPPER PIERRE.

The deposits of this division are in the main of marine origin. The western margin of the Pierre sea early in the history of this marine invasion, received great masses of detritus from the newly elevated portions of the land area. Following the partial retirement of the early Pierre sea there was another advance (see Plate VII) which appears to have been of long duration judging by the thickness of the fine-grained material deposited. This over a considerable portion of Alberta amounts to nearly 900 feet of grey and dark grey clay shales. The fossils found are of similar types to those of the lower member, the Claggett. In Montana it is called the Bearpaw shale. The name is generally retained in Alberta instead of the Pierre-Foxhill; but for Saskatchewan there is a possibility (in well-sections especially) that the two divisions of the Pierre may not be recognized owing to the lack of shallow-water deposits which elsewhere separate them. The use of the term Bearpaw which is distinctive may find favour for distinguishing these shales throughout Alberta. They are well exposed on either side of the broad anticline which shows exposures of Belly River rocks in southern Alberta. The margin of this sea was well within the foothills of the country near the 49th parallel; but within the present mountains it is not thought that any of the deposits of this period remain from which to infer the original extent. Marine fossils occur in the Bearpaw in the section on Oldman river, but on Highwood river the formation is mostly of dark sandy shales with considerable carbonaceous filaments between the beds and having a coal seam at the base. This possibly indicates an approach here to shallow water and an eastward bend in the shore-line. Whether the area so affected formed a large delta of which this is the southern part is problematical; but it may be remarked that in the North Saskatchewan section these shales are not definitely recognized below the Edmonton outcrops, while the same can be said of the exposures on the upper Athabaska. The reference to these beds in the discussion of the Smoky River shales was in connexion with the finding of *Inoceramus altus* at the summit of Table mountain and was merely an intimation that salt water deposition occurred in that locality after the deposition of the Wapiti sandstones. The northern extension of the Pierre sea is not known. Exposures in the MacKenzie valley and elsewhere in the north show marine beds similar in fossil content and appearance to the Benton shales, but above these, sandstone beds of Tertiary age. There is, therefore, a probability that the Pierre sea advanced from the south and did not cover the northern portion of the continent. The beds at the summit of Table mountain on Pine river may indicate possibly the extreme northwestern limit of this advance.

In the foothills north of the Bow river it is not definitely known that marine deposits of the upper Pierre are to be found. This may indicate land areas there during this last westward swing of the sea coast. The deposits in these localities being of continental formation may show by unconformities the land surfaces of this period or land areas in proximity to sea-level may be marked by a carbonaceous zone indicating the former rich vegetation. The division between the continental formations of the Belly River group and those of the succeeding Edmonton may be difficult to define in the foothills beyond the western limit of the Upper Pierre sea.

UPPER PIERRE SHORE DEPOSITS (PLATE VIII).

In all the sections across the beds remaining above the marine shales of the Cretaceous and now filling the Alberta syncline it is pointed out that a mingling of brackish and freshwater deposits forms the lower members. These must naturally extend westward only as far as the previous marine advance and were laid down on an extremely level plain in shallow water or marsh. From the extent and thickness of these measures the width of this marshy tract was at all times considerable though periodically narrowed by the accumulation of the sediments from the land and widened again by a slight subsidence due probably to surface load. The period was of long duration and allowed of the accumulation in this manner of about 700 feet of sands and clays but also of many coal seams, several of which are of great surface extent and thickness. This is especially true of the coal-bearing zone marking the final deposits at the sea-level stage.

The advance of the shore-line of the permanent land seemed to have been slow through the whole period, as the thick measures periodically submerged extend well under the Paskapoo sandstones of the Alberta syncline and thin out and almost disappear within the space now covered by these Tertiary measures.

In Saskatchewan the beds covering the marine deposits of the Pierre are nearly all of freshwater deposition, so that they are more likely to have been formed after the final retreat of the sea and to be of later age than the brackish-water beds.

The top of the Edmonton formation has been placed at a distinct coal horizon for convenience in mapping; but it appears to be also very near the top of the brackish-water deposition of this period. In southern Alberta there is no formation line drawn. The brackish-water beds form the lower part of the St. Mary River formation. As there is a very broad erosion valley between the exposures of these formations and a possible eastern extension in the table land of the Cypress hills a theoretical correlation is all that is attempted. The marine Pierre shales are overlain in the Cypress hills by only about 150 feet of marine sands which are of varying thickness. These although probably more nearly allied to the Fox Hills sandstones are the extreme limits of sands of marine deposition and correspond to the brackish-water beds to the west (Plate IX) and are covered by continental deposits which could not be transported there until general land conditions prevailed or until the Tertiary uplift. The correlation of the Edmonton with these land-formed beds could not be made but must be confined to beds beneath, that is, to the marine sandstones and shales of the top of the Pierre.

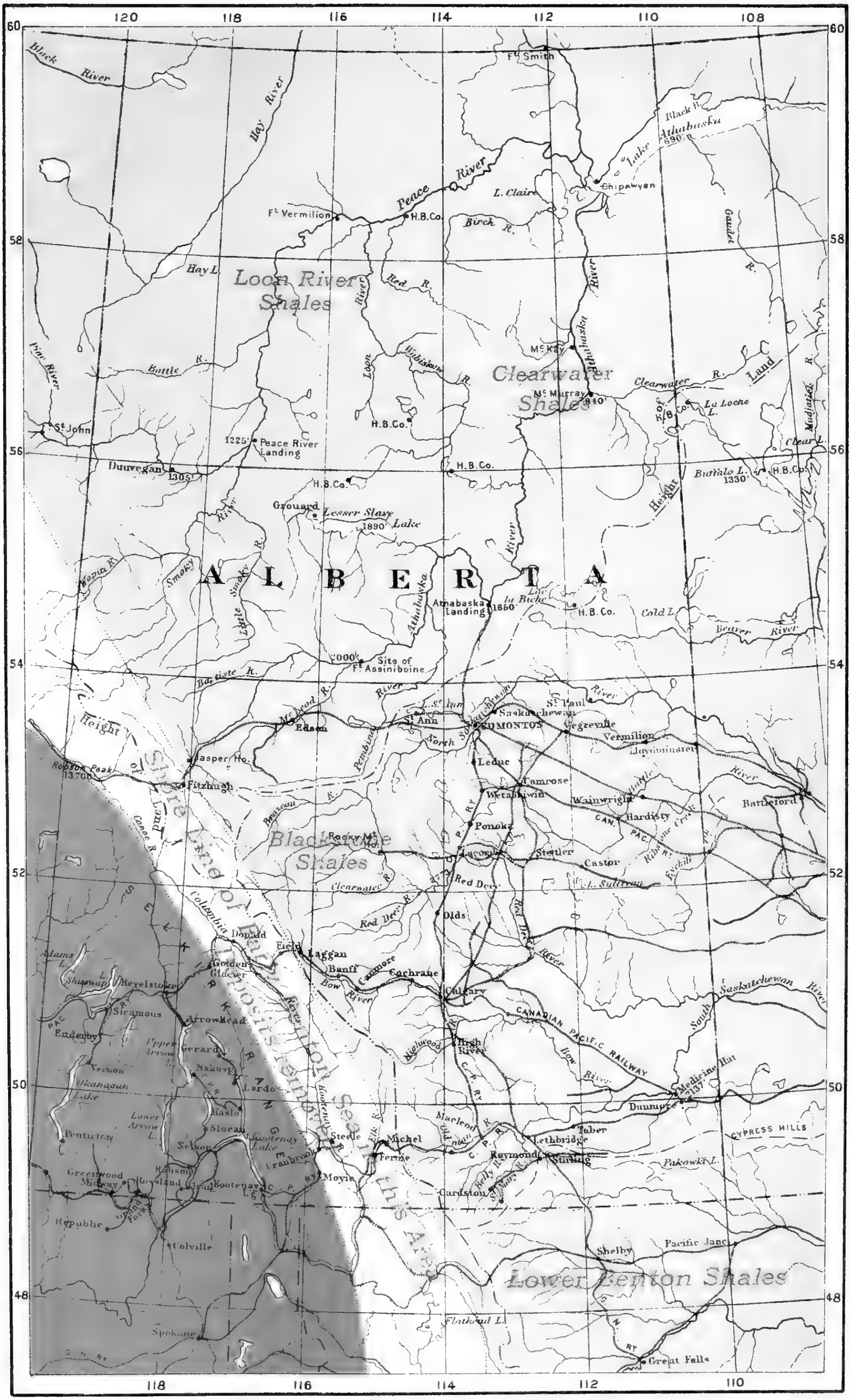
Eastward beneath the Tertiary beds of the Wood Mountain plateau a thin deposit of brackish and freshwater material makes its appearance (Plate X). It resembles the Tertiary beds, but the presence of remains of dinosaurs and turtles shows a proximity to the sea. This formation attains considerable thickness in Dakota and is called the Lance formation. As it is of similar deposition to the Edmonton it has been suggested that these two belong to the same period and were probably connected deposits. Under the general assumption that the Pierre sea retreated south and eastward, these beds could only have been formed during the final retreat and when the sea margin had withdrawn from nearly all of the area now within the boundaries of Canada.

Although there seems to be proof of marine inclusions in the Lance beds it must be assumed that the area, at that time a salt marsh, must have been bordered by surfaces above the sea and possibly considerably elevated to give the slope necessary for the transportation of the sandy material found. It is also clear that we now consider the deposits on these land areas to be of Tertiary age while the low-land formations may be Cretaceous. The Lance beds may thus without violence to our theories represent a deposition in a low-lying area subject to inundation from a sea still bearing a Cretaceous fauna bordered by land areas bearing Tertiary flora; the various fluctuations in level being reflected in alternating beds of apparent Cretaceous and Tertiary ages.

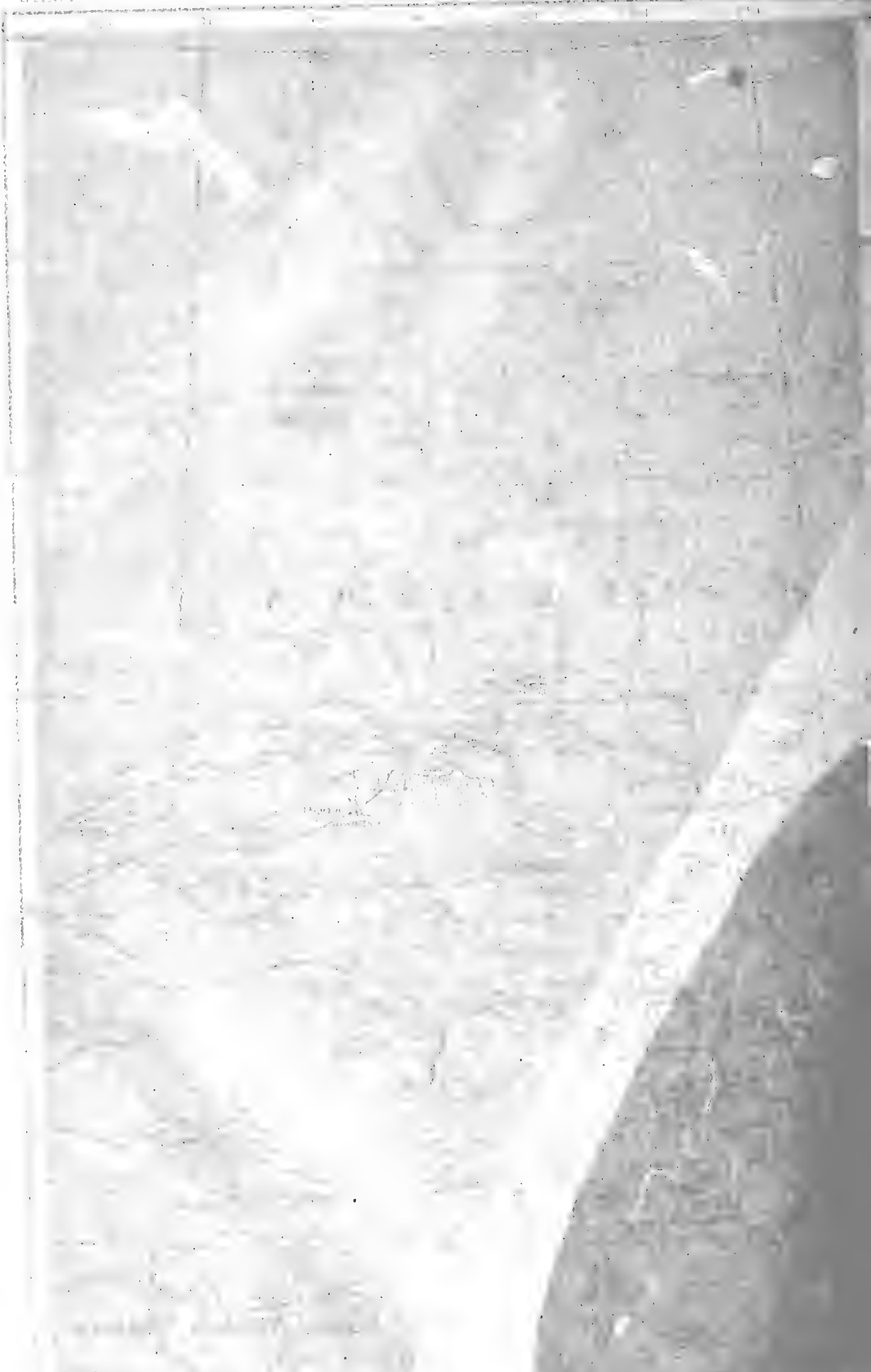
The correlation of this formation with deposits of the same time will naturally be made with the earlier Tertiary continental deposits of the interior called Paskapoo on account of the plant impressions preserved or with the marine Cretaceous deposits in the Gulf region whose presence at this time is indicated in the modified Fox Hills fauna found in the Cannon Ball formation in the upper Lance.

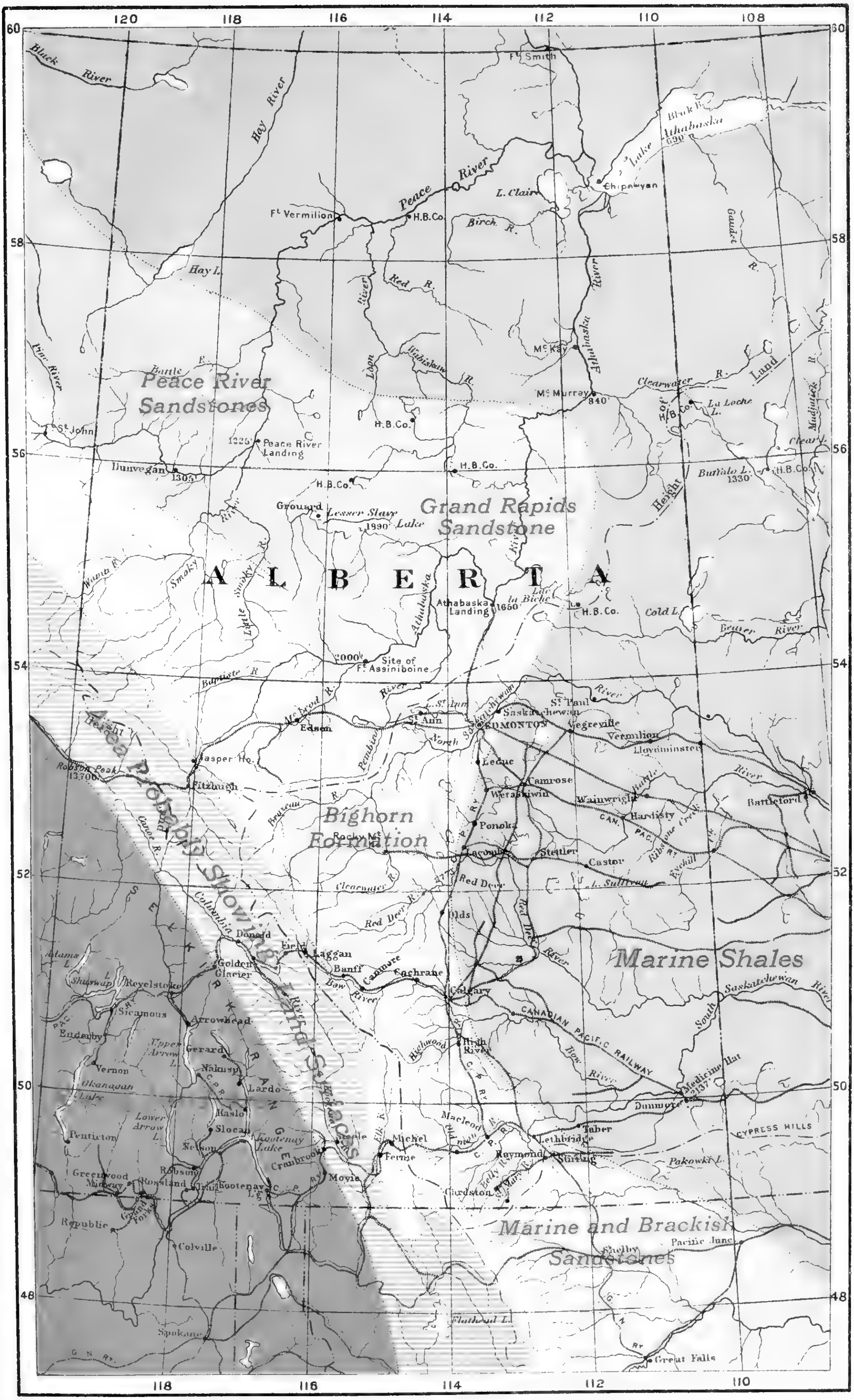
Nothwithstanding the presence of an early Tertiary flora in the beds immediately above the Edmonton, i.e. the lower part of the Paskapoo, it seems evident that their deposition was accomplished at a time when the sea still bore Cretaceous invertebrates and dinosaurs lived on the lowlands bordering the northward extension of the gulf waters. The upper part of the Paskapoo formation and the Porcupine Hills beds are no doubt Tertiary, but they cannot be separated from the underlying freshwater beds that may have been formed at the close of the Cretaceous.

The correlation suggested in the above paper and indicated on the plates showing the extent of the sea at several periods is again illustrated by its application to the areal geology as far as known in Plate XI. The northern part of the Cretaceous plateau is not well explored and the areal geology is mostly conjectural, but the suggestions of the possible mapping provide many problems for future study.

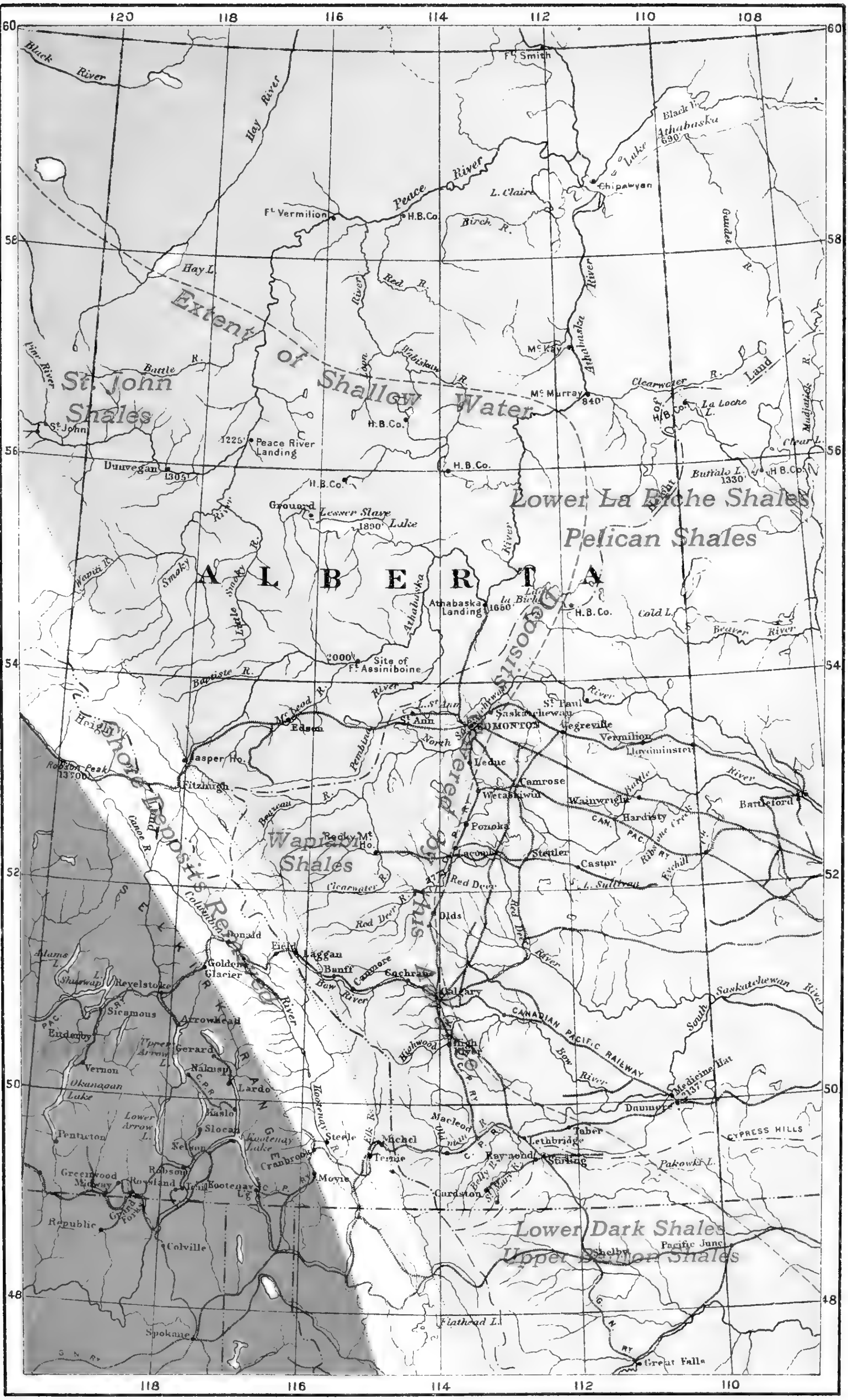


Early Benton Sea. Marine Deposits.

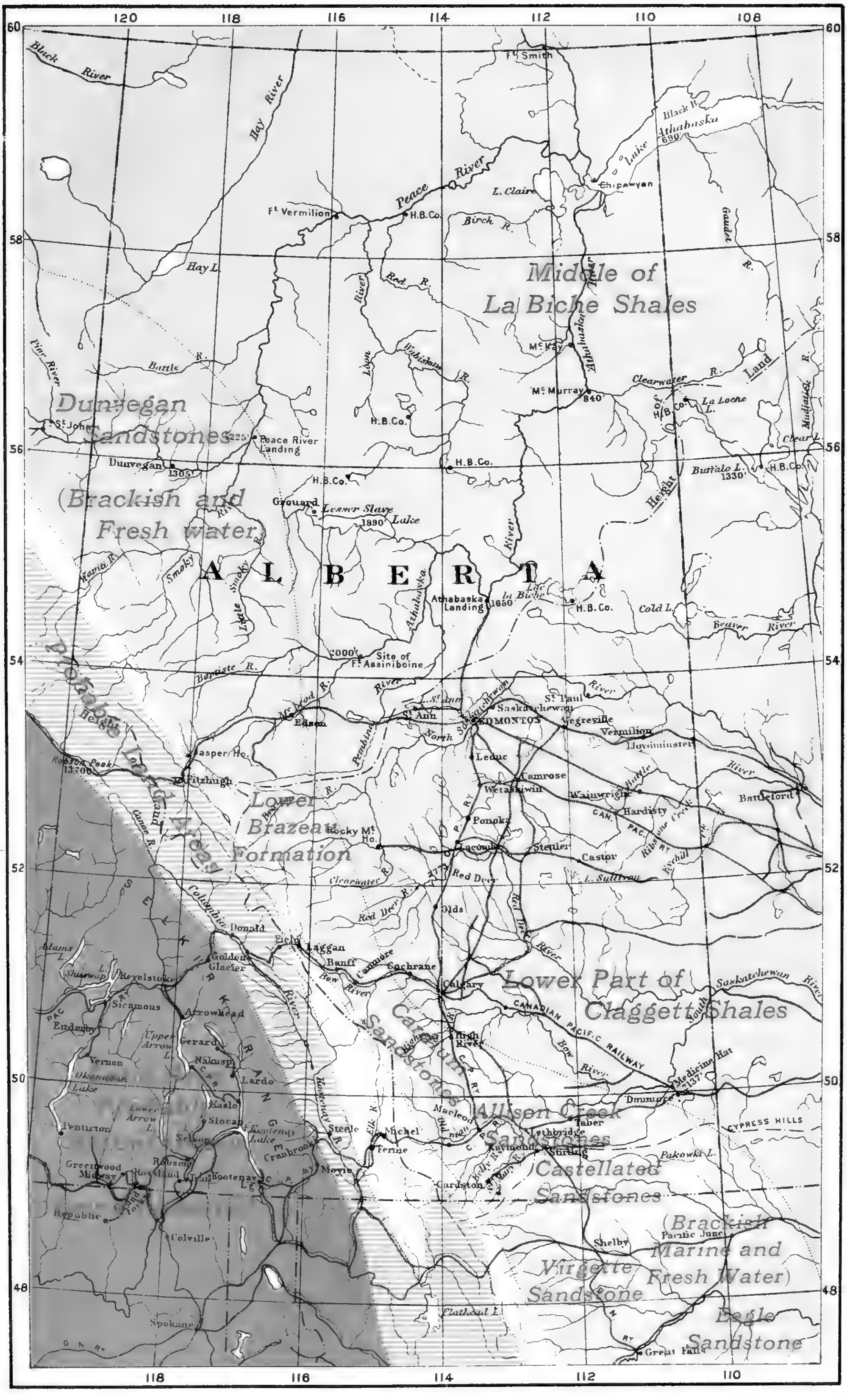




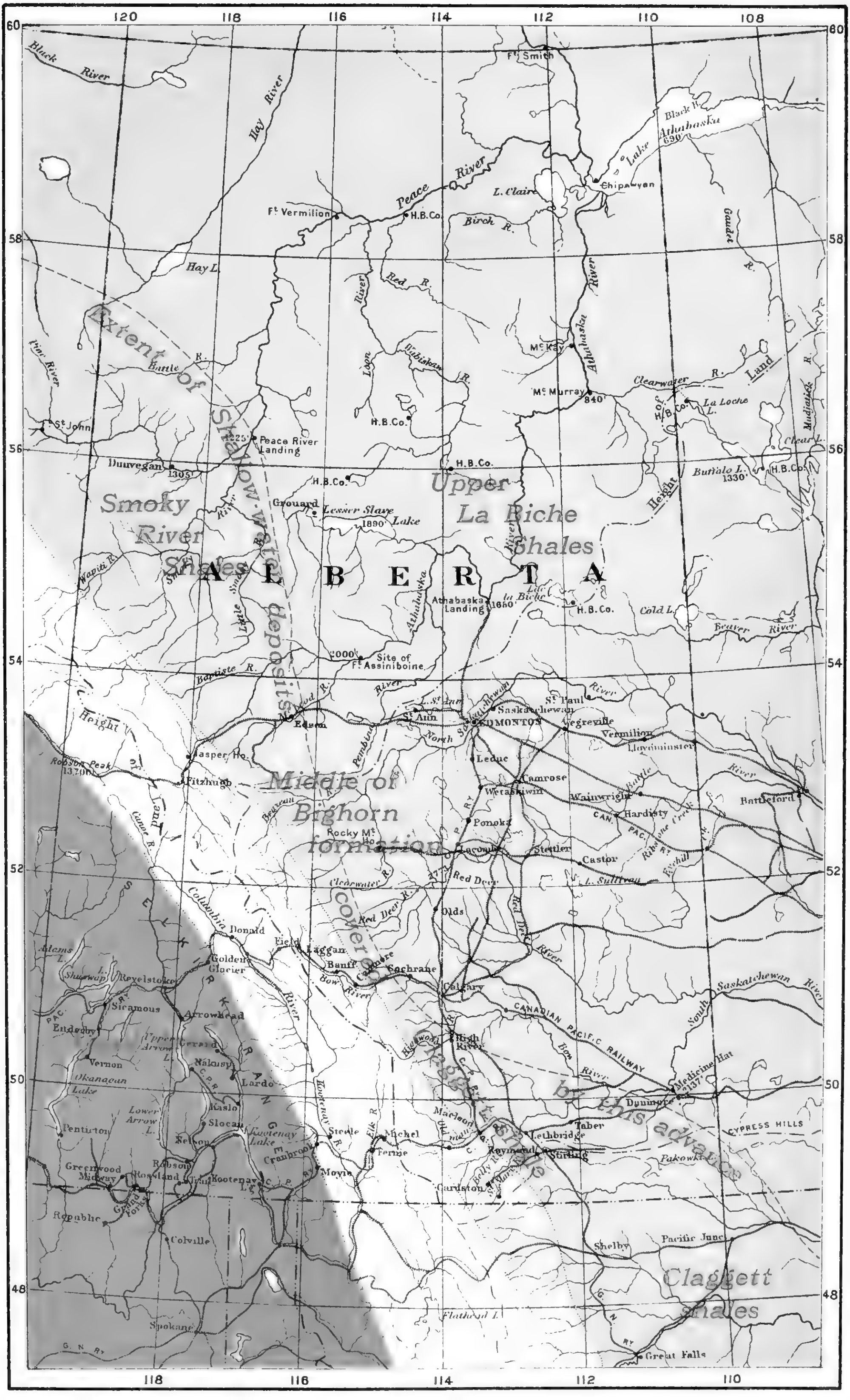
Benton Shallow Water Period



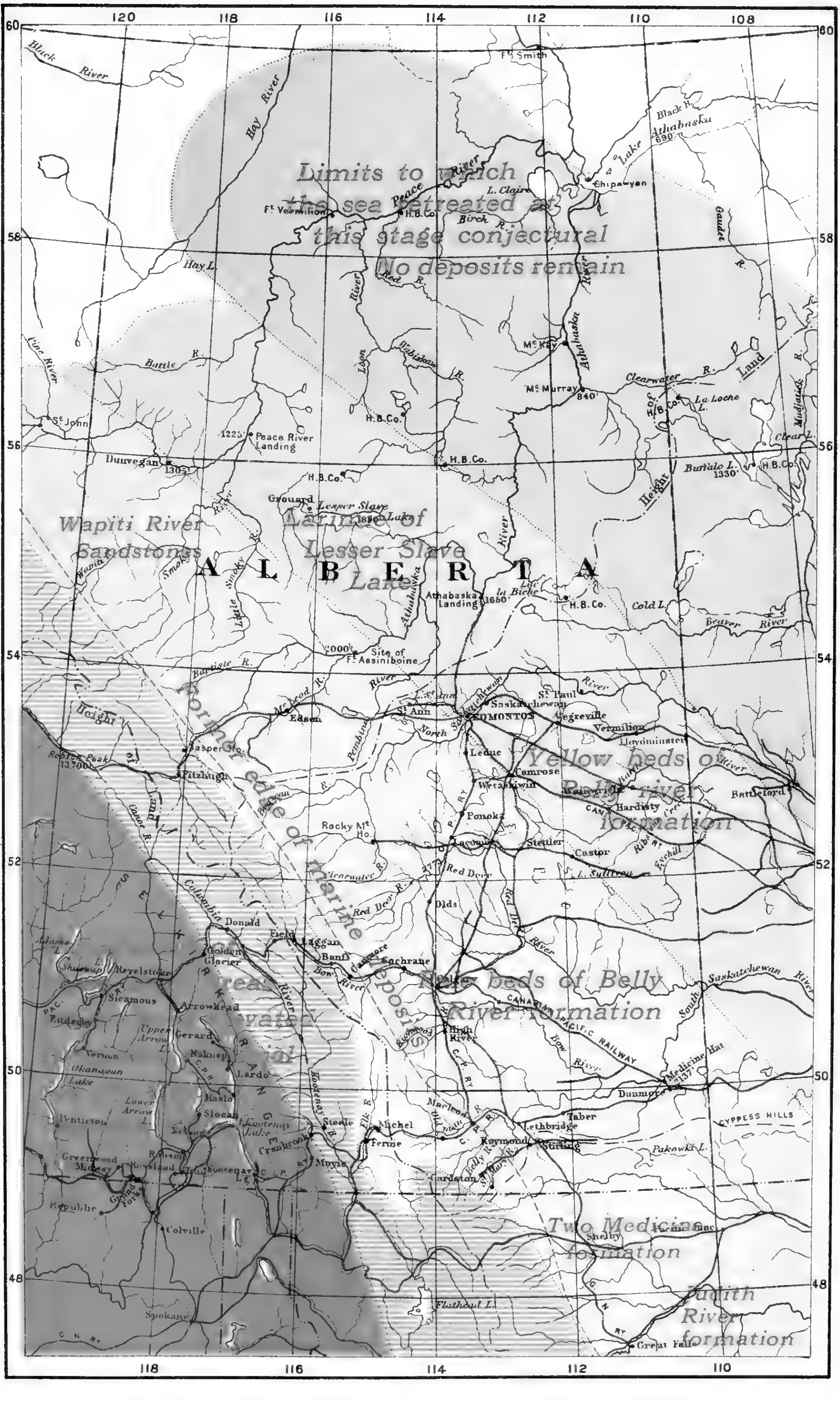
Late Benton or Niobrara Sea.



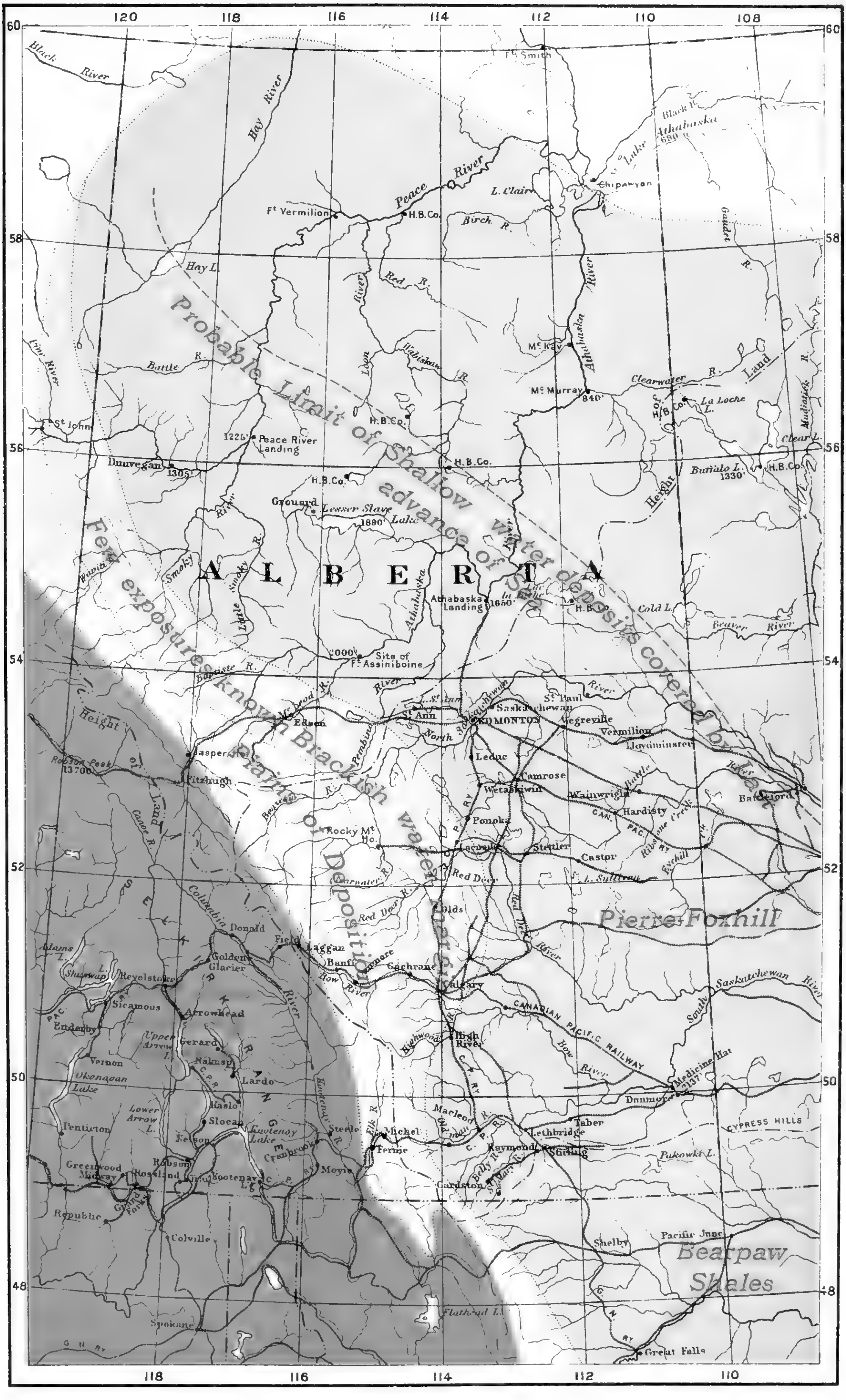
Shallow Water of Early Pierre Sea. (Dunvegan Stage).



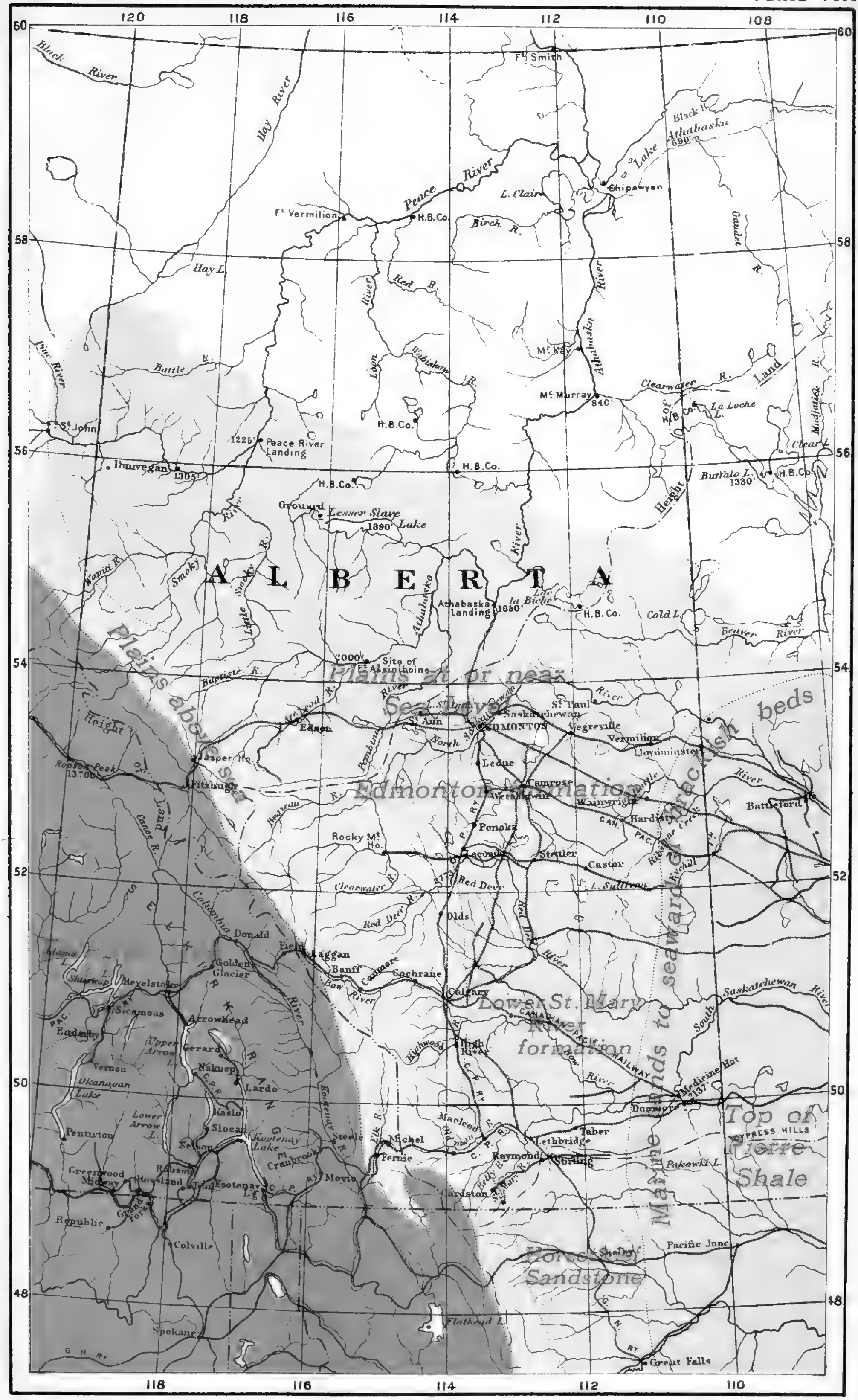
Lower Pierre Sea, Extent of Marine Deposits
(Claggett—Smoky River Stage).



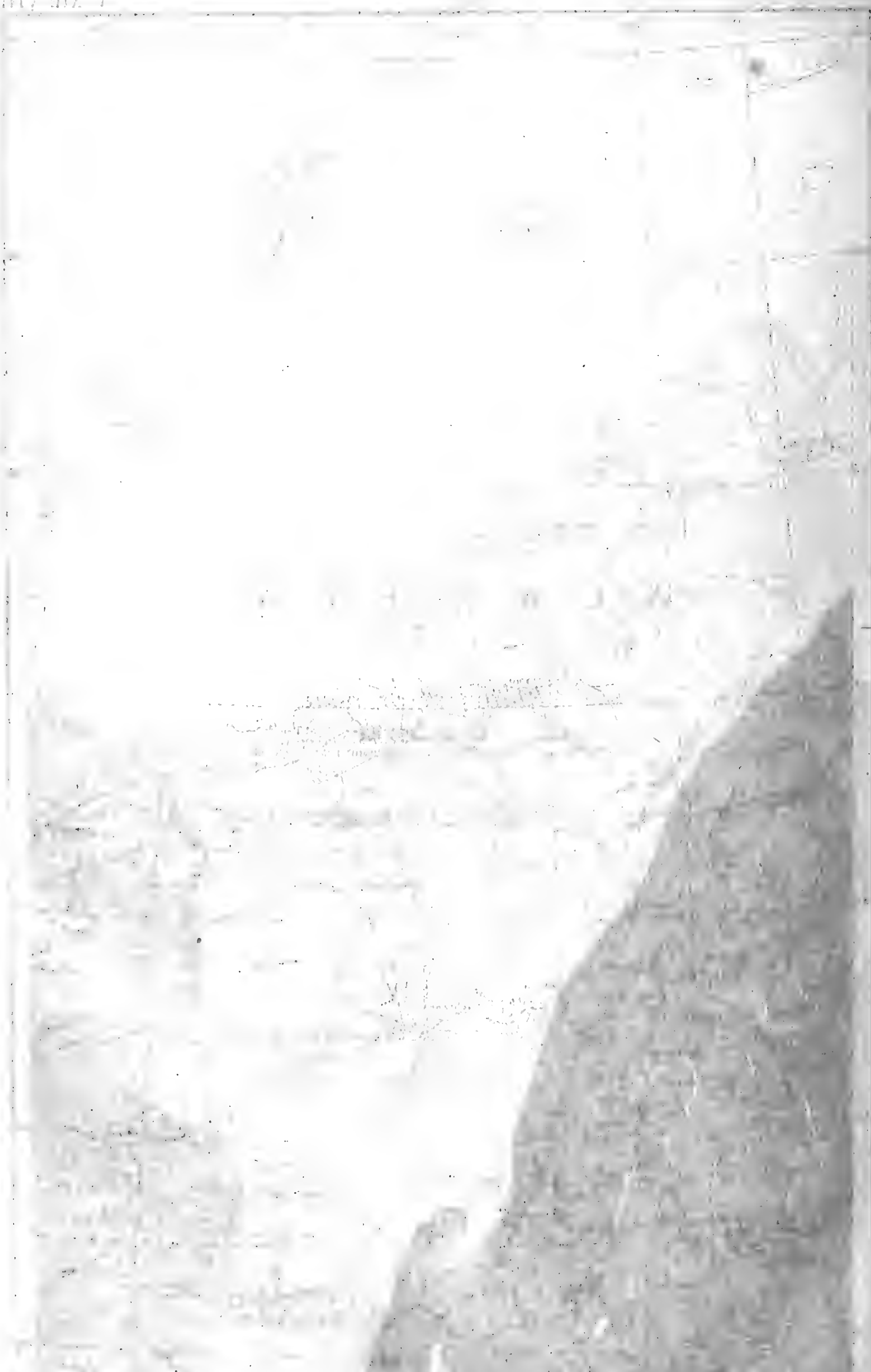
Mid-Pierre Retreat of the Sea, and Formation of Great Littoral Plain as it Slowly Withdrew.
(Upper Belly River—Judith River Stage).

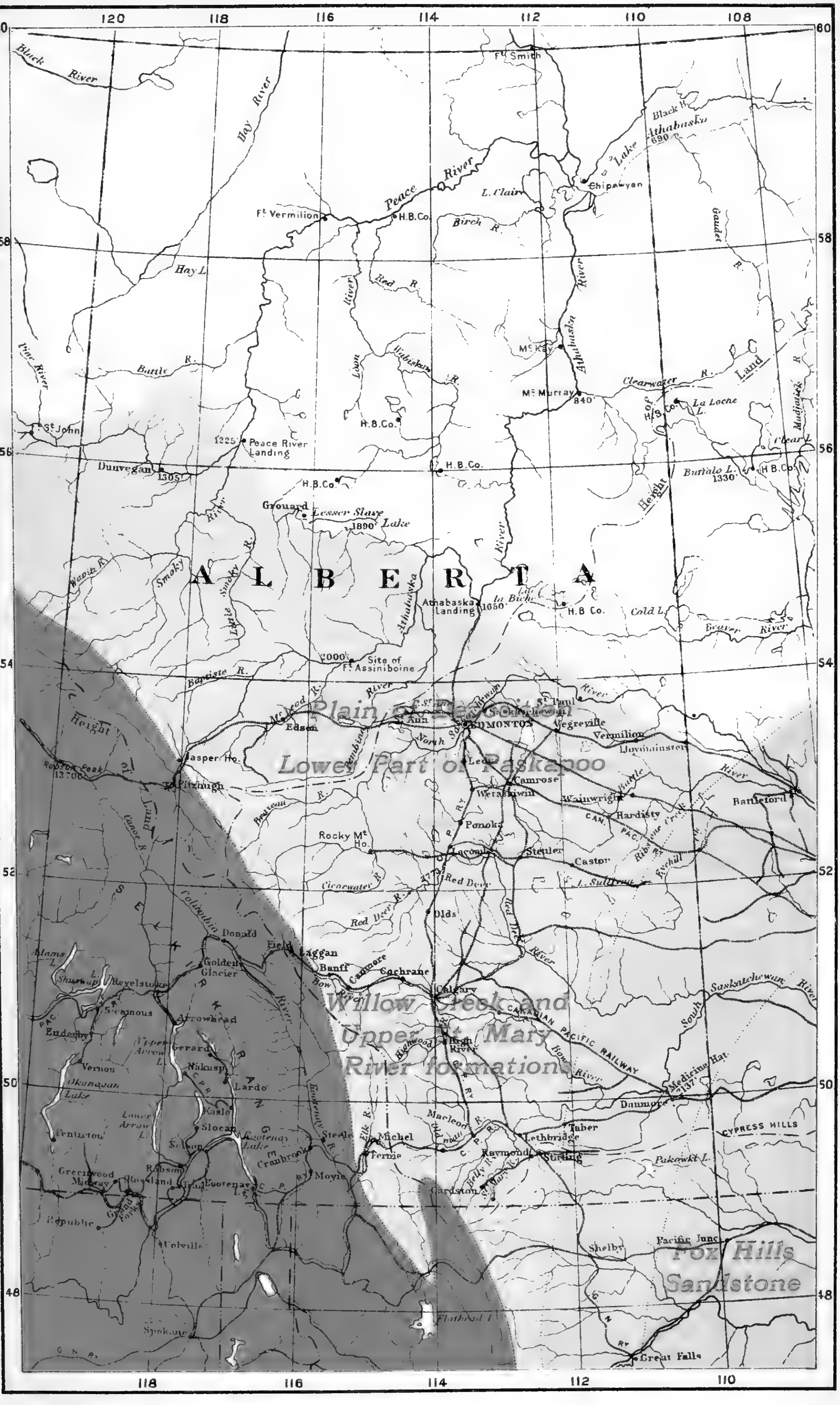


Upper Pierre Sea. Greatest Advance. (Bearpaw Stage).

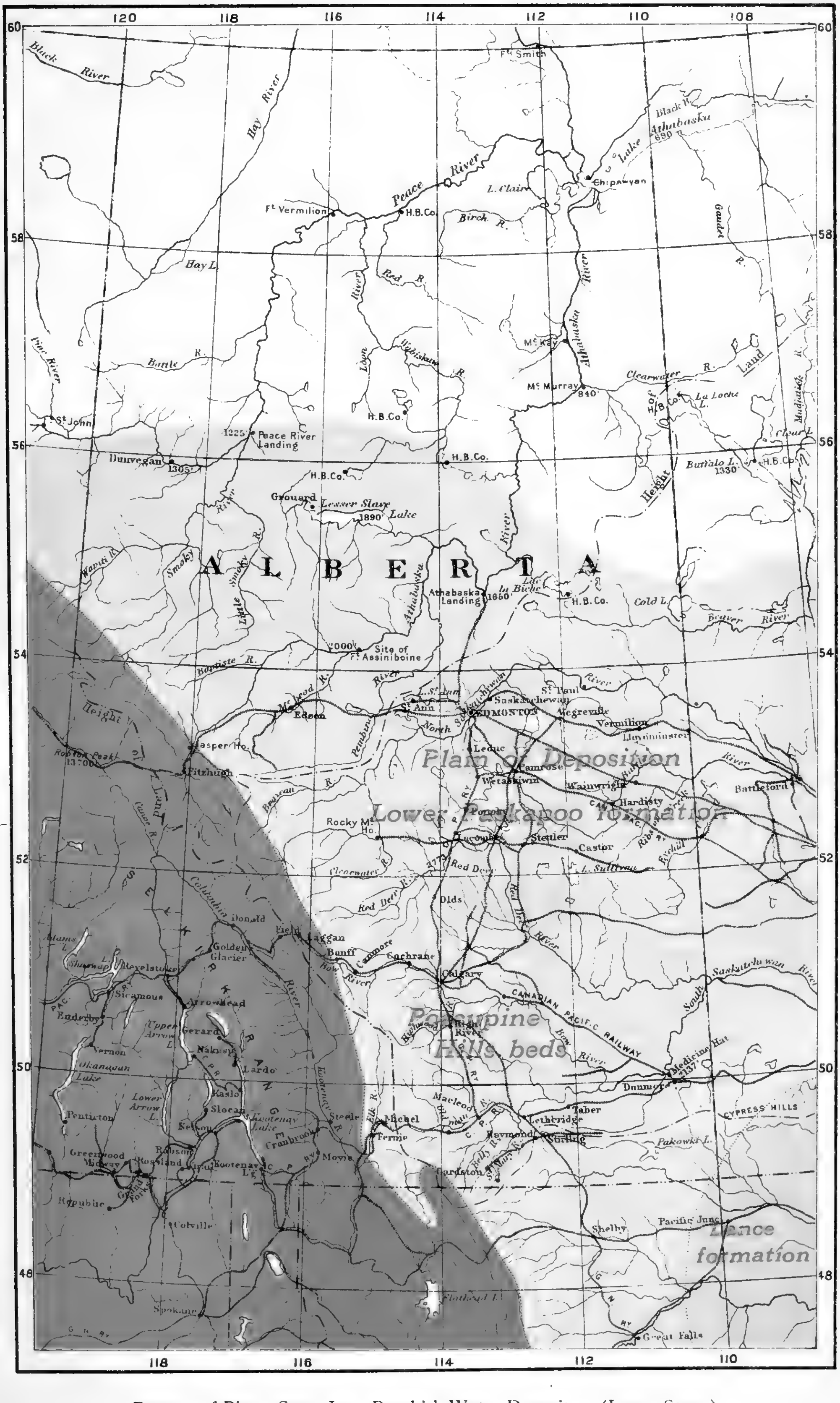


Retreat of Pierre Sea. (Edmonton Stage.)

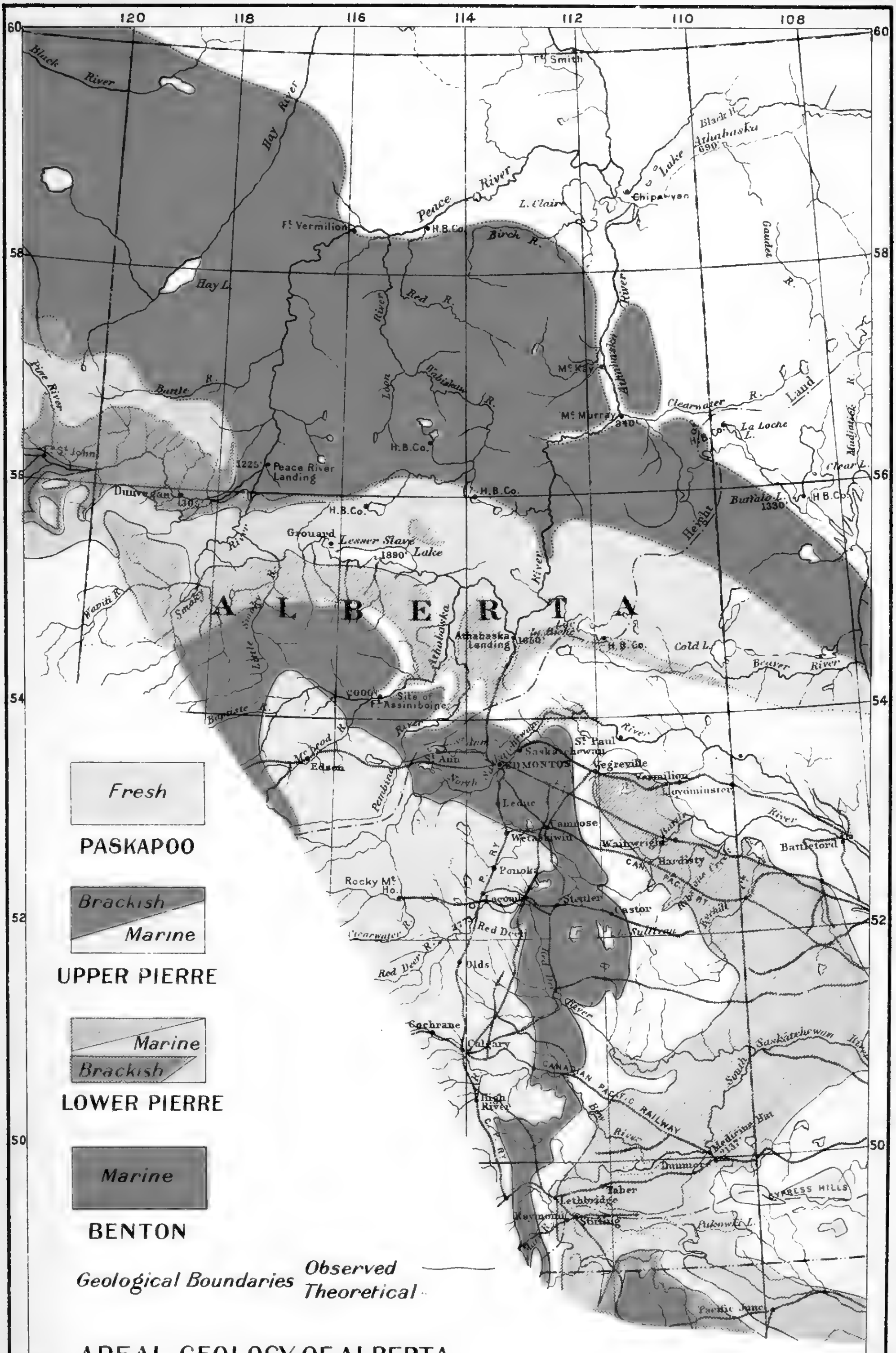




Retreat of Pierre Sea (Foxhill Stage).



Retreat of Pierre Sea. Last Brackish Water Deposits. (Lance Stage).



AREAL GEOLOGY OF ALBERTA
Illustrating Correlation Proposed

The Swarming of Odontosyllis.

By C. McLEAN FRASER, PH.D.

(From the Pacific Coast Biological Station, Departure Bay, B.C.)

Presented by DR. A. B. MACULLUM, F.R.S.C.

(Read May Meeting, 1915.)

On Feb. 10, 1913, Mr. F. A. Potts of Trinity Hall, Cambridge, read a paper on "The Swarming of Odontosyllis," at a meeting of the Cambridge Philosophical Society, which paper appeared in the Proceedings on April 23, following. Observations made on *Odontosyllis phosphorea* Moore, a species of Annelid found in the vicinity of the Biological Station, Departure Bay, B.C., provided material for the body of the paper, to which is added a comparison of the habits of this species with that of other Syllids and Nereids.

The observations made and recorded were of much interest and the conclusions appeared to be so but as is often the case when conclusions are based on very limited observations, further examination shows the necessity of considerable revision.

As far as the phenomenon of swarming is concerned, repeated observations confirm all of Mr. Potts' statements without producing anything of value in addition. The time of day at which spawning takes place seems definite without doubt, but definite as regards the position of the sun, not definite as to the time on the clock. Very few have been seen very much before sunset, but from sunset or possibly a little before it until almost dusk, that is for a period lasting from half an hour to an hour, they appear at the surface whether the sun sets early or late.

There is nothing further to indicate that the males are attracted to the females as they are in *O. enopla.* In every instance each individual whether male or female comes to the surface without any apparent regard to the position of any other individual. The movement at the surface seems just as liable to be away from as towards the nearest individual of the other sex. It would therefore seem that although the number of individuals is great, the chance for fertilizing all of the ova, or even a large portion of them, is very slight. The chances might be increased if the eggs were pelagic at or near the surface but they are not so. They may remain suspended for some time in water that is somewhat agitated but if placed in a receptacle where the water remains still they soon sink to the bottom. Since the water of the sea seems the most favorable for spawning when there is scarcely a ripple on the surface the eggs surely must be fertilized soon after ejection or not at all. No doubt this seeming waste is at least partially obviated by the movements of the Annelids themselves. As the female circles around with a motion that has been aptly described by an observer as a "wavy wiggle," the eggs are scattered right and left over an area relatively large. At the same time the male with a similar undulatory movement scatters the sperm, giving thereby a strong impetus to the movement of the very active spermatozoa. In the denser part of the swarm therefore, where these circles of distribution overlap, the chance for the fertilization of each ovum is not so slim as it would at first appear.

All of this then may be observed in the one evening if conditions are favorable and was observed by Mr. Potts. Numerous repetitions have merely substantiated the fact that the routine of the evening in which he was an interested spectator, is practically the same as that on any other evening during which the spawning occurs. With regard to the distribution of *Odontosyllis* in space and of its swarming in time, the limited extent of his observations did not serve as a satisfactory basis for his rather sweeping conclusions, but it is quite true that he makes a proviso for this in his paper.

Taking in the first place the geographic distribution of *Odontosyllis*, as Mr. Potts surmised, the limit was by no means reached in the much circumscribed area near Snake and Five Finger Islands. The Hexactinellid sponge referred to, as well as a number of other siliceous species, are present over a wide area in the Strait of Georgia, an area of which we have not as yet found the limits. It has been traced in a southeasterly-northwesterly direction, i.e., running the same general direction as the strait and parallel to the eastern shore of Vancouver Island and the other outlying islands, to the northwest as far as Northwest Bay and Ballenas Islands, at least 15 miles from the original location and to the channels between Lasqueti and Texada Islands, 20 miles or more in a slightly different direction, while to the southeast they are just as plentiful around Gabriola Reefs and Breakwater Island, at least 15 miles away in that direction. Furthermore, *Odontosyllis* has been found in a somewhat different kind of bottom in the channels between the islands east of Vancouver Island to the south of the Station. In some of these instances the depth was much less than that indicated in the drawing of the originally described area. Dredging has not been done at a distance of much more than 25 miles from the Station in this direction but this Annelid has been found in the most distant of these dredgings. It would seem, therefore, that instead of having a restricted distribution, it is one of the most widely dispersed species to be found in the vicinity. As to its presence or absence in Departure Bay I have nothing definite to record. If it is not to be found in the bay it is not because the bay is too shallow as the species has been found at a less depth than is found here in many places. The bottom in general and especially in the deeper parts is different from that where *Odontosyllis* has been found and it may be for that reason that it is not present if it is not. Since I have been especially interested in the distribution of this species we have dredged very little in the bay. Possibly if a diligent search were made it might be found. The reason for the swarming at the entrance to the bay it will be considered to better advantage after the time of swarming has received some attention. To this we shall now turn.

The swarms of *O. phosphorea* were first noticed in 1911 on August 15 and 16 and in 1912 on August 18. From this Mr. Potts concludes that there is a possibility of a periodicity in the case of *O.phosphorea* similar to that of the Palolo worms. If he had carefully considered the data before him he should not have come to such a hasty conclusion. According to his own remarks on *Nereis osawai* of Japan, after reading Izuka's paper on the subject "Their date of appearance is absolutely fixed for the days following the new moon." I believe the species found in the Gulf of Mexico has an even more restricted periodicity which is also absolutely fixed for a date definitely related to the time of the new moon. In 1911 full moon appeared on Aug. 9 and the last quarter on Aug. 17, Aug. 15 and 16, when the swarms of *Odontosyllis* were observed, were consequently nearly the end of the third phase. In 1912 there was new moon on Aug. 12, the first quarter falling on Aug. 19, consequently Aug. 18 is near the end of the first phase. Large swarms were also seen on Sept. 5. Since the last quarter of the moon came on Sept. 4, this date is near the beginning of the fourth phase.

In 1913 observations were made over somewhat the same period as in 1912, and dates nearly the same as those in 1912 were obtained. This approximation seemed to make it worth while to go into the matter much more fully in 1914. This was more readily accomplished since Dr. A. Willey, who was at the station for a portion of the summer, became interested in the outcome also. Either one or both of us made examination of the locality in which *Odontosyllis* had been found swarming, at more or less regular intervals from the middle of June until the middle of December. The accompanying table shows the results of these examinations as well as those for the two preceding years. As the phases of the moon are given it will be seen at a glance that there is no indication of periodicity in the swarming but apparently it may take place at any time within a period of three or four months. There are gaps between the dates, it is true, but none are of very great length and the search in every case, particularly if none or few were found, was sufficiently prolonged to get accurate information as far as the area in question is concerned.

TABLE OF OBSERVATIONS.

Date		Result of Observation	Time	High tide	Low tide	Moon's Phases New	Moon's Phases Full
1912							
Aug.	18	Plentiful	19.30	16.37	23.24		
	20	None		18.25	1.50		
	21	None		19.30	3.02		
	27						*
Sept.	5	Plentiful	19.00	18.13	0.39		
	10					*	
1913							
Aug.	2					*	
	11	Few	19.30	15.39	20.00		
	14	Few		17.45	23.30		
	15	None		18.08	23.51		
	16						*
	21	Numerous		20.06	13.48		
	22	Numerous		20.27	14.22		
	28	Few		16.26	21.24		
	31					*	
Sept.	6	Numerous	19.00	20.47	15.34		
	13	None		17.09	23.15		
	15						*
1914							
June	18	None					
	23	None					
July	1	None					
	18	None					
	22	None				*	
	25	Few	20.00	20.00	12.48		
	30	Numerous		22.29	16.42		
	31	Numerous		23.11	17.56		
Aug.	1	None		15.42	19.36		
	3	Few		17.15	22.23		
	5						*
	14	Numerous	19.30	21.47	16.16		
	19	Numerous		17.27	22.44		
	20	Few		17.49	23.20		
	21					*	
	29	Plentiful	19.00	22.29	18.30		
Sept.	4						*
	5	Plentiful		18.10	0.34		
	19					*	
	21	Very plentiful	18.30	18.00	0.43		
	22	Three		18.30	1.28		
Oct.	3						*
	6	Numerous	17.30	17.42	0.46		
	8	Numerous		18.17	13.44		
	18					*	
	27	Few		13.19	20.21		
Nov.	2						*
	4	Five (3m & 2f)	17.30	16.33	0.10		
	11	One	17.00	12.22	19.10		
	12	None		12.56	19.50		
	17	One female		15.40	23.06	*	
	24	None					
Dec.	7	None					
	16	None					

With regard to the time of tide Mr. Potts says, "The tide was full or just falling." This is scarcely accurate. On Aug. 15, 1911, it was low tide at 14.53 and high at 21.10, on Aug. 16, low tide at 15.34 and high at 21.40. The 1912 tides are given in the table. Sunset in the two cases in 1911 occurs well on in the rising tide and on Aug. 18, 1912 at about half tide on the fall. It seems more nearly correct to say that the largest swarms are found at high tide or somewhat before that time, as far as the area at the entrance of Departure Bay is concerned (See table). A possible reason for this lies in the fact that the flood tide comes in from the south. The current is divided by Protection and Newcastle Islands, part going through Nanaimo Harbor and Newcastle Channel to reach Departure Bay. The outer current is less obstructed and as usual arrives at the north end of Newcastle Island before the other current, but the distance it works into the bay varies, apparently depending more upon the direction and force of the wind than on any other factor. Unless the surface of the water is very smooth the line where the two currents meet can readily be traced across the entrance of the bay. The outside current would tend to carry these annelids, coming from the deep in the Strait of Georgia, forward with it until the other current meets it and as there is practically still water here (the doldrums on a small scale) the individuals become collected into a swarm and it is here they are found the most plentifully. When the water is very smooth the area may be very much extended but on ordinary occasions searching for them outside of the entrance to the bay has always produced negative results. This would account for the greater numbers being found on the rising tide. If the water is very smooth during the height of the spawning period they are probably found at any time of the tide. A smooth surface seems to be one of the requisites for swarming. I have never been able to find any at the surface even when the surface was but moderately disturbed. After some days of storm, they have been found on the next smooth evening to be present in very large numbers. It may readily be that at times during the spawning period, when it has not been possible to find any or many at the entrance of the bay, on account of tide and current conditions, they may have drifted in some other direction and at some other smooth spot they may be plentiful.

I have no doubt since *Odontosyllis* is found over such a wide area in dredged material, that the phenomenon of swarming occurs at other places as well as at the entrance to Departure Bay, as especially among the islands to the south there is an endless variety of current conditions and in this variety there must be some that suit. The swarming takes place at such an awkward time of the day for making observations at a distance from the station that none of these places have so far been discovered

The district along the east coast of Vancouver Island is very abundantly supplied with polychætes, both as to variety of species and to number of individuals. It must be that many of these come to the surface to spawn and possibly some of them swarm as does *Odontosyllis.* There is not much chance of finding these otherwise than by accident unless a study is made of them throughout the year so that some idea may be obtained as to when the swarms should be looked for. As yet nothing has been done except for a short time in the summer. Only one case, apart from *O. phosphorea*, has come under my notice. On Sept. 30, 1913, late in the afternoon, probably about 5 o'clock, a male specimen of *Nepthys cæca* (Fabricius) was found swimming at the surface near the station float. Apparently it came to the surface to spawn but no others were seen then or at any time since.

The polychætes serve as a main article of diet for many of the flat-fish, hence the extensive and intensive study of their life-histories is of importance from an economic as well as from a purely biological point of view. It is quite true that little attention has yet been paid to any of the flatfish of the Pacific with the exception of the halibut but many other species are of just as good flavor (in my opinion, much better) as the halibut, although of course they are much smaller. Since they are probably abundant in various localities, they must receive attention some day and the sooner the better.

On an Accumulation of Gas in the Tissues of the Frog as a result of Prolonged Submersion in Water.

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PRESENTED BY PROFESSOR SWALE VINCENT, F.R.S.C.

(Read May Meeting, 1915).

In some previous work directed in part to ascertain how frogs survive the winter in such climates as those of Manitoba, we were led to the conclusion.[1] "Frogs surviving degrees of cold such as those occurring during a Manitoban winter do so below the surface, near the margin of springs, and are themselves not subjected to temperatures below the freezing-point of water."

Since this conclusion indicated a possible prolonged submersion in water, and since we have been unable to find any definite statement as to whether frogs can survive such prolonged immersion, we have carried out a series of experiments to test this specifically.

Observations on such a point as this, if they have been made, are not improbably hidden amidst other data. Our library facilities have not permitted an exhaustive search, and the general textbooks have afforded us no assistance. Gadow[2] makes no statement on the matter, and Miss Dickerson[3] makes only the general statement "the frog......can live under water for months at a time......"

Our earlier experiments showed us that frogs survive immersion in water for very varying periods, and that, under the particular conditions, in most cases, previous to death, they became distinctly swollen and buoyant, being no longer able to dive below the surface. This buoyancy was due to the presence beneath the skin, and throughout the tissues, of a gas which analysis showed to be almost pure nitrogen. There also occurred varying absorption of water, up to about 30 or 40 per cent. of the original weight of the animal. Since

[1] A. T. Cameron, "Further experiments on the effect of low temperatures on the frog," Trans., 1914, vol. viii, Sect. IV, p. 265 (p. 266, line 1, should read as in the text above).

[2] Gadow, "Amphibia and Reptiles" (Cambridge Natural History), 1901.

[3] Miss M. C. Dickerson, "The Frog Book," (New York, Doubleday, Page & Co., 1908), p. 231.

we have not found in the literature at our disposal any reference to the phenomenon of gas-absorption and retention, though liquid absorption under suitable conditions has been frequently studied, we shall first give an account of our own experiments, and then quote such previously ascertained facts as bear upon them.

Late winter and spring specimens of *R. pipiens*, obtained from Illinois, were used throughout the following experiments.

A series of preliminary experiments were first performed. They indicated that frogs survived in boiled out water (in stoppered vessels) for periods of a few hours only, such times corresponding to those which they can survive in an oxygen-free atmosphere. Some frogs placed in a vessel through which flowed a constant stream of Winnipeg tap-water, in which they remained completely immersed, died in three or four days, becoming swollen and buoyant before death. The tissues, (heart, muscle, peripheral nerve, brain and cord) were not killed when somatic death had taken place, but responded to electrical stimulation.

A series of four experiments were carried out in a similar way to that just described. The first, second, and fourth can be used to compute the average time of survival of frogs immersed in Winnipeg tap-water. Living frogs in the third experiment were used to furnish various data required during the course of the investigation, so that this experiment cannot be used in determining the average. The frogs were observed once or twice daily, so that the figures for the time of death apply to some period during the preceding 24 hours, and the whole number of the average should perhaps be one integer less. The temperature of the tap-water during these experiments varied from 5° to 12°C. The daily variation was of a similar order.

Experiment 1. Commenced on February 1st, 1915. Four frogs were immersed in a wide-mouthed jar, containing about 5 litres of water. A wooden framework kept them below the surface of the water. A fairly fast stream of water was allowed to run through the containing vessel. Two frogs died during the fourth day of immersion, one during the seventh, and one during the seventeenth. The frog which survived for the longest period was a male. The sex of the others was not observed. All were swollen and buoyant. The swelling and buoyancy became marked a day or two before death.

Experiment 2. Commenced on February 18th, 1915. Eight frogs, four male and four female, were immersed in the same vessel. The females died, two in six days, one in eight days, and one in ten days; the males died, one in six days one in eleven days, one in twenty-four days, and one in forty-eight days. All were swollen and buoyant before death. The last three males were utilized in determining some of the figures shown in table I below.

Experiment 3. Commenced on March 10th, 1915. Ten frogs were confined under the same conditions. As noted above, a number of the frogs were removed before death had occurred, and the results cannot be used in determining the average period of survival. The data obtained in this experiment are shown in part in the tables below.

Experiment 4. Commenced on March 29th, 1915. Ten frogs were confined in a larger apparatus containing over ten litres of water. The other conditions were unaltered. In this experiment several frogs died in a swollen but non-buoyant condition. The five female frogs died, one on the third day, one on the seventh, one on the nineteenth, one on the twenty-fourth, and one on the thirty-sixth day. The first two and the fourth were swollen, but not buoyant. The others were swollen and buoyant. Three male frogs died, one on the thirteenth day, one on the sixteenth, and one on the fifty-second day. All were swollen and buoyant. The other two, both swollen and buoyant, were removed from water while still living, on the thirteenth day, and it is estimated for reasons given below that they would have died on the fifteenth day.

The average life of the frog, immersed completely in running Winnipeg tap-water, as deduced from experiments 1, 2, and 4, on a total of twenty-two frogs, is between fifteen and sixteen days. The extremes observed in these experiments were 3 days and 52 days. The experiments, on the whole, seem to show a somewhat shorter period for females. This is not improbably due to the time of year at which the experiments were carried out.

Numerous measurements on the dead frogs and observations on their condition were made. Many of the data obtained are shown in the following table. The figures for weight (column 5) are correct to 0·5 gram. Those for volume, obtained by displacement in water, are probably correct to 1 c.c. The density of the normal frog has been taken as unity within the limit of error of the methods of measurement employed; this figure was given by a number of measurements on normal frogs. The residual weight (column 8) was obtained either by direct weighing after the frog had been cut up under water for removal of gas, when absorbed liquid also escaped (adherence of water giving an error not greater than one gram as determined by actual measurement), or by subtraction of the measured absorbed liquid, (column 10) (in which 1 c.c. has been assumed to weigh 1 gram, since the liquid was in all cases a thin serum). In the former case the liquid absorbed has been determined by the difference between the figures in columns 5 and 8. The gas, when found by difference (column 11), has been calculated from the difference between columns 6 and 5, and can be regarded as approximately at normal pressure and room temperature. The figures in column 12, for gas measured and calculated to normal pressure and 15°C. were obtained by cutting open the frogs under water, and removing the gas as far as possible. This was transferred to a graduated gas-burette over mercury. In passing through a considerable amount of water any carbon dioxide present would be dissolved; subsequent treatment with moist sodium hydroxide showed no diminution in volume, indicating carbon dioxide absent. This may in part explain the difference in the figures in columns 11 and 12. In a number of cases the percentage of oxygen was determined by treatment with sodium hydroxide and pyrogallol; the results are shown in column 13. The time during which the frog was buoyant and before death occurred could not be observed in most of the experiments until but two or three frogs survived. As far as could be judged, this time (shown where observed definitely in column 14) increased with the time of survival during the first three or four weeks, and was thereafter irregular (due perhaps to emaciation, and weakness resulting from prolonged immersion); the average time is probably four or five days.

In the table the results are arranged in order of the gas absorbed (as found by difference).

TABLE I.

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
								Liquid absorbed		Gas absorbed			
No.	From expt. starting:	Sex	Time of submersion days	Wght. g.	Vol. c.c.	Density	Residual Wght. g.	(1) By difference c.c.	(2) By measurement c.c.	(1) By difference c.c.	(2) By measurement c.c.	Per-cent. O_2 %	Buoyancy Time. days
1.	29/III	f.	3	61	..	....	53·5	....	7·5	0	....	..	..
2.	"	f.	7	59	..	....	49·	....	10	0	....	..	..
3.	"	f.	24	93	..	....	70	....	23	0	....	..	..
4.	"	m.	13	71	74	0·96	55	....	16	3	....	..	..
5.	18/II	m.	48	34	37	0·92	33	1	....	3	2	..	1
6.	29/III	f.	36	70·5	74	0·95	58·5	....	12	3·5	....	..	3
7.	10/III	f.	6	66	73	0·90	55	11	....	7	5·9	4	..
8.	"	m.	7	58·5	68	0·86	52	6·5	....	9·5	4·5	..	..
9.	"	m.	6	50	60	0·83	50	0	....	10	6·0	2	..
10.	29/III	m.	15	77	88	0·87	59	18	18	11	....	..	4
11.	"	f.	52	63	74	0·85	58	....	5	11	....	..	7
12.	10/III	m.	11	71	86	0·83	57	14	....	15	14·4	0·7	2
13.	"	m.	12	52	68	0·76	43	9	8	16	....	..	..
14.	18/II	m.	11	....	..	....	....	....	....	....	15·6	..	..
15	"	m.	24	....	..	....	....	....	....	....	18·9	1	..
16.	29/III	f.	19	76·5	99	0·77	60·5	....	16	22·5	....	..	6

In addition to the results shown in the table itself, particular experiments yielded the following additional data:—

EXPERIMENT 2. The gas obtained from one of the frogs (No. 14 in the table) was tested specifically for inflammable gases, by adding oxygen and sparking. There was no change in volume, showing that such gases as hydrogen and methane were absent.

A second frog was examined under water to find out precisely the location of the gas. It was found in a number of pockets beneath the skin, and in addition was present in all the organs of the body. Intestines, stomach, liver, lungs, etc., floated when cut free from the rest of the body. This general distribution of gas not easily removed from the animal on cutting it open probably accounts for the greater part of the discrepancies in columns 11 and 12.

In this experiment, and in later ones, it was frequently observed that frogs, living and unswollen, after confinement under water for one or two weeks, from time to time gave off small bubbles of gas from under the skin round the eyes, and from the mouth.

In the case of the frog surviving till the forty-eighth day, the muscle and peripheral nerve were found to respond to electrical stimulation some hours after somatic death. No specific tests were made in other cases.

EXPERIMENT 3. The gas obtained from a frog dead after 7 days immersion (No. 8 in the table) was sparked down with excess of oxygen over sodium hydroxide solution, and the presence of nitrite proved by the formation of a transient black coloration with ferrous sulphate and sulphuric acid, indicating definitely that the gas obtained in these experiments is almost all nitrogen.

A second frog (No. 13 in the table) was examined specifically to find the nature of the liquid absorbed. 3·5 c.c. of a very faintly yellow liquid were obtained from the lateral lymph spaces. This liquid gave a colourless clot in one or two minutes. A few drops of a similar liquid were obtained from beneath the skin of the hind limbs, and 4 c.c. of a similar liquid from the abdomen. A considerable amount of gas was observed beneath the skin of the abdomen and of the hind limbs.

A third frog, a male, living after immersion for 12 days and not apparently swollen or buoyant, was pithed under water and examined. The intestines and lungs were filled with gas and floated to the surface when cut free. The remaining tissues sank.

A fourth frog, a female, was removed alive after immersion for 12 days; it did not appear to be either swollen or buoyant. It was pithed, and examined in air, for the presence of absorbed liquid. One or two drops of coagulable liquid were found in the lateral lymph spaces, and rather more in the abdomen, altogether 1 to 1·5 c.c.

Two frogs were removed alive and allowed to remain in air, in vessels the bottoms of which were kept covered with water. Subsequent observations on them are of some interest. The first, a female, was removed after $4\frac{1}{2}$ days, badly swollen, and buoyant. It commenced to breathe at once, and, as will be seen in the following table, rapidly lost both liquid and gas, the former somewhat more quickly. The second frog, also a female, after 15 days immersion was apparently dead at the bottom of the containing vessel, and tapping elicited no response. It was very swollen, but not lighter than water (neither rising nor sinking). On removal it at once commenced to breathe, and, as the table shows, rapidly lost absorbed water.

TABLE II.

Frog No. 1				Frog No. 2		
Time after removal	Weight g.	Volume c.c.	Density	Time after removal	Weight g.	Volume c.c.
0 hours	85	93	0·91	0 hours	66	66
2 "		92		7 "	55	56
4 "	82	90	0·91	1 day	49	50
6 "	81	88	0·91	2 days	47	49
8 "	80	86	0·93	3 "	47	46
12·5"	79	85	0·93	4 "	45	47
1 day	71	77	0·92			
2 days	69	70	0·98			
3 "	69·5	71	0·97			
4 "	68	70	0·97			
7 "	74	72	1·03			
9 "	74·5	75	0·99			
14 "	71	70	1·01			

The slight irregularities are largely due to the difference in volume found when the frogs were immersed during expiration or during inspiration. The increase in weight and volume which took place in the first frog during the fourth to ninth days of observation was probably due to the fact that the containing vessel contained so much water that a considerable area of the frog's surface was immersed, and the water intake was greater than the output.

At the end of the fourteenth day of observation the first frog, which had steadily become more active as it diminished in size and volume (lethargy is one of the noticeable accompaniments of the swelling), and which was now apparently quite normal, was pithed and examined. The lateral lymph spaces and abdomen contained only a drop or two of serum.

The second frog, which similarly had become very active, was also pithed and examined at the end of the observation period, with precisely similar results.

EXPERIMENT 4. Frog No. 1 in Table I contained 4 c.c. of liquid in the lateral lymph spaces, 3 c.c. in those of the hind limbs, and about 0·5 c.c. in the abdomen. The liquid coagulated to a clear clot within 10 minutes of removal.

Frog No. 2 in the table contained 8 c.c. of liquid in the lateral lymph spaces, 2. c.c. in the lower limbs, and a drop or two in the abdomen.

Frog No. 10 in the table contained 15 c.c. of liquid in the lateral lymph spaces, 1 c.c. in the lower limbs, and 2 c.c. in the abdomen. Many of the muscles were very oedematous. This is true generally of such swollen frogs.

These figures show typically the distribution of the absorbed liquid.

Two frogs of this experiment were removed from water alive on the thirteenth day (as already stated), with a view to ascertaining the condition before death. Both were distinctly swollen and buoyant before removal, and both breathed directly after removal.

The first, a male, weighed 69·5 grams, and its volume was 76 c.c. giving a density of 0·91, and gas absorption 6·5 c.c. Examination under water, after pithing, showed the gas chiefly beneath the skin, as usual. The residual weight was 54·5 grams, indicating that 15 c.c. of liquid had been absorbed.

The second frog, also a male, was very dropsical at each side when removed. Its volume was 93 c.c., its weight 84·5 c.c., the density being therefore 0·91 and the gas absorbed 8·5 c.c. The frog was pithed under water, and cut open, and the gas removed very satisfactorily and analysed. The residual weight was 65·5 grams, indicating a liquid absorption of 19 c.c. The gas removed measured (corrected to normal pressure and 15°C.) 7·3 c.c., and contained an unmeasurable trace of oxygen, the pyrogallol solution being barely coloured.

These experiments, together with those in table II, show that any changes after death can be neglected in considering previous results, since the bulk of the changes observed take place during life.

A sample of the skin from frog No. 6 in table I was hardened in mercuric chloride, stained with haematoxylin, and examined microscopically with similar preparations from a normal frog. No marked change was revealed.

EXPERIMENT 5. The gases obtained by boiling Winnipeg tap-water were analysed. They were collected over water, so that the figures for carbon dioxide are much too low. It was found that one litre of tap-water contained 9·3 c.c. of carbon dioxide, 5·3 c.c. of oxygen, and 25·4 c.c. of nitrogen. This result shows a value for oxygen much below that for saturation, agreeing with known results for other underground waters.[1]

According to Bohr[2] whose conclusions are based chiefly on A. Krogh's experiments, the skin of the frog permits simple diffusion, with no regulatory mechanism. The lungs provide the regulatory mechanism. The skin allows a fairly constant diffusion, and takes part especially in the excretion of carbon dioxide. The oxygen-intake through the skin is almost constant, and independent of the total magnitude of the metabolism. The greatest variations are only from 43 to 60 c.c. per kilogram per hour. The carbon dioxide excretion through the skin is on the whole greater, and varies more (from 92 to 179 c.c. per kilogram per hour). The corresponding figures for the lung respiration are, for oxygen-intake, 51 to 390 c.c., and for carbon-dioxide output, 0 to 90 c.c.

Pembrey,[3] in Schafer's Textbook, states "Edwards......found that frogs deprived of their lungs would live a long time, provided that the external temperature was low. This cutaneous respiration took place as readily in flowing water as in air, provided that the temperature of the water did not exceed 12°." He further states that Valentin found that absorption of oxygen was more active than discharge of carbon dioxide through pieces of skin removed from the body, while, on the other hand, Waymouth Reid and Hambly found no evidence of any secretory action, exchange of gases, according to these investigators, being the direct result of a difference of tension on the two sides of the respiratory septum.

Bearing these results in mind, the data yielded by our experiments lead to the following conclusions.

Frogs immersed in Winnipeg tap-water live normally, respiration proceeding through the skin, the oxygen necessary being furnished by the gases dissolved in the water. After a certain time, varying over a wide range with the individual, absorption of water takes place accompanied in most cases by absorption of gas. The water is apparently absorbed by all muscular tissue, there being marked oedema, and further, in the form of a diluted lymph distends all the lymph spaces, giving the animal a marked dropsical appearance. The gas, which consists of nitrogen (and probably of course argon) with one

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[1] See F. W. Clarke, "The Data of Geochemistry," Bull. No. 330, U.S. Geological Survey, 1908, p. 402.

[2] Bohr, Nagel's Handbuch de Physiologie, 1909, Bd. I, S. 160.

[3] Pembrey, Schäfer's Textbook of Physiology, vol. I, p. 723, 1898.

or two per cent of oxygen, is also found in all the lymph spaces, and distends all the body tissues.

The amounts of liquid absorbed, shown in Table I, are all too small by the amount actually absorbed in the tissues at the time of measurement, and unmeasurable. The one occasion in which no measurable liquid was found (No. 9) is probably therefore an extreme case, and we feel justified in assuming that the absorption of gas only takes place when liquid is being absorbed also.

"Retention of gas" is probably a more accurate description of the phenomenon. Up to the period at which swelling commences it must be assumed that gas passes through the skin by diffusion, both oxygen and nitrogen. This certainly takes place in one direction, inwards. The oxygen is used up, and the carbon dioxide presumably excreted through the skin. It cannot be definitely stated in what manner the nitrogen is normally got rid of. It seems most probable that the outward diffusion is as fast as that inwards. When swelling commences, in most cases some change takes place, so that the nitrogen can no longer be completely eliminated. If we assume that the oxygen and nitrogen are absorbed in proportion to their partial pressures, then it follows that a large part of the nitrogen is still got rid of in some way ot other. For example, case No. 16, Table I, shows that 22·5 c.c. of nitrogen were retained in 6 days by a frog whose original weight can be taken (from the residual weight) as approximately 60 grams. This would correspond to an oxygen intake of only 4·5 c.c. during the same period, which corresponds to 0·5 c.c. per kilogram per hour, a negligible figure compared with Krogh's results already quoted, even when the marked inertia of the frogs in these experiments is taken into account.

If gas and liquid absorption is allowed to proceed, then the animal becomes more and more lethargic, and finally dies, in a more or less distended condition. The cause of death may be connected with the physical distension, or with some change brought about chemically by the considerable dilution of the lymph and resulting lowering of the osmotic pressure of the body-fluids, or with both of these. If the animal is removed from water at any period before death has actually occurred, and allowed to remain in its normal moist atmosphere, then it becomes quite normal in three or four days.

The amount of gas absorbed should theoretically be proportional to the area through which absorption takes place (a function of the weight) and the time during which absorption takes place (called "Time of buoyancy", in Table I). There is no marked proportionality to the former shown in the table. That to the latter is not very distinctly shown. The figures are too few to prove any certain relationship, but there is certainly no proportionality to the time of immersion.

We shall deal later with possible causes of the absorption of water.

The following experiments were carried out in an endeavour to find some data throwing light on the cause of gas retention.

Experiment 6. Commenced on April 24th, 1915. Ten frogs were placed in the apparatus used in experiment 4, in running Winnipeg tap-water; the water was at such a height that the frogs could come to the surface to breathe, but that under normal conditions their bodies (excluding the heads) were continuously immersed in water. Frogs were found dead at the bottom of the containing vessel on the first, third, seventh, eleventh, thirteenth, fourteenth, and twenty-first day. None were markedly swollen. On the ninth day of immersion a frog was found dead, floating on the surface, after being buoyant and unable to dive below the surface for four days. It had been removed and measured after being buoyant for two days; its weight was then 59 grams, its volume 62 c.c., (density 0·95). Measured after death, it weighed 67·5 grams, its volume was 70 c.c. (density 0·96), indicating a gas absorption of 2·5 c.c. only.

At the end of 24 days the three living frogs were removed. One was slightly swollen and not buoyant. The buoyancy of one had been just perceptible for four days, but there was no measurable difference between weight and volume. The third frog was markedly distended, and had been floating at the surface of the water for 11 days. Its volume was 70 c.c., its weight 51 grams, (density 0·73), indicating a retention of 19 c.c. of gas.

The distinctly longer period of buoyancy required for retention of correspondingly large amounts of gas in this experiment, than in those where the frogs were completely immersed is probably to be explained by the fact that as soon as the buoyancy became marked the frogs were forced to the surface, and larger areas of skin were exposed to the air.

The experiment shows that cessation of lung respiration is in no way responsible for the gas-retention, a result in line with the conclusions of Bohr as to the continuous skin function in respiration in the frog.

The large number of deaths occurring in this experiment unaccompanied by the factors hitherto noted is due, without doubt, to the fact that it was carried on in late spring, when the frogs had been in the laboratory for a long period and when, under normal conditions they would have been feeding; it indicated that further experiments at this time of the year with laboratory frogs would not yield reliable results, and it was among the last performed of the experiments described in this paper.

Winnipeg tap-water is a particularly hard water. The following figures for the solids contained were determined by Dr. H. P. Armes, and furnished to us by Professor M. A. Parker of the Department of Chemistry. The sample was taken on August 29th, 1912 (there is no reason to believe that there has been any noteworthy change of composition in the interval), and the figures refer to parts per million by weight.

Free and saline NH_3	0·01
Albuminoid NH_3	nil
Oxygen consumed	0·28
N as nitrite	trace
N as nitrate	0·05
Ca	94·0
Mg	71·2
Na (calculated)	205·4
Cl	284·0
SO_4	212·1
Fe	0·05
Total solids	1158·0
Temporary hardness	354
Permanent hardness	172

The solution corresponds approximately to 0·1 per cent NaCl, and has therefore an osmotic pressure one sixth that of the frog's body-fluid; this suggests at once that the gas retention may be connected with this abnormally great amount of solute. Two possible mechanisms suggest themselves, the first, osmosis, the second, a specific pharmacodynamic effect of some constituent of the water on the frog, and presumably on the skin of the frog. The following experiments were carried out to test these possibilities.

EXPERIMENT 7. A bottle was filled with about 4·5 litres of tap-water to which two grams of sodium chloride per litre has been added so that the osmotic pressure of the solution was about three times that of Winnipeg tap-water. A constant stream of air was sucked through a tube reaching to the bottom of the vessel, and the water caused to circulate continually, so that the whole was kept thoroughly aërated. The conditions differed from those in the previous experiments by the greater aëration of the water (approximately saturated), its greater osmotic pressure, and also by the fact that the water was throughout at room temperature, i.e., on the average probably at least 10° higher.

The experiment was commenced on March 29th. Four frogs were immersed in the solution, and kept continuously below the surface. The solution was changed on the second day. One frog died during the third day. It was very swollen, weighed 82 grams, and over 20 c.c. of liquid were removed, indicating an absorption of over thirty per cent of the original body weight. At the end of the third day the other frogs were removed (all were apparently dead). Two, dead, gave the following figures: The first weighed 95 grams; 30 c.c. of liquid were removed from it (46 per cent of the original weight). The second weighed 65 grams; 20 c.c. of liquid were removed, amounting to 44 per cent of the original weight. The remaining frog commenced to breathe 3 or 4 minutes after removal. It weighed 65 grams. It lost weight steadily, and after 6 days weighed 45 grams, and had attained approximately constant weight. Accepting this as approximately the original weight, in this case also the absorption of liquid was over 40 per cent of the original weight of the frog. In no one of these frogs was any trace of buoyancy exhibited so that osmotic absorption is not in itself the mechanism causing retention of gas.

The following experiments were carried out in a similar apparatus and under similar conditions to those of experiment 7, different solutions being employed.

Experiment 8. Commenced April 24th, 1915. Four frogs were placed in distilled water. The water was changed on the third, tenth, and fourteenth days. Frogs died on the first, second, fourteenth and nineteenth days. They were only slightly swollen; none showed any trace of buoyancy.

This experiment indicated that the solid constituents of the Winnipeg tap-water are probably connected with the causation of gas retention, since in their absence this does not take place. We had hoped to show much longer average life in distilled water than in tap-water. The shorter life observed is probably due—as are the results in experiment 6—to the period of year when the experiment was performed, the frogs, which should normally have been feeding, being weakened after their winter fast. The higher average temperature may be an additional cause.

Experiment 9. Commenced April 19th, 1915. About four grams of calcium chloride (anhydrous) were dissolved in 5 litres of distilled water, the solution containing about three times the number of calcium ions as the tap-water. Four frogs were immersed. The water was changed on the third, and on the eighth day. Frogs died on the first, second, and eighth days. They were not markedly swollen, and showed no trace of buoyancy. The remaining frog was removed on the fifteenth day. It was apparently normal, and remained so for the following several days during which it was kept under observation.

EXPERIMENT 10. Commenced May 4th, 1915. About eleven grams of hydrated sodium sulphate were dissolved in five litres of water, giving a solution containing about three times the number of sulphate ions as are present in Winnipeg water. Four frogs were immersed in this solution. The water was changed on the sixth day. Frogs died on the seventh, eighth, and two on the ninth day. All were markedly swollen. None showed any trace of buoyancy.

These preliminary experiments to test whether any particular ions cause the gas retention have led therefore to no positive results.

Sulphate ions seem to produce a definite toxic effect. The results for calcium ions were not so certain.

We do not wish to discuss the osmotic phenomena concerned with the absorption of liquid through the skin of the frog. The results summarised in the following paragraphs have however some connection with our own, and are therefore mentioned.

Weymouth Reid gives in Schäfer's Text book[1] an account of his own experiments showing that, with living skin from the frog, the direction of easier osmotic flow of non-deleterious solutions is from without inwards; as its vitality declines, the skin becomes less and less permeable from without inwards, and the dead skin is more permeable in the reverse direction. The first period lasts from 70 to 80 hours in strong frogs after somatic death and only 24 hours or so in feeble animals at the end of the breeding season. Reid showed also that when freshly removed skin was immersed in 0·6 per cent. sodium chloride solution, with equal pressure on both sides of the skin so that filtration and osmosis played no part, there existed a current flowing from the outer to the inner surface of the skin. These experiments were carried out in 1890 to 1892.

Höber, writing in 1907,[2] and basing his remarks largely on Reid's experiments, pointed out that frog's skin was until that time the only membrane in which an absorption-power (resorbierende Triebkräfte) which could be traced to the epithelium, was demonstrable. He pointed out further that water can pass through the skin in either direction, since when frogs, tritons, or salamanders are placed in almost dry air they lose about 30 per cent. of their body-weight through the skin. He quotes Overton's conclusion that the osmotic pressure of frogs absorbing water, when immersed wholly or partially within it, is

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[1] Weymouth Reid, Schäfer's Textbook of Physiology, vol. i, p. 690.

[2] Höber, Korânyi and Richter's "Physik. Chemie u. Medizin," vol. i., p. 342, 1907.

kept constant by the excretion of a corresponding amount of water through the kidneys. Frogs placed in sodium chloride solutions of varying concentration show less and less absorption of water until with 0·65 per cent. solution the increase of weight stops with an apparent dynamic equilibrium.

Höber characterised such animals as "homoiosmotic" as compared with many others, such as sea-invertebrates and elasmobranchs, which cannot maintain an osmotic equilibrium and which he accordingly called "poikilosmotic."

A number of papers have appeared recently by Backman and collaborators, and by Brunacci. Unfortunately we have been unable to consult the originals, in Swedish and in Italian journals respectively, and have only seen the summaries in German journals[1] which are largely polemical with regard to priority concerning a modification of Höber's application of homoiosmotic properties to the frog.

Backman and Sundberg found that when *R. temporaria* (spring and summer frogs which had already commenced feeding) were immersed in fresh water only slight gains or losses of weight took place. Animals immersed in 0·6 per cent. sodium chloride solution for 24 hours gained over 20 per cent. in weight. If subsequently placed in distilled water for 24 hours, the whole of this increase was lost. If now placed in 0·6 per cent. sodium chloride solution again in the course of 100 hours there was only a very slight increase of weight. If placed in solutions of either sodium chloride or cane sugar, hypertonic to the body-fluids, there was steady loss of weight. In 11 per cent. cane sugar solution (in which the osmotic pressure was more than twice that of frog's blood) the animals died in less than 18 hours, and had lost in that time 30 per cent. of their body-weight.

Backman concludes that his experiments show that *R. temporaria* can live for a long time in a medium whose osmotic pressure is nearly the same as that of the frog. The solution at first produced marked effects, but the frog soon adapts itself to the medium and behaves in normal fashion. The frog cannot live in a medium whose osmotic pressure exceeds that of its own, but loses in weight and volume, while its body-fluids increase in concentration rapidly until isotonic with the surrounding medium.

He obtained similar results for toads (*Bufo vulgaris*) and tritons (*Triton cristatus*). He discusses the possibility of action on the skin by the salt solution, especially as explaining the absence of absorption in fresh water and the fact that absorption commences at once with

[1] Backman u.a., Zentralb. f. Physiol., 1911, vol. xxv, p. 837; Arch. f. d. ges, Physiol., 1912, cxlviii, 396; 1913, cli, 52; Brunacci, Zentralb. f. Physiol., 1911, xxv. 1167; Arch. f. d. ges. Physiol., 1913, vol. cl, p. 87; vol. cliii, p. 366.

weak (e.g. 0·15 per cent.) solutions of sodium chloride (this suggestion was first put forward by Durig[1]). and the counter possibility that absorption takes place through the alimentary tract, and not through the skin. He claims that his experiments show that the skin of amphibia allows salts to pass inwards, and water to pass outwards.

Brunacci experimented on *R. esculenta* (with both winter and summer frogs.) He found that summer frogs placed in distilled water (for from 3 to 8 days) did not change their skin color, had no fluid in the lymph sacs, and no large amount of urine in the bladder. The minimum value of the depression of the freezing point for blood was 0·430°. Similar frogs placed in hypertonic Ringer's solutions showed an alteration of skin colour (it became greyer) and a large absorption —shown especially by a large amount of a bright yellow coagulable liquid in the lymph sacs, especially in the lateral sacs, and large amounts of urine. The maximum value for the freezing point depression for the blood was 0·780°, obtained after immersion in 11 per cent. Ringer's solution. Generally speaking, the liquid in the lymph sacs had a value for $\triangle$ a little higher or lower than that of the surrounding medium, but always lower than that of the blood. Frogs set themselves rapidly in osmotic equilibrium with their surroundings, and the osmotic pressure of their blood always attained a higher value or the animal died. Winter frogs withstood a 2 per cent. sodium chloride solution for 24 hours, summer frogs only for 3 or 4 hours.

Apparently, in Brunacci's experiments the frogs were not completely immersed.

Finally we must refer to the recent note of M. H. Fischer[2] who has shown that frogs may remain for weeks after complete suppression of external kidney function (by ligaturing both ureters) indicating that excretion of water and urea and salts can take place through the skin in the case of this animal.

Comparing the above results with our own, we would point out that numerous experiments with markedly hypotonic solutions (all our experiments except those with distilled water come under this category) yield no evidence of adaptation, but only of more or less delayed action, and do not therefore support Backman's conclusions from his own experiments with 0·6 per cent. saline. The experiments of Brunacci with distilled water, and those of Backman with fresh water are in agreement with our own. All the results emphasise the different effects with moderately hypotonic solutions and with fresh or distilled water (very hypotonic).

[1] Durig, Arch. f. d. ges. Physiol., 1909, vol. lxxxv, p. 401; quoted by Backman, *loc. cit.*

[2] M. H. Fischer, Science, xli, p. 584, 1915.

Speaking generally the observations in these experiments agree for the most part with our own results, and bearing them in mind we conclude that the absorption of liquid which takes place at an uncertain and varying interval after frogs are immersed in Winnipeg tap-water is brought about by the solid constituents of the water acting on the cells of the skin (as suggested by Durig) and permitting normal osmosis to take place. While the possibility of absorption through the alimentary tract must be borne in mind, we think that the balance of the evidence is against this playing any large part in the total absorption, since it is evident that the skin can allow the passage of water in either direction and does so under suitable conditions, while, as we have pointed out, the gas-retention observed in our experiments seems to take place only when liquid is being absorbed, and the gas-exchange almost certainly takes place through the skin.

Although our own experiments with distilled water do not lend support, we think it probable that in a water containing smaller amounts of solid constituents than that which we had to employ, the average life of frogs completely immersed would be much longer than the sixteen days we have actually found.

Further, although our experimental data are insufficient to warrant more than the suggestion, we consider it probable that the gas retention is due to some pharmacodynamic action of one or more of the constituents of the tap-water on the skin of the frog.

Summary of Results.

(1) Specimens of *R. pipiens* immersed in Winnipeg tap-water during late winter and spring will live on the average sixteen days. The extreme periods observed are 3 and 52 days.

(2) The frogs remain perfectly normal for some time, but at a variable period before death ensues—usually several days—they commence to swell. The swelling is due in all cases to the absorption of water, and in most cases this is accompanied by retention of absorbed nitrogen. In such cases the frogs show marked buoyancy, and are unable to dive away from the framework confining them below the surface of the water. If the frogs are removed at any stage before death occurs, they recover completely in a few days. If allowed to remain, death ultimately takes place, and is presumably connected, physically or chemically, with the distension.

(3) The causes of the phenomena are discussed, and other experiments described which throw some further light upon them.

In conclusion we wish to thank Professor Swale Vincent for the interest he has taken in the work throughout its course.

The Upper Limit of Temperature Compatible with Life in the Frog.

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Presented by PROFESSOR SWALE VINCENT, F.R.S.C.

(Read May Meeting, 1915.)

In previous communications[1] the authors have determined the lower limits of temperature compatible with life in the frog. These were found to be $-1 \cdot 25° \pm 0 \cdot 15°$ C. for *R. pipiens*, and for *R. clamitans* and *R. sphenocephala* a few tenths of a degree higher. These results were obtained from experiments in which the minimal temperature was maintained for one hour. At such temperatures the tissues of the frog were not killed. Muscle, nerve, heart, and brain and cord (in response to gross stimulation) reacted normally after the animal was brought back to room temperature. We considered that the cause of somatic death was probably a specific temperature effect upon some part or parts of the central nervous system.

Somewhat similar results, as regards the minimal temperature at which life is possible, have recently been obtained for fish (*Fundulus heteroclitus*, the common mummichog) by W. H. Martin.[2]

The present paper contains the results of a number of experiments designed to ascertain the corresponding upper temperature limit for the frog, and to see whether the cause of death in this case was particularly connected with the central nervous system or could be traced to some other factor.

Published data bearing on the subject are apparently not very considerable in amount, and the greater part seems to be indefinite, if not inaccurate. Unfortunately library facilities here have not permitted an exhaustive search after data which from their nature are probably widely scattered and frequently noted incidentally in work on other problems.

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[1] A. T. Cameron and T. I. Brownlee, Trans., 1913, Vol. VII, Sect. iv, p. 107; A. T. Cameron, *ibid.*, 1914, Vol. VIII, Sect. iv, p. 261.

[2] W. H. Martin, "Some experiments on the freezing and thawing of live fish," Contributions to Canadian Biology, Sessional Paper 39b, Ottawa, 1915, Fasc. I, p. 73.

Gadow[1] states that "Anura are............very susceptible to heat; most of them die when their temperature rises to about 40° C. Under such conditions they die quickly when in the water, but in the air their moist skin counteracts the heat, lowering it by evaporation; otherwise it would be impossible for a tree-frog to sit in the glaring sun in a temperature of 120° F."

Miss M. C. Dickerson states[2] "The Salientia can endure a greater degree of cold than of heat. It is thought that in water death occurs at 40° C. Thus tadpoles and water frogs are often killed in large numbers in the shallow pools of Texas. Land frogs and toads hide away in cooler situations under moss and stones in shaded regions and pass through a period of aestivation till lower temperature returns. The tree-frogs can endure much higher temperatures than can dry-skinned toads or water-frogs. It is said that they can sit in the sun at a temperature of 60° C. This is possible because of the moisture secreted by their skins. The fact is that they do not actually experience this high temperature because evaporation keeps the surface cooled to a much lower point."

Lord Lister[3] states that "........the normal temperature of man is deadly to the cold-blooded frog. That animal, which under ordinary conditions exhibits very remarkable persistance of vitality even after somatic death, is killed by being held for about a quarter of an hour in the hand; and if one of its hind feet be similarly warmed the blood-corpuscles will be found packed and stagnant in the vessels of the webs, as if mustard or any other powerful irritant had been applied to them."

In Pembrey's chapter on "Animal Heat" in Schäfer's Textbook it is stated that, according to Delaroche[4], a frog exposed to a temperature of 45° or 50° C. survived two hours, and further, "It has been shown by Davenport and Castle[5] that by gradually raising the temperature tadpoles can be kept alive in warm water. Hertwig[6] has observed that........a temperature of 34° is fatal" (to the ova of the frog).

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[1] Gadow, "Amphibia and Reptiles," (Cambridge Natural History), 1901, p. 68.

[2] Miss M. C. Dickerson, "The Frog Book," (New York, Doubleday Page & Co., 1908) p. 16.

[3] Lord Lister, "The Third Huxley Lecture," (London, Harrison & Sons, 1907), p. 13.

[4] Pembrey, Schäfer's Textbook of Physiology, (Young J. Pentland, Edin. and London) vol. i, 1898, p. 815 (from Delaroche, Journ. de Phys., Paris, 1806, tome lxiii; 1810, tome lxxi.

[5] Davenport and Castle, Arch. f. Anat. u. Entwicklungsgesch., 1885, Bd. ii, S. 227; quoted by Pembrey, *loc. cit.*

[6] Hertwig, Sitzungsber, d. preuss. Akad. d. Wissensch., 1896, S. 105; quoted by Pembrey, *loc. cit.*

Summarizing, more particularly for mammals, Pembrey concludes: [1]"The limit of high temperatures appears to be fixed by the point at which the proteids of the body begin to coagulate." The experiments of Maurel and Lagriffe indicate that 39° to 40° is the maximum temperature which can be survived by the frog, and that temperature can only be survived for short periods.[2]

Some of the experiments of Babâk and Amerling[3] on *R. fusca* and *R. esculenta* have a bearing on the present enquiry. Thus:

A specimen of *R. fusca* became motionless and ceased to react after immersion in water in a thermostat at 40·5° C. for one hour, and after a further 15 minutes at 42° was in complete heat rigor and dead. A specimen of *R. esculenta*, treated in the same way, while motionless and no longer reacting to stimuli after one hour at 40·5°, showed no trace of muscle rigor and began to breathe half a minute after removal from the water. After a further 30 minutes at 42°, on removal this frog was motionless, did not react, but was not in heat rigor. After ten minutes reflex movements and breathing appeared, and after twenty minutes, locomotion.

Another specimen of *R. esculenta* was kept continuously in a thermostat for 3 hours at 40°, one hour at 41°, one hour at 42°, and almost half an hour at 43°. The slight pressure caused in removing it from the thermostat produced a marked outbreak of stormy reflex movements after which it very rapidly recovered.

R. fusca ceased to react after two and one-half hours in a thermostat at 39°, and only recovered very slowly.

Babâk and Amerling found also that this effect is not due to want of oxygen as claimed by Winterstein,[4] since the power of resistance is inverted in the two species in oxygen-free atmospheres. The time of year at which their experiments were carried out is not stated.

Becht[5] has shown that the "heat paralysis" induced in nervous tissue when the frog attains a temperature about 34°, is not due

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[1] Pembrey, loc. cit. p. 824.

[2] Maurel and Lagriffe, Compt. rend. soc. biol., 1900, vol. ccxvii, p. 432; quoted by Tigerstedt in Winterstein's "Vergleichende Physiologie," vol. III, 2nd half, p. 90, 1914.

[3] Babâk and Amerling, "Untersuchungen über die Wärmelähmung und die Wirkung des Sauerstoffmangels bei Rana fusca und Rana esculenta," Zentralbl. f. Physiol., 1907, vol. xxi, p. 6.

[4] Winterstein, "Ueber die Wirkung der Wärme auf die Biotonus der Nervenzentren," Zeitschr. f. allg. Physiol., Bd. I, 1902; quoted by Babâk and Amerling, *loc. cit.*

[5] Becht, "Some observations on the nature of heat paralysis in nervous tissue," Amer. J. Physiol., 1908, vol. xxii, p. 456.

to an asphyxia from lack of oxygen. His experiments indicate also that frogs (species not stated) whose cerebrum has been removed, will withstand a temperature gradually raised in two hours from room temperature to 39°, and then immediately lowered, without fatal results. Becht further points out that heat paralysis of nerve always precedes heat paralysis of muscle (heat rigor).

A large number of experiments have been carried out by numerous observers on the effect of heat on frog's muscle, the majority being directed towards determining the temperatures of coagulability of the different proteins present, and the coincidence of one or other of these with the shortening of muscle produced on heating, the loss of irritability, and the onset of heat rigor.

A full discussion of these results is given by Vrooman,[1] whose experiments on *R. pipiens* in this laboratory are confirmatory of those of Vincent and Lewis[2] and others using British frogs, and indicate that striped and unstriped frog's muscle, heated gradually from room temperature, undergo two contractions, the first at about 39°, (38° to 40°), the second at about 50° (49° to 51°); the first contraction is due to the coagulation by heat of the protein present in the muscle fibre during life, the second to changes in the connective tissue elements in the muscle.

Since the muscle does not recover from heat rigor, such experiments indicate that exposure of frog's muscle for a very short period at 40° is fatal. No experiments have apparently been performed in which frog's muscle has been kept for definite periods of time at definite high temperatures.

Alcock[3] has shown that frog's nerve is killed by a short exposure to a temperature of 40° to 42°, while Vernon's experiments seem to indicate that the fatal temperature for frogs' hearts is a degree or two higher still.[4] (for R. *temporaria* and R. *esculenta*). J. B. Hofmann quotes the fatal temperature for the frogs' heart as 42°.[5]

Our experiments can be divided into three series:

i. Experiments on the intact animal, immersed in water.

ii. Experiments on the intact animal, in air saturated with water vapour and kept at a constant temperature.

iii. Experiments on exsected heart, muscle, and nerve.

R. pipiens has been employed in all cases except where stated specifically; *R. clamitans* was used in a few experiments. Late winter

[1] Vrooman, "Heat rigor in vertebrate muscle," Biochem. J., 1907 vol. ii, p. 363.

[2] Vincent and Lewis, "Observations upon the chemistry and heat rigor curves of vertebrate muscle, involuntary and voluntary," J. Physiol., 1901, vol. xxvi, p. 445.

[3] Alcock, Proc. Roy. Soc. London, 1903, vol. lxxi, p. 275.

[4] Vernon, J. Physiol., 1899, vol. xxiv, p. 250.

[5] J. B. Hofmann, in Nagel's Handbuch der Physiologie, 1909, Bd. I, S. 231.

and spring frogs from Illinois were used. It must be emphasised that the results obtained only apply necessarily to the species mentioned at the time of year stated.

Before passing to the results obtained in the three series of experiments, it may be noted here that Lord Lister's experiment was repeated in a single case with a specimen of *R. pipiens*. The frog was held in the hand for 20 minutes. Breathing ceased after about 10 minutes; there were convulsive movements after 15 minutes. At the end of 20 minutes the animal was quite unconscious, but the heart was beating rapidly and strongly. The animal recovered in 10 minutes. Hence such treatment is not necessarily fatal in the case of *R. pipiens*.

I. EXPERIMENTS ON THE INTACT ANIMAL, IMMERSED IN WATER.

The water in a small thermostat was slowly raised from room temperature to the temperature desired, which was then maintained by successive additions of warm or cold water, the water being rapidly stirred. The frog was completely immersed. A small thermometer was passed through the gullet into the abdomen, and the temperature recorded taken as the frog's internal temperature. The frog was bound loosely to prevent movement. The thermometer was corrected against a certificated standard, and the temperatures given throughout the paper are correct to within 0·1°C.

It will be shown in another communication that frogs can remain immersed in cold water for several weeks without fatal results. At the temperatures employed in the following experiments the oxygen content of the water is not greatly lessened, and the fatal results are not therefore to be attributed to any deficiency in oxygen-respiration (which during such immersion takes place through the skin).

In a number of preliminary experiments the temperature of the water was gradually raised to a maximum and the frog then immediately removed, so that exposure to such maximum temperatures was but momentary. Under such conditions, when the time of heating from room temperature was from 25 to 30 minutes an internal temperature of 39·5° was completely fatal (all tissues killed). The corresponding external temperature was 44°. An internal temperature of 38·5° (external 42°) was fatal in two instances out of three though the heart recommenced beating and the muscles were not killed. The third animal recovered after a long interval (it was left overnight, and the exact time of recovery was not recorded). In experiments in which the internal temperature attained was 37·5° (2), and 37°, the animal recovered in an hour or less.

It is evident that 38° is about the limiting temperature to which *R. pipiens* can be exposed for a short time without fatal result.

The remaining experiments in which the frogs were immersed in water are shown in the following table. In these experiments the time taken to reach the constant maximum temperature from room temperature was from 10 to 30 minutes. These experiments were carried out between January 18th and 22nd, 1915.

Expt. No.	Temperature		Duration of exposure	Result	Remarks
	External	Internal			
1.	35°C.	35°C.	15 min.	Fatal	Unconscious when removed from water. Heart beat recommenced but there was no recovery.
2.	28.0°	28.0°	15 "	Not fatal	Became unconscious in 10 min. Recovered in 5 min.
3.	27.5°	27.5°	25 "	"	Became unconscious in 20 min. Recovered in one hour.
4.	26.0°	26.0°	35 "	"	Became unconscious in 30 min. Recovered in 2 min.
5.	35°–36°	35°–36°	30 "	Fatal	No sign of life when removed from water. Heart beat recommenced, but there was no recovery.
6.	33.0°	33.0°–33.2°	30 "	"	As in expt. 5.
7.	33.0°	33.0°–33.2°	30 "	"	As in expt. 5.
8.	32.0°	32.0°–32.3°	30 "	Not fatal	No sign of life when removed from water. Recovered.
9.	35.0°	35.0°–35.2°	45 "	Fatal	No sign of life on removal. Muscles responded to stimulation.
10.	32.0°	32.0°	60 "	"	Some muscle tissue responded to elec. stimulation. No recovery after 20 hours.
11.	31.0°	31.0°	60 "	"	On removal from water examination of web of foot under microscope showed corpuscles moving very slowly in larger

Expt. No.	Temperature		Duration of exposure	Result	Remarks
	External	Internal			
					vessels, although no heart beat was visible from the exterior. No recovery after 22 hours.
12.	30.0°	30.0°	60 min.	Fatal	No recovery after 20 nor after 44 hours.
13.	29.0°	29.0°	60 "	"	As in expt. 12. Muscles responded to stimulation after 44 hours.
14.	25.0°	25.0°	60 "	Not fatal	No sign of life after removal from water. Animal recovered in 18 minutes.
15.	25.0°	25.0°	120 "	Fatal	No recovery after 18 nor after 60 hours. After 60 hours, muscles responded to stimulation; stimulation of brain gave gross reflexes; heart was stopped.

II. EXPERIMENTS ON THE INTACT ANIMAL, IN AIR SATURATED WITH WATER VAPOUR AND KEPT AT A CONSTANT TEMPERATURE.

The experimental details were the same as the first series of experiments, except that the frog was placed in a small wide-mouthed bottle, connected to the air by a moderately wide tube, and this air-chamber was placed in the thermostat and the latter heated as before. The bottom of the bottle was just covered with water so that the frog was in an atmosphere saturated with water vapour and could not lower its own temperature by evaporation of water through the skin. It should be noted that in these experiments the thermometer passing into the gullet did not interfere with respiration, which proceeded normally, except as regards rate, until the animal lost consciousness. The results are shown in the following table. The external temperatures are those in the frog's containing vessel. The time taken to reach the maximum temperature varied from 40 to 60 minutes. The experiments were carried out between January 25th and February 25th, 1915.

Expt. No.	Temperature		Duration of exposure	Result	Remarks
	External	Internal			
16.	34.0°C.	34.0°C.	1 hour	Fatal	No sign of life when removed from the thermostat. 30 hours later muscles did not respond to stimulation.
17.	34.0°	34.0°	"	"	No sign of life when removed from the thermostat. No recovery after 28 hours.
18.	34.0°	34.0°	"	"	No sign of life when removed from the thermostat. After 15 hours there was no recovery. Muscles responded fairly vigorously to stimulation. On opening the thorax the heart was found to be beating feebly. Exposure and stimulation of the brain gave the usual gross responses.
19.	34.0°	34.0°	"	"	No sign of life when removed from thermostat. No recovery after 12 hours. Muscles only responded feebly to stimulation. Heart was stopped. Stimulation of brain gave feeble responses from back and forelimbs.
20.	33.0°	33.0°	"	"	No sign of life when removed from thermostat. No recovery after 96 hours. Stimulation of muscles at this time evoked response.
21.	32.6°–33.1°	33.0°–33.1°	"	Not fatal	Animal was unconscious when removed from expt. chamber but an irregular heart beat was visible. Partly recovered in 1¼ hours. A quarter of an hour later spasmodic movements occurred. Recovered completely.

Expt. No.	Temperature External	Temperature Internal	Duration of exposure	Result	Remarks
22.	33.0°–33.1°	33.0°–33.1°	1 hour	Fatal	No sign of life when removed from experiment chamber. No recovery after 14 hours. Stimulation through the skin evoked responses. After 35 hours the animal was completely dead.
23.	33.0°	33.0°	"	"	No sign of life when removed from expt. chamber. No recovery after 22 hours. Muscles responded to stimulation. No recovery after 48 hours. Muscles responded to stimulation. Heart stopped. Stimulation of brain gave usual responses.
24.	31.8°–32.1°	31.9°–32.1°	1 hour	Not fatal	Unconscious when removed from expt. chamber, but faint heart beat was visible. Completely recovered in less than 5 hours.
25.	32.0°	32.0°	"	Fatal	No sign of life when removed from expt. chamber. Blood seen to be moving slowly in web of foot. No recovery after 24 hours, but muscles responded vigorously to stimulation. After 50 hours no recovery but muscles still responded to stimulation. Heart stopped.
26.	32.0°	32.0°	"	"	No sign of life on removal from expt. chamber. 24 hours later, no recovery, muscles responded to stimulation, heart stopped.
27.	32.0°	32.0°	"	Not fatal	Animal unconscious when removed from expt. chamber; heart beat faintly perceptible from exterior. Animal completely recovered in less than 2 hours.

Expt. No.	Temperature		Duration of exposure	Result	Remarks
	External	Internal			
28.	30.8°–31.1°	31.0°–31.1°	1 hour	Not fatal	Animal unconscious when removed from expt. chamber. It recovered completely in 2 or 3 minutes.
29.	30.0°	30.0°	"	"	Animal did not become unconscious.
30.	30.0°	30.0°	"	"	Animal did not become unconscious.
31.	29.9°–30.1°	29.0° } 30.0°–30.1°	{ 20 min. 1 hour	Fatal	No sign of life when removed from expt. chamber. No recovery after 24 hours. Muscles alive. Heart beating slowly and weakly. Stimulation of brain gave usual responses
32.	29.0°	29.0°	1 hour	Not fatal	Recovered in 2 minutes. Then for a short time the animal was thrown into convulsive twitchings by touching it or other slight stimulation.
33.	27.9°–28.1°	28.0°–28.1°	"	"	Not unconscious.
34.	33.0°	33.0°	2 hours	Fatal	No sign of life on removal from expt. chamber. No recovery after 48 hours; muscles alive; heart stopped.
35.	33.0°	33.0°	"	"	Similar results.
36.	33.0°	33.0°	"	"	Similar results. After 18 hours, on opening the thorax, the heart was found to be stopped; stimulation of brain evoked feeble responses.
37.	33.0°C.	33.0°C.	2 hours	Fatal	No sign of life on removal from expt. chamber. No recovery after 20 hours. Muscles responded to external stimulation. After 26 hours the heart beat was faintly visible through the skin. There was no recovery after 96 hours.

Expt. No.	Temperature		Duration of exposure	Result	Remarks
	External	Internal			
38.	32.0°	32.0°	2 hours	Fatal	No sign of life after removal from expt. chamber. No recovery after 3½ hours nor after 72 hours.
39.	32.0°	32.0°	"	"	Similar results.
40.	32.0°	32.0°	"	"	Similar results.
41.	32.0°	32.0°	"	"	Similar results.
42.	31.0°	31.0°	"	Not fatal	Unconscious when removed. Recovered in 1 or 2 minutes.
43.	31.0°	31.0°	"	"	Unconscious when removed. Recovered in less than 4½ hours.
44.	31.0°	31.0°	"	Fatal	Unconscious when removed. Blood circulating slowly in web of foot. No recovery after 1 hour. 2½ hours later the heart was beating slowly. There was no recovery after 72 hours.
45.	31.0°	31.0°	"	Not fatal	Not unconscious.
46.	30.0°	30.0°	"	"	Not unconscious. Some convulsive movements on removal.
47.	30.0°	30.0°	"	"	Not unconscious.
48.	30.0°	30.0°	"	"	Not unconscious.
49.	30.0°	30.0°	"	"	Not unconscious.
50.	28.8°–29.2°	29.0°–29.2°	"	"	Not unconscious.
51.	25.0°–25.1°	25.0°–25.1°	"	"	Not unconscious.
52.	30.0°	30.0°	6.5 hours	"	No sign of life when removed from expt. chamber. Did not recover after 16 hours.
53.	29.8°–30.1°	30.0°–30.1°	"	"	Similar results.
54.	27.8°–28.1°	27.9°–28.3°	"	Not fatal	Unconscious when removed from thermostat but strong heart beat visible. Recovered in 2 or 3 hours.

In most of the above experiments no difference was observed between the internal and external temperatures of the frog, i.e. the difference did not exceed 0·1°C. The following experiments were carried out in an accurate constant temperature thermostat, for the use of which we wish to thank Dr. Davis of the Chemical Department of this University. In the first experiment the internal temperature of the frog was noted for some time; it took half an hour to reach a constant temperature, and two hours later was 0·2°C. above that of the external temperature. The frog then managed to eject the thermometer from its gullet, and only the external temperature could be noted. In subsequent experiments the frog was placed in the experiment chamber unbound, and was considered to have attained its maximum temperature in half an hour. Its internal temperature (since the animals remained almost motionless except at rare and short intervals throughout the experiments) certainly did not exceed that of the air chamber by more than 0·2° or 0·3°C. These experiments are of course too few to lay great stress on the individual results.

Experiment 55. April 6th, 1915. External temperature 25·2°C. The frog breathed fairly regularly for the first two hours. The breathing became rapid after 5 hours. After 11 hours the frog was unconscious and apparently dead. After 24 hours it was removed and examined. It was completely dead, electrical stimulation evoking no response. *The muscle and heart tissues were soft.*

Experiment 56. April 7th, 1915. Similar to experiment 55 and with precisely similar results. (Since there was a slight, though unlikely, possibility of asphyxiation producing the fatal result, a frog was placed in the air-chamber at room temperature and left for 24 hours, at the end of which period it was quite normal.)

Experiment 57. April 9th, 1915. External temperature 24·3°C. After 5 hours the frog was breathing a little faster than normal; after 9½ hours its condition was unchanged. At the end of 24 hours it was completely dead.

Experiment 58. April 19th, 1915. External temperature 22·3°C. The frog commenced to breathe somewhat more rapidly when first placed in the air chamber, but after 14 hours it was apparently normal and breathing slowly; its condition was unchanged after 17·5 hours. During this period the external temperature varied between 22·1° and 22·3°C. It then rose slowly to 23·0° and at the end of 21·5 hours the frog was removed from the thermostat. On removal it showed no sign of life. Examination showed movement of blood in the vessels in the web of the foot, muscles alive. Miscroscopic examination of a drop of blood from the anterior abdominal vein showed the corpuscles normal and no sign of laking. On opening the thorax the heart was found to be soft, congested, and stopped. It responded to stimulation but did not continue to beat.

EXPERIMENT 59. April 20th, 1915. External temperature 22·1°C. The frog commenced to breathe more rapidly when placed in the air chamber. After 10½ hours the frog was apparently dead and was removed. On removal there was no sign of life, but after a few minutes the heart commenced to beat. Breathing commenced two or three hours later, and the frog recovered.

EXPERIMENT 60. April 21st, 1915. External temperature 22·1° C. After 15 hours the frog was breathing normally. After 23 hours it was apparently dead. It was removed and allowed to cool slowly to room temperature. Examined 2½ hours after removal it showed no trace of recovery. Electrical stimulation through the skin evoked the usual response. The heart-beat was very faintly visible though the wall of the thorax. There was no recovery after a further 12 hours.

EXPERIMENT 61. April 23rd, 1915. External temperature 19·3°-20·0°C. (for the most part between 19·3° and 19·4°C.) Duration of experiment 36 hours. The frog did not lose consciousness. It was left in the air chamber after removal from the thermostat, and so allowed to cool slowly to room temperature. 3½ hours later it was taken from the air chamber, and was unconscious, only a faint heart beat being visible. Three hours later it commenced to recover, and had completely recovered in a few minutes. It was kept under observation for a week and remained perfectly normal. The result indicates that apparently a slightly longer time at the temperature of the experiment would have given a fatal result. The after effects may have been apnoeic owing to a perhaps slightly increased rate of breathing during the experiment, though it is doubtful if this would have caused unconsciousness for a period of three hours.

The results of the experiments 16 to 61 inclusive may be summarized in the following table.

Duration of experiment	Fatal temperature	Non-fatal temperature	Remarks
1 hour	34° C.	31° C.	33° C. was fatal in 75%, 32° in 50% of expts.
2 hours	32°	30°	31° C. was fatal in 25% of the expts.
6·5 "	30°	28°	
11 "	(25·2°)		See Expt. 55.
15 "		22·1°	" Expt. 60.
23 "	22·1°		" Expt. 60.
36 "		19·5°	" Expt. 61.

These results, when plotted (time against temperature) give a curve which is moderately regular, considering the small number of experiments of long duration. The curve indicates that *the highest temperature at which R. pipiens can maintain life continuously is about 18°C., while continued exposure to a higher temperature will prove fatal.*

A few experiments have been carried out with specimens of *R. clamitans.*

Experiment 62. April 30th, 1915. A specimen was kept at 35° (35·0° to 35·2°) for one hour. On removal from the air-chamber it was unconscious. The heart commenced to beat after one or two minutes. The animal had not regained consciousness after 5 hours. On opening the thorax the heart was found to have stopped. Tapping caused it to recommence beating, which continued. The muscles of the hind limbs were dead; those of the fore limbs reacted to electrical stimulation.

Experiment 63. April 30th, 1915. The frog was kept at 34·0°-34·2°C. for one hour. On removal the animal was unconscious. The heart beat was vigorous, and stimulation through the skin gave the usual results. There was no recovery after 2 nor after 12 hours.

Experiment 64. May 2nd, 1915. Internal temperature 30·0°-30·2° for one hour. The frog did not lose consciousness.

Since the limits obtained in these three experiments are the same as for *R. pipiens* for the same time, it is evident that similar conclusions can be drawn for the two species.

III. EXPERIMENTS ON EXSECTED HEART, MUSCLE, AND NERVE.

In these experiments the exsected tissues were kept in modified Locke solution, and in each experiment similar tissues were kept in the same solution at room temperature for the same period of time without deleterious effect. The experiments were carried out in March, 1915 (except No. 8 of the muscle-nerve experiments, performed on May 15th).

A. Experiment with the Heart.

Three hearts kept at 35° for one hour were all killed. Of six hearts kept at 34° for one hour only one recovered. At 33° for one hour, one of three recovered. The same result was obtained at 32°. At 31° for one hour, five hearts out of six recovered their spontaneous beat, while the sixth responded to stimulation.

These results indicate that the same temperatures are fatal for the heart as for the intact animal, and suggest a possible cause of the death of the animal. That the cessation of the heart-beat is the actual cause of death is however disproved by the numerous cases shown in the tables in which the heart beat persisted, or recommenced, although somatic death was certain.

B. Experiments with Muscle-Nerve.

The gastrocnemius-sciatic preparation was employed. The results are shown in the following table. Tests of recovery were usually made one-half hour to one hour and one-half after the removal of the preparations from the thermostat, when the preparation had cooled to room temperature.

Expt. No.	Duration of exposure	Temperature	Number of preparations used	Result for Muscle	Result for Nerve.
1.	1 hour	40°C.(39·8°-40·0°)	6	All killed (rigor)	
2.	"	39·0°	6	All killed (rigor)	
3.	"	38°(37·9°-38·0°)	6	None killed	All killed
4.	"	38·0°	6	"	"
5.	"	37·0°	6	"	3 killed; 3 survived.
6.	"	36·0°	6	"	None killed
7.	2 hours	36·0°	6	5 killed (no rigor)	The nerve of the surviving muscle was dead.
8.	"	36°(35·9°-36·2°)	6	4 killed (2 in rigor, 2 not in rigor)	The nerves of the two surviving muscles were dead.
9.	"	34°(34·0°-34·2°)	6	2 killed	The nerves of three surviving muscles were dead. One nerve was not killed.
10.	6 hours	31·0°	6	All killed (no rigor)	
11.	"	29·0°	6	4 killed (no rigor)	The nerves of the two living muscles were dead.
12.	"	28°(27·8°-28·0°)	6	2 killed (no rigor nor opacity)	The nerves of the four living muscles were dead.

In experiment 8, the two surviving muscles responded only feebly when stimulated shortly after removal from the thermostat. Eleven hours later there was no recovery in the other four muscles, and these two muscles also were dead; five controls of six were normal.

These experiments give a curve for muscle somewhat similar to that for the intact animal, at a slightly higher temperature level, while data obtained from observations on the surviving tissues in the longer experiments in series II give points on this curve.

The death point of peripheral nerve (as indicated by electrical stimulation in cases where the muscle survived) is one or two degrees lower than that of striped muscle.

It would seem possible that the cause of death in muscle subjected to moderately high temperatures (25° to 35°C.) for a few hours is not protein coagulation, since there is in almost all cases no trace of heat rigor, the muscles remaining soft and translucent (compare also experiment 55, series II).

DISCUSSION OF RESULTS.

Experiments on the intact animal in air and in water indicate a certain degree of variation in the effect of continued exposure to definite temperatures. This is shown especially in the experiments in air, in which the animals were kept for one hour at 31° and at 32°.

The experiments in air lead to the unexpected conclusion that the highest temperature at which *R. pipiens* can maintain life indefinitely is about 18°C. while a temperature a degree or two higher will prove fatal within a few days. The fatal temperature is to a great extent a function of time, varying from 19° or 20° to 39° or 40° as the time is shortened. Allowing for the slight individual variations mentioned, the effect is specific. Further, recovery, when unconsciousness intervenes, occurs within two or three hours, or not at all.

The cause of somatic death cannot be stated. The heart, specific effect on which might be regarded as most likely to be the cause, has been shown to be functioning in numerous cases where somatic death has occurred. Brain, nerve, and muscle are apparently normal after somatic death. Injury to other organs would probably not result in immediate death, but in death after partial recovery. Such delayed results were not obtained in any of the experiments of short duration (one or two hours).

A possible cause of death might be laking of blood, with resulting absorption of haemoglobin and a toxic effect thereform (this was suggested to us in discussion by Dr. A. Gibson). This seems precluded by the fact that in a number of experiments blood-corpuscles were seen moving in the vessels in the web of the foot, though somatic death had occurred (see experiments 11, 25, 44), and particularly by the results in experiment 58, where after somatic death, microscopic examination of the blood revealed no abnormality.

In a number of cases increased breathing was observed, and in the experiments lasting several hours this may have produced marked over-oxygenation. What would be the ultimate effect of this we cannot say.

Since the different systems separately appear not to be killed under the conditions mentioned, and yet somatic death occurs, we can only attribute this last to an interference with the machinery of coordination between the different systems. Such machinery may be nervous or chemical. The blood affords the most probable channel for the latter. There is no apparent change in the blood though accurate examination of the serum might reveal changes.

It is tempting to assume that the coordinating mechanism affected is connected with the central nervous system, but it must be remembered that the central nervous system remains alive. We have already quoted Becht's results on the heat paralysis of nerve, which, he points out, always precedes that of muscle. The most noticeable external effects in our experiments are on respiration (first a quickening and then a cessation) and heart-beat (similar results). Both of these are probably produced through the central nervous system. Neither is in itself a cause of death. The frog can live for a short time with the heart removed, and, as we shall show elsewhere, can live for several weeks immersed in water, with lung respiration stopped.

It is to be noted that temperatures which cause unconsciousness invariably prove fatal if maintained for a sufficient time.

The experiments on *R. clamitans* indicate that this species is subject to temperature limitations similar to those of *R. pipiens.*

The experiments in water give a curve (plotting temperature against time) similar to but steeper than that plotted from those in air. The curve indicates a similar limiting temperature (continuously maintained). We cannot explain the cause of the more rapid fatal effect produced in water. The difference in the results for *R. pipiens* and those obtained by Babák and Amerling for *R. fusca* and *R. esculenta* indicates considerable variation in the resistance offered to high temperature by different species.

The experiments on exsected muscle show the same important relationship between temperature and time. The similarity of this result for striped muscle and for the whole animal, in spite of the fact that striped muscle survived somatic death in almost all the experiments recorded, does not lend support to the theory that the cause of death of the animal is through the central nervous system.

We cannot account for the cause of death of muscle at moderate temperatures (25°-35°). It does not seem due to such heat-coagulation of proteins as would produce heat-rigor at higher temperatures, although it seems almost certain that such heat-coagulation and heat-rigor would be produced at markedly lower temperatures than those hitherto recorded (about 40°C.) if there were long exposure to such temperatures; some of our experiments showed rigor after exposure to 36°C. Meigs has suggested that the heat shortening of striped muscle tissues is dependent, not on the aggregation of the particles of coagulable protein, but on some other process, not improbably the formation of a large quantity of lactic acid.[1] This suggestion may have some application to our results.

Our results do not accord with any statements previously published (that we have been able to find) on the upper limits of temperature compatible with life in the frog.

We must repeat that the results in this paper apply to *R. pipiens*, late winter and spring specimens, (and to *R. clamitans*) and may not apply to other species nor at other times to these two species.

We desire to thank Professor Swale Vincent for the interest he has taken in this work.

[1] Meigs, "Concerning the supposed connection between protein coagulation and the heat shortening of animal tissues," Amer. J. Physiol., 1909, xxiv, p. 13, and p. 184.

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SECTION IV

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On the Resistance of B. Anthracis Spores to High Temperature.

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Presented by DR. J. G. ADAMI, F.R.S.C.

(Read May Meeting, 1915).

In order to test the results obtained by one of us in observations recorded in the preceding article, it seemed serviceable to study the heat resistance not of a number of various species, but of several different strains of one spore-bearing species, thereby determining whether the temperature of spore destruction is a specific character or whether, as the results previously obtained seemed to indicate, the temperature of such spore destruction is a variable.

For this purpose *B. Anthracis* appeared to us the most suitable species, and that for several reasons:

(1) This has been employed as a stock species for testing the value of disinfectants.

(2). It is a form which through its pathogenic and growth properties is easily distinguished, and

(3) There is little difficulty in obtaining strains from different sources.

We have obtained cultures answering in their cardinal properties to *B. Anthracis* from the following sources:

I. From the American Natural History Museum through the courtesy of Prof. Winslow, 4 strains, labelled respectively 107; 108; 109; 316.

II. Department of Agriculture, Washington, 7 strains labelled Burt; Boerner; Borden mule, Falfurias, 6087; 6071; and Davis.

III. The McGill Pathological Laboratory, stock culture 2 strains, O.S.C.$_1$; O.S.C.$_2$

IV. McGill University Department of Hygiene, 1 strain, H. L. In all, 14 strains. It is quite possible that certain of these may be of common origin.

Of these fourteen strains it deserves note that in every case the growth upon agar was abundant, raised, glistening, greyish-white or white. There were, it is true, variations in the extent of growth. Thus while the growth of 6087 was abundant, it was more delicate than was the case with all the other strains. All were Gram positive, though here again there was variation—in some all the individual bacilli were Gram positive (107, 316, Falfurias, Davis, 6087, Burt, Borden mule, Boerner, and the three stock cultures) while the remaining three (108, 109, 6071) showed some Gram negative interspersed among the Gram positive bacilli. Many of the strains showed beading; but our experience is that this is a variable property: successive growths taken from the same stock culture will exhibit now beading, now absence of beading. There was variation also in the shape, namely most strains exhibited the typical square ends; but certain strains (109, Davis) presented club and dumb-bell forms, and 108 and Davis possessed rounded ends.

Here again our experience is that prolonged growth in the laboratory media leads to variation in size and shape. Regarding spore formation, all presented central spores. There was, however, some variation in the rapidity and extent of production. A more striking variation was observed in the viscosity of the different strains. Some, (107, O.S.C.$_{1}$, O.S.C.$_{2}$, and H.L.) were drier and somewhat granular, easily breaking apart or flaking on attempted removal: the majority were distinctly shiny, stringy on attempted removal. These more shiny produced the more perfect emulsion in salt solution, whereas the granular forms tended to remain adherent, forming a sediment in the salt solutions. These four forms, therefore, required care in the process of planting from the salt solution on to the agar slants and in them it was found advisable to transfer some of the sediment.

The method of testing followed closely that described in the previous paper submitted by one of us. All cultures were transferred to plain agar slants, left to grow for five days, then examined for spore formation. All showed this. Saline solution was heated in the water-bath, which has already been described, to 80°, 85°, 90°C. Spores were then transferred by means of a platinum loop from the agar cultures to tubes containing the heated saline solution, maintained in the bath at a constant temperature for one hour, and then replanted upon agar slants. If no growth was observed after an incubation period of forty-eight hours, the results were regarded as negative. The results are given in Table I. All were capable of growth after heating at 80°C, none after heating at 90°, while five of the fourteen resisted an exposure to 85°C.

Table I.

Strain	heated one hour at 80°C.	85°C.	90°C.
316	+	+[1]	–
O.S.C.(1)	+	+[1]	–
O.S.C.(2)	+	+[2]	–
H.L.	+	+	–
Borden Mule	+	+	–
108	+	–	–
Burt	+	–	–
Boerner	+	–	–
Falfurias	+	–	–
Davis	+	–	–
6071	+	–	–
107	+	–	–
109	+	–	–
6087	+	–	–

Studying the above table together with the character of the different strains above recorded, it will be observed that no correlation is to be made out between any one feature, such as viscosity, strength of Gram positive staining, square endedness, etc., and heat resistance of the spores. The one obvious feature is that strains of the *B. Anthracis* vary in their heat resisting power. It is not possible to lay down that there is a specific thermal death point for Anthrax spores.

Following upon these observations the question presents itself as to whether or not this same variation exists between spores of the same strain of a species. With a view to ascertaining this point the following experiment was made and the results recorded in Table II.

Two cultures were selected, Davis and 607[1].

1. These two cultures were subjected to temperatures of 80°, 85°, and 90°C, for periods of five, fifteen, thirty, and sixty minutes.

2. Spores from these were transferred on the point of a platinum needle into a cubic centimetre of broth which was then well shaken up. A loopful of these emulsions was transferred to the heated broth tubes in the water-bath. After the required exposure a loopful of this broth was transferred to agar, which was plated. The plate cultures were left to grow for forty-eight hours, when the number of colonies, each representing a surviving parent spore, was counted.

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[1] Scanty growth in 24 hours.
[2] Scanty growth in 48 hours.

Table II.

Species.	80°C. Number of minutes of exposure. 5.	15.	30.	60.	85°C. Number of minutes of exposure. 5.	15.	30.	60.	90°C. Number of minutes of exposure. 5.	15.	30.	60.	
Davis...	9	0	7	2	3	0	0	0	1	1	0	1	colonies.
6071.....	1	0	6	0	5	2	1	0	50	5	0	1	

While this method could not be used for an exact comparison of the two species selected, the above figures seem to us to indicate the existence of spores in a single species possessed of unequal powers of resistance to moist heat.

From the results obtained from these two experiments we have arrived at the following conclusions:

1. That there is no correlation between any one growth characteristic and the heat resistance of the spores.

2. That strains of *B. Anthracis* vary in their heat resisting power.

3. That individual spores of the same strain of *B. Anthracis* vary in their resistance to heat.

4. That there is no specific thermal death point for Anthrax spores.

We wish to express our indebtedness to Professor Adami for enabling us to submit this paper to you.

Pre-Cambrian Goldfields of Central Canada.

By J. B. TYRRELL, F.R.S.C.

(Read May Meeting, 1915).

For almost fifty years gold has been known to occur in the Pre-Cambrian rocks of Central and Northern Canada. First discovered at what was afterwards known as the Richardson Mine in Hastings County, Ontario, it has since been found to be widely distributed wherever the greenstones, porphyries and conglomerates of the Pre-Huronian Complex occur from northern Quebec westward to the Province of Saskatchewan.

Production has been confined to the Province of Ontario, and until recently the quantity obtained from any one locality has not been large. Up till the 31st December, 1914, the total production of gold from the Pre-Cambrian rocks of the Canadian Shield was 718.500 fine ounces.

However desirable it might be for the material welfare of the community that gold should occur in sufficient abundance to be extracted at a profit in all of the places where its presence is known, the facts are that it occurs in many places where, either on account of being too sparsely scattered, or for other reasons, it cannot be mined at a profit, to the one place where the value of the gold won is greater than the cost of winning it. Nevertheless we will here set aside the question of profit or value for a short time, and consider it as a geological unit, regardless of whether the vein matter or rock in which it occurs contains 2 dwts. or 2 oz. or 200 oz. to the ton. The determination of the presence of the quantity of gold contained in rock (or vein matter, etc.) may be the question of greatest immediate economic importance in regard to it, but a thorough knowledge of the rocks with which it is associated, and of its mode of occurrence in those rocks may be of inestimable service in assisting to ascertain the extent of known goldfields, and in discovering and developing new ones.

In addition to the above considerations it would appear not unlikely that the gold-bearing veins in the Pre-Cambrian rocks of Central Canada are all of about the same age, in which case their presence should be of material assistance in helping to define the age of the rocks with which they are associated.

In order to understand clearly what is here meant by the Pre-Cambrian rocks of the Canadian Shield, and the particular subdivisions of those rocks with which we are now more particularly concerned, we may define them as the crystalline, sub-crystalline or metamorphosed rocks which constitute the great Eocontinental Crescent that extends around the basin of Hudson Bay through the Provinces of Quebec, Ontario, Manitoba, Saskatchewan, and Alberta, and into the unorganized portion of Canada north of the last of these three Provinces. Wherever they are in contact with rocks of Palaeozoic age they lie unconformably below them.

In 1905 an international Committee of six geologists was appointed to decide on a workable classification for these rocks, and the following classification was unanimously adopted.

[1]Pre-Cambrian
Keweenawan
Unconformity

Huronian	Upper *Unconformity* Middle *Unconformity* Lower

Unconformity
Keewatin
Eruptive contact
Laurentian

Since this classification was proposed a very large amount of work has been done in Canada on these rocks by Drs. Adams, Barlow, Coleman, Lawson, Miller, and other Canadian geologists.

Of these [2]Dr. Lawson has proposed the following classification:

Algonkian	Keweenawan *Unconformity* Animikie

Eparchaean Interval

[1] Report of International Committee on Lake Superior Geology. Jour. of Geol. Feb.-Mar., 1905.

[2] A. C. Lawson. A Standard Scale for the Pre-Cambrian Rocks of North America. Compte Rendu Congres. Geol. Inter. 12 Session, Canada, 1913.

Archaean	Algoman (granite-gneiss, batholitic in Huronian)	
	Irruptive contact	
	Huronian	Upper
		Unconformity
		Lower
	Unconformity	
	Laurentian (granite gneiss, batholitic in Ontarian)	
	Irruptive contact	
	Ontarian	Keewatin
		Coutchiching

[1]Dr. Coleman's classification is as follows:

Post-Laurentian	Keweenawan
	Discordance
	Animikie
	Discordance
	Upper Huronian
	Small Discordance
	Lower Huronian
	Great Discordance
	Laurentian in eruptive contact with lower rocks.

[1] A. P. Coleman. The Pre-Cambrian Rocks north of Lake Huron. 23rd Rep. Ont. Bur. Min., 1914, p. 206.

Pre-Laurentian	Sudbury Series.
	Great Discordance
	(Granite eruptive through the Keewatin).
	Keewatin, probably = Grenville Series.

[1]Dr. Miller has proposed the following classification:

Keweenawan......	Diabase of Cobalt, Norite of Sudbury, and Sandstones, conglomerates and marls of Thunder Bay, etc.
Animikean........	Quartzite, Conglomerate, etc., of Cobalt, etc., Slate, conglomerate, etc., of Hudson Bay, etc.
Algoman..........	Intrusive granite.
Temiskamian......	Conglomerate, quartzite, slate, etc., often schistose and usually dipping at a high angle.
Laurentian........	Granite and gneiss.
Loganian..........	Crystalline limestone and Iron Formations (sedimentary). Keewatin complex (igneous).

But the latest classification, and the one which includes work done in 1914 in the district in which Sir William Logan first proposed the "Division of the Azoic rocks of Canada into Huronian and Laurentian" is that of W. H. Collins.[2]

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[1] W. G. Miller and C. W. Knight. The Pre-Cambrian Geology of Southeastern Ontario, 22nd Rep. Ont. Bur. Min. Pt. II, 1914, p. 126.

[2] W. H. Collins. The Huronian Formation of Timiskaming Region, Canada. Museum Bull. 8. Geol. Sur. Can., Dec. 28, 1914.

	Nipissing Diabase, Sudbury Norite, etc.
	Intrusive Contact
Huronian	Whitewater Series.
	Cobalt Series
	Unconformity
	Bruce Series
	Great Unconformity
pre-Huronian	Batholitic granite intrusives
	Intrusive contact
	Sudbury Series Temiskaming Series Fabre Series, etc.
	Unconformity
	Granite Intrusives
	Keewatin Group

Mr. Collins points out clearly that it was Sir William Logan's intention to subdivide the Pre-Cambrian rocks of the Canadian Shield into a lower, highly metamorphosed or close folded portion which he called "*Laurentian*," and an upper sedimentary and comparatively little altered portion composed of rocks usually lying much more nearly horizontal than vertical which he called "*Huronian.*"

Sir William Logan's own first characterization of these two great subdivisions is as follows:

[1]"In the same report (1845-6) is mentioned, among the Azoic rocks, a formation occurring on Lake Temiscamang, and consisting of

[1] Sir W. E. Logan. On the Division of the Azoic rocks of Canada into the Huronian and Laurentian. Can. Jour. Ser. II, Vol. 2, pp. 439-442. Nov., 1857.

siliceous slates and slate conglomerates, overlaid by pale sea-green or slightly greenish-white sandstone, with quartzose conglomerates. The slate conglomerates are described as holding pebbles, sometimes a foot in diameter, derived from the subjacent gneiss, the boulders displaying red feldspar, translucent quartz, green hornblende, and black mica, arranged in parallel layers, which present directions according with the attitude in which the boulders were accidentally enclosed. From this it is evident that the slate conglomerate was not deposited until the subjacent formation had been converted into gneiss, and very probably greatly disturbed; for while the dip of the gneiss, up to the immediate vicinity of the slate conglomerate, was usually at high angles, that of the latter did not exceed nine degrees, and the sandstone above it was nearly horizontal."

"The group on Lake Huron, we have computed to be about 10,000 feet thick; and from its volume, its distinct lithological character, its clearly marked date posterior to the gneiss, and its economic importance as a copper-bearing formation, it appears to me to require a distinct appellation, and a separate color on the map. Indeed, the investigation of Canadian Geology could not be conveniently carried on without it. We have, in consequence, given to the series the title of Huronian.

"A distinctive name being given to this portion of the Azoic rocks, renders it necessary to apply one to the remaining portion. The only local one that would be appropriate in Canada is that derived from the Laurentide range of mountains, which are composed of it, from Lake Huron to Labrador. We have therefore designated it as the Laurentian series."

The Huronian conglomerates, etc., here mentioned as occurring on Lake Timiskaming are undoubtedly those since described by Dr. Miller as the Cobalt Series, while the Huronian sediments north of Lake Huron are described by Collins, where they are stated by him to have a thickness of 14,290-16,565 feet.

As far as my observations have gone Logan's subdivision has a general application throughout the Pre-Cambrian rocks of north central Canada. Mistakes were undoubtedly often made by Logan himself and his successors in placing various groups of rocks incorrectly in one or other of his great subdivisions, but those mistakes do not vitiate the correctness of the general idea. The law of priority of nomenclature should be strictly adhered to. Where other and later names have been applied they are only valid as long as the groups for which they have been used are not known to be identical with groups previously named, but as soon as identity with formations of known age has been established the earlier names should prevail and the later ones should be dropped. The fact that a name once correctly given has been wrongly used for years by some or even by all geologists is no justification for rejecting that name altogether, or for refusing to apply it correctly when its proper meaning as originally used has been determined. I therefore agree with Dr. Coleman and Mr. Collins in retaining the name Huronian in the general classification of the Pre-Cambrian rocks of Central Canada.

The great unconformity between Logan's *Huronian* and *Laurentian* is clearly shown in the classifications of Collins, Miller, and Coleman, and is probably indicated by the *Eparchaean Interval* in that of Lawson, in which latter case the name *Huronian* is incorrectly applied by him to beds below this *Interval* or *Unconformity*.

From the point ot view of the Economic geologist this unconformity is of the first importance. Above it are great basic intrusives associated with such rich ores of copper, nickel and silver as are found at Calumet, Sudbury and Cobalt, while gold seems tc be conspicuously absent. Below it is an intimately folded and fused mixture of sedimentary and igneous rocks, the latter varying in character from basic basalts to highly acid granites. Large areas of these rocks appear to be barren of useful metals of any kind, but where such a metal is present it is not silver, copper or nickel, as in the overlying formations, but it is usually gold. Gold in the Pre-Cambrian rocks of the Canadian Shield is thus practically confined to the Pre-Huronian, or to what Sir Wm. Logan evidently intended to call Laurentian, rocks. It may seem to be a heterodox statement to make, but nevertheless, it is true, that gold-bearing veins do not occur in the Huronian rocks of Central Canada, when these rocks are correctly designated, but are confined entirely to rocks of *Pre-Huronian*, or to what Logan would call *Laurentian*, age.

The Pre-Cambrian rocks lying below the Huronian in the Canadian Shield are somewhat differently designated in the various classification cited above, but that used by Dr. Miller holds most closely to priority of nomenclature, and therefore will be adopted, with the addition of the Couchiching of Lawson.

In some cases it will be difficult, or perhaps impossible to say with certainty to which subdivision of the Pre-Huronian the gold-bearing veins in any particular district should be allocated. It is true that these veins usually occur in areas characterized by the presence of greenstones or other rocks of Keewatin age, but in many cases it is clear that they have been formed subsequent to the deposition and folding of the later Temiskamian rocks, and in the absence of evidence to the contrary it would appear not improbable that they may have all been formed at about the same late period of Pre-Huronian time.

VEINS CONTAINING ARSENOPYRITE AND GOLD.

Beaver Lake. Gold has been found rather widely distributed in quartz veins in an area of Pre-Cambrian greenstones and schists on the north side of Beaver Lake in the Province of Saskatchewan, close to one of the principal waterways used by the early fur traders when on their way from Montreal to the Churchill and Athabasca districts.

The rocks in which the gold-bearing veins occur are acid quartz-mica schists, and altered quartz and feldspar-porphyries, all included in the much disturbed Archaean complex, and probably all of Keewatin age.

The Mica schists are well exposed on the property of the Beaver Lake Mining Company. The more massive varieties consist of a groundmass of finely granular quartz mixed with an abundance of biotite, included in which are larger crystals of feldspar, both striated and unstriated. Most of these crystals have been much crushed, and now have ragged edges, their borders being often altered to calcite. The foliation of the schist is distinct and regular, and dips N. 70° W. ∠ 35°. Close to the principal quartz vein on this property the schist is much more thinly foliated than elsewhere, and under the microscope the constituent minerals show a definite linear arrangement. This rock has probably been originally the same as the more massive variety mentioned above, but the minerals in it are as a rule more decomposed, calcite is more largely developed, and narrow bands of secondary quartz are fairly abundant. The schist is also impregnated with small well formed crystals of arsenopyrite. Cutting across the schist are many minute fractures or jointage planes, in which pyrite is often present.

The veins in which the gold occurs are of white quartz, associated with which are sericite and perhaps chlorite in dark irregular patches and narrow bands. In these darker patches and bands gold may occasionally be seen. The veins conform closely in dip and strike with the foliation of the schist. I was able to obtain gold on assay also in the schist impregnated with arsenopyrite adjoining the veins, and I believe the gold has been introduced with the arsenopyrite.

On the Eagle and Beaver Claims, which lie some distance south of the property of the Beaver Lake Mining Company, the rock is a schistose andesite-porphyry with a pepper and salt appearance on weathered surfaces, varying to a fine-grained chlorite schist. The coarser parts of this rock are composed of phenocrysts of plagioclase imbedded in a groundmass of rod like crystals of plagioclase and flakes of chlorite ? which are drawn out and wrapped closely round the feldspar phenocrysts. The finer grained rock has largely gone to chlorite, but contains much secondary quartz, calcite and arsenopyrite. In one place in this latter schist there was a vein or band of almost massive arsenopyrite, which in places on the surface was oxidised to green earthy Scorodite.

On the Palace and adjoining claims, which lie a short distance to the eastward of those already mentioned, the rock is a light green schistose feldspar porphyry, in which phenocrysts of plagioclase, usually much decomposed and with ragged edges, lie in a fine-grained groundmass of feldspar and chlorite. Sometimes quartz is present, both as phenocrysts and in the crystalline matrix.

The schists and porphyries here described are doubtless of Keewatin age, but whether the gold-bearing veins belong to a later stage of the Archaean or not was not determined.

It is interesting to note here that Mr. Bruce, of the Geological Survey of Canada, who examined this district in the summer of 1914, and whose brief report appeared in July 1915, records the occurrence on Beaver Lake of some bands of conglomerate, similar to those elsewhere referred to the Temiskamian, folded in with greenstones, etc., which at no great distance are cut by gold-bearing veins. This would indicate that the veins, which were formed subsequent to the folding of the rocks, were later in age than the conglomerates.

Long Lake. Gold also occurs associated with arsenopyrite at Long Lake about 25 miles south-west of Sudbury in rocks of Temiskamian age cut by basic intrusions probably of Algoman age.

[1] Dr. Coleman describes the gold ore and rocks associated with it as follows:

"On the road south of the (Long) lake the (Temiskamian) quartzite is still more disturbed, and is cut by dykes of coarse-grained and also of fine-grained diorite. Presently one observes that large blocks of the quartzite are enclosed in the diorite and are somewhat metamorphosed and penetrated by many small quartz veins. The mine itself is on such a mass of quartzite, a large irregular block enclosed in the diorite, part of it still showing bedding and cross bedding. In thin sections of the ore one finds the quartz crushed and rolled out and accompanied by some plagioclase, the whole evidently a good deal recrystallised, since no original grains can be seen. The diorite is rather dark greenish-grey and consists mainly of plagioclase and hornblende, with some biotite, epidote and apatite."

"The ore of the Long Lake mine is of an unusual character, consisting simply of the quartzite impregnated with mispickel, and in part also with pyrite. The mispickel is seldom in crystals visible to the eye, but is often diffused in small particles, giving a bluish tinge to the

[1] A. P. Coleman. The Pre-Cambrian Rocks north of Lake Huron. 23rd Ann. Rep. Ont. Bur. Min. 1914, p. 218.

quartz. Under the microscope these dark grey particles of mispickel can be seen irregularly scattered through the quartz. The gold, which is very fine and seldom visible, is associated with the mispickel rather than the pyrite."

"The source of the gold in this unusual variety of ore is probably to be sought in the diorite which shattered and carried off blocks of the quartzite, while magmatic solutions introduced silica, compounds of arsenic and sulphur and also gold. These materials were deposited in the small fissures and also in the pore spaces of the original sandstone which became transformed to the compact quartzite or arkose which now forms the ore."

"The relation of the diorite to the Laurentian granite is not certain, though the two seem more or less to blend toward the south and east of the mine."

The rock called by Dr. Coleman Laurentian is the same as that for which I am using Lawson's name Algoman.

Mr. J. A. Dresser informs me that he examined a number of thin sections of the quartzite from Long Lake under the microscope, and found that feldspar grains or crystals were abundant in places among the quartz grains. Small crystals of arsenopyrite have been introduced into these feldspar crystals, but he did not find them in the quartz grains. Decomposition of the feldspars had gone too far to be certain whether they were orthoclase or plagioclose.

Eastern Ontario. In eastern Ontario Arsenopyrite and gold are found associated together at the Cordova and Deloro mines in Hastings County. Dr. Miller describes these occurrences as follows:

[1]*Cordova Gold Mine.* "The ore-bodies occur in a coarse-grained gabbro-diabase which invades the Grenville and Hastings series. The veins are of quartz, with which are associated iron pyrites, feldspar and calcite. The wall rock has been altered to a chlorite-schist, or chlorite-mica schist, sometimes 50 feet wide, there being a gradual transition between the fresh gabbro-diabase and the schist. The latter is impregnated with quartz veinlets, parallel to the schistosity. Consequently there is not a definite boundary line between the ore and the schistose wall rock."

"The deposits may have been formed by hot solutions which followed the intrusion of the gabbro-diabase."

"The coarse-grained rock at the Cordova gold mine, has sometimes the texture of a diabase and sometimes that of a gabbro, one facies passing gradually into the other. It has been, therefore, called the Belmont gabbro-diabase, the word "Belmont" referring to the lake

[1] Willet G. Miller and Cyril W. Knight. The Pre-Cambrian Geology of South-eastern Ontario. 22nd Rep. Ont. Bur. Min. Part II, 1914. pp. 110 and 31.

or township of the same name. The feldspar, which is labradorite, is partly decomposed to saussurite and other secondary materials. The other chief constituent is pyroxene, and it is frequently altered to chlorite and green hornblende. Pyrite, apatite and titaniferous magnetite or ilmenite are present in the usual subordinate quantities."

"The gabbro-diabase series is important from the economic point of view, as in it at Cordova are the auriferous veins of the Cordova Mine."

"*Deloro Mine.* The ore bodies at the Deloro Mine and adjacent properties lie near the contact of the intrusive granite of the western edge of Huckleberry hills, with dark Keewatin schists and associated crystalline limestone of Grenville age."

"The ore bodies consist essentially of quartz lenses in the schist which contain visible gold and mispickel. The lenses conform to the strike of the schist and cut across dykes of granite which intrude the latter."

"The ore of the Deloro mine and of adjacent properties appears to be genetically connected with the Moira granite intrusion. The openings occupied by the ore bodies were probably formed by the contraction of the granite mass on cooling, and the ores came from the waters that followed the intrusion."

The Keewatin, Grenville and Hastings Series are all portions of the Pre-Huronian Complex, and the gabbro-diabase and Moira granite are near the top of this Complex, and are of Algoman age.

Of the occurrence of gold associated with arsenopyrite here recorded from three widely separated localities, one is genetically associated with a granite, another with a diabase, while the source of the third was not determined. All are of Pre-Huronian age, and two, namely those at Long Lake, and in Hastings County belong to the terminal portion of that Period, namely the Algoman, while the third, at Beaver Lake, is probably of the same age.

VEINS CONTAINING PYRITE AND GOLD.

The three cases described above have been taken as typical examples of the occurrence of gold in association with arsenopyrite in quartz veins in the Pre-Cambrian rocks of Canada.

Now we will turn to the larger class of veins in which gold is associated with pyrite while arsenopyrite is generally absent.

These veins occur in rocks of Pre-Huronian age which immediately overlie or adjoin granitic batholiths by which these rocks are intruded, and they are found more especially in places where the rocks have been sheared or otherwise rendered schistose, so that ore-bearing solutions were able to find their way readily through them.

Such veins are composed largely of quartz, and in them, besides gold, the following Tellurides have been recorded.

Calaverite
Hessite
Sylvanite
Tetradymite
Altaite

Associated with the quartz gangue the following minerals have also been recorded.

Calcite
Ankerite
Sericite
Chlorite
Tourmaline
Scheelite
Galena
Zinc blende
Tetrahedite
Molybdenite
Pyrite
Arsenopyrite
Chalcopyrite
Bornite
Covellite

Where the enclosing rock is schistose the veins usually run more or less closely parallel to the schistosity, or at a comparatively low angle to it. Where their general strike varies from that of the schistosity of the rock they usually follow the lines of the schist for certain distances and then cut suddenly across it, in this way forming step-like veins, both in vertical and lateral extention. Where the transverse breaks are small the whole vein system may appear as a series of disconnected lenses arranged *en echelon*. The mineral bearing solutions rose through the rock along the lines of least resistance, sometimes on fault planes, but more usually on planes where crushing or shearing forces, possibly assisted by shrinking, had caused lines of weakness and incipient fracturing. As the solutions rose through the rock they deposited quartz with the minerals associated with it. From these main channels the solutions spread out into the adjoining rock, altering it, and replacing portions of it with quartz and pyrite, so that most of the veins as now seen are portions of the rock itself which have been metasomatically altered to vein matter through the influence of the solutions rising through the established, though often interrupted, channels.

Veins often occur near the contact of intrusive acid dykes with other rocks, usually more basic than the dykes. In some cases these dykes have been shown to be connected with batholiths of granite or similar rock, while in many other cases the origins of the dykes are unknown.

Rice Lake District. Beginning with the records of the presence of gold in the localities farthest west and coming eastward we will first consider the Rice Lake district, near the eastern border of Manitoba.

Gold here occurs in quartz veins associated with pyrite, with a small amount of chalcopyrite and siderite.

[1]Dr. Moore states that the rocks of the district belong to the

Rice Lake Series or Keewatin "made up of acid igneous rocks, including quartz-porphyry, rhyolite and orthoclase-porphyry," with altered diabase and elypsoidal greenstone.

Wanipigow Series (*Lower Huronian? or Temiskamian*) consisting of conglomerate, arkose, graywacke, chert, jasper, grey gneiss and schist in a closely-folded syncline.

Manigotagan series of granite, pegmatite and gneiss, mostly newer than and cutting the sediments of the Wanipigow series and thus probably of Algoman age.

Speaking of the gold-bearing veins [2]Dr. Moore says:

"The Rice Lake rocks contain more of the large quartz veins than the Wanipigow," and again, "the granites and pegmatites are believed to be the source of the quartz veins, and the gold ore of this region."

In describing this district [3]Dr. Wallace gives the following interesting information about the character and age of the rocks in which the gold veins occur.

"The feldspar porphyry which is the dominant rock in the Keewatin in this area, and in which the quartz veins as a rule lie, is even in its altered condition remarkably poor in quartz, and was originally a plagioclase feldspar rock probably to be classified among the trachytes."

"The Keewatin eruptives of this area are noteworthy in that the more basic phases, elsewhere so pronounced, are here very imperfectly represented. The rocks are either acid quartz-porphyries or intermediate feldspar-porphyries very poor in quartz (with fine-grained

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[1] Sum. Rep. G.S.C. 1912, pp. 262-270 and map.

[2] Op. cit. p. 264-265.

[3] R. C. Wallace. The Rice Lake Gold District of Manitoba. Trans. C.M.I. Vol. 16 pp. 538-544, 1913.

felsitic equivalents), the phenocrysts being very markedly drawn out in the direction of shearing."

"The quartz veins lie in the feldspar and quartz porphyries north and south of the Huronian (Temiskamian) sediments."

From the above descriptions it is clear that the quartz veins were formed about the period of the intrusion of the Algoman granite, towards the close of the Pre-Huronian epoch. It is also interesting to note that they occur in an area where quartz and feldspar porphyries of Pre-Temiskamian age are abundant.

Lake of the Woods. In the Lake of the Woods district rocks of Temiskamian age have not been recognized, the series being confined to the Keewatin schists, agglomerates, etc., into which are intruded granites of either Laurentian or Algoman age. Near the Keewatin-granite contact gold-bearing veins have been discovered in a number of places.

At the *Mikado mine*, where a very persistent quartz vein occurs, the country rock is a chloritic calc schist cut by dykes or masses of fine-grained biotite-granite-porphyry (felsite) doubtless offshoots from a large granite mass to the North.

The principal quartz vein carrying gold is approximately vertical and is near the contact between the granite and greenstone. Down to the greatest depth to which it has been followed it is very regular in general character, being everywhere found to contain a little gold.

In its deeper portions it is in the granite but higher up it crosses the line of contact into the greenstone, and where it crosses the line it becomes decidedly narrower. This line of constriction and entrance of the vein into the greenstone is accompanied by a decided enrichment for thirty feet or so beneath it, forming an ore-shoot with a value of from ten to twenty-five dollars in gold to the ton, in a vein with a general tenor of less than one dollar to the ton.

At the *Sultana Mine* the vein is also close to the Keewatin-granite contact.

At the *Combined Mine* [1]Mr. Parsons gives the following description of the conditions. "The vein is nearly horizontal, though its dip varies considerably. By some it has been looked upon as a blanket vein which lies between overlying trap, exhibiting a pillow structure, and a dark underlying felsite or fine-grained porphyry. With the quartz, which in the principal vein varies from two to four feet in thickness, is a large body of rusty carbonate rock which seems to be derived from the alteration of porphyry or felsite and shows considerable sericite. In places this rock becomes a calcareous sericite schist.

[1] A. L. Parsons. Goldfields of Lake of the Woods, Manitou and Dryden. 21st Ann. Rep. Ont. Bur. Min. 1912, pp. 190-1.

"On examining a thin section of this latter rock, it was found to be a porphyry, whose phenocrysts instead of being quartz are plagioclase feldspar in distinct individual crystals and twin crystals which exhibit beautiful zonal extinction. From the extinction angle of this plagioclase, it appears to be from the albite end of the series and probably indicates that the first part to separate out was andesine or oligoclase, while the latter part is albite. The groundmass is extremely fine-grained and is made up principally of feldspar in which are a small number of inclusions of chlorite, and a few larger crystals of hornblende altering to chlorite."

At the *Bully Boy Mine.* "The vein accompanies a porphyrite cutting altered trap."

"The light-coloured rock accompanying the vein shows on the freshly broken surface phenocrysts which have a conchoidal fracture and in the field would be taken for quartz; consequently it was assumed that the rock was quartz-porphyry. On examining a thin section of this rock under the microscope, it was found that instead of being a quartz-porphyry, the rock is a porphyrite having approximately the composition of andesite. The phenocrysts proved to be plagioclase, very similar in composition to that found at the Combined mine. Apparently the feldspar is albite or oligoclase."

At the *Regina Mine* the vein cuts the contact of the Keewatin greenstones and a later granite.

Manitou District. A little farther east, in the Manitou district, sedimentary rocks, of later age than the Keewatin, begin to make their appearance, and at the Victory Mine the country rock is a sedimentary quartzite, associated with a fine-grained light green calc-phyllite, with occasional bands of magnetite. Gold is present in narrow veins of quartz of later age than the quartzite.

The locality is a short distance west of a band of diabase-porphyrite or altered quartz-porphyry, but whether these are older or newer than the quartzites was not determined.

Farther east, at the Foley Mine on Shoal Lake, the gold-bearing quartz veins occur in a granite of post-Keewatin age close to an intrusion of lamprophyre, which is stated by Dr. A. C. Lawson to be slightly younger than the conglomerate of his Seine River series here included in the Temiskamian, and therefore the lamprophyre would be approximately of Algoman age. No direct connection has been traced between the quartz veins and the lamprophyre, but the absence of such veins around the border of the granite batholith where lamprophyre is also absent would indicate the probable connection between the two. It would seem likely, therefore, that the veins at the Foley Mine are also of Algoman age.

Sturgeon Lake. Turning northward from Seine river, gold has been found in many veins in the rocks around the shores of Sturgeon Lake. The veins are of quartz with calcite and siderite, carrying free gold, pyrite, chalcopyrite, sphalerite and galena. The rocks of the area are schistose and massive greenstones, representing altered diabase or andesite, quartz porphyries and coarse porphyrites, often with large phenocrysts of plagioclase, all of which are typical of the Keewatin complex throughout central Canada. Intimately mixed with these are some small areas of sedimentary graywacke and dolomite, which may possibly represent the Temiskamian in this district. These rocks are intruded by the Sturgeon Lake granite and associated porphyries which Dr. Moore[1] considers to be newer than the Laurentian and which are therefore probably of Algoman age. At the St. Anthony mine the main vein is close to the contact between the schist and graywacke and the granite which has been intruded into them, the north end of the vein being wholly in the granite, and the south end wholly in the schist and graywacke.

On the Barnard Claim the veins occur at the contact of greenstone (Keewatin) and quartz-porphyry, which is regarded by Dr. Moore as a phase of the Sturgeon Lake granite. The veins occur not only on the contact itself, but they run out into both rocks. Speaking of the quartz stringers in the quartz porphyry Dr. Moore writes that they suggest "that the fissures had been developed at the time of cooling and contraction of this rock."

Everywhere throughout the Sturgeon Lake District the gold-bearing veins are more or less closely associated with the occurrence of quartz-porphyries or feldspar porphyrites. Such porphyries may be both of Laurentian and Algoman ages, though the latter are the ones genetically connected with the gold veins.

Michipicoten District. In the Michipicoten District, which lies North-east of Lake Superior, gold-bearing veins occur in the Pre-Cambrian rocks over a very considerable area.

The veins are composed chiefly of quartz, though the quartz is often associated with a large amount of Ankerite. They usually exhibit a streaked or banded appearance, with irregular lighter and darker bands, the lighter bands being of fairly pure quartz, while the colour of the darker bands is usually accounted for by the presence of chlorite or tourmaline. In one place the quartz was darkened by the presence of molybdenite or graphite. Pyrite and pyrrhotite are the principal metallic minerals present, but these are not so abundant in the veins carrying quantities of ankerite, as in those in which this latter

[1] E. S. Moore. The Sturgeon Lake Goldfield. 20th Ann. Rep. Ont. Bur. Min. 1911, p. 138.

mineral is absent. In one vein the pyrrhotite was replaced by Arsenopyrite. Chalcopyrite, galena and sphalerite were also recognized. Gold occurs both in the clear quartz, and in the darker bands, where the pyrite or pyrrhotite is usually most abundant, and I also found a few small flakes of gold in a quartz-porphyry which formed the wall rock of one of the veins.

Of the rocks more or less closely associated with the gold-bearing veins, that which is considered to be the oldest is a fine-grained greenstone of Keewatin age, often showing ellipsoidal structure, and with the component minerals very much decomposed. The more massive varieties gradually pass into green chloritic schists high in calcite or ankerite.

Associated with the greenstones and schists are extensive bodies of quartz porphyries with phenocrysts of quartz, orthoclase and plagioclase, the latter often predominating. These porphyries are altered in many places to a thinly foliated sericite schist.

They are called by [1]Dr. Coleman *Wawa Tuffs*, and with the underlying greenstones and some overlying patches of Iron Formation are included by him in the Keewatin Complex, though it is not improbable, as he points out, that some of the porphyries and acid schists are younger than the Keewatin.

Overlying these schists, etc., are highly altered and squeezed conglomerates called by Dr. Coleman *Doré Conglomerates*, and considered by him as the equivalents of the Temiskamian Series.

There are also granites of at least two different and distinct ages, some of which are stated by Dr. Coleman to be in eruptive contact with the Doré Conglomerates, in which case these latter would correspond with similar rocks of Algoman age in other parts of Canada.

Of basic intrusives a coarse quartz-diorite that occurs at Mackay Point on the south side of Wawa Lake is older than the gold veins. A Mica lamprophyre rich in olivine occurs on a number of properties associated with the veins, but whether it is older or younger than them it was impossible for me to determine in the time at my disposal. A fine-grained diabase also occurs as dykes on a number of mining claims. None of these diabase dykes were seen to intersect veins on the surface on any of the properties examined; and all the shafts were full of water at the time of my visit, so that it was impossible for me to inspect them where they had been encountered underground, nevertheless I was credibly informed that these dykes cut off the veins, and consequently are younger than them.

[1] A. P. Coleman and A. B. Willmott, Michipicoten Iron Region. 11th Rep. Ont. Bur. Min. 1902, pp. 152-185 and Map.

The veins occur under rather different conditions in the different rocks of the district. As a general rule the vein-walls are sharply defined. In a few places one or other of the walls is marked by a fault, but this did not appear to be a general condition.

In some places, where the adjoining rocks are schistose, veins may occur as an imbricating series of short, apparently disconnected, lenses, such as might be formed in fissures caused by torsional or diagonal strains exerted on the rock. In other places, where the rocks are more massive, they occur in fissures or planes of jointage or shrinkage, and in such cases they may run straight for a certain distance and then may turn off sharply at the intersection of two jointage planes.

In the vicinity of many of the veins the wall rock has been somewhat altered by the introduction of secondary minerals such as quartz, tourmaline and calcite, but considered generally, the veins would appear to have been largely formed by solutions ascending in open fissures and depositing their load of quartz, etc., between the previously formed walls of those fissures, rather than by a metasomatic replacement of the walls of narrow fissures by quartz and its associated minerals.

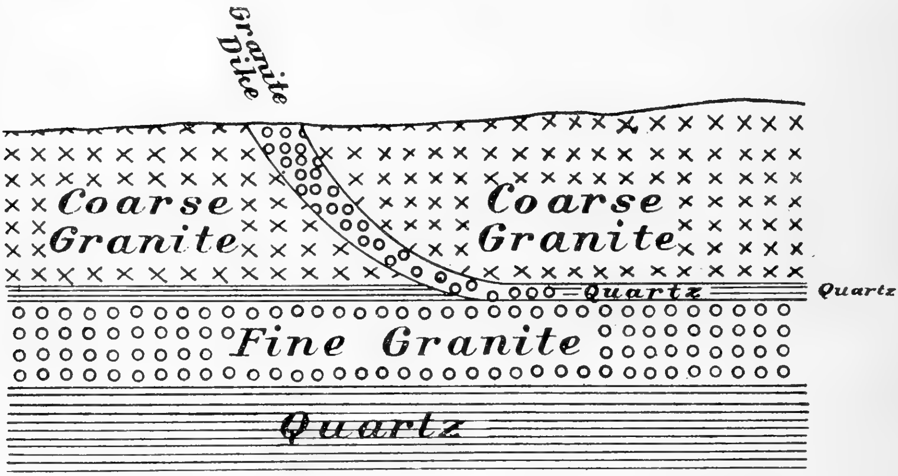

Fig. 1. Granite dyke running into quartz vein, Kitchigamini Claim.

Dr. Coleman states that the gold-bearing veins occur for the most part in the quartz-porphyries and sericite schists, but my experience was that many of them were in the zone of contact near the borders of later granitic or dioritic intrusive masses. At Mackay Point on Wawa Lake they occur in irregular fractures in a coarse, dark, quartz-diorite not far from the contact with a fine-grained quartzose schist. At the Hornblende Claim the country rock is a biotite schist. At the

Grace Mine the principal vein is at the contact of a massive feldspar-porphyry and an old greenstone. At the Kitchigammi Claim the vein is close to the contact of a coarse, gneissoid, hornblende granite, typical of the Laurentian areas throughout the country, with a fine-grained biotite granite which has been intruded into it. Narrow tongues or dykes of the fine granite run out into the older coarse granite, and in one place one of these narrow dykes may be clearly seen to terminate in a quartz vein, indicating the essential unity in age between the two.

The exact age of the later granite or other intrusive rock associated with the gold-bearing veins was not determined, but in view of the fact that some of the granites of the district have been proved to be newer than the Doré Conglomerate, and that the veins at some of the mines, as at the Kitchigammi, are of the same age as the newer granite, it would seem not improbable that the gold-bearing veins of this district are of post-Temiskamian or Algoman Age.

Whiskey Lake. One hundred and fifty miles south-east of Wawa Lake, which lies about the centre of the gold-bearing portion of the Michipicoten district, is Whiskey Lake, on and near the shores of which quartz veins, carrying pyrite and gold occur in rocks included by Dr. Coleman in his Sudburian series, which is equivalent to the Temiskamian Series. These veins are therefore also of post-Temiskamian or Algoman age.

West Shining Tree. Ninety miles north of Whiskey Lake is the West Shining Tree District in which gold-bearing veins have been discovered in considerable numbers. The prevailing rock is a greenstone of Keewatin age, sometimes amygdaloidal, and often with strongly marked ovoidal structure. Occasionally the angular masses between the ovoids are replaced by quartz. The greenstone is cut by dykes or bosses of much altered diorite, diabase and feldspar porphyry, the latter of which varies from a rock with abundant, but now highly altered, phenocrysts of plagioclase and orthoclase in a medium grained groundmass composed chiefly of grains of quartz, but without quartz phenocrysts, to a schistose porphyry with squeezed phenocrysts of plagioclase, apparently Labradorite, and needles of hornblende, in a fine-grained groundmass of quartz, feldspar and iron oxide. No evidence was seen in this district of the age of the gold-quartz veins.

Porcupine. From West Shining Tree the Keewatin greenstones, etc., continue northward for 70 miles to Porcupine, which is now the richest gold-producing district in the Province of Ontario, or in fact in all Canada.

The character of the gold-bearing veins of the Porcupine district has been described in detail by Mr. A. G. Burrows[1] and need not be repeated here, father than to draw attention to the minerals associated with the gold, namely Pyrite, Pyrrhotite, and occasionally Arsenopyrite, and gangue minerals such as Scheelite, Tourmaline, and Feldspar (plagioclase?), and to the conclusion that the veins were formed at considerable depth.

The rocks in which the quartz veins occur are greenstones and greenstone schists, quartz- and feldspar-porphyries, and quartzites of the Iron Formation, all of Keewatin age; conglomerates and graywacke of Temiskamian age; and quartz-porphyries and granites belonging to the Pre-Cambrian Complex but of uncertain age.

In the vicinity of the Hollinger Mine the greenstones and quartz-porphyries have been folded, sheared and altered by lateral pressure, and at a subsequent period, when the direction of pressure had changed to some extent, veins were formed as a number of lenses *en echelon*, in a series of overlapping fissures, the individual lenses running with the foliation of the schist, while the whole vein system varies from it at an angle of 10° to 20°. On the Hollinger property the oblique pressure would appear to have caused the various layers of the schist to slide on each other, and in places to separate, producing channels for the circulation of mineral-bearing solutions, while on some other properties the layers of rock broke under the pressure, and gave rise to faults in and near which the gold-bearing solutions were able to circulate.

The majority of the veins occur in the green schist, although as a rule they are within a short distance of the schistose porphyry.

Gold occurs not only in the quartz veins themselves, but in the rock of the adjoining country for some distance on both sides of the veins, almost invariably associated with pyrite, the two minerals having replaced portions of the wall rock.

In the vicinity of the Dome Mine, Temiskamian slates and conglomerates occur closely folded in with the greenstones, schists, and porphyries of Keewatin age, and the gold-bearing veins occur in the conglomerates as well as in the greenstones and schists. The veins were evidently formed after the conglomerate had been subjected to the diastrophic forces which reduced it to its present condition, for they have not participated to any material extent in the deformation. At the same time there is no evidence to indicate that the veins in the conglomerate are different in age from those in the greenstone, so that they may all be considered as post-Temiskamian or Algoman in age.

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[1] A. G. Burrows. The Porcupine Gold Area. 21st Report Ont. Bur Min. 1912, pp. 205-249.

During the period of vein formation the rocks were subjected to very considerable strain, and openings, or lines of flowage for solutions, were formed in them both vertically and horizontally. In these openings large veins or masses of quartz were gradually deposited, either in the openings themselves or by replacement in the adjoining wall rock.

In other places in the Porcupine District, but especially to the south of the outcrops above mentioned, quartz-porphyry, varying in some places to a grey granite, is rather prominently exposed. It is generally massive or nearly so, and in it, usually near the contact of older greenstone, are often narrow veins of quartz which may occasionally carry gold. These veins differ from those of the Hollinger and Dome zones, for while the fissures in which these latter were deposited were caused by the dislocation and separating of the various layers of the schist through the influence of pressure, the fissures in the massive porphyry do not show any evidence of having been formed by pressure, but they were probably formed by the shrinking of the porphyry on cooling at the time when the gold-bearing solutions were exuding from the parent magma. The source of the gold was doubtless the same, but the mode of formation of the two classes of fissures in which the quartz and gold was deposited was different.

Swastika. Fifty miles south-east of Porcupine is the district of Swastika and Kirkland Lake, where, for a number of years, gold-bearing veins have been known to occur. The rocks which underlie this country, arranged in increasing age from above downwards, are as follows:

Diabase	
Lamprophyre & Minette Albite Diorite	Algoman ?
Graywacke Conglomerate	Temiskamian
Iron Formation or Jaspylite Diorite-porphyry Greenstone	Keewatin & Laurentian ?

KEEWATIN.

Greenstones.—Beginning with the oldest, the basement rock of the district is a fine-grained greenstone of Keewatin age, which in many places is hard and massive, while in other places it is slaty or schistose. The more massive phases often exhibit the ellipsoidal or pillow structure so common in basic rocks of this age.

Examined in thin sections under the microscope this basic rock usually shows traces of ophitic structure, and appears to have been originally diabase, or similar igneous rock, which has been very highly altered, the alteration consisting in the formation of secondary hornblende and chlorite from former pyroxenes, and in the decomposition of the plagioclases with the formation of saussurite and the introduction of carbonates, the latter being probably derived, in part at least, from the decomposition of feldspar rich in lime. Quartz, usually showing strain shadows, is a secondary constituent in some of the rocks examined, while pyrite and magnetite are also both common secondary constituents, some of the smaller grains of magnetite having a surface covering of leucoxene.

This greenstone is remarkably similar throughout, both in horizontal and vertical extension, the alteration from its original character being just as far advanced 200 ft. below the surface as on the surface itself.

Diorite-porphyry or *Metagabro-porphyry.* Intruded into the greenstone is a diorite- or metagabro- or feldspar-porphyry, which, on the surface, weathers to a dirty white colour, but on fresh exposure varies in colour from light green to red. It is usually distinguished by the presence of light-coloured phenocrysts of plagioclase, often altered to saussurite, with occasional crystals of biotite, imbedded in a finer grained matrix of plagioclase, hornblende and chlorite. Quartz is also often present, and in some places to such an extent that the rock becomes a quartz-mica-diorite. In other places the ferromagnesian constituents may be absent and the rock then partakes of the character of aplite.

As a general rule the contact of the diorite-porphyry and the older greenstone is not a simple plane, but is rather a zone of varying width in which the rocks are mixed together in a very irregular manner. As originally formed, the contact was doubtless characterized by fragments of greenstone included in the porphyry, and probably also by tongues of porphyry extending into the greenstone. This original complexity has since been greatly accentuated by the squeezing and crushing to which both rocks have been subjected, accompanied by the formation of a number of small faults in and along which the rocks have moved in a very irregular manner.

The porphyries may be correlated with the acid rocks which Dr. Coleman has called Wawa tuffs in the Michipicoten district.

An analysis of a specimen of this porphyry given by Mr. Bruce[1] contained about 50 per cent. of feldspar, chiefly Albite.

Near the porphyry-greenstone contact narrow dykes of felsite were seen not far from the Railway station at Swastika. They are very similar in composition to the Metagabro-porphyry and may be a later phase of the same magma.

Iron formation or *Jaspylite.* I did not see any Iron Formation in place in this district, but pebbles of Jasper derived from it are abundant in the overlying conglomerate of the Temiskamian series, and Mr. Burrows has recorded its occurrence at several places in the vicinity.

TEMISKAMIAN.

Conglomerate and *Greywacke.* Unconformably overlying the greenstone and diorite-porphyry are conglomerates, greywackes, etc. They consist of a green fine-grained groundmass, the particles of which are in places rounded and waterworn, while in other places they are sharp, crystalline and angular, suggesting a volcanic or tufaceous origin. Some beds are fine-grained throughout, while others are packed with well-rounded, waterworn pebbles or boulders of the older rocks, such as greenstone, diorite-porphyry, red jaspilite, etc. In the finer varieties of these sediments it is often difficult to distinguish them with the naked eye from altered igneous rocks, but the presence of particles of jasper usually furnishes a distinguishing characteristic.

All have been deposited in water in a horizontal or approximately horizontal attitude, but since their deposition they have been squeezed, folded, and upturned, so that the beds are often highly inclined or vertical. Many of the pebbles are shattered and broken, and in some cases the green matrix has been squeezed in between separated portions of pebbles of such distinctive rock as red jasper.

POST-TEMISKAMIAN OR ALGOMAN?

Lamprophyre. In the railway cutting east of Swastika Station dykes of minette are intruded into the Keewatin greenstone. The rock is characterized by slender hornblende needles averaging one-eighth of an inch in length, and a few plates of chlorite. In a groundmass of orthoclase and plagioclase are crystals of hornblende, biotite (now chlorite) and diopside, while apatite is an abundant accessory. While the biotite has been altered, the other mineral constituents are quite fresh, in which particular it differs strongly from the older Keewatin rocks through which it cuts.

[1] E. L. Bruce. The Swastika Gold Area. 21st Rep. Ont. Bur. Min. 1912, p. 259.

Dykes of very similar minette or 'lamprophyre' from a few inches up to many feet in width occur at the Tough-Oakes Mine, and on other mining claims in the vicinity of Kirkland Lake. They are approximately vertical, and follow the general strike of the conglomerate.

Some of the widest of these dykes are again cut by small narrow dykes, which stand out in relief on its weathered surface, and are much lighter in colour than the adjoining rock. They are found to consist chiefly of a soda or soda-lime feldspar, and are not dissimilar in composition to the dykes of albite-diorite described below.

A narrow dyke of bright green mica-lamprophyre, probably of the same age as the above, and consisting of chlorite, orthoclase, some plagioclase, calcite and phenocrysts of biotite (now represented by chlorite) runs north-eastward across the claim of the Swastika Mining Company, near Swastika Station, cutting both the greenstone and the diorite-porphyry. It is closely associated with the principal gold-bearing vein on the property.

Albite-Diorite. In the railway cutting a short distance west of Swastika Station on the T. & N. O. Railway, and in other places, dykes of coarse red albite-diorite, not very dissimilar in composition to the diorite-porphyry, cut through the Temiskamian conglomerate, and alter it to some extent near the contact. The abundant feldspars, which may compose 80% of the rock, are albite-oligoclase, in which twinning and zonal banding are common. Biotite is bleached or completely altered. The groundmass is fairly coarse, and consists entirely of tabular plagioclase.

Mr. Bruce[1] gives the following analysis of a specimen from the cut west of Swastika Railway Station

SiO_2	Al_2O_3	Fe_2O_3	MgO	CaO	K_2O	Na_2O	CO_2	H_2O	S
56·25	18·42	1·56	2·38	6·13	0·32	8·10	4·58	0·22	0·10

indicating the presence of about 82 per cent of feldspar, chiefly Albite.

Granite and Syenite, younger than the Temiskamian Conglomerates are recorded by Mr. Burrows, who refers to them as follows: "There are areas of granite and syenite within a short distance of the gold deposits. An examination of a number of specimens from these plutonic areas shows that these rocks contain albite, usually as phenocrysts, similar to the feldspar-porphyry. It is quite likely that the granite, syenite and feldspar-porphyry belong to the same period of intrusion and are different facies of a plutonic rock which underlies the whole area. The syenite and granite have been exposed by deep erosion."

[1] loc. cit. p. 263.

Temiskamian Conglomerate overlying Feldspar-porphyry south of Kirkland Lake. Many of the pebbles in the Conglomerate are of the underlying porphyry.

Temiskamian Conglomerate and Sandstone unconformably overlying Feldspar-porphyry, south of Kirkland Lake and a short distance east of Plate I.
The Conglomerate and Sandstone are resting against an old shore cliff of the Temiskamian sea.

"While the gold-bearing veins were formed subsequent to the intrusion of the porphyry, it is likely that they are genetically connected with this intrusive rock which occurs as dykes and boss-like masses. The cooling of the intrusive was apparently accompanied by shrinkage, faulting and displacement in the porphyry itself and in the adjacent rocks. The gold-bearing, silicious solutions that deposited their burdens in the fissures and other fractures in all probability represented the end product of the intrusion of the acid rocks that have been mentioned."[1]

Quartz Veins. Quartz veins occur in the greenstone, diorite-porphyry and conglomerate or greywacke, and some veins have also been observed in the albite-diorite.

Most of them dip at a high angle, usually not more than a few degrees from vertical, though the dip may vary to some extent at different depths. Thus, at one place a vein may dip at an angle of 70°, while above or below it may be vertical, or even dip in the opposite direction.

In the greenstone and porphyry the veins are of quartz of a white or light blueish colour, often enclosing irregular masses of country rock. Very often the vein matter is distinctly banded, and in such cases the bands may be of green chloritic material, or they may contain a considerable percentage of dark tourmaline.

In the conglomerate the veins may contain a considerable proportion of specular iron ore, or, as in the case of the Tough-Oakes vein, they may contain a very large quantity of molybdenite. In almost every vein in which gold is found pyrite is more or less freely disseminated through the quartz, and also through the country rock adjoining the vein. Some of the gold is intimately associated with this pyrite, while other portions of it are scattered through the quartz quite independently of the pyrite.

Many of the quartz veins are at or near the contact of the diorite-porphyry and greenstone or conglomerate. The contact zone is not usually very sharply defined, for the rocks were very much disturbed, crushed and faulted by dynamic agencies as they assumed their present condition. The veins may run parallel to the general trend of the contact or they may branch off at angles from it along subsidiary fissures which have extended out into one rock or the other.

Faults. In the tremendous disturbances to which these old rocks have been subjected, numerous slips have occurred, and faults have been formed of greater or less displacement.

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[1] A. G. Burrows and P. E. Hopkins. "The Kirkland Lake and Swastika Gold Areas." 23rd Rep. Ont. Bur. Min. 1914. Pt. II, p. 18.

See also J. B. Tyrrell. "The Occurrence of Gold in Ontario." Trans. I.M.M. Vol. 23 pp. 143-162. London, 1914.

On the Burnside Claims a dyke of fine-grained diabase, now largely altered to calcite, runs north and south, almost at right angles to the strike of the other rocks, and on the line of the dyke the older rocks appear to be considerably faulted and thrown.

Sesekinaka.[1] In the Sesekinaka District, which lies a short distance North West of Swastika, gold-bearing quartz veins are associated with reddish diorite-porphyry or Albite-diorite and lamprophyre, very similar to those at Swastika, and probably of about the same age, though I did not see any outcrops of the Temiskamian rocks in connection with them.

Munro.[2] Twenty-five miles north of Sesekinaka, in the townships of Munro and Guibord, the folded slates, quartzites and conglomerates of Temiskamian age, as well as the greenstones of Keewatin age, are cut by a number o' quartz veins containing an appreciable quantity of gold. Some of these veins cutting the Temiskamian slates are very closely associated with, and even occupy the same fracture planes as, dykes of green mica-lamprophyre similar to that which cuts the greenstone and porphyry at Swastika.

While the veins occur in the folded Temiskamian rocks they have not participated in the folding, but have been formed at a later date, most likely in association with the intrusions of lamprophyre which probably occurred in Algoman times.

Larder Lake. Twenty-five miles east of Swastika is the Larder Lake District, near the border line between the Provinces of Ontario and Quebec, in which gold associated with pyrite has been found in and near a number of quartz veins.

The rocks are similar in character and age to those at Kirkland Lake, though an old dolomite is rather more abundant. Mr. Wilson[3] gives the following description of the porphyries which he includes in the Keewatin. "The microscopic study of the quartz porphyry shows the rock to consist of phenocrysts of quartz, orthoclase, and plagioclase, enclosed in a matrix of quartz and feldspar, usually accompanied by some carbonate and chlorite. The plagioclase phenocrysts range all the way from albite to labradorite, but the alkalic

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[1] See A. G. Burrows and P. E. Hopkins. "The Kirkland Lake and Swastika Gold Areas," pp. 34-35. 23rd Rep. Ont. Bur. Min. Part II, 1914.

and C. Spearman "Rocks and Ore Deposits at Sesekinaka." Can. Min. Jour. Feb. 1, 1915, pp. 69-73.

[2] For the age cf these rocks see Map 21c "*Munro and Guibord*" in Rep. Ont. Bur. Min. Vol. XXI Pt. 1., Toronto, 1912.

[3] M. E. Wilson. "Larder Lake District." Memoire 17E Geol. Survey of Canada. Ottawa. Govt. 1912.

See also R. W. Brock. "The Larder Lake District," 16th Rep. Ont. Bur. Min. 1907, pp. 202-218.

varieties predominate. In those sections in which basic plagioclase becomes abundant, the orthoclase disappears, so that the rock passes out of the granite-rhyolite family into the diorite-andesite group of rocks, and is, therefore, not properly quartz porphyry but quartz porphyrite."

"Throughout considerable areas the porphyry and greenstone appear to be very much intermingled, so much so as to form a pseudo-conglomerate, and it is possible that some of this rock may be simply the interior, coarser portion of acidic volcanic flows. In a few places, however, well-defined dykes of the porphyry intrude the greenstone, and a similar relationship holds for the rhyolite and aplite."

Abitibi. Forty miles north of Larder Lake gold is found in similar quartz veins on the shores of Lake Abitibi. W. G. Miller[1] gives the following description of these veins.

"The half-dozen deposits examined occur in rocks of Keewatin age. These rocks here consist essentially of green schists, which are cut by dykes of fine-grained granite or porphyry, varying in width from a few inches to fifteen feet or more. They have been shattered, narrow cracks running across them characteristically transversely from wall to wall. These cracks are filled with quartz, and there are also at times lenses and irregular masses of quartz replacing the dyke material or enclosed between it and the wall rock. Fragments of the dykes are frequently cemented by the quartz, forming a breccia."

Harricanaw. In the Province of Quebec, eighty miles east of Larder Lake, gold has been found in quartz veins with pyrite on the shore of a beautiful body of water known as Kienawisik Lake, which discharges its waters northward by the Harricanaw river. Mr. Bancroft,[2] in describing the district, says:

"The gold occurs in quartz veins, all of which contain much tourmaline, very little calcite, pyrite, and a little chalcopyrite. One of the veins also carries a little galena and zinc blende."

In describing one particular vein, he says, "The marginal portions of the vein are, in places, very nearly pure tourmaline. For a few feet the enclosing granodiorite has been brecciated in small fragments, which are now distributed through a matrix of quartz and tourmaline, the latter mineral predominating."

The rocks underlying the country and associated with the gold veins are, amygdaloidal basalts and greenstones of Keewatin age,

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[1] Willet G. Miller. "Lake Abitibi Gold Deposits." 16th Rep. Ont. Bur. Min. 1907, pp. 219-220.

[2] J. A. Bancroft. "Report on the Geology and Natural Resources of an Area embracing the Head Waters of the Harricanaw River." Report of Min. Operations, Quebec, 1912, pp. 199-236.

similar to those so common in the pre-Cambrian areas of northern Canada. Granite and granodiorite-gneiss with a distinctly foliated structure of Laurentian ? age intrusive in the greenstone. Diorite-porphyries, quartz-porphyries, etc., intrusive into both the greenstone and the gneiss. As some of these porphyries which are intrusive in the gneiss have not participated in the diastrophic processes which have affected it, they are evidently considerably younger than it, and in default of other evidence may be considered to be of Algoman age. These are the dykes which would seem to be most directly associated with the gold-bearing veins.

The various districts and properties briefly described above include most of the better known occurrence of gold-bearing quartz veins in the Pre-Cambrian Shield of Central Canada. In writing about the properties I have quoted freely from the reports of the geologists who have visited and described them, but nevertheless, I have personally visited most of them during the past four years, and to facilitate their study have had prepared between three and four hundred microscopic sections of the ores and of the rocks with which the ores are associated. Many of these sections have been examined for me by Professor T. L. Walker, and Messrs. G. S. Scott and E. Thomson.

In a general consideration of the veins they may be divided into different groups according to their mineral contents. I have already considered them in two groups according to whether the chief associated mineral is (1) Arsenopyrite, or
(2) Pyrite.

The Pyrite group may be again divided according to whether the veins are characterized by

a. Tourmaline and Scheelite
b. Molybdenite
c. Zinc blende and Galena
d Chalcopyrite,
etc.

Or, disregarding their mineral contents, they may be divided into two general classes according to the character of the fissures in which they occur, namely,

1st. Veins in shear or fracture zones, formed by pressure.

(a.) Where the rock had previously been rendered schistose by dynamometamorphic processes. In this case the direction of pressure, which may have been from any quarter in any of the three dimensions, undoubtedly controlled the movement of the rock. In some cases the layers of the rock moved on each other without fracturing, and left thin cracks between these layers to serve as channels for mineral solutions. In other cases the layers broke across in many places, giving rise to fractured and faulted zones through which the solutions could rise in very irregular channels.

The veins on the Hollinger and McIntyre properties represent different phases of this class.

(b.) Where the rock was fairly massive.

In this case the rock usually broke in a series of small irregular fractures with a more or less linear arrangement.

2nd. Veins in small isolated fractures, without any evidence of shearing or faulting, like fissures formed by contraction on cooling. They are typical Gash Veins, and are usually short and disconnected.

Wherever the age of these gold-bearing veins could be definitely determined they appeared to be Algoman, and in conformity with the idea of Metallogenetic Epochs suggested by Waldemar Lindgren we may regard them as characterizing a strongly marked Chrysogenetic Epoch which prevailed over the whole area of the Canadian Shield.

Conclusions.

The following conclusions would seem to be justified from the foregoing consideration of the Pre-Cambrian rocks of the Canadian Shield. Whether these conclusions will apply to, or have any significance in, Nova Scotia, southeastern Quebec and the Appalachian region generally, I have not yet determined.

1. The veins are Pre-Huronian in age, no gold-bearing veins having been recorded in rocks of Huronian age in Central Canada.
2. They frequently occur in both basic and acidic rocks of Keewatin age.
3. Wherever the later Temiskamian rocks are present in association with the Keewatin rocks the gold-bearing veins are clearly determinable as being younger than the Temiskamian series.
4. They are very generally associated with Albite-porphyries.
5. These porphyries, etc., may reasonably be regarded as apophyses from batholitic granitic intrusions of Laurentian and Algoman age.
6. The gold quartz veins have not been found, and do not seem to occur, in the body of the batholiths of granite or gneiss, whether these are of Laurentian or Algoman age, as evidenced by their absence in the vast areas of hundreds of thousands of square miles in northern Canada, where such granites alone are well exposed.
7. In the Algoman Period, in which most, if not all, of the gold-bearing veins in the Pre-Cambrian rocks of Central Canada would appear to have been formed, we have a Chrysogenetic Epoch, during

which gold rose from the deeper parts of the earth, and was deposited in such fissures as occurred in the rocks at the time, no matter through what agencies those fissures were produced.

8. The existence of a single Epoch in the Pre-Cambrian, characterised by the formation and presence of veins carrying such a distinctive and much sought for mineral as gold, should be of great service in assisting in the determination of the age of other formations in these old rocks, where so many criteria which can be used in the determination of the age of later rocks are not available.

Notes on Some Hitherto Unrecorded Occurrences in British Columbia, of Uncommon Minerals, Collected by the late W. J. Sutton, of Victoria.

By R. W. BROCK, F.R.S.C.

(Read May Meeting, 1915.)

In the death of W. J. Sutton, Canada lost one of her most enthusiastic mineralogists. Unbounded was his love for his science which may truly be said to have filled his life. It had been his hope and intention to retire from his professional work, and to devote himself to the large mineralogical and petrographical collection which he had gathered, presenting it to a public institution as the nucleus of a museum, for the instruction and pleasure of his fellow citizens. He possessed much geological and mineralogical knowledge of British Columbia that is new which undoubtedly he would have given to the world had he secured the leisure to prepare it for publication.

In looking over the collection recently, the writer noticed some interesting specimens of minerals not generally known to occur in British Columbia, and some whose occurrence, he believes, have not been recorded. These will be mentioned and such as have not previously been recorded, should be credited to this ardent mineralogist. As the collection numbers about 13,000 specimens, it is highly probable that a careful examination would disclose many other new occurrences.

Realgar—occurs in masses of 6 m.m. diameter, liberally sprinkled through calcite. Locality—Yreka Mine, Quatsino Sound, B.C.

Fibroferrite—radio-fibrous silky masses of pale yellow color on decomposed rock or ochre. It must occur in considerable amount, as one specimen was about 5 c.m. x 5 c.m. x 2 ½ c.m. —Locality Bog Iron Mine, West Arm, Quatsino Sound, B.C.

Prehnite lining druses up to 5 c.m. in diameter, often with quartz in centre. Locality—Head of Comox Lake, B.C.

Rhodonite—Locality Tobago Claim, Robertson River, Cowitchan Lake, B.C.

Wad—Locality—Salts Spring Island, B.C.

Ilvaite—Crystalline masses with chalcopyrite. Locality—Three Jays Mine, Alberni Canal, B.C.

Cinnabar—in veinlets and desseminated, in altered basic igneous rocks. Locality—Sechert, B.C.

Mercury—Native. Locality—Sechert, B.C.

Smithsonite—Light blue botrioydal encrustations lining cavities. Locality—Quesnel, B.C.

Arsenic—native Antimonical. In milk-white calcite gangue. Localities—Small Island South of Queen Charlotte group; Koksilah River, Shawnigan, Cowitchan, Vancouver Island; Bridge River.

Iron—native—Locality—Head of Bay, Nootka Sound.

Magnesite—White chalk-like masses. Locality—Lac la Hache, 105 miles north of Ashcroft.

Chalcocite—Massive. Locality—Dewdney Group, Sydney Inlet, West Coast, Vancouver Island.

Noble Serpentine—Malahat Mountain. Vancouver Island.

Zoisite—Massive, crystalline, columnar. Malahat Mt., Vancouver Island.

On the Heat Resistance of Bacterial Spores, With a Consideration of the Nature of the Spore-like Bodies Seen in B. Tuberculosis and Allied Forms.

By ELEANOR SHANLY.

Presented by DR. J. G. ADAMI, F.R.S.C.

Read May Meeting, 1914.

Every bacteriologist will agree that the proof of the spore lies in its resistance. There is abundant evidence on every hand that its resistance to heat and disinfectants is markedly superior to that of the vegetative non-spore bearing stage of the bacillus from which it is developed, or of non-spore bearing bacteria in general. The *B. Anthrax* spore, commonly but mistakenly regarded as "the most resistant known," is employed as the test *par excellence* of efficiency of disinfectants. Koch found that the bacillus of *B. Anthracis* is killed by an exposure to one per cent phenol for two minutes but that the spores, subjected to solutions of this strength, survive from one to fifteen days.[1] The spore's greater capacity to withstand heat, particularly moist heat, is attested by general statements in all the text-books. "The temperature necessary to kill bacteria is not far above 60°C. for ten minutes, in a moist condition, where spores are present 90°-100°C. is required and this must sometimes be applied by the intermittent method." In using the Arnold steam sterilizer we have always assumed that the average spore would stand twenty minutes in steam at 100°. McFarland[2] states that some spore-bearers are able to withstand boiling for an hour. Sternberg notes that while the spore of *B. Anthracis* requires four minutes boiling to kill it, the spores of *B. Alvei*, *Wurtzel bacillus*, and *B. butyricus* withstand a similar treatment, as also that Globig worked with soil bacteria which resisted streaming steam for five to six hours. Madzsar[3] did not destroy the spores of *B. gangraena pulpae* of Agkovia by the action of steam at 100° for twenty-three minutes, and according to Wiel[4] *B. mesentericus*

[1] Frost and McCampbell: "General Bacteriology," p. 49. I purposely quote here from the ordinary text-book rather than from special and advanced work on the subject, in order to emphasize the general trend of opinion upon the matter of resisting qualities of spores.

[2] McFarland: "Text-book upon the Pathogenic Bacteria."

[3] Ctbl. f. Bakt. 29: 1901, p. 745.

[4] Ctbl. f. Bakt. Abt. I, 30, 1911, 500-526.

ruber will ordinarily succumb only after being subjected to steam for from one to six hours. These statements point to a recognition of specific variations in thermal resistance on the part of endospores. There is, however, a singular lack of definite data as regards the thermal resistance of endospores in general and of investigations coördinating these data regarding the resisting powers of the spores of individual species—a search through Baumgarten's Jahresbericht for the last ten years covered by that publication (i.e. for the years 1901-1910 inclusive) reveals not a single investigation of this nature.

The sporadic, unscientific state of our knowledge in this respect is exemplified by the contradictory views brought forward in explanation of certain supposedly resistant bodies associated with *Tubercle bacilli.* More particularly in old cultures or old foci of tuberculosis, small round or oval bodies are found and the bacillus itself may take on a beaded form. Young rods, at first Gram negative, lose this character with age; these bodies are Gram positive. They may be found in obsolescent, encapsulated, caseous tubercles in the lung when the most careful staining fails to reveal a single tubercle bacillus. As methods of staining this organism both in tissue and in smears have been most fully elaborated, it does not seem possible that any bacillary rods present escape detection. On the other hand matter free from true bacilli but containing these resistant forms will set up typical tuberculosis when inoculated into guinea pigs. These granules grown upon a favorable medium, moreover, can be made to revert to the typical acid-proof Gram negative form of the *Bacillus Tuberculosis.*[1] Do these bodies then represent resistant forms—spores— of the specific organism of tuberculosis? In contradiction it is urged that they have not the full resistant power of true spores since subjection to a heat of 80°C. will render this caseous matter innocuous. But there is no conclusive evidence establishing a resistance to a temperature of 80°C. as the lower boundary of all true spore territory. Granting the known variation in the powers of resistance between species there is the possibility that the notable extremes of high resisting power may have their counterpart in those of low resistance. If it were found, on submitting the spore-bearing bacteria to a uniform heat test, that they fell into a series varying from those with spores resisting the moist temperature of boiling water, or even higher, down to those withstanding heat a few degrees higher than that fatal to bacterial bodies, then in this table we should include as true spores the beaded bodies of *B. Tubercle*—the Much's granules of Hodgkin's disease, and the allied forms seen in old tubercular foci, *provided we find these possess higher resisting powers than do the vegetative bacilli.* In addition, this scale of

[1] W. B. Wherry: Jour. Infect. Dis. Vol. XIII, 1913, p. 144.

resistance between spores might well be a further means of differentiation or diagnosis between species.

It was with the two-fold object, first, of determining more precisely than hitherto the limits and the specific differences of heat resistance in various bacterial endospores, and secondly, to determine whether the evidence can be adduced which would allow us to regard these bodies in the tubercle bacilli as spores, that the present investigation was entered upon.

THE METHOD EMPLOYED.

Previous experiments on the heat resistance of spores show that there are many different factors influencing the thermal death point of endospores which have to be taken into consideration. Differences in the constitution and chemical reaction of media, surface tension, age and the previous history of cultures, and particularly the nature of the heat employed, must all be taken into account in order to obtain uniform results. The disturbing influence of these factors may, however, be counteracted to a large extent by the simple expedient of subjecting all the cultures tested to an identical procedure, both as regards preliminary growth and age of growth, and as regards medium and mode of testing. Our object was not to study these factors of variation, but on the contrary by subjecting all the various cultures to the same procedure to gain thus constants which would permit us to answer surely the main question: do different species of spore-bearing bacteria present constant differences in the susceptibility of their spores to the action of moist heat?

Preliminary observations demonstrated that surface cultures upon agar-agar media of the various forms employed showed no obvious alteration in the resistance of the spores between a week and two months. Such surface cultures were therefore employed throughout, and for each test a suspension of the spores and spore-bearing bacteria taken from an agar culture at least a week old was used. The medium of suspension was standard "Lemco" peptone bouillon rendered one per cent acid to Phenolphthalein. That they might heat up rapidly, small, thin-walled test tubes 0.5 mm. thick and 12 mm. in diameter, were half filled with the broth and brought to the required heat in the water bath about to be described; when the proper temperature was attained the spores were introduced by means of a platinum loop. Our early experiments had impressed us with the difficulty of maintaining a constant temperature, and more particularly with the slow arrival of the fluid within a test tube at the temperature of the surrounding fluid. For this reason it has seemed to us that the routine exposure of spores to a stated temperature for ten minutes or one-quarter of an hour too frequently gave false results, since for a considerable part of the time of exposure the spores might be subjected to a temperature below that recorded in the immediately surrounding fluid, when the temperature was taken not within the test tubes, but in that surrounding fluid. It therefore appeared that this source of error would be eliminated, and a more thorough test afforded, if the period of exposure were extended from fifteen minutes to an hour. Thus unless otherwise stated, our results represent the exposure of the spores in suspension to a given heat for a period of one hour. At the end of sixty minutes the tubes were taken out of the bath, immersed in cold water, and surface inoculations made upon Lemco peptone broth agar, the original tubes being employed now as controls to demonstrate the complete destruction—or otherwise—of all the spores.

THE WATER-BATH.

Studying the earlier literature, it is impossible not to realize that the methods employed by most observers, whether to test the thermal death-point of bacteria, or to determine the heat resistance of endospores, have been very imperfect. In the course of these observations an endeavour has been made to eliminate as far as possible the imperfections.

1. As already indicated, if a glass tube containing fluid be immersed in a water-bath, it requires many minutes before the contents of that tube attain the same temperature as that of the surrounding fluid. Therefore, to determine accurately the temperature to which a suspension of spores is exposed, it is essential that the thermometer be immersed not in the surrounding fluid, but actually within the suspension itself, in other words, for accurate work the amount of a suspension of spores employed must be sufficiently large to permit the placing in it of a thermometer or, what comes to the same thing, a control test tube must be employed in which the thermometer is immersed. This must be of same size and contain same amount of fluid as the test tubes that are employed to hold the suspensions of spores.

2. The amount of loss of heat from the free surface of a water-bath is much greater than, we think, is ordinarily imagined. At temperatures between 60°C. and 100°C. it was found that this loss was so great that employing a large water-bath of two jackets we repeatedly found it impossible in the dry, winter air of Montreal to maintain the water in the inner receptacle within three or four degrees of that in the outer. When using a very large surface, as, for example, that of the routine "serum inspissator," with which we made our first experiments, the water in the outer compartment might be boiling

while that in the inner could not be raised above 94° or 95°C. This great loss of heat is obviated by covering the various compartments of the water-bath. By this means we were eventually able to bring the temperature of our different compartments to within a degree of difference within five to ten minutes.

3. It seemed to us—although here we may be introducing unnecessary refinement—that the temperature in our control test tube could be preserved at a more even level if, instead of the ordinary two compartments, we suspended in the ordinary large water-bath (about a foot across, outside measurement) a beaker filled with water to contain the tubes which were being tested. This method, it is true, by bringing the surface exposed during the various manipulations to a minimum, reduced the amount of evaporation and loss of heat. In this way we found that we could without difficulty keep the contents of our test-tubes for sixty minutes at a temperature which with occasional and by no means constant oversight varies within but two degrees during the experiment.

4. In his observations upon the thermal death point of tubercle bacilli present in milk, Theobald Smith [1] has explained the occasional survival of tubercle bacilli after an exposure as long as sixty-five minutes to a temperature of 60°C. (whereas in bouillon and distilled water at most fifteen to twenty minutes is necessary to kill all bacilli at this temperature) by the formation of a surface pellicle over milk heated in the air. In this, he states, the bacilli are carried by fat globules which shield them from the effects of the heat. Our observations suggest to us that here Theobald Smith has not afforded the whole explanation. It is not the mere formation of the pellicle that preserves the bacilli, but in addition this pellicle is the site of evaporation and cooling so that its temperature in consequence of evaporation is distinctly lower than that of the mass of underlying fluid. Milk suspensions of the bacilli in sealed pipettes were killed in the usual time. As has been pointed out, this surface evaporation and rapid loss of heat is easily prevented in the water-bath by closing the various compartments above. It has seemed to us that a similar arrest of evaporation and so of surface cooling is to be obtained by lightly plugging the test-tubes with cotton wool. To make quite sure, however, that our results or some of them, have not been due to this cooling of the surface film, we have made tests in which four test-tubes containing an equal amount of Anthrax spores have been placed for sixty minutes in the water-bath at a temperature of 85°C. Two of the test-tubes had poured into them a covering layer of albolene, the other two being

[1] Jour. Exper. Med., Vol. IV., 1899, p. 217.

employed as controls. At the conclusion of the heating, agar plates were made from each of the four tubes. These results were as follows:

The test was repeated three times, each time with greater accuracy, and each time, strange as it may seem, the average number of colonies on the plates from the broths protected by albolene was greater than that of the other plates. Clearly the protective effects of a surface tension layer has been overcome.[1]

As the result of these various preliminary tests, we employed for these observations the water-bath represented in the accompanying diagram. The compartments A and B represent the compartments of the ordinary water-bath, C. represents a glass beaker 4 inches in diameter, fitting into and suspended by a circular opening in the copper disc D made of 0.1 inch copper. Covering C is another disc, E, of the same metal provided with a dozen openings, each nine-sixteenth of an inch in diameter, permitting thus the passage through them of test-tubes to half an inch in diameter. The test-tubes, it will be seen, are immersed so that the level of the contained fluid is well below the level of the water and that the air is also heated.

Since elaborating this apparatus we have found that Rosenau[2] has employed a very similar apparatus. He likewise has closed in the upper surface of his water-bath, and has determined the thermal death point by placing the thermometer within the test-tubes in which are the suspensions. On the other hand he employed two, not three compartments, and says nothing about closing the test-tubes so as to reduce evaporation and surface cooling.

What is quite the most accurate and delicate instrument yet devised for testing the heat resistance of spores is the apparatus of C. Balfour Stewart,[3] in which the outer jacket contains benzol boiling at 80°C., the inner closed chamber, whether it contains air or water, if worked properly can thus maintain a constant temperature of 80°C. This instrument is admirably adapted for testing the resistance of spores to what may be termed the critical temperature of 80°C. over periods of different length—five minutes, ten minutes, an hour, etc. For this research in which it is desired to determine the resistance of endospores subjected for a constant time to different temperatures, the apparatus cannot be employed.

A point in our procedure that is sure to be criticised is the employment of peptone broth for our suspensions rather than distilled water. It is generally accepted that the thermal death point of bacteria varies

[1]A possible explanation of this result is that given by Theobald Smith, namely that oily matter in the fluid formed a protective layer about those spores which came, into immediate contact with the layer of albolene.

[2] U.S. Treasury Dept., Hygiene Lab. Bulletin No. 42, Jan. 1908.

[3] Thompson Yates Laboratory Reports, Vol. III, Pt. I, 1900, p. 38.

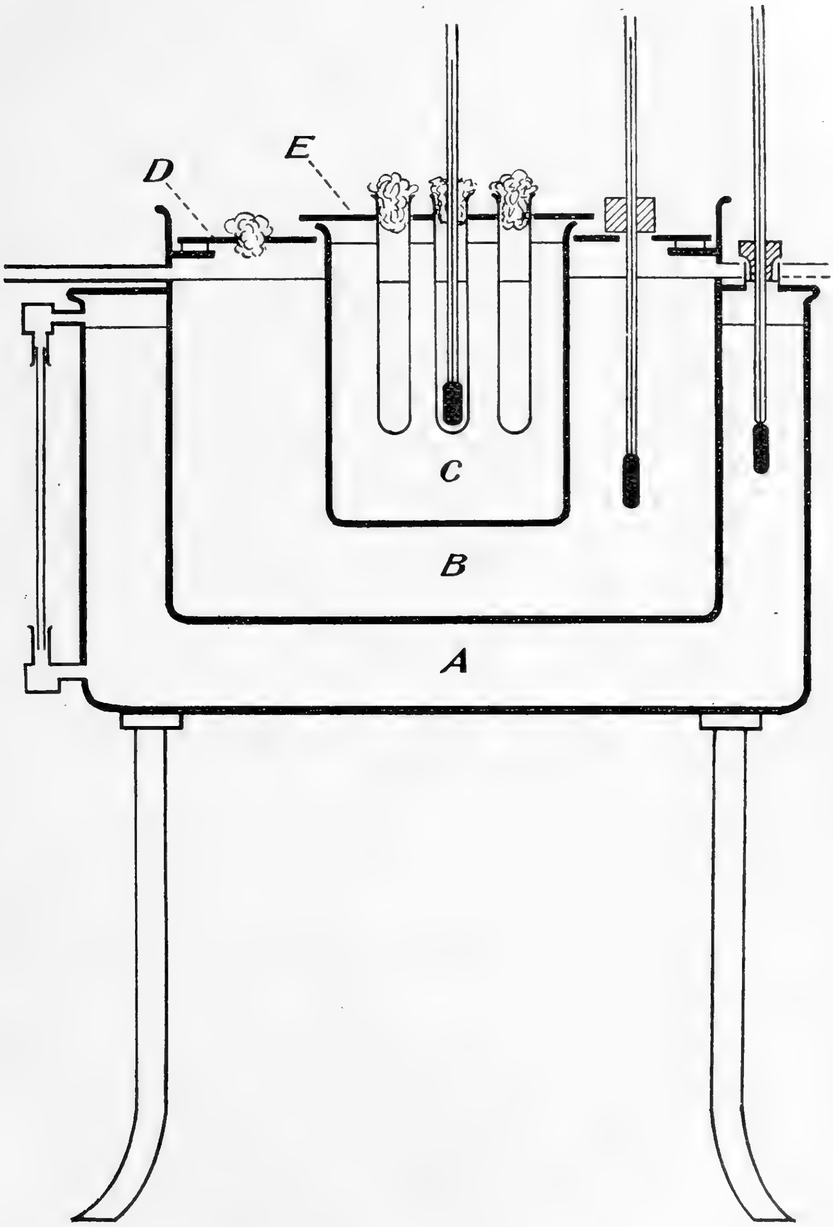


Diagram 1.

somewhat according to the medium on which they are suspended, and thus as not all laboratories employ the same method of making broth, should they therefore endeavour to repeat these observations, they might obtain results not wholly consistent with ours. In the course of these observations we found as a matter of fact that the employment of melted peptone broth agar as the medium of suspension did very materially raise the death point of Anthrax spores. With so thin a solution as ordinary peptone broth apparently little change is brought about in this respect. Thus Theobald Smith found no difference in the thermal death point of tubercle bacilli suspended in distilled water and peptone broth respectively, and tubercle bacilli are more susceptible organisms than are endospores. As already stated we selected this broth in order that we might thus gain additional controls, and this advantage appeared to us to outweigh any possible disadvantage.[1]

THE CULTURES EMPLOYED.

Using this apparatus we have tested twenty-six different cultures of sporulating bacteria. Some half-dozen others either died out, or became contaminated during the course of experiments, and as the records are not perfect we have not included them, for the majority we are indebted to Professor Gruner, late Pathologist to the Royal Victoria Hospital, who has made extensive study of the *B. subtilis* group.[2] Unfortunately, Dr. Gruner left Montreal in March, leaving behind no notes as to the species differentiation of many of these forms. Many were merely designated by number. We learn from him that these were members of his collection not necessarily members of the subtilis group, which for one reason or another he was reserving for future study. Time has forbidden that we should make a full study of the differential characters of these forms, while further we have felt some little delicacy in labelling them prematurely. The other portion of our collection we owe to the courtesy of Dr. Winslow who has afforded them from the well-known collection maintained at the American Museum of Natural History, New York. I would here express my very sincere thanks to Dr. Gruner and Dr. Winslow for their courtesy.

RESULTS.

For the present we would state the results obtained with bacilli possessing true endospores, leaving for separate consideration the further discussion regarding the significance of the granules in the tubercle

[1] Anthrax spores were killed in an hour at 90°C. when suspended in broth, suspended in agar as noted later, some few rare spores survive this temperature.

[2] Gruner and Fraser: Observations on the *B. Mesentericus* and allied organisms. Jour. Infect. Dis., Vol. X, 1912, p. 210.

bacillus and allied forms. The various species were grown in pure culture and the suspensions made as already described were subjected for sixty minutes to temperatures ranging in differences of five degrees from 55°C. to one hundred. Or more accurately, most observations were made first at the temperature of 80°C. so frequently employed in tests upon spores, and from here onwards successive estimations were made of five degrees difference, both above and below this temperature. The accompanying chart affords more eloquently than any words the results obtained.

In studying the chart and the results therein indicated, it must be called to mind that previous workers have most often afforded the results of fifteen to twenty minute exposures at different temperatures. Many forms which will survive exposure for fifteen minutes at 80°C. are killed by exposure for half an hour, and yet more by exposure for an hour. The test is distinctly severe. Secondly, whereas in most of the observations there has not been a variation of more than a degree on either side of the temperature indicated, in some there has been a variation of two degrees on either side, thus 80°C. indicates a temperature which during the hour may have varied between 78 and 82°C. With rare exceptions the results have been harmonious, occasionally thus there have been forms which have given no cultures after exposure to 85°, whereas a few colonies have survived 90°C. In all such cases careful re-tests have been made so that we believe that this chart affords an accurate table of the termal resistance of the forms employed.

Chart of the Heat Resistance of Endospores for Periods of 1 hour at

	Centigrade.							Source.
	70°	75°	80°	85°	90°	95°	100°	
"533" (1)........	+	+	+	+	+	+	+	Royal Vic. Hosp. Dr. Gruner—large surface colony.
"633"...........	+	+	+	+	+	+	+	
B. gastrophilus...	+	+	+	+	+	+		do.
"533" (2)........	+	+	+	+	+	—	—	do. —lobed colony.
"Spore 8"........	+	+	+	+	+	—	—	Contamination of B. ochraceus.
"Spore 7"........	+	+	+	+	+	—	—	Contamination possibly B. subtilis.
"Spore 1"........	+	+	+	+	+	—	—	Aerobe isolated from Blackleg virus.
B. petasites......	+	+	+	+	+	—	—	Dr. Gruner.
B. ochraceus.....	+	+	+	+	+	—	—	Dr. Gruner.
B. subtilis........	+	+	+	+	+	—	—	Dr. Gruner.
B. Megatherium..	+	+	+	+	+	—	—	Dr. Gruner.
B. liodermos.....	+	+	+	+	+	—	—	Amer. Mus. of Nat. Hist. (Dr. Winslow).
B. plicatus.......	+	+	+	+	+	—	—	do.
B. subtilis........	+	+	+	+	—	—	—	do.
B. mycoides......	+	+	+	+	—	—	—	do.
B. megatharium..	+	+	+	+	—	—	—	do.
B. vulgatus......	+	+	+	+	—	—	—	do.
B. gummosus.....	+	+	+	+	—	—	—	Dr. Gruner.
"634"...........	+	+	+	+	—	—	—	do.—reticulated growth.
"Spore 19".......	+	+	+	+	—	—	—	do.—wrinkled brown growth.
B. anthracis......	+	+	+	+	—	—	—	Laboratory stock culture.
B. mesentericus...	+	+	+	—	—	—	—	Dr. Winslow.
B. anthracoides..	+	+	+	—	—	—	—	Dr. Winslow.
"623"...........	+	+	+	—	—	—	—	Dr. Gruner.
B. cereus........	+	+	—	—	—	—	—	Dr. Winslow.

DISCUSSION OF CHART.

Nevertheless attention must be called to certain very important points that have presented themselves during the course of this investigation. These I will take up in detail.

1. It is obvious that all endospores do not possess the same resisting power to heat.

2. Very few spore-bearing species possess spores which are capable of surviving a moist heat of 100°C. for sixty minutes. Only two of the series possess this power.

3. *B. Anthracis*, which is so often spoken of as the type resistant sporulating organism, will only survive a temperature of 85°C. for one hour, thus coming relatively low down in the list. The strain employed by us was an old stock laboratory strain which has been in the Pathological Laboratory of McGill for many years.

4. At the other extremity of the scale is a culture of *B. cereus* obtained from Dr. Winslow which failed to survive exposure to 75°C. for one hour. This form possesses what otherwise were typical endospores.[1]

5. So far as it is safe to draw any conclusions from this restricted series, an hour's exposure to a temperature of 70°, rather than 80°C. affords the test for the existence of endospores.

6. While this is the case, it has been most noticeable that temperatures here given are not the temperatures resisted by *all* the spores of a given culture; on the contrary the majority of the spores are killed by the standard exposure to temperatures 10-20 degrees below those here indicated. Or in other words, the highest positive sign in the chart represents the upper limit of heat resistance possessed by a minority of the spores of any given culture in our series: *it represents the maximal resistant power of the spores* exhibited by some only of the endospores present in a given culture of a given strain of a bacterial species. *The heat resistance of spores is thus very far from being a constant quantity*, even if possibly in a given species different cultures have this in common, that they will afford a certain number of spores having the same maximal thermal death point.

We do not believe that this is generally recognized. The following experiment is one of a large number which we have undertaken. Two sets of agar tubes were melted by boiling, then the first was placed in the water-bath and allowed to come to 90°C., the second was cooled in water to about 40°C. The culture of *B. Anthracis* and six cultures

[1] Note during proof reading. On repeating our tests with transplants from the original cultures, I find that the spores of *B. cereus* now withstand treating to 80°C. for one hour. So also I obtain positive results with *B. vulgatus* and *B. mesentericus* at 90°C.

of other bacteria which had resisted a temperature of 90°C. for one hour in broth were selected. A uniform loopful of these spores in each case was transferred to a tube containing about one centimetre of broth, and made into a uniform emulsion, and without delay a standard loopful of each emulsion was transferred to the melted agar tubes of the first series, and of the second series respectively. That at 40°C. was immediately poured upon a Petri dish for use as a control. The 90°C. agar was maintained at this heat for one hour, and then also plated. After twenty-four hours the number of colonies on the two plates were compared. The heated showed an enormous reduction in the number of colonies that developed. In fact *the vast majority of the spores are destroyed with this length of exposure at this temperature; there are only rare survivors.* Thus to give an example, the plates afforded the following results:

Culture "No. 1." Control 150,000 colonies. Subjected to 90°C. 10 colonies.

B. Anthracis, Control 37,500 colonies. Subjected to 90°C. 2 colonies.

Here regarding the anthrax bacillus, it must be recorded that we have found the endospores to resist a temperature five degrees higher when heated in agar broth than in plain peptone broth.

7. Different strains of organisms of the same species are liable to exhibit different resisting powers. This fact has been noted by previous observers. Thus more particularly A. Schmidt[1] has called attention to the varying resisting powers exhibited by the spores of *B. Chauvei.* He, too, has observed that it is only certain of the spores that possess strong resisting powers, the majority being rapidly destroyed. He found that the spores obtained from cultures were less resistant than those taken directly from the flesh of animals which had died from Quarter Evil. Several observers, among them Wiel,[2] Rokato,[3] and Pfeiffer,[4] have called attention to the varying resistance of the spores in different strains of the Anthrax bacillus. In our own series it will be observed that we studied two strains of *B. Megatherium* and of *B. Subtilis* respectively, obtained from well accredited sources, and that the two strains show a difference of a few degrees in their maximal thermal resistance.

Taking all these data into consideration, it becomes evident (a) that *in any one culture the spores present exhibit marked difference in the degree of their resistance to moist heat,* and (b) that *in any one*

[1] Inaug. Diss. Bern, Strassburg, 1906.
[2] Ctbl. f. Bakt., Abt. 1, 30, 1911, p. 560.
[3] Ibid. Vol. XXXIV, 1903, 725.
[4] Zeitschrift f. Mika. u. Paras. Krankh. u. Hy.g.d. Hausthiere 1, 1900, 124.

species different strains vary in their maximal heat resistance. It is very obvious therefore that one of the questions proposed in our introductory paragraphs must be answered in the negative: *the heat resistance of the endospores of any given spore-bearing bacterial species cannot safely be employed as a means of species differentiation.*

ON THE HEAT RESISTANCE AND THE SIGNIFICANCE OF THE GRANULES IN TUBERCLE AND ALLIED BACILLI.

I now come to the second part of this investigation, namely to the study of the relationship of the bodies seen in tubercle bacilli to endospores proper, as determined by their heat resistance. For the purpose of this research I am greatly indebted to Dr. W. B. Wherry of Cincinnati for providing me with the culture of a strain of *B. tuberculosis*, which exhibits the spore-like bodies to an extent rarely observed. The culture in question was brought to America from Koch's laboratory in Berlin by Prof. V. C. Vaughan of Ann Arbor in 1888, and has been cultivated outside the body ever since, until now it has attained an extreme degree of saphrophytism, growing easily on the ordinary media of the laboratory, and forming colonies which are visible in the course of three days. Dr. Wherry has described and figured this organism,[1] and we can wholly confirm his general description.

Nocard and Roux[2] observed the spore-like bodies in old cultures of the tubercle bacillus particularly when strained by Ehrlich's method. Metchnikoff[3] has described them in tubercular sputum, as also in the anterior chamber of the eye of a rabbit dead of tuberculosis. Klein[4] found them in glycerine-agar and broth cultures, and they have been described and pictured by Coppen Jones.[5] These spore-like bodies are found frequently in preparations from old pulmonary cavities as rounded bodies of greater diameter than the tubercle bacilli; from one to three or more may occur in a single rod. They take up the dye strongly, and still retain it when the rest of the bacillary body is decolorized by nitric acid. These bodies form abundantly in this strain obtained from Dr. Wherry, and we have found that with age they become Gram positive. I herewith reproduce a figure of these bodies afforded by Dr. Wherry (Plate II) drawn after vital staining

[1] Ctbl. f. Bakt. Erste Abt. Originale 70, 1913, p. 115.
See also Jour. Infect. Dis. XIII: 1913, p. 144.

[2] Ann. de Pasteur, I, 1887, p. 19.

[3] Virchow's Arch., Vol. 113, 1888, p. 63.

[4] Ctbl. f. Bakt., Bd. 7, 1890, p. 793.

[5] Ctbl. f. Bakt., Abt. I, Vol. XVII, 1895, p. 1.

with the Casselman Company's new methylene blue. It will be seen that these bodies have a distinctly spore-like appearance although they differ from spores proper in that several may be present in one single bacillary rod.

Within the last few months bacilli presenting the same "diphtheroid" appearance have been isolated by Bunting, Rosenau and others[1] from the enlarged lymph glands in the remarkable condition known as Hodgkin's disease, or lymphogranulomatosis. Some years ago Fränkel and Much studying material from this disease, discovered and figured in the enlarged glands granules and occasional beaded bacilli which now are known as "Much's granules," closely resembling the granules and beaded forms of the tubercle bacillus, and at last year's meeting of the German Pathological Society many of the speakers supported the view that these represented an attenuated form of the *B. tuberculosis.* The organism isolated by Bunting has, however, such different growth characters that at the present time we must regard it as belonging to a different species. Through the great kindness of Prof. Rhea, I have been enabled to study and employ a culture of these diphtheroid bacilli isolated by him from a case of Hodgkin's disease that occurred at the Montreal General Hospital. (Plate IV).

This very fact that the bodies under debate are apt to be multiple in the course of a single bacillary rod, the further fact that both the tubercle bacillus and the *B. diphtheroid* (which also possesses metachromatic beading in many of its strains) show, under certain conditions, well-marked branching, has led to a general consensus of opinion of late years that these two species are to be placed among the so-called "higher bacteria" close to the group of Streptothrices, of which the *Actinomyces hominis*, the organism of actinomycosis or "lumpy jaw" is the best known example. Now these streptothrices while very minute, have all the characters of the lowest moulds or so-called hyphomycetes. They form a densely filled branching mycelium, and the peripheral threads are liable to break up into a succession of beaded *gonidia;* at other times the fine hyphae break up into bacillary forms. It is becoming thus not unusual to compare the beaded forms in the tubercle bacillus with the more typical gonidia-like bodies of the streptothrices.

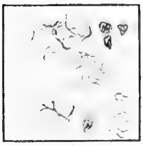
THE THERMAL DEATH POINT OF THE GONIDIA OF MOULDS.

It seemed thus interesting to observe whether the asexual fructifications, spores, or gonidia, of the commoner moulds possess the same

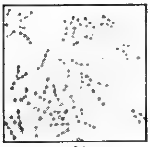
[1] I am indebted to Prof. Adami for this description of the organism associated with Hodgkin's disease.

II

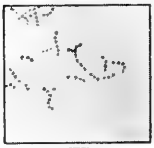
III



IV



V



VI

II B. tuberculosis

III (fig 4) Diphtheroid bacilli isolated from a case of Hodgkin's disease, by Dr. Rhea—magnification same as in Plate II, and much higher than figs 1, 2, 3

IV ,V (fig 1, 2) Branched and beaded forms from sputum of case reported by Musser, Pearce and Gwyn—either a streptothrix or a branched and beaded tubercle bacillus (after figs in Trans Assos. Amer. Physicians 16: 1901, p. 208).

VI (fig 3) Streptothrix filaments, branched and beaded, stained in sections from abcess of human brain—to compare with previous illustrations This was localized without signs of tuberculosis elsewhere, nor did inoculations of the brain material set up tuberculosis in guinea pigs The felted masses as seen in other parts of the section resembled in size and arrangement those present in actinomycosis

heat-resisting properties as do the endospores of bacteria. It is not a little remarkable that scarcely any attention seems to have been given this question. I have found only one reference to the matter in the course of my reading, and that, merely the vague passing statement that the thermal resistance of the spores of forms like Mucor and Penicillium is distinctly less than that of bacterial endospores. It seemed worth while, therefore, to study this matter in its broader aspect to observe what is the resisting power of the gonidia of the lower moulds, and to compare this with the resisting power of the presumed spores of the tubercle bacillus.

Having obtained luxuriant growths of two fungi, Penicillium glaucum and Mucor Sp.[1](?) on bread exposed to the air of the laboratory, we subjected them under the same conditions to the test of heating in broth. After the required period of heating, the broth was cooled and poured upon sterile bread in test-tubes. The first experiment was that of heating for sixty minutes at 100°C. then 60°C. Following these were a series decreasing both in the degree of heat, and in the length of the time of exposure, until at length it was found that the gonidia would not germinate after heating for ten minutes at 40°C. This is a confirmation of the preceding statement that they are distinctly less resistant to heat than are endospores. Evidently with a very moderate heat the spore case of these large gonidia becomes ruptured when they are immersed in fluid.

THE THERMAL DEATH POINT OF THE PRESUMED SPORES OF B. TUBERCULOSIS.

The method used for testing the tubercle bodies was varied to the extent that all growths of this bacillus were planted upon either Dorset's egg medium or upon glycerine agar, which media are known to be much more satisfactory for this organism than plain agar-agar; the Diphtheroid bacillus of Hodgkin's disease was transferred to hydrocele agar. As showed years ago by Prudden and Hodenpyl,[2] the intravenous inoculation of tubercle bacilli killed by heat, results in the production of characteristic tubercles around the clumps of the dead bacilli where they become arrested in the capillaries. While these tubercle-like growths eventually become absorbed and disappear, and normally no progressive infection is set up, these "pseudotubercles" nevertheless by their presence delay a sure diagnosis regarding the vitality of inoculated bacilli. It is therefore inadvisable to employ animal inoculation as the test, in researches upon the ther-

[1] This was a mucor having the general characters of *Mucor mucedo* though the Sporangia were smaller than is usual with this species.

[2] New York Med. Jour., June 6th and 20th, 1891.

mal death point of tubercle bacilli. The culture method becomes thus the most convenient, and at the same time the only indisputable way of ascertaining the resistance of these bacilli to heat. The following table represents the results of tests of the same character as those undertaken with the endospores and the gonidia.

	55°C. 15 Min.	55°C. 30 min.	58°C. 60 min.	65°C. 10 min.	70°C. 10 min.
B. tuberculosis (typas humanus) Laboratory culture................	+	–	–	–	–
B. tuberculosis (Wherry's strain)....	+	–	–	–	–
Diphtheroid Bacillus from Hodgkin's Disease (Dr. Rhea).............	+	–	–	–	–

It is clear from the above observations that these bodies seen in tubercle bacilli, as also in the diphtheroid bacilli at times from Hodgkin's disease are in the first place very much less resistant to moist heat than are many of the obvious endospores studied in this series, and in the second place, that their resistance is not greater than that of ordinary non-granular or non-beaded tubercle bacilli. Wherry has already come to the same conclusion with regard to strains studied by him.[1] The same has been the experience of most observers both as regards the resistance to heat, and the resistance to chemicals.

Thus to take one who is perhaps the most careful and exact bacteriologist of our time, Theobald Smith [2] finds that suspensions of the caseous matter from bovine tuberculosis exhibits no greater heat resistance than does a suspension of active cultures of the bovine bacilli, made upon blood serum, when both are suspended in bouillon. Exposure to a temperature of 60°C. for twenty minutes was sufficient to destroy the bacilli in both. So long ago as 1887 Sternberg[3] found that tuberculosis sputum exposed to 60°C. for ten minutes was inocuous when injected into guinea pigs. Grancher and Ledoux-lebard[4] note that avian tubercle bacilli are killed by exposure of twenty minutes at 60°C., but not of ten minutes, human bacilli were found dead after an exposure of ten minutes. Bonhoff [5] found a culture of the human tubercle bacillus in glycerinated broth was killed by an exposure of twenty minutes to 60°C., and more recently Rosenau [6] comes to a

[1] "When suspended 0·85 percent. NaCl. solution these cultures were not killed at 15 minutes nor 30 minutes at 55°C., but were killed by heating to 60°C. for 15 minutes." (Jour. Infect. Diseases, Vol. XIII, 1913, 114.)

[2] Theobald Smith, loc. cit.

[3] "Disinfection and Disinfectants." Report to the Amer. Public Health Assoc. Concord, N.H., 1888, p. 148.

[4] Arch. de Med. Exper., Vol. IV, 1892, p. 1.

[5] Hygienische Rundschaw II, 1892, p. 100.

[6] U. S. Treasury Dept., Hygienic Lab. Bulletin, No. 42, 1908.

like conclusion. It must, however, be added that there have been certain contrary observations. Thus in 1888 Yersin[1] testing an old glycerine broth culture containing "sporulating bacilli" notes that these withstood being heated for ten minutes at a temperature of 60°C., after this exposure they continued to multiply and caused tuberculosis when inoculated into rabbits. We are not told of the effects of heating to the same temperature for twenty minutes. DeMan[2] employing the soft, almost cheesy matter, from the udders of tuberculous cows and heating this in sealed tubes found that this would stand an exposure of 60°C. for thirty and forty-five minutes. Two guinea pigs inoculated with material from these exposures became tuberculous, while after exposure for sixty minutes the guinea pigs remained well. He repeated and confirmed these results and found also that bacilli in sputum are rendered inocuous by exposure to 60°C. for sixty minutes. Here it will be seen that according to his results the time necessary for the destruction of the bacilli is considerably lengthened, and more recently Gavina[3] according to Wherry, is stated to have found that employing "sporulating" cultures he obtained tuberculosis in guinea pigs when these were inoculated with cultures heated for fifteen minutes at 96°C., but did not gain any results when he inoculated these animals with "non-spored cultures which had been heated for ten minutes at 80°C.,

It will be seen, that so far as they go, our observations support and confirm those of Theobald Smith and Wherry, and fail to substantiate the observations of deMan and Gavina. *What is obvious is that these spore-like bodies have no greater resistance to heat than that exhibited by many non-sporing bacteria.*

Our wholly unexpected results with the Gonidia of pencillium and Mucor indicate, however, that typical gonidial *spores are possessed of no increased resistance to moist heat.* It is thus still within a possibility that these bodies in the tubercle and diphtheroid bacilli are of the nature of gonidia, and as such are to be classed as spores, or if so, as bodies *totally distinct in nature from the endospores of bacteria.* I regret that I have obtained these results too late in the course of my observations to make a study of the thermal resistance of the gonidia-like bodies in the closely allied streptothrical forms. I would in conclusion suggest that there is need for a full inquiry into the properties of the gonidia of moulds and streptothrices. If, as here indicated, they are not heat resistant, to what extent are they resistant in other ways—to desiccation for example, and to chemicals? Are we wrong

[1] Annales de l''Inst. de Pasteur, II, 1888, p. 60.

[2] Arch. f. Hygiene XVIII, 1893, p. 133.

[3] Ctbl. f. Bakt. Abt. 1, Originale, 70, 1913, p. 115.

in regarding them as resistant forms? Are they developed not so much in order to withstand adverse conditions as to be a means of abundant multiplication capable of easy transport and diffusion?

It is now my pleasant duty here to thank Prof. Lloyd and Prof. Derick of the Botanical Department, for their interest and assistance, and to acknowledge in all gratitude that in whatever measure this paper possesses of scientific value it owes to Prof. Adami, under whose supervision, as head of the Bacterial Department of the University, this work has been carried out.

APPENDIX.

When the above paper was presented at the Montreal Meeting of The Royal Society in May, 1914, the results were regarded as so opposed to the popularly accepted views regarding the heat resistance of spores as to warrant some criticism. Principal Harrison of Macdonald College has been so good as to tabulate what he regards as debatable points. They are as follow:

I. Species nomenclature.

II. Whether laboratory stock cultures have the resisting power of freshly isolated organisms.

III. Whether there does not exist a discrepancy between these results and those recorded by other investigators and in the text books.

IV. Whether if these results hold good, the sterilisation of media should not be easier than as a matter of practical experience we find it to be.

If I may be permitted to discuss these criticisms in order, I would say:

I. As regards nomenclature, I freely acknowledge that the circumstances under which the work was conducted, forbade my making a precise analysis of the cultural characteristics of the different spore-bearing growths at my disposal. The problem I set out to solve was to determine whether bacterial spores as a body possessed a common maximum heat resistance. What seemed necessary, therefore, was to select a collection of different types of bacterial growth and test their heat resistance. The exact nomenclature of these types was for this purpose a secondary matter, and while to round off my investigation I should have wished to name my cultures with precision, the time at my disposal was inadequate. A subsequent paper will demonstrate that I have, with Dr. Malone, endeavored to meet this objection.

II. I fully recognize the cogency of Principal Harrison's second criticism, and am quite prepared to find that there is a difference in the heat resistance of spores according as to whether the strain has been for many generations in the laboratory or has recently been isolated. I have kept this matter in mind. It will be observed in the table here given (page 14) that two strains of both *B. Megatherium* and *B. subtilis* showed variation in resisting powers. I have isolated two new strains of these forms and tested them soon after isolation. Both withstood the relatively high temperature of 90°C. for one hour. It may therefore be found that the spores of forms growing naturally possess higher resisting powers than those of forms growing for long periods in the laboratory. If this be true, it will, however, only support further my main deduction, that heat resistance is a variable quantity.

III. As to a possible discrepancy between the results here recorded and those of previous observers, it may be pointed out that this discrepancy is really only apparent. Previous observers have with rare exceptions employed a much shorter period during which the spores have been exposed to the given temperature. The results of those observers who have most nearly approached our method of testing spore resistance are, if they be analysed, similar results. For example, Weil[1] notes that he has only very occasionally come across strains of *Anthrax bacillus* yielding highly resistant spores, and he and Dannappel[2] both point out that *Anthrax* spores are rapidly destroyed by streaming steam.

The former pointed out that rarely do the spores resist streaming steam for one minute: the latter found that 70 per cent of *Anthrax* strains afforded spores which would not resist streaming steam for one minute. With many cultures five to fifteen seconds exposure was sufficient to destroy the spores, and Weil found no strain which would stand this exposure for seven minutes. This is little in accord with the general opinion regarding the extraordinary resisting powers of the spores. Nor must we confuse results obtained by subjecting spores to the influence of anhydrous solutions such as glycerine and oil. As Bullock[2] has shown, *Anthrax* and *Subtilis* spores require to be heated to 170°C. for at least half an hour, or to 180°C. for ten minutes when immersed in these fluids in order to kill them surely. In other words they may as well be subjected to dry heat at the ordinary at-

[1] Ctbl. f. Bakt. Abt. I, 30, 1911, 500.

[2] Ref. in Ctbl. f. Bakt. Abt. 4, 6, 1900, 841.

mospheric pressure. Bullock, it is true, has one interesting incidental observation which may throw some light upon my results: he notes that *B. subtilis* spores are more easily killed in bouillon than in normal saline solution. Now my observations were made with bouillon. One out of five coverslips smeared with the spores still grew after immersion in normal saline solution in the autoclave for 45 minutes at 101.5°C.: nineteen coverslips smeared with the same and immersed in bouillon were all rendered sterile at this temperature in 30 minutes. An interesting point, to which Bullock does not call attention, is that his method and his tables clearly demonstrate the existence in his culture of spores having varying resistances to high temperatures. Dr. Malone and I take up this matter in an article shortly to be published.

IV. Lastly, I am inclined to think the observations just recorded answer Principal Harrison's final criticism. We have to recognize that the resistance of spores to heat varies greatly according to their environment. In media like glycerine which favor exosmosis the resistance is raised, in those favouring endosmosis the resistance is lowered. My observations should not be taken as evidence that all spores are easily destroyed by heat.

May I be permitted here again to acknowledge my indebtedness to Professor Adami for his kind supervision.

Diatoms from the Eastern Coasts of Vancouver Island, B. C., Canada.

By L. W. BAILEY, LL.D., and A. H. MACKAY, LL.D.

(Read May Meeting, 1915).

So far as known to the writers no observations relating to the Diatoms of the Pacific Coast of Canada have as yet been published. Yet, considering the wonderfully rich Diatom flora which characterises the waters of California and Oregon, and especially those of Puget Sound, it may well be believed that the micro-organisms which distinguish the coasts of British Columbia may be equally rich and varied.

The observations which follow relate to a very small part of the coast in question, viz.: to the vicinity of Nanaimo, the seat of the British Columbia Biological Station, together with a number of the small islands in and about Departure Bay. The collections were made by members of the Biological staff and were kindly placed at our disposal by Dr. C. MacLean Fraser, Director of the station, and Professor McMurrich. They consist in part of plankton forms obtained by the use of fine silken tow nets, in part of material scraped or washed from the surface of *Zostera* and other coastal *Algae,* and partly of soundings or harbor muds. No absolute separation can be made between these three groups, but each has distinctive features of its own, and each differs from the others alike in the mode of collection and in the subsequent treatment. It is therefore proposed, as far as possible, to consider them separately.

I. PLANKTON DIATOMS.

The Plankton, as seen upon removal from the tow nets, presents the appearance of a flocculent precipitate, the colour of which varies from nearly white to pale yellowish or greenish, and of which the different portions cling together with great tenacity. In many instances these features are due to the preponderance of long horned, chained or filamentous forms such as *Chaetoceros*, *Thalassiosira*, *Skeletonema*, *Melosira* or *Biddulphia*. Mingled with these, though usually in much less numbers, are such circular forms as *Coscinodiscus*, *Actinocyclus*, *Actinoptychus*, and *Cyclotella;* or ovoid forms like *Surirella* and *Cocconeis*.

In the preparation of plankton material for examination it is often sufficient to merely remove from the water the contained salt by repeated washings. But not unfrequently there are with the Diatoms numerous microscopic *Crustacea* (Copepods, etc.), or it may be *Infusoria* of different kinds; and the removal of these presents greater difficulties. The use of acids will remove calcareous organisms, but is apt to separate the cells of concatenate species, or, if they are only imperfectly silicified, to destroy them altogether. Probably the most satisfactory method is the use of fine metallic screens, which will not only filter off most of the Crustacea and Infusoria but may be employed advantageously also in the separation of the larger from the smaller species of Diatoms.

After cleaning, the Plankton Diatoms may be examined either in water or dry, when they are better seen than when mounted in balsam. For the preparation and mounting of slides as well as for the recognition of many species we are indebted to Oliver Kendall, Jr., of Providence, R.I., U.S.A. In the determination of the species hereinafter listed, reliance has been largely placed upon the publications of Dr. H. H. Gran of Christiania, Norway, especially his contributions to the "Nordisches Plankton" of Professors Brandt and Apstein in Kiel (Leipzig, 1905); and again on the figures and descriptions in "Diatomées Marines de France" of MM. H. and M. Peragallo; and on those of Dr. Henri Van Heurck's "Synopsis des Diatomées de Belgique." Dr. A. Schmidt's "Atlas der Diatomaceenkunde," Wolle's figures, and various special papers such as those of Brightwell on the Filamentous and Long-horned Diatoms; the "Diatomaceen-typen-platte" of about 400 species mounted by J. D. Moller of Wedel in Holstein, and a thousand slides of named collections from over the whole world by Professor J. Tempère of Paris were consulted. The average or extreme dimensions of the species have been wholly determined by Dr. A. H. MacKay of Halifax, Nova Scotia, and are noted briefly in the general list according to a notation system there explained.

CHAETOCEROS.

This genus is by far the most abundant and most varied of the typical Plankton Diatoms, and at the same time one of the most difficult to differentiate. Dr. Gran divides the species into two subgenera, in the first of which (sub-genus *Phaeoceros*) the chromatophores are equal in each cell and extend even into the bristles; while in the second (*Hyalochaetae*) these do not extend into the bristles which are filiform or hairlike. To the first group belong *Chaetoceros Peruvianum* Brightw., *Ch. criophyllum* Castr. and *Ch. boreale* Bails.; while the others listed in the sequel belong to the second.

Ch. decipiens Cl. is one of the most common as also one of the most conspicuous forms, and is easily recognized, partly by the large size both of the chains and individual frustules, partly by the form of the interspaces separating the frustules, which vary with the seasons from that of narrow ellipses almost to circles, and lastly by the character of the bristles which proceed from the angles of the cells, and contrast both in direction and size with the terminal bristles. All the bristles are smooth. *Ch. Peruvianum*, *Ch. boreale* and *Ch. criophyllum* are also large species with stout rigid spines, those of the two last being also strongly imbricated. *Ch. didymum* Ehr. is a fairly large species distinguished by the presence of small conical processes in the middle of the surfaces of the contiguous cells. *Ch. paradoxum* Cl. is most readily recognized by its resting spore known as *Syndendrium diadema* Ehr. when these are present, the convex surface of the valve being adorned with somewhat numerous processes, suggesting the specific name of the spore.

Ch. crinitum Schütt, as its name implies, is thickly beset with long flexible hairs. This is also the case with *Ch. sociale* Lauder, of which two varieties occur, one with the small irregular cells closely united to form a more or less curved, crescentic, sometimes almost circular chain, with the bristles for the most part extending outwardly from the latter, while the second is not circular but presents rather the appearance of an umbelliferous flower cluster, one bristle of each cell being greatly elongated and so placed as to form with the similar bristles of other cells a sort of stalk or stem supporting the group, while the remaining bristles are short and diverge from each other. Both varieties are rather rare. *Ch. saltans* Cl, and *Ch. subtilis* Cl. also occur. *Ch. dichaeta* Ehr. was observed by Kendall.

SKELETONEMA.

This genus, which is readily recognizable by its lattice-like structure, is extremely abundant in most of the collections from the vicinity of Departure Bay. It probably embraces several species but only one, *Skel. costatum*, has been clearly distinguished. Chains of fifty or more cells are of frequent occurrence and exhibit considerable variety in diameter as well as in the intervals separating the individual frustules.

THALASSIOSIRA.

Two species of this genus, *Th. decipiens* Grun. and *Th. Nordenskioldii* Cleve are very common in the collections from Vancouver Island, the former being characterized by the wide separation of the frustules with a corresponding length of the slime-string which holds them together, the engine-turned sculpture of the valve and the crown of bristles bordering the latter; while the second species has the frustules more closely approximated, lacks the engine-turned aspect, and has fewer bristles, turned outward from the angle between the flat ends and the truncated edges. *Th. subtilis* Ostend or what was believed to be this species, was observed in only one instance, the numerous small and four-angled structureless cells being united by jelly into an irregular colony. *Th. gravida* Cleve has also, apparently, been observed.

COSCINOSIRA.

Coscinosira polychorda Gran., of which only one specimen has been observed, differs from *Thalassiosira* mainly in the fact that the connecting threads (slime organs) between the cells, are from four to nine in number, instead of being single as in the last named genus. Peragallo notes that Gran admits the structure of the frustule itself is that of *Coscinodiscus lineatus* Ehr. which he admits as *Forma polychorda;* but he has never seen the form living, and thinks it not sufficiently distinct to be noted as a variety, much less as a distinct genus. Gran, however, considered it to be a genus neritic on the coasts of northern Europe.

LAUDERIA.

Lauderia borealis Gran, is not uncommon in the plankton of Vancouver Island. Chains of considerable length, but loosely connected, are not unfrequently met with. Owing to imperfect silicification the cells are apt to shrivel or become contorted during the process of cleaning. The cell wall is marked by delicate transverse bands.

STEPHANOPYXIS.

Specimens of *Stephanopyxis*, believed to be *S. appendiculata* Ehr, have been rather frequently observed in the collections under review, though they can hardly be said to be common. The rather large size of the frustules with conspicuously areolated valves and the crown of several bristles which separate or rather unite the frustules into chains, readily attract attention. It is a species of wide distribution, being found alike in Europe, Africa, and North America. The frustule of two valves when 40 microns in the direction of the chain may be over 30 at right angles, each frustule being separated about 7 microns by the interlocked spines.

CORETHRON.

This genus is probably the most peculiar of all the plankton diatoms, sometimes presenting features which suggest a doubt whether it is properly a diatom at all. In general shape, that of a lengthened cylinder, it bears some resemblance to such forms as *Rhizosolenia* and *Ditylum*, but the cylinder is terminated at each end by a dome-shaped cap, around the base of which is a circlet of long and straight bristles, extending sometimes in the general direction of the cylinder, more often widely divergent or stellate and sometimes reflexed parallel to and closely adjacent to the cylinder itself. When seen in end-view the frustule presents the form of a circular disc, ornamented with conspicuous dots or circles near the edge, and surrounded by from ten to fifteen or more bristles, radiating outwards and suggesting comparison with *Bacteriastrum*. The bristles are, however, undivided.

A more singular series of appendages is often found in the form of somewhat lengthened finger-like processes. Their resemblance to the pedicellaria of Echinoderms is very marked but their function is not at all evident. I have seen no reference to these curious organs in any literature at my command; but they are common on the specimens of this species observed in the waters of British Columbia. When both sets of bristles are turned in the same direction the forms of *Corethron* suggest comparison with a meteor or sky-rocket. Sometimes, but more rarely, they are turned back and lie along and parallel to the cylinder itself. Specimens presenting similar characters occur abundantly in Antarctic waters, as shown in collections made by Amundsen's Antarctic Expedition and sent to me (Dr. Bailey) by Dr. Gran of Christiania.

BIDDULPHIA.

The most common of the Biddulphias found in the Vancouver collections is *B. aurita* (Lyng.) Bréb., a species of very wide distribution. It occurs in large numbers and exhibits much variety, being found in both broad and narrow forms and in every stage of development, some specimens being three or four times the size of others. Some indeed depart so widely from the ordinary type as almost to deserve recognition as distinct species.

B. Roperiana Grev., *B. obtusa* Ralfs., *B. granulata* Roper, and *B. suborbicularis* Grun, appear to be found in the order named, with another form so distinctive as not to coincide with any other species described in our literature. *B. turgida* Ehr. and *B. polymorpha* (Ktz.) V.H. and another variety, with *B. laevis* Ehr. will be found listed under the genus *Cerataulus* Ehr. *B. antidiluviana* will be found under the genus *Amphitetras* Ehr. in the list with a rare related form.

Besides the above there is present a species of large size which, instead of having only the single prominence in the centre of each cell as in *B. aurita*, has an additional prominence on either side of the central one in addition to those of the angles which latter are without processes or horns. In the undulating character of each valve surface it resembles *B. Tuomeyi* Bail, found at Campeachy Bay, Cal., and may be a variety of that species.

TRICERATIUM.

This genus is by Gran, Albert Mann and others regarded as inseparable from *Biddulphia*, except as regards a few forms referred by Cleve to a new genus, *Trigonium*. I have preferred here to retain the old name, at least as regards the three-angled forms. Of these the old and wide-spread *Tr. alternans* Ehr. is fairly common in the Vancouver collections; while with it but less common is a much larger species having small areoles radiating from the centre, with large vacant spaces at the angles. Some instances have also been observed of a quadrangular form (by some known as *Amphitetras* Ehr.) with large pentagonal areolations and punctate angles.

Finally, forms occur resembling the *Tr. undulatum* of Brightwell, but these seem to be identical with *Ditylum Brightwellii* as figured by Gran, being enclosed in a cylinder and armed at either end with a long stout central bristle. The fact that such cylinder sometimes contains, even in a single cell, triangular, quadrangular and pentagonal frustules, goes far to justify the view that all these shapes are varieties of a single polymorphous genus.

COSCINODISCUS.

Though one of the most frequently occuring Diatoms in plankton collections, species of *Coscinodiscus* are not remarkedly abundant in the gatherings from Vancouver waters, at least about Nanaimo. Not less than 22 species, however, have been recognized, as given in a subsequent list. Of those named there *C. excentricus* Ehr. is perhaps the most common but the smallest; while *C. concinnus* Sm. is probably the largest. This species can usually be recognized not only by its large size, but by the fineness and closeness of its markings, and usually by the occurrence of a submarginal area traversed radially by short radial fine lines. A central umbilical rosette may or may not be present according as it is the upper or lower valve which is visible. Another large form, marked by a central rosette is *C. asteromphalus* Ehr., a very widely distributed species which is regarded by some authorities as only a variety of *C. oculus-iridis* Ehr.

ARACHNODISCUS.

This is one of the most beautiful diatoms to be found on the Pacific coast, where it is often found sessile on the fronds of algae, and is, therefore, not strictly planktonic. Several specimens have been found near Vancouver Island, apparently of the species *Ehrenbergii* Bail., but *A. ornatus* A.S., which occurs at least in a varietal form at San Francisco, may also be represented among them.

ASTEROMPHALUS.

The only species of this genus observed is believed to be *As. arachne* Bréb. It is distinguished by the presence on its circular disc of an excentric generally five-rayed figure dividing it into five unequal sectors, the longer ray being slender with the shorter stout rays bilaterally disposed to it, forming a somewhat spider-like outline.

ASTEROLAMPRA.

This genus closely resembles the last, but the sectors are similar and equal, while the rays are all alike from the centre to the circumference of the disc. Only one specimen was observed, but the species could not be satisfactorily identified.

AULACODISCUS.

This beautiful genus represented by *Au. Oregonus* Bailey was found in only one of several gatherings, from Newcastle Island near Nanaimo, but it is here tolerably abundant. Dr. MacKay does not think it agrees exactly with the specific description, and has therefore provisionally marked it as var. *octavius* in allusion to its eight sectors.

AULISCUS.

This genus occurs with the last, to which it is closely related. There would appear to be several species of which one is *Au. coelatus* Bail. var. *riphis* A.S., and another *Au. sculptus* Sm.

HYALODISCUS.

Representatives of this genus are very common in the collections under review, and apparently represent four species. Of them *H. laevis* Ehr. is at once the most abundant and of largest size. *H. subtilis* Ehr. is usually much smaller but variable. *H. Whitneyi* Ehr. and *H. stelliger* Bail. are, perhaps, of doubtful occurrence.

ACTINOPTYCHUS.

A. undulatus Ehr. is a very widely distributed Diatom, is not rare in the Vancouver Island collections, and is easily recognized. In addition two other forms which may be new were observed. One resembles *A. undulatus* in its ordinary form, but of the six segments three alternate ones are marked by conspicuous prominences or umbones, something like those of *Aulacodiscus* but smaller. The other differs from the ordinary form in some respects and is ten-rayed. It may prove to be one of the numerous varieties of *A. undulatus.*

ACTINOCYCLUS.

This genus is represented by at least one species. *A. subtilis* Ehr. The surface of the circular valve is marked by two sets of radiating lines of which one is very fine and closely approximated, while the other consists of more conspicuous dots or bars which are widely separated. The species are often irridescent under medium high powers when slightly out of focus.

ASTERIONELLA.

Representatives of this genus are occasionally met with but the identity of the species is not easily determinable. Forms bearing a close resemblance to *Ast. Japonica* Cl. have been observed, the inner part of each cell broad and somewhat triangular, and from the base gradually and continuously narrowing to the obtuse extremity. Others have been referred by Dr. MacKay to *Ast. formosa* Hassell. var. near *Ast. Bleakeleyi* Sm., and doubtfully to *Ast. notata* Grun.

DITYLUM.

Forms believed to be referable to the genus *Ditylum* Bailey are met with in the collections from Vancouver Island sometimes in large numbers. One has the general shape of *D. Brightwellii* Grun. as figured by Gran, viz.: that of a cylinder somewhat puckered at either end and having at the ends long stout central bristles; but instead of the surrounding crown of fine hairs, single small bristles project obliquely outwards from either angle of the cell. Another and still more doubtful form has the sides of the cylinder in the shape of two sigmoid lines which intersect each other opposite the middle of the cell, and at their extremities are extended into short recurved spines on either side of a central stout spine. Only one specimen of the latter has been seen.

ACHNANTHES.

Seven species of this genus have been observed of which the most common are *A. longipes* Ag. and *A. subsessilis* Ktz. Some doubtful varieties were thought to be observed occasionally.

AMPHIPRORA.

Four species of this beautiful genus have been observed, *A. alata* Ktz. and *A. sulcata* O'Meara belonging to the group with complex zones and sigmoid keels; and the following with simple zones by some authors segregated into the genus *Tropidoneis* Cleve, viz.: *A. lepidoptera* Greg. with a var. *proboscidea* C., and *A.* maxima Greg. var. *gracilis* Grun. Owing to the slight silicification of some of these species and their consequent transparency they are not always easily seen.

AMPHORA.

Not less than nineteen species of this genus appears to have been observed as indicated in the sequel. Of these probably *A. ovalis* Ktz. with its varieties is the most common. Besides those listed an additional form has been observed which resembles *A. exserta* Gran of Campeachy Bay. But it has a different striation, while another resembles *A. angularis* Greg having similar sinuous borders constricted in the middle and with similarly produced ends. It may possibly be *A. laevissime* Greg. There have been observed and noted several other forms which could not be relegated to any of the species in the list given at the end of this paper.

THALASSIOTHRIX.

This genus appears to be quite abundantly represented in the plankton gatherings of Vancouver Island. Its zigzag chains often embrace a considerable number of individual frustules of variable length and breadth. To the writer they seem to correspond quite nearly to *Th. nitzschioides* Grun. But in the list prepared by Dr. MacKay who has seen only prepared mounts, the only species given under this genus is *Th. Frauenfeldii* Grun. (following Peragallo). The genus *Thalassiothrix* Cleve et Grunow is limited to the hair-like forms with the more or less serrate edges. The form described first above is in Dr. MacKay's list *Thalassionema nitzschioides* Grun, with a sculpture on the edges of from 7 to 8 in 10 microns instead of 10 to 12. It therefore approximates the varieties *Javanica* Grun. or *lanceolata* Grun. rather than the type species which has also been noted by him. The separation of the older *Thalassiothrix* into two genera, giving the linear or lanceolate forms so often connected in zigzag to the genus *Thalassionema*, is a very appropriate amendment.

FRAGILLARIA.

Representatives of this genus in the form of long bands or ribbons embracing many individuals and of various sizes are common in the collections from Vancouver Island, especially those of early spring; but the distinctive features are so few that the identity of species is not easily determined. In the most frequently occuring forms the frustules in zonal view are simple regular prisms, without enlargement either at the middle or ends and with rather inconspicuously striated margins. Most of these appear to belong to *Fr. capucina* Desm. which is now placed in the new genus *Staurosira*, which includes the species with strong and easily visible striation with an ample smooth central area on the valval face.

NITZSCHIA.

Fifteen species of this genus have been identified from Vancouver Island, and are listed on another page. Perhaps the most common, at least in certain gatherings, is *N. seriata* Cl. which may possibly be the *Pseudonitzschia migrans* Cleve of the general list reported by Dr. MacKay. It is a characteristic plankton Diatom, common in northern waters, and easily recognized by its long string of frustules overlapping at the ends. *N. longissima*=*Nitzschiella* Bréb. is less common but more conspicuous owing to its great length and striking form. It exhibits two varieties.

RHIZOSOLENIA.

The representatives of this genus are all remarkable for their large size and cylindrical form, as well as for the prominence of their terminal spines. *Rh. setigera* Brightw. and *Rh. styliformis* Brightw. are the forms usually met with in the Vancouver waters as they are in those of the Atlantic. In *setigera* the valves are cone-shaped, pointed and only slightly inclined, while the processes, at first cylindrical and solid at the base, subsequently become abruptly drawn out into hair-like bristles; but in the Vancouver forms the spear-head enlargement figured by R. Ramsay Wright from Canso, Nova Scotia, (Contr. Biol. St'ns Can.), has not been observed. *Rh. styliformis* is a smaller species with valves obliquely pointed, and the process at the end solid with two lateral ears.

A single specimen of what was thought to be *Rh. hebetata* Bailey was observed. Gran recognizes two varieties of this species—*hiemalis*, long-spined, with thick and solid processes perforated at the base and the cell wall thick; and *semispina* with long drawn out valves and processes which are produced into hair-like bristles, the cell wall being only of medium thickness. The former is the type of Bailey's *Rh. hebetata*.

II. Forms not Distinctly Planktonic.

The forms here included are all to be found at times in planktonic gatherings, but do not exhibit the same adaptations to *flotation*, and are either attached to or sessile upon algæ, or themselves exhibit an algoid mode of growth. They are most abundant in shallow waters and especially where these are freshened, as at the mouths of streams or estuaries. Their preparation for study involves not only the removal of salt but of algæ, crustacea, and infusoria as well, this being effectively secured with sulphuric acid and potassium chlorate. The cleaned material may then be mounted in styrax or balsam.

COCCONEIS.

This genus is very abundantly met with in the collections from Vancouver Island, some gatherings containing little else. The species are also remarkable for their variety and beauty. No less than eighteen are enumerated as species in the appended list, although some are considered on good authority to be but varietal forms. A few have been noted provisionally as new species, and on fuller investigation may prove to be but very divergent varieties. The difference between the two valves of *Coconeis* and the evident range of variation in size and sculpture account for the difficulties of the definite determination of the species.

C. scutellum Ehr. as usual is most abundant, being often found clustered in very large numbers on the fronds of algæ. As many as nine varieties are noted some of which have figured as species by their first describers. Dr. MacKay notes provisionally a species as possibly new and of specific distinction. He notes under the name of *C. parallela* a distinctive form of which at least six varieties have been observed. The sculpture consists of dots in longitudinal rows parallel to the longer axis, to some extent suggesting a *Raphoneis*. But the 2, 3 and 4-rowed varieties have forms with and without a sub-marginal line or band which he thinks demonstrates them to be *Cocconeis*.

C. Nanaimoensis and *C. Fraseri* are provisional names given to two forms somewhat resembling *Raphoneis Archeri* O'M., the former showing a fine sculpture along the ribs of more than 20 to 10 microns. Their relationship in valve sculpture and shape to *C. costata* and *C. pinnata* suggested at first their cocconeoid character.

C. dirupta Greg. is not uncommon in some of the gatherings, as in one of 20 fathoms; but it is wanting in others. The same is true of *C. interrupta* Grun. Another form resembling *C. dirupta* also occurs and may be only a variety; but while resembling it in size and the division of its surface into quadrants, has the divisions, (instead of being made by simple lines or narrow zones across the valves, with the surfaces between finely punctate or more or less curved and divergent lines), made by broad vacant spaces, arranged much as in some forms of *Stauroneis*, while the dots in the intervening areas are much larger, coarser and without definite arrangement. The differences seem sufficient to justify its being regarded as a new species.

EUCAMPIA EHR.

This interesting genus which is neritic on the west coasts of Norway is thus characterized by Gran:

Cells bound in chains, valves in outline elliptical, with two blunt polar processes but without bristles. Chains curved spirally (axis of spiral parallel with the trans-apical axis) with large spaces between the cells. Chromatophores numerous, small.

A. Chains broad, cells shorter or as long as the breadth of the chain.

1. *E. zodiacus* Ehr.

B. Chains small, cells many times longer than the breadth of the chain.

2. *E. groenlandica* Gran.

The species found in the Vancouver waters is *E. zodiacus* Ehr. It does not appear to be abundant or generally distributed, but a chain of seven cells, besides several smaller ones, was observed in a gathering from north of Brandon Island (22 June, 1912). The breadth of the chain was 27-73 microns.

ETHMODISCUS.

A form closely resembling *Ethmodiscus punctigera* Castracane occurs in one of the Vancouver gatherings from Porpoise Bay, B.C. It resembles *Coscinodiscus concinnus*, and like the latter is of exceptionally large size, and with very fine radiating punctate striæ which scarcely reach the centre, but it is lacking in the sub-marginal corona of distinct points which is a feature of Castracane's species. (See Challenger Report V. 16.)

GRAMMATOPHORA.

Grammatophoras are very abundant in some of the gatherings from Vancouver. Besides the common and widely distributed *Gr. marina* and *Gr. Serpentina*, they include the large *Gr. maxima*, the distinctive *angulosa*, *oceanica* with its varieties, *Japonica*, and a variety, possibly of *angulosa*, provisionally noted by Dr. MacKay.

SURIRELLA.

This genus does not appear to be very abundantly represented in the diatom flora of Vancouver Island, but nevertheless a considerable number of distinct forms, some of which are quite large, have been observed. *S. lata* Sm., *S. fastuosa* Ehr. and *S. ovata* Ktz. have been noted together with a form related to *lata*, and coming close to *S. Japonica* A.S. as indicated in the general list. Other forms seen have not yet been determined. They are found chiefly in connexion with algae or in bottom muds, and in some circumstances are not easily distinguished from forms of *Campylodiscus* or *Cocconeis*.

NAVICULA.

This prolific genus is represented in the Vancouver waters by not less than 47 species, many of which, however, are inconspicuous or of rare occurrence. The complete list is given at the end of the paper. One of the larger species is *N. Lyra* Ehr. and its conspecies, *N. didyma* or its relatives has been noted, as well as *N. elliptica* Ktz. and *N. humerosa* Bréb. and *N. viridis* Ktz. Several varieties of *N. Smithii* have been observed, some of which are very common. *N. aspera* is listed under the genus *Trachyneis* Cleve, and is widely distributed in at least four varieties.

PLEUROSIGMA.

This genus which Cleve subdivided into the *Pleurosigma* proper and the *Gyrosigma* (in which the scupture lines cut at right angles) is represented by at least nine species, three of which, *Balticum*, *decorum*, and *intermedium*, are well known and widely distributed forms *Pl. Olympianum* Terry, first discovered in Puget Sound in view of the Olympian range of mountains, resembles *Pl. Balticum* Sm. in size and general appearance, but differs in being gradually but markedly constricted towards the centre and has oblique instead of rectangular striation. *Pl. fasciola* Sm. is also common.

SYNEDRA.

This genus is represented by about ten species. Some of them differ from the described forms to such an extent as to suggest that they may be new. Three of these will be found in the general list at the end with notes pointing out the differences which characterize them. Among the most frequently occurring forms is *S. affinis* Ktz. of which there may be several varieties, the most abundant being var. *tabulata* Grun. It is possible that a variety of this species may sometimes be confused with *Thalassionema nitzschioides* of Grunow. *S. pulchella* var. *Smithii* Ralfs has also been noted to be present.

The occurrence of *Synedra undulata* Bailey is interesting as adding another locality to the wide distribution of the species first found by the late Professor J. W. Bailey in Florida. It has since been met with at many points on the Atlantic seaboard of America as far north as the Gulf of Saint Lawrence. The writer has seen it in collections from the Sandwich Islands, and now reports its occurrence in the waters of British Columbia.

S. ulna Ehr. is a fresh water species with a great many described varieties. From the large volume of water from the British Columbian rivers we should expect to meet with some of these.

GENERAL OBSERVATIONS.

Abundance and Variety. Perhaps the most notable feature of the collections from Vancouver Island is their richness both as regards their individual and collective representation. The total number of species recognized is about 270, with a considerable number still unidentified. Different gatherings, however, vary greatly both as regards the nature and abundance of the forms represented.

The Plankton. This is particularly rich, though varying with the seasons. Compared with other parts of the world it exhibits a notable resemblance to the plankton of the colder latitudes both north and south. Of the genera noted by Herdman as characteristic of the North Sea, viz., Chaetoceros, Skeletonema, Thalassiosira, Lauderia, Thalassiothrix, Rhizosolenia and Bacteriastrum, all with the possible exception of the last abound in Vancouver waters, while many other forms not strictly planktonic are common to the two. Similar forms are also found in Christiania Fjord in Norway, in Barentz Sea and in the Antarctic.

An interesting connecting link with the latter is found in the curious genus *Corethron*. In the North, as about Norway and Sweden, forms of this genus, according to Gran, are rare and much smaller than in the Antarctic, as collected by Amundsen and others (see Castracane in Challenger's Report, and Karsten "Das Phyloplankton des Antarkteschen Meeres—Deutsche Tiefsee Expedition, 1898-1899, Bd. II, 2 Teil, p. 101, Taf. XII-XIII.) Those of British Columbia are abundant and of good size, but specially resemble the Antarctic species in the prominent development of claw-like appendages which appear to be but little developed or wanting in the European forms.

Of the planktonic genera above mentioned *Chaetoceros* is certainly the most common, the most varied and the most abundant. The long spines with which its frustules are armed and by which it is so admirably adapted for flotation, tends to form tangled masses from which other forms are removed with difficulty. *Skeletonema* though apparently represented only by a single species, is also very abundant, forming long chains or dense masses, sometimes indeed making up nearly the whole of a particular gathering. Next to this species would probably stand, *Thalassiosira* with its several species and the curious connexion of its frustules by what the Germans call the slime-thread.

Seasonal Variations. The abundance and variety of the Plankton vary greatly with the seasons, though no systematic observations bearing upon the point have yet been made. Gatherings made in early spring were in some instances almost destitute of Diatoms of any kind, *Thalassiosira* being the most persistent, where a few months later they were abundant.

III. Non-Planktonic Forms.

Habitat. The distinction between Planktonic and non-Planktonic forms is not an absolute one. While species which like *Chaetoceros*, *Corethron*, *Thalassiosira* and *Skeletonema* are rarely found in shallow coastal waters, species proper to the latter may be drifted from their native habitat by currents and thus become commingled with those whose natural home is more distant from the shore and which are more truly planktonic. Apart from habitat the most important distinction is to be found in the absence among the shore forms of marked adaptations to flotation such as are found in the presence of prominent horns or processes like those characteristic of *Chaetoceros*, *Skeletonema*, *Biddulphia*, *etc.* These are rarely met with in littoral species.

On the other hand, while circular forms like *Coscinodiscus* are abundant in the true plankton, other and related genera, such as *Actinocyclus*, *Actinopytchus*, *Aulacodiscus*, *Arachnodiscus*, *Cyclotella* are equally abundant nearer shore and are often found attached to or sessile upon the fronds of marine algæ. Such forms as *Achnanthes*, *Cocconeis*, *Gomphonema*, *Fragillaria*, *Grammatophora*, *Licmophora*, *Melosira*, *Navicula*, *Pleurosigma*, *Rhabdonema*, *Synedra*, and *Surirella* are especially abundant in littoral gatherings. Some species of Cocconeis cover the flat surfaces of algæ in countless thousands.

More Common Species. Among forms which are very common the following may be mentioned:

Acnanthes longipes.
A. brevipes.
Actinoptychus undulatus.
Biddulphia aurita.

Cocconeis scutellum.
Coscinodiscus asteromphalus,
C. excentricus,
C. radiatus.
Epithemia zebra,
Fragillaria capucina (Staurosira capucina),
Grammatophora marina,
G. serpentina,
Hyalodiscus laevis,
H. subtilis,
Licmophora Lyngbyei,
Melosira nummuloides,
M. Borreri,
Navicula aspera (Trachyneis aspera),
N. elliptica (?),
N. humerosa (?),
N. Lyra, (?),
N. Smithii.
Nitzschia sigma,
Rhabdonema arcuatum,
Rhizosolenia setigera,
Surirella,
Synedra.

More Rare Species. The uncommon or rarely occurring species are too numerous to be listed, and would only duplicate unnecessarily the general list appended. The following appear to be the more interesting of this class:

Asterionella,
Amphitetras (Triceratium),
Arachnodiscus Ehrenbergii,
Asteromphalus arachne,
Asterolampra,
Aulacodiscus Oregonus,
Auliscus coelatus,
A. sculptus.
Campyloneis Grevillei, var. Argus,
Cerataulus polymorphus,
Campylodiscus Thuretii,
Cocconeis interrupta,
Dimmerogramma,
Ditylum Brightwellii (Triceratium undulatum),
Ethmodiscus punctigera,

Euodia Janischii,
Eucampia zodiacus,
Eunotogramma bivitatum,
Fragillaria Pacifica (Opephora Pacifica=var. O. Swartzii),
Glyphodesmis Williamsoni,
Grammatophora maxima,
G. Japonica,
Melosira Sol,
M. undulata,
Navicula (many species),
Pleurosigma Olympianum,
Opephora Swartzii,
Raphoneis Archeri,
Synedra undulata.

IV. Geographical Distribution.

Of the forms listed as found about Vancouver Island the following are common to the Atlantic and Pacific coasts of Canada:

Acnanthes brevipes,
longipes,
subsessilis,
Actinoptychus undulatus,
Amphora costata,
ovalis,
Amphiprora alata,
lepidoptera,
Biddulphia aurita,
Roperiana,
laevis,
Chaetoceros boreale,
cryophyllum,
crinitum,
decipiens,
didymum,
dichaeta,
Peruvianum,
sociale,
Cocconeis scutellum,
pediculus,
Coscinodiscus asteromphalus,
concinnus,
centralis,

Coscinodiscus excentricus,
radiatus,
griseus,
Cymbella gastroides,
Diatoma vulgare,
Ditylum Brightwellii,
Epithemia zebra,
Fragillaria capucina,
Gomphonema,
Grammatophora marina,
serpentina,
Hyalodiscus laevis,
subtilis,
Licmophora Lyngbyei,
flabellata,
Mastogloia exigua,
Melosira Jurgensii,
nummuloides,
sulcata,
Borreri,
Navicula aspera,
bombus,
directa,
elliptica,
forcipata,
Hennedyi,
humerosa,
Lyra,
palpebralis,
Smithii,
viridis,
Nitzschia Tryblionella,
vermicularis,
longissima (Nitzschiella),
scalaris,
sigma,
Plagiogramma Gregoryanum,
Pleurosigma angulatum,
intermedium,
fasciola,
Rhabdonema arcuatum,
Rhoicosphenia curvata,
Rhizosolenia setigera,

Rhizosolenia styliformis,
hebetata,
Schizonema (Navicula) Grevillei,
Skeletonema costata,
Surirella fastuosa,
S. ovalis,
Syndendrium diadema,
Synedra ulna,
acus ?
undulata,
Thalassiosira Nordenskioldii,
Triceratium.

In this connexion reference may also be made to two species which, though not first found or named by us, have been found in the Vancouver collections. One is *Eunotogramma bivittatum* Grun. found in plankton at a depth of 20 fathoms; and the other *Pleurosigma Olympianum* found in Pugets Sound. Both are rare species, not represented in many collections.

List of Diatoms from the Eastern Shores of Vancouver Island, B.C.,

As Determined by L. W. BAILEY, LL.D., A. H. MACKAY, LL.D., and OLIVER KENDALL, JR.

(The determinations were made from the mounted slides by comparison with the descriptions and figures of the different authorities quoted. The nomenclature is intended merely to refer the species and varieties to descriptions or figures already published without prejudice to the synonymy which appears to stand in need of revision. When the identification is doubtful a brief description of the more apparent peculiarities of the variation is noted under a provisional name).

NOTATION OF MEASUREMENTS.

To indicate the range of variation observed in the individuals of each species two of the extreme measurements are selected from Dr. MacKay's notes wherever more than one measurement is found. The unit adopted is the Micron, the one thousandth part of the millimeter, thus avoiding the useless and dangerous load of decimal points, cyphers and the "mm" ticket for each number.

The length and breadth are indicated uniformly in the same order, the latter being enclosed within parentheses, thus: 61(17) means that the length of the species is 61 microns and the breadth 17.

As the breadth of a given species may vary as its valval or zonal aspect is presented, the letter v or z prefixed indicates the fact, thus: v61(17) or z61(14). The valval breadth is always at right angles to the zonal breadth.

In the case of the tubular species like *Melosira*, the length of the unit frustule is the diameter of the tube-like filament. The zonal breadth is the length of the unit frustule from articulation to articulation—in the direction of the filament. The valval breadth is the diameter of the end view of the filament—in this case the diameter of the circular valve, and is identical with the length of the frustule although at right angles to it.

When the filament has not a circular cross section, the longer diameter of the valve is the same as its length, the shorter is the valval breadth. For instance: in a band of connected frustules like *Rhabdonema* or *Tabellaria*, the breadth of the ribbon is the length of the frustule or unit diatom. The zonal breadths are the breadths of the individual frustules across the connecting zones tying them up into the band or ribbon. The valval face will not be visible until a frustule breaks off from the ribbon and turns on its longitudinal axis ninety degrees.

When the valval breadth varies symmetrically or distinctively, for example, as in a variety of *Navicula Crabro* 36 microns long which contracts midway to 8 microns and swells out towards each end until it is 14 microns broad, the facts can be briefly noted thus: v36(14:8:14), the colons separating *indefinitely* the maximal and minimal breadths. The formula of *Synedra Baileyi* (MacKay) would be expressed thus: v271(9.5:7.5:8:7.5:9.5), which means that the valval face of the diatom 271 microns long is capitate, $9\frac{1}{2}$ microns broad then narrowing down to $7\frac{1}{2}$ and swelling up to 8 at the center, and so on.

The fineness or coarseness of *sculpture* is another important feature which is capable of brief notation, whether they are lines, rows of points, pearls or cell-like elements. The letter "s" at the end of the parenthesis connotes the sculpture. The figure following indicates the number of elements in the space of 10 microns, thus: *Synedra Baileyi* might be described: v270(9:7:8:7:9) s11, the latter figure indicating that the lines of sculpture are eleven in the space of 10 microns.

Nitzschia socialis Greg. with its coarse sculpture on the keel and its fine sculpture on the valve can be represented thus: v127(8)s6:15, the two orders of sculpture being separated by the colon.

When the sculpture is of the same order but varies in fineness, the figures are separated by a dash (—) beginning with the central and ending with the peripheral lines or striæ, thus: *Cocconeis scutellum* Ehr. var. *Baldjickiana* Grun. = v50 (30)s6—4, the two last figures indicating that there are six rows of pearls to 10 microns at the centre varying to four at the outer rim.

Where there is a distinction between the upper and lower valves it can be indicated by prefixing "u" or "1" before the "v"; and so forth.

ALPHABETICAL LIST OF THE VANCOUVER DIATOMACEAE.

Achnanthes brevipes Ag. 1v50(9)s8, v67(17), v75.
" " var. *minor* Perag. v26(11)s8, z30(4)s10.
" *exilis* Ktz. Kendal.
" *longipes* Ag. z52(7)s6, uv104(23:20:23)s8:5.
" " var. v67(31)s3:8, Valve oval, 25 lateral ribs on each side about 3 apart, four rows of dots between the central ribs, and two between the others, 8 to 10 dots in 10 microns. From Departure Bay.
" *Lorenziana* Grun. v40(17)s8. One specimen. on algæ.
" *minutissima* Ehr. v23(3+)s12, v30(3.5)s12.
" *parvula* Ktz. v18(5)s15, v30(10)s16.
" *subsessilis* Ktz. v45(9)s11. v60(10:8:10)s9.
Achnanthidium lanceolatum Bréb. z22(3)s12, z35(5) s11.
Actinocyclus subtilis Ehr. v35.
Actinoptychus socius A. S. n.v. v24, ten-rayed.
" *undulatus* Ehr. v22, v75, Common.
" " var. v33, ten-rayed.
" " var. Three of the alternate segments marked by a circular dot.
Amphiprora alata Ktz.
" *lepidoptera* Greg. 120(20).
" " var. *proboscidea* C1.75s20, 105(16).
" *maxima* Greg. var. *gracilis* Grun. 192(36)s18.
" *sulcata* O'Meara, 110(25:10:25)s8.
Amphitetras antediluviana Ehr. n.sp. ? Has large areolation. Resembles (but is not identical with) quadrangular forms of *Triceratium favus*.
Amphora angusta Greg. var. ? 25(?)s9, 40(5)s8, 41(7)s8+.
" " var. *oblongella* Grun. v45(8)s15, v68(10)s15.
" *arenicola* Grun. z45(22)s10, z53(20)s12.
" n.sp. v73(6)s15, Like *A. graefii* C1., except that the striae stop short of a radiant area opposite the central nodule, and the ends have a downward turn below the line passing through the central nodule.

Amphora binodis Greg. var (?). 53(13)s18, 65(12)s?.
" " var. *bigibba* Grun. 20(7)s?, v54.
" *clara* A.S. 47(11)s8.
" *costata* Sm. v33, v50(10)s8.
" *cymbifera* Greg. 50(8)s9.
" *dubia* Greg. var.? 46(9)s14, 55(13)s10.
" *Eunotia* Cl. 49(7.5)s15.
" *exigua* Greg. 33(5)s17.
" *hyalina* Ktz. 50(10)s0, 75(15)s0. (One-sixteenth oil-immersion).
" *macilenta* Greg. 37(9)s15.
" *marina* (Sm). z31(17)s16.
" *ovalis* Ktz. 37(9)s14, 48(9)s14.
" " var. *affinis* Ktz. 25(7)s13. 50(7)s13.
" " var. *marina* Sm. 28(9)s16.
" *proteus* Greg. 45(9)s11, 52(9)s13.
" *pusio* var. *parvula* Floegel. 21(17)s17.
" *scabriuscula* Cl, 50(22)s6.
" *salina* Sm. (Kendall).
" *turgida* Greg. 35(6)s7–8, 50(12)s8.
Arachnodiscus Ehrenbergii Bail. var.? v(200)s7.
Asterionella formosa Hassel. var.? (Near *A. Bleakeleyi* Sm.). 57(5:3:4)sO.
" *notata* Grun. ? 140(6)s0.
Asteromphalus arachne Bréb. (51)s6.
Aulacodiscus Oregonus Bailey, v.n. v(100)s7–6, eight-rayed.
Auliscus caelatus Bailey. var. *riphis* A.S. (60).
" *sculptus* Sm.
Asterolampra Ehr. Sp.? (Bailey). One specimen.
Biddulphia aurita Bréb. z(4+10+14+9+3) (20)s6, z(13+29+14) (18)s8, z55(33)s10.
" *granulata* Roper. (Kendall).
" *obtusa* Ralfs. z38(22)s9, z60(50)s9.
" *Roperiana* Grev.
" *suborbicularis* Grun. v31(30)s8.
" n.sp. z(15+15+24+15+15) (36)s11:20. Horns uniform, truncate, slightly coverging, 15 microns long; head 15 microns long with two bristles arising from the convex centre extending beyond the horns, sculpture dots about 11 in ten microns. Connective zone 24 long 36 broad with a quincunce hatching very fine about 20 to 10 microns. The remaining symmetrically like the first two parts described. Resembling in some respects *B. longicruris* Grev. var. *Japonica*, or *B. longicruris* Grev., or *B. Chinen-*

sis Grev. The horns of uniform width with slight convergence are quite different in general appearance from those of any other species.

Campylodiscus Thuretii Bréb. v50(50)s2:6:12.

Campyloneis Grevillei var. *Argus* Grun. v53(40)s5, v75(63)s5:3.5.

Cerataulus polymorphus (Ktz) H.V. z(20+35+) (60).

" *turgidus* Ehr. 104(88)s10.

" " forma *major spinifera* Peragallo. z(11+22+68+ +) (65).

Chaetoceros boreale Bail.

" *cryophyllum* Castr, z16(32).

" *crinitum* Schutt.

" *decipiens* C1. z50(20).

" *didymum* C1. z26(18), z50(30).

" *dichaeta* (Kendall).

" *Peruvianum* Brightw. z33(33), z36(27).

" *saltans* C1. z33(37), z35(26).

" *sociale* Laud. z9(13), z7(11).

" *subtilis* C1. z20(35).

" (?)

" (?)

Cocconeis costata Greg. v16(10)s7, v21(12)s8, v22(13)s6. Common.

" " var. *Pacifica* Grun. 1v23(15)s6+

" *curvi-rotunda* Temp. & Peragallo 10. v33(23)s20, v57(46)s20.

" *dirupta* Greg. v22(16)s17, v33(21)s8, v90(76)s14, v88(77) s19.

" " var. v75(60)s14. A wide sigmoid cross with arms reaching nearly to the margin is without sculpture.

" " var. *flexella* Jan. v 24(12)s17, v27(18)s18.

" " " n.v. v72(60)s16:10. Differs from the first variety by having a sigmoid midrib in the centre of the vertical smooth area, and the smooth area of the arms extend to the periphery widening to the margin. The rows of dots are about 10 in 10 microns, while the dots run 16 to 10.

" *distans* A.S. v18(9)s7, v22(12)s9. Three rows on each side of the midrib, and parallel. Veıy like *C. parallela* following.

" n.sp? v38(32)s8–5, v43(39)s6–4. 23 or 24 ribs in each The ribs run into the midrib which is heavier near the centre. The ribs become more swollen where they cross the sub-marginal line. Found in Departure Bay and near Newcastle by the collector, Dr. MacLean Fraser.

Cocconeis granulifera Grun. v34(23)s7, v50(28)s5.

" *grata* A. S. v34(25)s11.

" *interrupta* Grun. v45(36)s20. Near *C. pellucida* and *curvirotunda.*

" *molesta* var. *amygdalina* (Bréb.) Grun. v16(9)s ?.

" " *minor*, v5(3)s ?, v9(5)s ?.

" n.sp. v29(25)s7–4:20, v50(30)s6–5:20.16 to 17 ribs in the first and 25 and 27 in the second. The midrib swells gently from each end to the center. The finer markings on the ribs are clearly distinct in a 1-16 oil immersion. It is a very beautiful species.

" *parallela* n. sp.? var *4–lineata-marginata* n.v. v37(25)s5. Has 4 rows of dots parallel on each side of the midrib, with a submarginal line. 5 dots to 10 microns in line and across the lines.

" *parallela* sp. var. *4-lineata* n.v. Probably the other valve of the former. It lacks the marginal sculpture.

" " var. *2-lineata-marginata* v31(18)s5/8. Two parallel lines on each side, with closer dots on or near the margin.

" *parallela* n,sp var. *2-lineata* n.v. v15(9)s5, v30(17)s6. Two parallel rows of dots on each side only.

" " " " *3-lineata n*.v. v17(8)s9, v18(9)s7. Three parallel rows of dots on each side.

" *pediculus* Ehr. v13(6.5)s14.

" *pinnata* Greg. v25(18)s6, Twelve ribs on each side.

" " " n.v. v42(28)s4:13, v50(35)s3:19. Margin distinctly scalloped into about six dentate angles on each semi-perimeter. Ribs (costae) on some valves; others with only the finer sculpture indicated in the notation.

" *pseudo-marginata* Greg. v45(18)s19.

" *scutellum* Ehr. v27(18)s10–8, Common.

" " var *adjuncta* A. S. v35(27)s8–5, v50(40)s7+–.

" " " *Baldjickiana* Grun. v34(23)s6–4, v55(43) s6–4.

Cocconeis scutellum var. *compressa* n.v. v21(12)s10. Slightly compressed on the sides. Marginal rim 3 microns wide. Curved transverse rows of dots which align in straight longitudinal lines, with long, and transv. axes just visible passing through the centre.

" " " *japonica* A.S. v45(30)s8–6. Dots quadrate.

" " " *Morrissii* Sm. v56(44)s7–5.

" " " *parva* Peragallo. v12(7)s8, v21(10)s8.

" " " *stauriformis* Sm. v16(10)s13, v18(9)s10.

" " " *riparia* Brun. v28(19)s12–5, v41(30)s10–8.

" n.sp. v(60(34)s9, v58(33)s10, v62(33)s11:9, v63(49)s8:9–15. Near *C. maxima* Grun., *C. Lorenziana* A. S., and *C. Brittanica* Naeg. Marginal band 4 microns wide approximately, with the coarser sculpture. Midrib somewhat naviculoid occasionally. The following related forms occur: v43(30)s4:9, v67 (47)s4:9.

Corethron Hystrix Hensen. Diameters of the bowl-shaped discs 18, 20, 24, 40 and 45 microns, with from 16 to 25 long seta projecting from the rims.

Coscinodiscus asteromphalus Ehr.

" *centralis* Ehr. v45 to v78, s6 to 7, to 8.

" *concinnus* Sm. v54s8–12, v85s8–12, v120s10–11–12.

" *curvatulus* Grun. v48s10, v54s8, 10 or 12 fascicules.

" *debilis* Grove, v50s17, v75s16.

" *divisus* Grun. v37, v50s8.

" *excentricus* Ehr. v33s14, v65s5–6, v93s5–6.

" *fasciatus* (Kendall).

" *griseus* Grev. var. v31s11–12.

" *Kutzingii* A.S. v40s15.

" *lineatus* Ehr. v30s8, v55s7. And two varieties.

" *oculus-iridis* Ehr. v140s3–5–15, v285s4– .

" *patera* Castr. (Kendall).

" *radiatus* Ehr. var. minor A.S. v25s16.

" *radio-furcatus* n.sp. v40s8–10, v43s8-12. Rays bifurcating.

" *radiosus* Grun. v30, v36s20.

" *Rothii* Grun. v36, v126s8. Sixteen fascicules with apicules.

" *subtilis* Ehr. v53s10, v78s8.

" *stellaris* Roper, v65s14.

Coscinosira polychorda Gran. One specimen.
Cyclotella striata Ktz. v25s12. Noted once.
Cymbella gastroides Ktz. A fresh water species noted by Kendall—from the coastal rivers. Several fresh water species are noted in the list.
Dimerogramma minor Greg. v45(3:12:3)s10. Departure Bay.
" *marinum* Greg ? v33(5:8: ? ?)s6. Fragment-over one-third. Dep. Bay.
Diatoma vulgare Bory. Bailey. Kendall. Freshwater species.
Ditylum Brightwellii Grun. Two species noted by Bailey.
Encyonema gracile Rabh. v58.
Epithemia zebra Ktz.
Ethmodiscus punctigera. (Kendall).
Eucampia zodiacus Ehr.
Eunotia gracilis (Ehr) Rab. v30(5)s11.
Eunotogramma bivittatum Grun. v114(4:7.5:4)s8. Plankton, 20 fathoms.
v112(5:10:5)s6.
Euodia Janschii Grun. ? v54(8)s7.
Fragillaria capucina Desm.
" *Islandica* (?)
" *striatula* Lyngb. z44(8)s(?). z55(8)s20+.
Glyphodesmis Williamsonii Greg. v60(7).
Gomphonema éxiguum Ktz. v25(7)s15(?), v40(7)s12.
" *intricatum* Ktz.
" *olivaceum* Ehr. v27(6)s10–15, v42.
" *subclavatum* Grun (?) v33(6)s12.
Grammatophora angulosa Ehr. z24(12)s13, z35(15)s12.
" " var. *hamulifera* Ktz. z16(17)s16.
" *Japonica* Grun. var (?). z42(7)s ?.
" *marina* (Lyngb.) Ktz. z30(6)s20+, z85(7)s20, v74(5:4:6:4:5)s20.
" *maxima* Grun. 96(?)s20, 176(30)s ?.
" *oceanica* Ehr. z55(13)s20, z78(?)s ?.
" " forma *communis* Grun. z74(24)s ?.
" " var. *macilenta* Sm. z66(15)s ?, z84(18)s ?.
" " " *vulgaris* Grun. z90(14)s ?.
" *serpentina* Ehr.
" n.sp. z15(24)s20″, z16(17)s17. Approaching Ehr. but striae finer, and valve broader than long.
Hyalodiscus laevis Ehr. v25 and 14, v33 and 15, v102 and 48.
" *subtilis* Ehr. var. ? v22 and 9 (Not var. *scotica* of Peragallo).

Hyalodiscus Whitneyi Ehr. v42 and 30. Periphery plane, umbilicus granular.
" ? v30, rim 1 to 2 microns thick. Valve radially striated 20+ in 10m. Central area finely quincunce – more than 20 in 10m.
Lauderia borealis Gran. z25(120÷6)sO=z25(20), z30(16).
" ?
Licmophora angelica (Ktz) Grun.
" *Californica* Grun. v75(12)s8-11, v80(4:15)s8-10.
" *flabellata* var. splendida Sm. v155(6)s ?, v240(6:4:6)s ?.
" *gracilis* Ehr. v51(3:11)s ?, v95(3:16)s ?.
" *hyalina* Ktz. v52(4:15)s ?.
" *Jurgensii* Ag. v31(5:9)s14, v84(4:8)s14, v96(3:9)s14.
" *Lyngbyei* Ktz. v(70 and 73) (6:15)s ?, v(63 and 66) (5:12)s ?.
" *paradoxa* Lyngb. v(70+5) (4:12)s ?, v(85+5) (3:14)s ?.
Mastogloia exigua Lewis. v24(7)s20:4 (3 loculi), v34(14)s20:3(5 loc.).
" ? v46(13)s20:3(6 loc.)
Melosira Borreri Grev. z25(35)s ?, z15(45)s ?.
" *dubia* Grun. (?). z17(20)s ?, z34(24)s ?, z40(25)s ?.
" *Jurgensii* Ag. z6(8)s ?, z17(12)s ?.
" *nummuloides* (Bory)Ag. z14 (20)s ?.
" *Sol* Ehr. v45, 55s4.
" *sulcata* Ktz., v15, v20, v25s5, v37s5.
" " var. *coronata* Ehr. v27s5.
" *varians* Ag. z20(30)s11, z34(26)s14.
Navicula abrupta Greg. A fragment. Striae 9 in 10 microns.
" *advena* A.S. var. (?) v40(12)s8.
" *ammophila* Grun. v24(5)s12. (*Schizonema*).
" " var. *planatica* Grun. v44(6)s11, v62(8)s12.
" *apiculata* Bréb. v25(12)s9. Departure and Porpoise Bays.
" *arenicola* Grun. v22(4)s13.
" *bombus* Ehr. v60(25:15:25)s8, v35(17:13:17)s6.
" *Botnica* Grun. var(?), v54(11)s19, v75(15)s20. Sharper at ends than the species.
" *brevis* Greg. v72(30)s15, v75(27)s14. Had the submarginal line of *N. formosa and liburnica*. Probably a variety.
" " var. *elliptica* Grun. v60(25)s14. Has the submarg line.
" *cancellata* Donk. z50(18)s6. Not uncommon.
" " var. *appiculata* Greg. v33(9)s7, v36(7+)s6.
" *clavata* Greg. v41(24)s9–10, v43(28)s9–10.

Navicula clavala var. *Cariboea* Cl. v35(21)s9, v52(29)s10. Dep. Bay.
" *cincta* Ehr. v24(4.5)s15.
" *contsructa* Grun. (Kendall).
" *Crabro* var. *perpusilla* Cl. v33(12:11:12)s7, v35(15:14:15)s7.
" " *simplex* n.v? v36(14:8:14)s10, Ribs simple, unbroken.
" *cryptocephala* Ktz. v27(6)s ?. One specimen in plankton.
" *cyprinus* Sm. v75(12)s10. .
" *directa* Sm. v60(8)s8. Eel grass. v60(10)s8, Newcastle Island.
" " var. *incus* A.S. v155(16)s4–5, v165(9)s4.
" " " (?), v26(4)s10, v34(5)s10.
" *elliptica* Ktz. v48(16)s10.
" *formosa* Greg. v67(27)s12.
" *forcipata* Grev. var. nummularia Grev. v27(16)s11+.
" (*schizonema*) *Grevillei* Ag. v46(12)s ?.
" *Heufleri* Grun. v30(5)s10.
" *lanceolata* Ktz. v34(7)s12.
" " var. *phyllepta* Ktz. v30(9)s17.
" *liber* Sm. var. (?), v46(8)s20.
" *lyra* Ehr. v76(37)s10.
" *minuscula* Grun. (?), v16(5)s ?—striae over 20 in 10 m.
" *mollis* Sm. v29(6)s17, v51(8)s16. (Schizonema).
" *multicostata* Grun. var. minuta Cl. v72(17:13:17) s6–7. Var. of *Crabro*.
" " var. *perpusilla* Cl. v27(23:21:23)s7, v30(13:12:13)s7, v36(15:13:15)s6. Same as *N. Crabro*, var. *perpusilla* Cl.
" *neglecta* Thw. v45(10)s12.
" *Northumbrica* Donk. (?). v40(6)s10, v90(13)s13.
" *palpebralis* var. *semiplena* Greg. v75(11)s12.
" *pennata* A.S. v60(10)s7, v66(8)s7+, v75(14)s8.
" *peregrina* Ehr. var. *mensicus* Shum. v30(6)s10.
" *radiosa* Ktz. var. *longa* n.v. v152(16)s8. Longer than the species described which vary from 70 to 100 microns.
" (*Schizonema*) *ramosissima* var. *amplius* Grun. v27(4.5)s12, v54(10)s14.
" *rhombica* Greg. v45 (17)s17, v48(14)s17.
" *rhomboides* Ehr. v58(18)s20+, v70(22)s20+.
" *rostellata* Ktz. var. (?). v72(13)s6, v75(20)s6.
" *Smithii* Bréb. v30(10.5)s8, v42(18)s8, v63(30)s8.

Navicula Smithii var. *scutellum* O'M. v15(8)s8, v35(21)s8.
" " " *pelagi* A.S. v46(24)s8, v59(34)s8.
" " " (?). v60(30)s8. v67(33)s8. Differentia unnoted.
" *spuria* Cl. v84(5.5)s6.
" *suborbicularis* Greg. v27(12)s9.
" *vacillans* A.S. v51(16)s10.
" " var. *delicatula* Cl. v19(6)s14, v25(8)s15.
" " " *minuta* Grun. v27(11:10:11)s13.
" *viridis* Ktz. var. *rostellata* Ktz. v54(13)s12.
" *viridula* Ktz. var. *avenacea* Bréb. v24(5)s12, v46(9)s12+.
" " var. *subsalina* P. v43(8)s9.
" *Hennedyi* Sm. (Kendall).
" *humerosa* Bréb.
" *splendida* Greg.
Nitzschia angularis Sm. v170(18)s4:?, v200(16)s3–6:?.
" *angustata* Sm. v63(9)s10, v70(8)s17.
" *constricta* Greg. v20(7.5:7:7.5)s16, v27(8:7:8)s16.
" *hybrida* Grun. v93(?)s11:?.
" *insignis* Greg. var. (?). 103(10)s5:12.
" *longa* Grun. Fragment.
" *panduriformis* Greg. var. *continua* Grun. 27(9), 30(9).
" " var. *delicatula* Grun. v30(6:5:6)s14:20, v37(9)s9:?.
" " " *minor* Grun. v22(7:6:7)s16, v31(7:6:7)s10.
" *paradoxa* Gmel. v67(13)s12, v118(7)s8:?.
" *punctata* Sm. var. *coarctata* Grun. v26(9:8:9)s15, v31(9:8:9)s15.
" " " minima n.v. v18(7:6.5:7)s16.
" *rigida* Ktz. v142(7)s8:?, v145(6)s8:?.
" *seriata* Cl. (Kendall), See *Pseudo-Nitzschia*.
" *Sigma* Sm. v168(11)s6–7:?, v220(10)s6–7:19.
" *socialis* Greg. v80(5)s7–8:14–15, v108(10.5)s7:15, v120(8)s6–7:15.
" " var. *Baltica* Grun. v135(7)s5:?.
" " " *massiliensis* Grun. v140(7)s8:?.
" *Tryblionella* Grun. (Kendall).
" *vermicularis* (Ktz.)Grun. v260(?)s10:?, v300(12)s8:?.
Nitzschiella longissima Bréb. v210(1)+55(6)+210(1)=v475(1:6:1).
" v110 (1.5)+80(9)+110(1.5)=v300(1.5:9:1.5).
" " var. *parva* Bréb. v150.
" " " *reversa* Sm. v50(1)+70(7)+50(1)=v170(1:7:1)s1.

Opephora Pacifica Petit. v23(2:4:3)s8, z18(8:6)s8, v36(6)s6–7.
Plagiogramma Gregoryanum Grev. v20(6)s8, v25(8)s8, z25(10)s10, v46(9)s8.
" *interuptum* Grun. v40(3:6:3)s12.
" *pulchellum* Grev. v42(15)s5. v30(12)s6.
Pleurosigma angulatum Sm. var. *strigosum* Sm. v150(17)s18, v205 (20)s18, v230(22)s18+.
" *Balticum* Sm. var. *Californicum* Grun. v232(26:27:26) s14t:13L.
" *delicatulum* Sm. v144(20)s20+.
" *fasciola* Sm. v30(1)+75(10)+30(1)=v135(1:10:1)s ?, and v25(1–2)+75(12)+25(1–2)=v120(1:12:1)s ? sigmoid.
" *intermedium* Sm. v160(20)s20, v200(22)s20+.
" *longum* Cl. var. lanceolatum Per. v260(31)s16:15.
" *Olympianum* Terry.
" *rigidum* Sm. v110(19)s18.
" *strigosum* Sm. v364(22:22:25)s16.
Podosira minimum Grun. (?). v18.
Pseudo-nitzschia migrans Cleve. v31(13)s11.
Rhabdonema arcuatum Ktz. z35(28/6)s5, z53(66/16)s5, z78(48/?s5.
" *minutum* Ktz. (?). z15(20/?)s20, z30(20/5)s20.
Raphoneis n.sp. v57(8)s6. Long oval with margin showing edge of striae. Four rows of distinct dots on valve, the two lateral rows two-thirds of full length, central. The inner rows full length, more roomy, central.
Rhizosolenia hebetata Bail. (Bailey).
" *setigera* Brightw. z9, z12.
" *styliformis* Brightw. (Bailey & Kendall).
Rhoiconeis genuflexa (Ktz.) Grun. z23(10)s15, z233(14)s19, z50(14) s20.
Rhoicosphenia curvata (Ktz.)Grun. z15s13, z33(5:15)s12, v(36+10) (3:8:4)s12–16, v60s12–16.
Rhopalodia musculus Ktz. 60(16), =*Epithemia Musculus* Ktz.
" " var. *producta* Grun. 22(6)s5.
Scoliopleura tumida (Bréb) Ral. var. (?). 75(12)s15.
Skeletonema costatum Grev. z9 with 8 costae, z18 with 12, z33 costae unnoted.
Stauroneis Gregorii Ralfs. v58(13)s20.
Staurosira (Fragillaria) capucina Desm. z20(5)s15, v37(5)s16, z70 (98/14)s15.
" " mutabilis Sm. z30(5)s8, z48(?)s8.

Stephanopyxis appendiculata Ehr. z30(36/2)s4, z30(7+36/2+7:37/2 +7+45/2+9)=z30(148/3)s4. (30= breadth 7=spines, 36/2=18=length of nearly hemispherical frustule).

Striatella (?) z57(32/8)s20+ or ?, v97(31)s ?.

Surirella fastuosa Ehr. var. (?). v70(57)s2.

" *Japonica* A.S. var. v86(36'30:36)sl.9:11, v108(48:44:48)s 1.9:11, v115(24:23:24)s1.9:11. Differs from *S. Japonica* between the marginal band of loculi and the sub-central parallel band of minute dashes normal to the periphery and nearly a micron apart, an interstitial row or band of groups of four dashes opposite each marginal loculus with a single dash beneath each group approaching the subcentral band.

" *lata* Sm. var. (?). v81(33)—sl.3.

" *ovata* Ktz. v32(18)s4, v33(20)s4, v46(26)s4.

Syndendrium diadema Ehr. = the spore of *Chaetoceros paradoxum* Cleve.

Synedra acus (Ktz) Grun. var. (?). (Kendall).

" *affinis* Ktz. v100(2+:2:6:2:2+)s13, v60.

" " var. *tabulata* Grun. v86(2:5:2)s11, v123(3.5:5.5:3.5) s11. v165(2:4.5:2)s11, v135(2:5:2)s9, v180 ( )s11. z151(10:8:10)s10, v208(2+:5:2+) s12, v116(2:5:2)s12.

" n.sp.? v98(3:2:5:2:3)s11, v252(9:7:9:7:9)s11, v300(10:7:8:7: :10)s14. z195(15:9)s7, v271(9.5:7.5:8:7.5:9.5) s11. Valve with marginal dots 8 to 10 microns. Double row from centre coalesce into one near the ends, then enlarge into a central cluster in the clear area of the capitate end. Zone view narrower at one end.

" *Gallionii* Ehr. var. (?). v215(5:10:5)s16, v250(4:9:4)s15. Differs from the type species decidedly in its finer sculpture—15 or 16 lines to 10 mu instead of 9 or 10.

" *investiens* Sm. v12(3)s10, v45(4)s11.

" n.sp. ? v85(4:8:4)s20,10 mu at centre smooth, ends round, the valve soon broadening to the centre, the sculpture very fine across the whole valve except at the very ends and 10 mu at the centre. Another measured specimen gave v87(4:7.5:4)s20. Striation very distinct under a 1/16th oil immersion objective.

Synedra pulchella Ktz. var. Smithii Ralfs. v116(3:2:5:2:3)s16.
" *ulna* Ehr. (Bailey and Kendall).
" *undulata* (Bailey) Greg. (Bailey).
" n.sp. ? z108(21/2)s13+, v125(4:9:4)s12, v175(4:9:4)s12, v174 (4:8:4)s12, v168(4.5:9:4.5)s14, v200(4:9:4) s11, v144=69(4.5:7.5)s12+12(7.5)+63 (7.5: 4.3)s12.=smooth. Marginal (and all) striation wanting at the centre for a space varying in different specimens from 6 to 15 mu, 9 to 12 being most common. The sculpture is marginal and the breadth of the valve instead of tapering regularly often tapers decidedly when approaching the ends for a short distance. Found at several points.
Tabellaria floculosa (Roth.)Ktz. v20. A freshwater species.
Thalassionema nitzschioides Grun. var. *Javanica* Grun. v40(3)s7+, v46(2:3:5:2)s8.
Thalassiosira Nordenskioldii Cleve. v22(z18), v27(z18)s4t:10. v32(z10) 4t:10.
" *gravida* Cleve.
" *decipiens* Grun.
" *subtilis* ostend.
Thalassiothrix Frauenfeldii Grun. v115(7)s8+.
Trachyneis aspera Ehr. var. *clepsydra* Donk. z170(33:31:33)s10, v185 (30)s10.
" " " *intermedium* Grun. v105(23)s7.
" " " *pulchella* Sm. v55(15)s12, v66(18)s11, v93(15(s14.
" " " *vulgaris* Cl. v61(16)s11.
Triceratium arcticum Dr. v(144:144:144)s3.7:12 at corners; v(160: 160:160) s5:12 at corners. Porpoise Bay.
" *alternans* Sm. Found at several points.
" *undulatum* (Ehr.) Bright. *Dytilum Brightwelli* Bailey.

NOTE: The provisional new specific and varietal names used in the foregoing list are due to Dr. Mackay who does not, however, propose to establish them; for they have been hurriedly given without even an attempt to avoid their repetition, and merely to mark temporarily some of the more distinct variant forms. Other forms were observed, but more time and material will be necessary for authoritative descriptions which should be accompanied with figures.

It should be remembered too that the specific and varietal nomenclatures of the diatomaceae require a profound and extensive scientific revision which a knowledge of their numerous and world wide forms and distribution may soon enable us to attempt.

The formula-like notation of measurements is simply an accommodation to the forms of type likely to be found in the fonts of the general printing offices.

A British Columbia Example of the Contact Metamorphism of a Granite Rock to a Garnet.

By R. W. BROCK, F.R.S.C.

(Read May Meeting, 1915.)

In the Summary Report of the Geological Survey for 1902, the writer gave a brief description of the contact metamorphic deposits of the Boundary Creek District of British Columbia, calling attention to the fact that here the metamorphism to garnet, epidote and other typical contact minerals was not confined to limestone but that other rocks, even granodiorite, were altered in like manner to a similar and indistinguishable product.

As this type of deposit had just been recognized and the observed contact metamorphic deposits had been in limestone, geologists considered such deposits to be peculiar to this rock, and its presence as a host to be essential to their formation. The writer's Boundary Creek observations were therefore discredited. Since that date a number of such deposits have been found and described in which the altered rock is not limestone, and it is now fully recognized that the action is not confined to a rearrangement of the molecules present in a limerock, with the addition of silica, but that there are other important chemical changes and that these may occur in many rocks, though limestone appears to be most susceptible.

While it is therefore no longer necessary to corroborate these Boundary Creek observations, the alteration of the Boundary Creek granodiorite to a garnet rock furnishes such a clear and striking instance that it seems desirable to have it placed on record with the Society.

The geology of the District[1] is complicated through deformations, igneous intrusions and flows, and metamorphism.

The chief formations may be grouped as follows:

Glacial and Recent Deposits	Pleistocene
Pulaskite and Pulaskite porphyry Augite Porphyrite Midway Volcanic Group	Miocene
Kettle River Formation (Conglomerate Sandstone Shale)	Oligocene

[1] In addition to the Summary Report, 1902, page 95, description of the geology will be found in Memoir 21, G.S.C., "The Geology and Ore Deposits of Phoenix" by O. E. LeRoy, Memoir 19 "Geology of Mother Lode and Sunset Mines" by O. E. LeRoy; Memoir 38, "North American Cordillera, Forty-Ninth Parallel" by R. A. Daly.

Unconformity

Granodiorite................................Jurassic ?

Igneous Unconformity

Serpentine (altered basic intrusive) }
Phoenix Group—(Porphyrites, tuffs, etc.) } Mesozoic ?

Attwood Series (Argillites, limestones, quartz,
jasperoids)........................Palæozoic

The description of the granodiorite, given in the Summary Report, may be quoted:

"At various points throughout the whole district, bosses, irregular masses and dykes of a light-grey granitoid rock make their appearance. It is a quartz-bearing biotite-hornblende rock, in places apparently granitic, in others rather dioritic. It is probable that it will prove to be, generally, a granodiorite.

It sends out numerous dykes throughout the country, especially in the southern portion of the district. These have usually a porphyritic structure with a microgranitic groundmass. . . . . ."

"The granodiorite is evidently intrusive cutting all the rocks[1] above mentioned. The mechanism of its intrusion is extremely interesting for it unquestionably forced its way up through the overlying rocks by digesting them and rifting off fragments. This is proved by the contacts, both along the sides and roofs of the masses. These are, except in the case of the dykes, rarely sharply defined, but are irregular and suture-like. The intrusive holds inclusions of the surrounding rocks, and the surrounding rocks are often filled with granite material.

The composition of the intrusive seems to be affected by the digested material of the rock into which it has forced itself. It is also shown by the way in which the granodiorite is exposed in small, more or less circular but irregularly bounded masses in different parts of the district such as in Wellington Camp and on Hardy Mountain. In many cases no definite boundary can be assigned to the granitic mass. From the way in which the rock makes its appearance in all parts of the district, it is evident that the whole of it, at no great depth, is underlain by this rock. This rock has a strong resemblance to the Nelson granite of the Kootenay district both in composition and in its relationship to the surrounding rocks. The Nelson granite which has been carefully studied is a sort of granite representative of the Monzonite group of rocks, intermediate between the alkali and lime-alkali series of rocks and about on the boundary line between granite and diorite."

[1]All the rocks given below it in the table of formations.

"The Boundary Creek rock will be found on analysis to contain a greater percentage of alkaline earths but this may be due to the material it has acquired from the rocks into which it has been introduced and may represent only a local peculiarity. As the Nelson granite occurs to the north and east of this district and probably also to the west, the Boundary Creek rock in all probability belongs to the same great intrusion. If so, its age will be about Jurassic. This agrees with its stratigraphical position in this district."

The granodiorite, altered to garnet, is found on Pass Creek, in the northeast corner of the Boundary Creek sheet, near a contact of pulaskite, which cuts and dykes it. It is a medium to coarse-grained rock, of pure grey colour, rich in coloured constituents, (dark green hornblende and some biotite) as well as in plagioclase, orthoclase and quartz. Its habit is typically that of a granodiorite.

Under the microscope, magnetite, titanite and a few zircons are the usual accessory minerals. Orthoclase is partly replaced by microcline. The plagioclase approximates Ab_3An, and is therefore chiefly oligoclase. It is frequently altered to kaolin. The characters of the texture and minerals are those common in granodiorite and need no detailed description.

The normal aspect of this rock is shown in Plate I. Fig. 1.

This granodiorite is rather heavily dyked by pulaskite and pulaskite porphyry and is in places altered to garnet, sometimes solid, almost pure, garnet masses, sometimes accompanied by notable quantities of other contact minerals.

The solid garnet masses may be dyke-like, attaining a width of ten feet. The transition from the unaltered granodiorite is usually gradual extending over several feet. The first symptom of alteration from granodiorite to garnet seen in approaching a garnet mass, is a greenish discoloration of the rock, giving it a spotted appearance. A short distance beyond, garnet becomes distinct as small greenish crystals scattered through the parent mass. Not infrequently a nucleus of granodiorite is left in the centre of a crystal. Plate I. Fig. 2. illustrates this phase. The dark portions of the photograph are garnet. Proceeding inward the garnet crystals become larger. Their growth is marked by a pronounced zonal structure. As the garnets increase in size, the granodiorite matrix is correspondingly diminished until finally the individuals coalesce and a solid mass of garnet results. When the matrix has been reduced to less than half of the mass, it becomes altered to a greenish material.

Plate II, Fig. 3 illustrates a stage considerably more advanced than Plate I, Fig. 2. The garnet individuals are here large; the granodiorite matrix is reduced to less than half the mass and altered to the green material which is largely pyroxene with a little orthoclase.

Plate II, Fig. 4 shows slightly more advanced stage, the host is reduced to narrow bands between the large crystals. The zonal growth of the crystals can be detected in the photograph.

Plate III, Fig. 5 is all garnet except the small interstices between crystals. The large crystal on the left of the photograph shows a core of granodiorite. The final stage is solid massive garnet in which nothing of the host is left, even the nuclei of crystals having been transformed to garnet. As such material is homogenous, it shows nothing of interest in a photograph.

In color the garnet varies from greenish, in the small crystals sparsely scattered through the granodiorite, to yellowish-brown and red. In one case, where garnet is accompanied by pyrrhotite, the garnet is white, suggesting that the iron was taken up by the sulphide.

Under the microscope, the garnet shows its ordinary characters. The zonal structure so noticeable in the hand specimens is still more pronounced. The granodiorite cores are generally considerably altered, generally to kaolin and epidote with a little orthoclase but some of the minerals, especially the accessories, remain intact.

In the following table, two analyses of granodiorite from other localities are given for purposes of comparison. The Pass Creek granodiorite (Analysis 3), is that shown in Plate 1, from the edge of a garnet mass on the Iron Chancellor claim. The garnet analyzed (Analysis 4), was taken from the specimen shown in Plate 3, a few feet from the granodiorite of Analysis 3.

	1	2	3	4
SiO_2	66·46	62·08	62·55	43·73
TiO_2	0·27	·73		
Al_2O_3	15·34	16·61	16·51	18·28
Fe_2O_3	1·68	1·53	1·75	7·35
FeO	1·83	3·72	2·08	0·63
MnO		·11	·34	1·41
MgO	1·11	2·44	1·69	0·82
CaO	3·43	5·20	5·77	23·66
SrO		0·3		
BaO		·09		
Na2O	4·86	3·18	6·70	2·00
K_2O	4·58	3·29	2·52	0·58
H_2O at 110 C	0·29	·16	0·75	1·24
H_2O above 110 C		1·00		
P_2O_3	0·08	·30		
S			0·08	
	99·93	100·47	100·74	99·68

1. Nelson granite from Kokanee Mountain, West Kootenay—Analysis by Dr. F. Dittrich, Heidelberg.

2. Trail Batholith, two miles west of Trail, given by Daly, page 347, Memoir 38, G.S.C.—Analysis by M. Connor.

3. Pass Creek granodiorite—Plate 1, near garnet zone. Analysis by L. L. Bolton.

4. Garnet shown in Plate 3, an alteration product of the Granodiorite of Analysis 3. Analysis by A. G. Burrows.

Plates.

The plates are reproductions from photographs of a series of specimens taken across the contact between a zone of garnet, formed by contact metamorphism, and the granodiorite country rock, Iron Chancellor claim, Pass Creek, Boundary District. The photographs are by L. L. Bolton and are about natural size.

Plate I, Fig. 1. Granodiorite from edge of garnet mass.

Fig. 2. Same rock but with small green garnet crystals developing. The dark masses are garnet. This shows the first stage in alteration to garnet mass.

Plate II, Fig. 3. Same but alteration more extensive as the zone of intense metamorphism is approached. The light portions are garnet; the dark is the granodiorite host, somewhat altered to pyroxene and orthoclase.

Fig. 4. Same. Process further developed; the crystals are larger and individuals have coalesced; little of the original host remains. Note the zonal structure of the garnets.

Plate III, Fig. 5. Same, approaching the massive garnet. The residue of the host is restricted to small interstitial fillings between garnet individuals. The garnet crystalon the left shows a core of granodiorite.

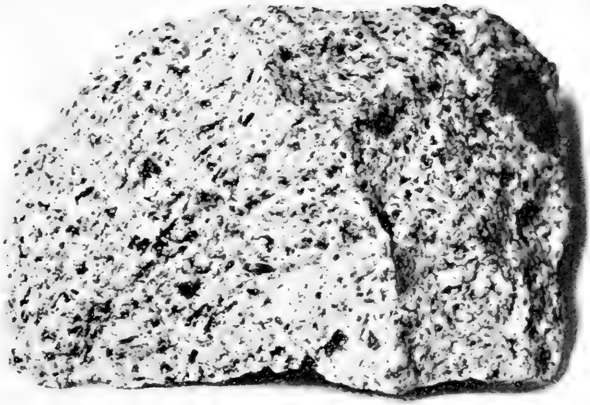


Fig 1

Fig. 2.

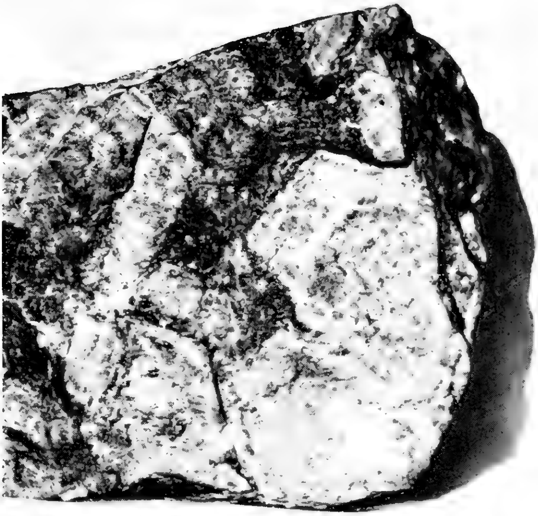


Fig 3

Fig. 4.

Plate III.

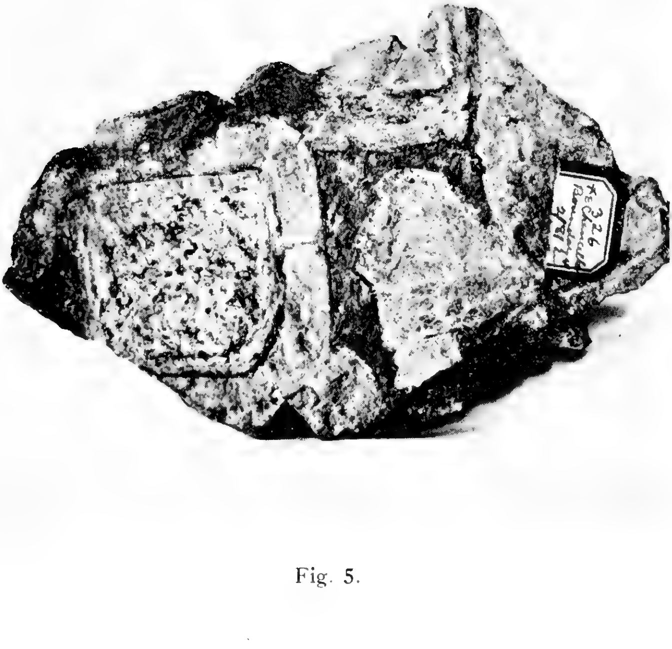


Fig. 5.

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SECTION IV

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Trematodes from Marine and Fresh-Water Fishes, including one Species of Ectoparasitic Turbellarian.

By A. R. COOPER, M.A.

Presented by DR. B. A. BENSLEY.

(Read May Meeting, 1915.)

The following paper is a semi-descriptive list of flat-worms, with one exception trematodes, taken from marine and fresh-water fishes at the Marine Biological Station and Lake Station on Georgian Bay, respectively. Unless otherwise stated the hosts were actually procured in the immediate vicinity of St. Andrews, N.B., and Go-Home, Ont., in the former case from Passamaquoddy Bay. Twenty-nine species belonging to 24 genera are reported from 29 species in 27 genera of fishes, and of these one is a Triclad Turbellarian while five are ectoparasitic or monogenetic trematodes. Ten species (Nos. 3, 7, 10, 11, 13, 14, 16, 18, 20, 25) are to my knowledge here reported for the first time from Canada.

Very early stages in the development of several species were found encysted in what are in all probability at least the second intermediate hosts. They seem to point to a very simple life-history in each case, although nothing is given with regard to the period between the eggs and such very young stages. In several instances eggs—containing living miracidia in the case of *Allocreadium commune* (Olss.) from may-fly nymphs of the genus *Blasturus*— were found in the uteri of mature encysted individuals or extruded into the cavity of the cyst, which facts point to self-fertilization or parthenogenesis, since each cyst contained only one worm. A thorough study of the fertilization processes of any species falling into this category would doubtless bring to light some very interesting facts.

A few explanatory figures are given for the assistance of future workers in this field, while an apparently long list of references is supplied. The latter, however, contains in most cases only those works giving adequate descriptions of the species in question. The numbers in bold-faced type throughout the text refer to this list.

Most of the measurements were made after the species were cleared in oil of cedar-wood, and in no case was an individual, compressed for the purpose of getting a better view of the internal anatomy, used as a subject for such drawings or measurements.

I wish to here express my indebtedness to the Biological Board of Canada who, by placing means and equipment at my disposal, have made this work possible.

Species from Marine Fishes.

1. *Micropharynx parasitica* Jägerskiöld. **29**, pp. 359-61.

On the skin of the dorsal surface of *Raja laevis* (Mitchill), Barn-door Skate.

A Triclad Turbellarian. Appear as white oval flakes, ranging in size from very small specimens just visible to the naked eye to those attaining a length of ten millimetres; quite difficult to detach without injuring the posterior end.

2. *Dactylocotyle denticulatum* (Olss.). **19**, p. 10.

Gills of *Pollachius virens* (L.), Pollack.

One specimen from a small pollack from St. Mary Bay, Nova Scotia.

3. *Microcotyle poronoti* MacCallum. Figs. 1-5, Pl. I.

Gills of *Poronotus triacanthus* (Peck), Dollarfish. St. Mary Bay, N.S.

Body about 4 mm. in length, or about 2·8 mm. exclusive of the caudal disc, somewhat stout, thick and spindle-shaped from a dorsal or ventral aspect (Fig. 1), symmetrical. Breadth opposite the genital atrium about 0·4mm. and at the widest part, which is at the middle of the worm, 1.0mm. Caudal disc or sucker-bearing portion occupies the posterior two-fifths of the body, projects slightly forward ventrally (Fig. 2) and is provided with suckers varying in number, in most specimens at hand, from 35 to 45 pairs, although one specimen, somewhat larger than the others, shows 63 pairs. The individual suckers are from 0·085 to 0·105mm. in breadth. Anterior sucker 0·10 long by 0·05mm. wide and with a membranous septum which, being low, does not completely divide the cavity into two parts. Three groups of "sticky glands" almost in a straight line ahead of the mouth-opening. Oesophagus terminates behind the genital opening where it forks into the two main intestinal trunks. These send out numerous lateral branches both inwards and outwards, the former simple and the latter branching once or twice, but all almost completely obscured, in transparent preparations, by the vitelline follicles. The main trunks seem to terminate within the body proper; at least they could not be traced with certainty beyond the posterior end of the group of testes on account of the fact that, since all material at hand was fixed and preserved only in 2% formalin (5 of commercial 40% formaldehyde solution to 95 of water), their walls were poorly preserved and in sections their lumina were indistinguishable at the anterior border of the caudal disc from the numerous parenchymatous spaces of that region. Better preserved material might show, however, that they extend into the caudal disc and are surrounded by the follicles of the appendages of the vitellaria. A comparatively large pigmented spot is situated in the tissue of the ventral surface, immediately below the posterior edge of the pharynx. Common genital opening ventral and slightly ahead of the beginning of the intestinal trunks at the hinder end of the first quarter of the distance from the anterior end of the body to the anterior edge of the ovary. It is provided internally with numerous short, stout spines, the largest of which are 0·011mm. long and 0·005 mm. broad at their bases. Most of these spines are situated on an anterodorsal muscular elevation which almost completely fills up, at least at certain levels, the whole of the atrium; a few smaller spines are, however, located on the posterior wall, even close around the termination of the vas deferens (Fig. 3). The ovary begins on the right side of the space between the vitellaria and, after taking two short, compact turns towards the right, proceeds to the left, passes forward almost in the median line, backward again, then forward and finally backward to the beginning of the oviduct, the bulk of the organ thus forming two closely applied and somewhat laterally compressed Λ-shaped portions (Figs. 1 and 4). The ovum at the oocapt measures $0{\cdot}025 \times 0{\cdot}014$mm. The oviduct, after taking one or two turns laterally or dorsoventrally, is met by the genito-intestinal canal, the junction of which with a minute median branch of the right intestinal trunk is so small that it appears in only one section of a 10μ series. The single median vaginal opening is situated dorsally, about two-fifths of the distance from the anterior end of the body to the anterior end of the ovary or about three times as far from the latter as from the common genital opening. It leads into a simple median canal which, after proceeding backwards half way towards the anterior end of the ovary, divides into two vaginal canals which diverge slightly in passing a short distance farther and join the paired yolk-ducts. The latter, parallel for most of their length, converge ventral to the ovary and eventually unite to form a common yolk-reservoir which in turn empties through its very much constricted continuation into the oviduct to the left of the beginning of the ovary (Fig. 4). From this point the oviduct takes a comparatively wide curve posteriorly and to the left, and then passes forward to expand dorsally into the ootype which is surrounded by the little differentiated, so-called shell-glands. The uterus, which begins at the anterior end of the ootype in a slight expansion, depending on the number of yolk-cells present, passes forward in the median line above the yolk-ducts but below the ovary, and opens ventral to the opening of the vas deferens in the posterior wall of the genital atrium (Figs. 3 and 4). The vitellaria of the two sides, although extending almost to the forking of the oesophagus, are very distinct in front; but posteriorly in many specimens the boundary between the two appendages which extend into the sucker-bearing region cannot be distinguished. The average condition, however, is that the appendage of the left vitellarium is quite separate from that on the right side and passes a little farther backwards (Fig. 1). I could not ascertain to my satisfaction whether these appendages surround the posterior ends of the main intestinal trunks. The testes occupy about one-quarter of the length of the body proper, are situated behind the ovary and number about 22. The vas deferens commences near the beginning of the ovary, on the right side, then proceeds forward in the median line, dorsal to the uterus, and opens posterodorsally into the genital atrium at the summit of a low elevation which is directed ventrally and slightly forward and is provided at its base with a very few of the spines from the posterior wall of the atrium. Just behind this penis-like structure the vas deferens is surrounded by a fairly extensive sphincter muscle (Fig. 3).

In the preparation of the foregoing description, which is based on a small number of specimens, it was seen that this worm does not belong to either of the four American species described by Goto (**6**, pp. 78-83) and that it differs specifically from the eight new species described by MacCallum and MacCallum (*Zool. Jahrb.*, Abth. Syst., 34: 223-244) and MacCallum (Ibid., 35: 389-402), and consequently, before MacCallum's recent paper ("Notes on the Genus Microcotyle", in Ibid., 38: 71-78) was at hand, it was named *M. poronoti* sp. nov. In order to ascertain whether I was dealing with the same form as that described by Dr. MacCallum I sent my material to him and was kindly assured that without doubt I had found the same species. In correspondence Dr. MacCallum states that this species varies considerably, perhaps on account of age, the testes, for example, ranging from 18 to 32 in fourteen of his mounted specimens, while the organs of attachment on the posterior disc are, as in most of the species of this genus, inconstant in number.

4. *Otodistomum cestoides* (van Ben.) =Stafford's *O. veliporum* (Creplin). **11**, pp. 521-22; **18**, pp. 516-18; **26**, pp. 482-83.

Stomach of *Raja laevis*.

Specimens at hand range in length from 12 to 48mm. The eggs average in length, 0·070, in width, 0·042 and in thickness of shell, 0·0028mm.

5. *Lepidophyllum steenstrupi* Odhner. **17**, pp. 68-69; **26**, p. 487.

In urinary bladder of *Zoarces anguillaris* (Peck), Eelpout.

6. *Sinistroporus simplex* (Rud.). **11**, pp. 525-26; **26**, pp. 484-85.

In intestine of *Pseudopleuronectes americanus* (Walb.), Winter flounder, and *Pholis gunnellus* (Linn.), Butterfish.

Nine trematodes from four specimens of the first-named host are referred to this species, since they agree essentially with the description of *D. simplex* Rud. excepting that, as Stafford observed (**26**, pp. 484-85) and used as the basis for the new generic name, the gonopore opens in all specimens on the ventral surface to the left of the oesophagus, as shown in Fig. 6. The following measurements of two specimens, both fixed in glacial acetic acid and cleared in oil of cedarwood, the first being the largest at hand and the other a typical one from the remaining lot (actually that shown in Fig. 6), are given for the sake of comparison: (1) Length, 4; greatest width, 0·86; width opposite the acetabulum, 0·62; diameter of ventral sucker, 0·40, of oral sucker, 0·17, of pharynx, 0·137, length of same, 0·153; ovum, not ready to be extruded, 0·068 × 0·043; (2) Length, 3·4; greatest width, behind posterior sucker, 0·77; width opposite ovary 0·70, opposite acetabulum, 0·65, at middle of oral sucker, 0·31; length of oral sucker, 0·23, width, 0·25; length of pharynx, 0·137, width, 0·120; length of oesophagus (slightly coiled), 0·22, (same of straight oesophagus in another speciman, with body length of 2·5, 0·26); width of acetabulum, 0·36, length, 0·29; length of stem of excretory vesicle, 1·48; ova, with incomplete shells, average in sectioned material, 0·078 × 0·036.

In addition it is noteworthy that the testes are crenulated in most specimens, that is, not spherical nor elliptical, as in Stafford's *S. productus*, (**26**, p. 485), which in the absence of a more complete description, seems to be probably only large examples of *S. simplex*. The anterior testis is generally smaller than the posterior and situated to the left of the median line, the posterior being midway between the intestinal coeca. Both have quite thin walls and loosely arranged contents, which doubtless accounts for their different shapes, for in some specimens the outline of the anterior testis is entire. In one worm (Fig. 6) no traces of the testes could be found even in a series of sections 10 thick, while in another only one large testis was seen. Furthermore the vitellaria are divided, on each side, into three more or less separate regions, one median to the corresponding coecum of the intestine, the second, lateral, and the third, which may or may not be continuous with the lateral group, opposite the uterus and extending from the hinder edge of the acetabulum to the ovary. The shell-gland is situated to the left of the median line, and the ovary slightly to the right in many cases. The median excretory vesicle branches laterally immediately ahead of the ovary. The latter was bilobed instead of trilobed in one specimen.

Only one young specimen was taken from a Butterfish.

7. *Hirudinella clavata* (Menzies). **2**, pp. 662-99; **11**, pp. 539-40.

Stomach of *Thunnus thynnus* (L.), Tunny or Albacore. Little River, St. Mary Bay, N.S.

Nine specimens, all from the stomach of one host, fixed and preserved in 5% formalin and consequently much contracted, especially posteriorly, ranged in length from 3 to 21mm. The following measurements of one specimen (Fig. 7) corresponding in width at the ventral sucker to Linton's largest alcoholic specimen are here given, with Linton's data in brackets, for the sake of comparison: Length, 13·5 (18); diameter of head, about opposite the middle of the oral sucker, 2·0 (1·75); diameter of body at ventral sucker, 4·5 (4·5), behind ventral sucker, 4·2 (4·2); diameter of mouth, contracted in all examples to a minute aperture, (1·75); length of acetabulum, 4·5 (5·5), width, 4·5 (4·5); length of aperture of ventral sucker, 1·36 (2·5), breadth, 1·14 (1·8). The measurements of the largest specimen at hand (Fig. 8) are as follows: Length, 21; diameter of head, 2·8, of body at ventral sucker, 6·3, behind ventral sucker, 6·0, at widest part, 7·3; length of acetabulum, 7·3, width , 7·0; length of aperture, 3·0, width, 1·7. The average dimensions of the eggs were 0·036 × 0·023mm. as compared to 0·034 × 0·024 given by Linton. Owing to the great degree of contraction in these specimens both the anterior and posterior portions of the body were much wrinkled transversely, the latter, however, much more so than the former (Fig. 8). Only a very slight dorsoventral flattening was noticeable, and the arching was not marked, even anteriorly. Furthermore, by reference to the figures it will be seen that the dilatation of the hinder end of the body, as figured by Darr, is only slightly indicated, this again on account of extreme contraction. In one medium-sized specimen, dissected, the testes, ovary and shell-glands were found very much flattened against each other longitudinally close behind the acetabulum.

8. *Derogenes varicus* (O. F. Mueller). **24**, p. 961; **26**, pp. 483-84.

Stomach of *Salmo salar* (L.); intestine of *Sebastes marinus* (L.); encysted on the viscera and in the muscles of small fish (determined for me by Dr. Philip Cox as *Clupea harengus* L.) from the stomach of the Salmon, Bay of Fundy, N.B.

All of the encysted specimens at hand contain brownish-yellow eggs but are very small, measuring 2·01 × 0·43mm. (at the acetabulum). Those free in the stomach of the other hosts give quite similar measurements. From their positions in the muscles of the small herrings, especially when found far back near the caudal fin, one is led to conclude that if the larval stages, possibly the miracidia, do not penetrate from the outside (vide infra, under several species encysted in fresh-water fishes) they are distributed from the stomach and intestines, where they may find entrance to the tissues, to other parts of the body by the blood stream. In support of the latter and more probable hypothesis the position of a particular specimen was quite significant. It was found in the haemal arch of one of the vertebrae near the caudal fin of a small fish, with its anterior end protruding laterally into the muscles. It was an adult, since the uterus was filled with eggs, and had evidently developed in situ, for it was considerably constricted anterior to the acetabulum by the haemal arch whose aperture was much smaller than the diameter of the worm. The dorsal aorta of the host was all but obliterated at this particular level!

From the small size of both encysted and free individuals, as compared with the measurements given by Stafford, this must be the small variety mentioned by him as occurring in the Salmon. In some specimens the acetabulum was twice as large as the oral sucker.

9. *Hemiurus appendiculatus* Rud. **24**, p. 960; **22**; **25**, pp. 399-401.

Stomach of *Osmerus mordax* (Mitchill), Smelt; encysted in body cavities of free-swimming Copepoda.

The former lot consisted of only five very small specimens of the same size as those from the copepods, excepting the largest, the only one which contained eggs, which was about 0·68 long and 0·19mm. broad just behind the acetabulum. An average example from the second lot gave the following measurements: Length, 0·56; width behind acetabulum, 0·137; diameter of oral sucker, 0·077, of ventral sucker, 0·086. From these data, which although they are from a contracted specimen, agree sufficiently with those given by Pratt (**22**, p. 355) to warrant the reference of the worms to these species, especially in conjunction with the general appearance and disposition of the reproductive organs, it will be seen that the acetabulum is not twice the size of the oral sucker as Linton records in many places for the adults, but almost equal to it, a fact which Pratt's measurements (0·08 and 0·053, respectively) indicate and which is mentioned in Stafford's description of *D. pelagicum* Staff., the latter writer, however, giving no measurements of the suckers. Eggs from the uterus of the mature specimen from the stomach of the Smelt averaged 0·020× 0·009, the true measurements being probably a little larger than this, since the shells were much contracted and only the inner protoplasmic contents could be clearly seen. The vitelline masses showed in cleared material some tendency towards lobulation.

One copepod which contained an individual of this species was determined as a female of *Acartia clausi* Giesbrecht, common at the mouth of the St. Croix River according to Willey (**30**).

10. *Hemiurus levinseni* (Odhner). **14**, pp. 106-7.

Encysted in the muscles of the small *Clupea harengus* L. from the stomach of the Salmon—see under Species No. 8, above.

Three specimens, associated in the above location with encysted *Derogenes varicus* are referred to this species since they agree satisfactorily with Odhner's description of the species as given by Looss (**14**). The following measurements are of the largest of the three from a coronal series of sections: Length of body (appendix invaginated), 1·18, width opposite ovary, 0·31; width of oral sucker, 0·15, of acetabulum, 0·14; length of ductus hermaphroditicus, 0·12; egg, on the average, 0·028 × 0·014mm. The vitelline glands in all of the three specimens are so closely applied to each other, immediately behind the ovary, that at first sight they appear to form a single mass similar to that of the genus *Aphanurus* Lss., but on closer inspection can be seen to be distinctly separated from each other. This close apposition is doubtless due to the longitudinal contraction of the worms, the glands themselves, like the ovary and testes, being much flattened antero-posteriorly. The caudal appendage is comparatively short, not more than one-quarter of the length of the body proper in the two smallest individuals where it is protruded, and relatively much smaller in the largest in which it is invaginated. The intestinal crura are very large in these young specimens—all of them containing eggs, however—and occupy much more of the body than do the reproductive organs and ducts.

No specimens were found free in the stomach of the Salmon, but since Stafford reports *H. appendiculatus* for *Solmo salar*, a further search would doubtless have brought some to light. A re-examination of his material might possibly necessitate the recognition of two or more species.

11. *Brachyphallus crenatus* (Rud.). **14**, pp. 157-8.

Habitat, similar to that of the preceding species, also in the anterior part of the intestine of one of these food-fishes.

Only two specimens were found, one of which got damaged in the clearing fluid. The following data apply to the other and smaller of the two, the one found free in the intestine of the small herring: Length, 1·06; greatest width, opposite ovary and vitelline glands, 0·26; length of appendix, completely invaginated, 0·23; diameter of oral sucker, 0·132, of acetabulum, 0·137, of pharynx, about 0·07; average length of egg (from sections of the broken specimen), 0·025,—although this one also contained eggs. From these measurements it will be seen that these individuals approach more nearly Looss' description of the species than Lander's (**8**), although both were naturally quite young. Moreover, the structure of the vitelline glands, shown in Figs. 9A, B and C, confirm this statement. Whereas those of Lander's *crenatus*, that renamed *B. affinis* sp. nov. by Looss' are almost entire in outline, those of these specimens are, as in Looss's *crenatus*, deeply indented, the indentations being well seen in sections and passing into the substance of the gland for some distance. In the larger, broken specimen the right gland is deeply trilobed while the left (in sections) shows only very slight indications of a bilobation; in the other, as indicated in the figures, the right, viewed from the right side, is four-lobed while the left shows only three main lobes. Either gland may appear, when seen obliquely from the opposite side, almost entire, a fact noted by Looss under his remarks on *B. affinis*. A further point of interest in connection with the determination of this species is that, although no specimens were found free in the stomach or intestines of the Salmon, it is quite possible that *Clupea harengus* is one of the intermediate hosts, if not the only one, and that a further search would show that here on the Atlantic Coast we might find *B. crenatus* in the same host as in Europe, viz., *Salmo salar*. Apart from these remarks I do not presume to discuss the validity of Looss' new (American) species, since only two young specimens are at hand.

12. *Stenocollum fragile* (Linton). **10**, p. 295.

Pyloric coeca of *Gadus callarias* L., Cod.

A few small trematodes, poorly preserved, and broken during the clearing processes, are doubtfully referred to this species, since, apart from the fact that they are quite depressed or ligulate throughout their length and that the neck, as far back as the acetabulum, is covered with extremely minute scales, arranged in two sets of diagonal rows crossing each other at right angles, they agree fairly closely with Linton's description (loc. cit.).

13. *Tocotrema lingua* (Creplin). **13**.

Encysted on the gills of *Hemitripterus americanus* (Gmelin), Sea-Raven.

The following measurements, of the only intact specimen at hand, mounted as a transparent preparation, compare favorably with those of Linton's "No. 3" (**10**, p. 296): Length, 0·447; maximum breadth, 0·172; breadth of anterior sucker, 0·042; length of pharynx, 0·028, breadth, 0·017; breadth of "acetabulum" (genital sucker), 0·028. The somewhat flattened, spheroidal cysts were found in fairly large numbers, firmly attached to the smaller bony supports of the gill-filaments. Each cyst is, as noted by Linton, covered with dense black pigment which in larger specimens tends to collect around the periphery and leave the centre free (Fig. 13). The wall of the cyst proper is composed of a firm transparent connective tissue which renders the procuring of whole specimens of the contained larvae a matter of considerable difficulty. The latter was seen to be quite active in situ in most cases.

I have also noticed that the skin of a number of fishes taken in Passamaquoddy Bay, notably *Tautogolabrus adspersus* (Walb.), Cunner, is greatly infected with small pigmented cysts, similar to those just described, which in all probability would be found to contain larvae of this species: Linton describes the species from the Cunner.

Species from Fresh-Water Fishes.*

14. *Gyrodactylus medius* Kathariner. **7**, p. 158.

On the skin of *Micropterus dolomieu* Lacépède, Small-mouthed Black Bass.

A single specimen taken from the dorsal fin of a small bass, 14mm. in length, is referred to this species chiefly on account of its size, 0·32 × 0·057mm. The large hooks (Fig. 10) in the posterior disc, however, are relatively simpler and larger than in Kathariner's *G. medius* and *G. gracilis*, being 0·054 in length. They and the sixteen smaller peripheral hooks, each 0·034 in length, compare more favorably, as to size, with Wegener's description of *G. elegans* v. Nordm. (**28**, pp. 12-13).

15. *Ancyrocephalus paradoxus* Creplin =*Tetraonchus unguiculatus* (Wag.). **28**, pp. 18-22.

On the gills of young *M. dolomieu*.

The specimens at hand are all much smaller than those described by Wegener, the largest (curved as in Fig. 11A) being 1·0 in length by 0·17 in width. That portion of the worm behind the vitelline glands, which occupied in the same specimen about 0·32mm.. of the whole length, is comparatively thin and usually somewhat crenulate laterally (Fig. 11A). The posterior disc of another specimen (Fig. 11B) gave the following measurements: Length, 0·085; width, 0·102; while the pharynx of still another was 0·050 in transverse diameter. In these obviously quite young specimens the chitinous "clamps," two in number, supporting the pairs of hooks, were very small, difficult to see and in many cases apparently absent. The anterior end in every case was much more pointed than that shown in Wegener's figure.

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*The list of monogenetic species should include *Diplobothrium armatum* F. S. Leuckart (Zool. Bruchstücke, III Helm. Beiträge, Freiburg, 1842: 13-18, Fig. 6, Taf. I) which, since the preparation of the manuscript of this paper, I have found on the gills of *Acipenser rubicundus* Le Sueur, the Lake Sturgeon, from the St. Lawrence River, near Iroquois, Ontario.

16. *Ancyrocephalus cruciatus* (Wedl). **27**, pp. 22-24.

On the gills of young *M. dolomieu.*

The largest example, very much contracted longitudinally and curved ventrally, measured 0·48 × 0·24mm. As indicated in Fig. 12 (of a specimen, 0·50 × 0·13) B, no more than six pairs of peripheral hooks were recognized in the posterior disc. Furthermore the chitinous clamp connecting the ventrally directed or more anterior pair of central hooks is not exactly similar to that shown in Wegener's Fig. 5 (loc. cit., p. 24), but seems to be made up of two pairs of pieces. The posterior disc is in all specimens distinctly excavated on its ventral surface.

17. *Diplostomum cuticola* (v. Nordm.). **11**, p. 513.

Encysted on the mesenteries and in the kidneys of *Notropis atherinoides* (Raf.), Minnow, in the coelome of *N. cornutus* (Mitchill), Red-fin Minnow, and in the liver of *Eupomotis gibbosus* (L.), Sun-fish, at Go-Home; and on the mesenteries of *Semotilus atromaculatus* (Mitchill), Creek Chub, at Toronto.

The largest cyst was from the latter host and measured 1·70 × 1·14mm. It contained, as did many of this lot, two worms, 0·93 and 0·43 in length.

Records are also at hand of diplostoma encysted in the livers of young *M. dolomieu*, on the mesenteries of *Boleosoma nigrum* (Raf.), Johnny Darter, on the viscera and mesenteries of *Percina caprodes* (Raf.), Log Perch, and in the liver of young *Amploblites rupestris* (Raf.), Rock Bass. All of them belong to this species, in all probability. Not a few of the larger cysts were found to contain two worms, one usually much smaller than the other.

18. *Diplostomum volvens* v. Nordm. **3**, p. 317.

In the lenses of the eyes of young *M. dolomieu.*

A typical example, so contracted as to show the anterior appendages and the short conical posterior portion in what was considered, by reference to numerous figures at hand, to be the normal position at rest, has a length of 0·31 with maximum breadth of 0·20mm.

19. *Azygia lucii* (Mueller) = *Azygia tereticollis* (Rud.). **18**, pp. 519-20; **4**, pp. 16-17.

Stomach of *Lucius lucius* (L.), Pike, *L. masquinongy* (Mitch.), Maskinonge, *Salvelinus namaycush* (Walbaum), Salmon Trout, *Lucioperca* sp?, Pickerel, *M. dolomieu* Lac.

The following table gives the measurements of the largest specimens at hand, excepting those from the last named host, which were all immature:

Host	*L. masquinongy*			*L. lucius*		*S. namaycush*	*Lucioperca*
	(1)	(2)	(3)	(1)	(2)		
Length	48·0	45·5	21·0	20	14	11	7·5
Breadth at middle	2·4	2·2	1·40	0·74	1·42	1·48	1·98
Maximum breadth	2·6	2·7	......	......	......	....	....
Diameter of oral sucker	1·24	1·39	1·0	0·80	0·77	0·83	0·93
Same of acetabulum	1·39	1·39	1·0	0·68	0·71	0·83	0·90
Pharynx	0·62 × 0·37	0·65 × 0·43	0·48 × 0·29	0·37 × 0·27	0·40 × 0·31	0·37 × 0·34	0·32 × 0·27

The following measurements are applicable to (1) and (2), respectively, from the Maskinonge: Ovary from the anterior end, 30, 30·5, first testis, 32, 32·5, second testis, 35, 36, while in both the centre of the acetabulum is 4·5 from the anterior end. All of the measurements given for the examples from the Maskinonge warrant the view that they are identical with Stafford's *Megadistomum longum* Leidy, but after a careful comparison of the smallest with those from the Pike, I am inclined to the view, also expressed by Odhner (**18**, pp. 520-21), that this species is only to be considered as a very large *Azygia lucii.* The smallest specimen showing eggs (not yet mature) in the uterus was 8mm. in length, while that from the Pike was 6mm. in length, but this characteristic ("Eiproduktion") seems to be by no means constant, since many longer specimens, for example, No. 2. under *L. lucuis* in the above table, shows less mature eggs than those in the 6mm. example. On the other hand, examples of intervening lengths may have their uteri distended with ripe eggs! Those from the Pickerel, comparable to Stafford's *Mimodistomun angusticaudum* were so poorly preserved and so contracted longitudinally that I do not feel justified in separating them from *A. lucii.* The acetabulum is situated at the junction of the anterior and middle thirds of the body, and the ovary and testes are crowded together posteriorly as in several of Goldberger's species. All from the Trout are immature, including the largest, 11mm. in length,—a statement which also applies to those from the Small-mouthed Black Bass. A number from the Pike show the globose excretory vesicle of Goldberger's *A. bulbosa* (**4**, pp. 22-26); but this character, together with the length, extent and "breaking" of the vitellaria are of such a variable nature as to lead me to conclude that they are of little use in the distinction of species,—at least as applied to the material at hand.

Very young and immature *Azygia* were also found in *Perca flavescens* (Mitchill); they probably belong to this species.

20. *Azygia acuminata* Goldberger. **4**, pp. 17-22.

Stomach of *Amia calva* L., "Dog-fish", Bowfin.

Nine specimens from two individuals of the host species are referred to this species, since, presenting no evidence of undue contraction, they agree in essentials with Goldberger's description. The testes are situated close together towards the posterior end of the body, the anterior being smaller than the posterior and in four specimens to the left of the median line, in four to the right, and in one (the smallest, 6mm. of the table below) in the median line. The ovary, immediately in front of the anterior testis, is smaller than it and also in the median line (Fig. 17). The vitellaria begin in all specimens at about the same level, a short distance behind the acetabulum, but vary in extent posteriorly and on the different sides. In two the right is longer than the left, in two they are at about the same level, while in the remainder the left extends farther than the right. The oral sucker is relatively larger than that described for this species, and the pharynx is spherical with a larger cavity than in *A. lucii*. The following table gives the measurements of four examples, the first two being all that were taken from one host:

Length..................	6 mm.	7 mm.	8 mm.	20·5 (largest)
Maximum breadth........	0·70, between suckers.	1·17, post. to acetabulum.	1·67, post to acetabulum.	2·63, post.to acetabulum.
Diameter of oral sucker...	0·56	0·77	1·00	1·38
Same of acetabulum......	0·46	0·65	0·77	0·99
Pharynx.................	0·18×0·18	0·27×0·27	0·31×0·24	0·46×0·45

21. *Crepidostomum cornutum* (Osborn). **20.**

Stomach of *M. dolomieu* from Go-Home Bay, Flat-Rock Lake and Musquash River; stomach and pyloric coeca of *Ambloplites rupestris;* and intestine of *Ameiurus lacustris* (Walb.), Channel Cat, from Flat-Rock Lake and Musquash River.

The largest specimen at hand from the Black Bass gives the following measurements: Length, 3·70; breadth, at middle, 0·46;

diameter of oral sucker, 0·40, length, 0·46, of acetabulum, 0·31; centre of latter, 1·14 from anterior end. Those from the Channel Cat were considerably smaller and included a number of immature forms. This species was also found encysted around the heart, in the gonads and in the dorsal musculature of the cephalothorax and anterior part of the abdomen of *Cambarus propinquus* Girard from Go-Home and Killarney, Ont., and of *C. virilis* Hagen from Go-Home, Killarney and Shawanaga, Ont. Although the Small-mouthed Black Bass takes *C. bartonii* (Fabr.) as well as these two species of crayfish as food at Go-Home, cysts were found only in examples of the latter taken from the preserved stomach-contents of a small number of bass. Furthermore, representative lots of free *C. bartonii* from the above locations as well as from the Don River, at Toronto, were examined, but no cysts were met with. Crayfish, sp.?, were also recorded from the stomach of the Channel-Cat from Flat-Rock Lake, but none were examined for cysts. The latter, themselves, ranged in diameter from 0·37 to 2·0mm., while the largest worm taken from a cyst and fixed (in an extended condition) measured 2·9 × 0·46. Eggs were seen to be extruded from the worms in all cysts above a diameter of 0·86mm. They were so numerous as to occupy considerably more than half the volume of the largest cysts and to give them the peculiar dark-brown color which permits of their being so easily recognized with the unaided eye.

22. *Crepidostomum laureatum* (Zeder). **26**, p. 490.

Intestines of *Perca flavescens* (Mitchill), Perch; *Eupomotis gibbosus* (L.), Sunfish; *Boleosoma nigrum* (Raf.), Johnny Darter; and *Etheostoma iowae* Jor. & Meek.

A small number of mostly immature specimens from each of the above hosts are referred to this species chiefly on account of the fact that in all of the largest the ventral pair of papillae are, unlike those of the foregoing species, considerably smaller than the remaining two pairs (Fig. 14), although, "originating close together under the anterior end of the mouth sucker, they curve backwards and outwards, moustache-like, across the corners of the mouth until their outer, bluntly pointed ends project laterally past the sides of the sucker and posterior to the level of the other papillae," thus resembling those of *Acrodactyla petalosa* (Lander) as described by Stafford (loc. cit., p. 491). Further resemblances to the latter species are: The position of the genital opening about half way between the suckers; "ovary close behind and to one side of the ventral sucker;" "testes close together, half way between ventral sucker and posterior end," irregular in outline (also characteristic of *C. laureatum*) and somewhat oblique; "vitellaria from pharynx to posterior end." On the other hand, the ventral sucker in all of the largest at hand is, as indicated in the table below, noticeably smaller than the oral; yet the body is "often of uniform breadth, (but) narrowed in front of the ventral sucker and behind the second testis" (Fig. 14). Again, since, so far as I am aware *A. petalosa*, the original description of which was not available, has been reported from *Acipenser rubicundus* LeS. only, while *C. laureatum* has been found in the Yellow Perch, one of the hosts listed above, I thought it advisable to refer the material to the above species, especially too, in view of its scarcity and of the added fact that no figures are given with Stafford's paper while those by Linton are of evidently much contracted specimens.*

The following table shows the occurrence of the species and measurements of the largest specimens from the different hosts:

Host	*Perca flavescens.*	*Eupomotis gibbosus.*	*Boleosoma nigrum.*	*Etheostoma iowae.*
Number of specimens	10	6	8	1
Measurements of largest of the lot: Length	0·86	0·77	1·20	0·86
Max. breadth	0·27	0·24	0·25	0·24
Diam. of oral sucker	?	?	0·120	0·120
Diam. of vent. sucker	?	?	0·102	0·102
Diam. of pharynx	?	?	0·051	0·043
Remarks	Poorly preserved	Unsatisfactorily preserved	This is Fig. 14, one egg to be seen	3 or 4 eggs.

Eggs from another lot measured when fresh, 0·062—0·069×0·041—0·044.

*Since the preparation of the manuscript of this paper I have obtained numerous specimens of *Acradactyla petalosa* (Lander) from *Acipenser rubicundus* LeSueur, the Lake Sturgeon, from the St. Lawrence River, near Iroquois, Ontario, and am able to confirm Stafford's description (704, p. 491) of the species, especially in regard to the position (and size) of the genital opening and the large size of the cirrus-sac. The latter characters, however, seem to be more distinctive of the genus than do the arrangement and size of the oral papillae, particularly the posterolateral pair, which, as also brought out by the above comparison of the two species, closely resemble those of *C. laureatum*. A typical specimen gives the following measurements: Length, 2·44mm.; maximum breadth (immediately ahead of the anterior testes) 0·61; length of oral sucker, 0·38, diameter, 0·33; diameter of ventral sucker, 0·27.

Fig. 15 of a specimen of *C. cornutum* from *Ambloplites rupestris*, the same in length as the *C. laureatum*, shown in Fig. 14, is given for the purpose of comparison.

A number of small cysts, the largest being 0·23mm. in diameter, containing very young trematodes belonging to the genus *Crepidostomum* were dissected out of may-fly nymphs of the genus *Hexagenia*, sp. ?, taken from the stomach of a Small-mouthed Black Bass from the Musquash River above Flat-Rock Falls and from specimens free in shallow water at Go-Home. The largest of those freed from the cysts measured 0·412 × 0·190, while that shown in Fig. 16 was 0·232 × 0·136. The former bore such a close resemblance, when stained and cleared, to individuals of *C. laureatum* of the same size from the above lots that I consider that in all probability these immature encysted forms are the young stages of the latter species, and consequently that the nymph of *Hexagenia*, sp. ?, is the intermediate host. While, as regards the reproductive organs, only the anlagen of the testes and the structures in the immediate neighborhood of the ovary were to be made out, the anterior papillae, suckers and what was considered to be the first appearances of the excretory vesicle, were clearly shown. The latter in all of the preserved specimens was in the form of a large clear space situated posteriorly above the testes,—these being actually flattened against the ventral body wall—and occupying almost the whole posterior half of the worm (Fig. 16). In fresh material this structure was seen to be opaque white and apparently solid, like that shown in Osborn's Fig. 2. (**20**, p. 65) and supposed by him to be "a supply of food for the developing worm," but the applicaton of acetic acid of 50% strength, followed by 70% alcohol, cleared it, by apparently dissolving the contents, and thus rendered the whole worm of a uniform transparency. Sections show that it is a sack with thin walls, in which are numerous nuclei, having as yet no connection, in a specimen 0·36 × 0·13, with a short invagination of the cuticle at the posterior end where the excretory pore is situated later.

No records are at hand of *Hexagenia* nymphs having been found in the food-contents from the stomachs of the above hosts.

23. *Centrovarium lobotes* (MacCallum). **26**, p. 493.

Intestine of *Ambloplites rupestris*.

The largest specimen at hand measures as follows: Length, 2·35; maximum breadth, just behind the acetabulum, 0·71; diameter of oral sucker, 0·154, of ventral sucker, 0·187; pharynx, 0·102 × 0·051.

24. *Clinostomum marginatum* (Rud.). **1.**

Encysted in the muscles of *Eupomotis gibbosus* and *Perca flavescens* and on the gills and in the muscles of *M. dolomieu.*

The following table gives the measurements of four examples, those from the Sunfish and the Bass being the only specimens of three lots:

Host	*Eupomotis gibbosus.*	*Perca flavescens*	*M. dolomieu* (1)	*M. dolomieu* (2)
Length	5·5	4·3	4·7	4·0
Width at anterior end	0·86	0·52	0·77	0·71
Width half way from anterior end to acetabulum	1·67	0·93	1·36	1·17
Width at acetabulum	1·70	0·93	1·42	1·16
Width half way from acetabulum to ovary	2·17	1·05	1·86	1·33
Width at ovary	2·21	1·16	1·76	1·42
Width half way from ovary to posterior end	2·01	1·08	1·48	1·33
Length of preacetabular region	1·05	0·86	1·14	0·77
Length of postacetabular region	3·6	3·2	4·0	2·8
Distance from acetabulum to ovary	1·30	1·42	1·70	1·24
Distance from ovary to posterior end	2·17	1·61	1·90	1·42
Length of uterine sac	0·3	?	0·68	?
Distance from anterior end of uterine sac to acetab.	0·6 ?	?	0·62	?
Length of genital gland field	0·77	0·76	0·71	0·71
Transverse diameter of oral sucker	0·31	0·21	0·27	0·27
Transverse diameter of acetabulum	0·80	0·55	0·71	0·65

A comparison of these with similar measurements given by Cort (loc. cit., p. 180) will show that we are dealing with *C. marginatum;* and I feel all the more certain of this in view of the fact that other specimens from the muscles of the Perch and the Small-mouthed Black

Bass, which I sent to Dr. Ward, were considered by Cort (l.c., foot-note p. 177) to belong to this species.

25. *Allocreadium commune* (Olsson). **16**, pp. 499-503.

Intestine of *Catostomus catostomus* (Forster), Red Sucker, and *Fundulus diaphanus menona* Jor. & Cop.; and gall-bladder of *Notropis cornutus* (Mitchill), Red-fin or Shiner.

The following are the respective measurements of the largest specimens from the three hosts, in oil of cedar: Length, 0·89, 0·80, 1·05; breadth at acetabulum, 0·41, 0·42, 0·40; diameter of oral sucker, 0·13, 0·17, 0·13, of acetabulum, 0·22, 0·22, 0·18; length of ventral sucker, 0·19, 0·21, 0·20; pharynx, 0·085 × 0·068, 0·068 × 0·068, 0·060 × 0·051; eggs, 0·068 × 0·043, 0·062 × 0·040, 0·068 × 0·034. These data compare favorably with those given by Odhner, excepting in the case of the acetabulum, but the discrepancy may be accounted for by the obvious fact that the specimens are all quite young. The pharynx is more spherical than cylindrical, and there is no distinct prepharynx. In many cases the anterior border of the subterminal oral sucker slightly overhangs the aperture to form a sort of lip. In all of the larger specimens the gonopore is situated in the median line just behind the forking of the oesophagus, being much closer to the pharynx in contracted individuals, but in the small ones from the gall-bladder of the Shiner it is situated slightly to the right or left of that point, more often to the left. In these latter the seminal vesicle does not reach to the posterior edge of the acetabulum, while in the former it ends opposite the ovary. The ovary itself is placed on the right side—in a few to the left—just anterior to the first testis, and is smaller than either of the testes which are equal in size and situated in the median line (Fig. 18). In much contracted examples the ovary may lie to the right side of and dorsal to the acetabulum. The vitellaria extend from the pharynx to the posterior end, greatly obscuring the rest of the reproductive organs, the intestinal coeca and even the acetabulum (when viewed from above).

Very small distomes, 0·22 × 0·06mm., showing no traces of reproductive organs as yet but otherwise resembling the smallest of those from the Red-fin, were taken from the swim-bladder of a minnow, *Notropis atherinoides*(?).

On June 4, 1912, Mr. W. A. Clemens drew my attention to the fact that a living may-fly nymph of the genus *Blasturus* (sp. ?) which he had collected near the Station at Go-Home, harbored a living worm. A closer examination showed that this worm, which could be clearly seen through the transparent exoskeleton of the host, was moving backwards and forwards to the left of the nymph's intestine and consequently keeping in motion a large number of eggs and several free-swimming miracidia, distributed throughout the soft tissues of the whole nymph from the head-region to the tail. The eggs, obviously extruded from the worm and resembling in every way those yet in the uterus of the latter, were found to contain living miracidia. Notes made at the time show that a typical specimen gave the following measurements: Length, 0·079; maximum width, 0·050; diameter of operculum, 0·018; length of miracidium, 0·071. These are somewhat greater than those given above, but this is due to the shrinkage of the latter during the dehydrating and clearing processes, for my notes give as measurements of fresh material from the flukes from the gall-bladder of the Shiner: Length, 0·066–0·070; width, 0·038–0·040; diameter of operculum, 0·017–0·021. Furthermore, it was recorded that this encysted worm closely resembled those from *C. catostomus* and *Fundulus diaphanus menona* and gave the following measurements: Length, 1·10; width, 0·37; diameter of oral sucker, 0·11, of acetabulum, 0·17. This nymph host, which is possibly an intermediate one for this species of trematode, was later diagnosed by Mr. Clemens as *Blasturus cupidus* Say ("Rearing Experiments and Ecology of Georgian Bay Ephemeridæ," in: *Contributions to Canadian Biology*, 1911-'14, Fasc. II, p. 120), while owing to the absence of insufficient literature the fluke was at that time placed in the genus *Halicometra*. Two other Mayfly nymphs of the same species were found to contain similar worms and many free eggs.

26. *Cryptogonimus chyli* Osborn. **21.**

Stomach, intestine and pyloric coeca of *M. dolomieu;* coeca of *Ambloplites rupestris;* and encysted in small *M. dolomieu*, *Ambloplites rupestris* and *No tropis hudsonius* (Dewitt Clinton), a Minnow.

The largest adult specimens at hand measure: From the Black Bass, (1) 0·96 × 0·18, (2) 0·86 × 0·29; from the Rock Bass, 1·15 × 0·13. The smallest Black Bass, in the intestine of which was found an example of this species, was 24·5 in length, while the smallest worm containing eggs was from a 47mm. Rock Bass and measured 0·41 × 0·12. A very thorough examination of small Black Bass of all sizes, from those just hatched to adults, showed that the encysted worms were to be found only in those ranging in length from 9mm., the size when they take their first food, to 35mm. The cysts, themselves, are ellipsoidal in shape and range from 0·20 × 0·14 to 0·28 × 0·22. Most of them are situated in the musculature along the sides of the body from the eyes to the caudal fin, but a few are to be found just beneath the skin of the gill-covers and branchiostegals, on the visceral organs, in the coelomic cavity and in the liver. The earliest stages of the worm (Fig. 19) are easily recognized, even before they are removed from the cysts, by their characteristic black "eye-spots" and opaque-white, Y-shaped excretory system, which latter, as in *Crepidostomum laureatum*, does not seem to communicate with the exterior for some time. In fact my study of these early appearances of the excretory system, in fresh as well as in preserved material, leads me to agree with Osborn in his suggestion that "the process is one of storage during encystment as a mode of disposal of the waste products pending the liberation of the worm." A much smaller cyst, containing two distinct eye-spots but no indications of the forked excretory vesicle among the mulberry-like mass of amoeboid cells, was perhaps a yet earlier stage. On the other hand, the largest cysts (Fig. 20) contain much larger worms, quite active in situ, especially when stimulated by a little pressure, in which there are to be seen, besides the well-developed excretory vessels, the oral sucker, pharynx, oesophagus, intestinal coeca and the beginnings of the two ventral suckers and of the reproductive organs (Fig. 21). No mature worms were taken from cysts. The only cyst found in *Not. hudsonius* was located in the muscles near the caudal fin of a 28mm. specimen, while one only was found in the muscles of an adult Sunfish. The smallest Rock Bass found to contain the cysts was 18mm. in length.

Although the distribution of these young and encysted stages was pretty thoroughly studied, no experiments were carried out for the purpose of finding out how the very earliest stages, whatever they may be, obtain entrance to the young Bass. Two possibilities suggest themselves, namely, that they enter directly from the outside by piercing the skin and boring their way into the muscles, which would account for their encystment in these structures, or they are carried by the blood stream from the stomach and intestines, into whose walls they may pass after coming in with the food, to the farthest points of the body, for instance the muscles at the base of the caudal fin. On account of most of them being situated in the muscles along the sides of the body and on the head, I am inclined to the former suggestion, which, however, I am unable to support by any further facts.

27. *Gasterostomum pusillum* Stafford. **26**, pp. 494-95.

In stomach, intestine and coeca of young *M. dolomieu*, and intestine of *Boleosoma nigrum*.

The measurements of two of the largest specimens, respectively from the intestine and pyloric coecum of young Bass, are as follows: Length, 0·45, 0·68; width, 0·154, 0·172; diameter of anterior sucker, 0·120, 0·137, of oral sucker, 0·051, 0·051. Although these do not closely agree with those given by Stafford, I am inclined to refer the worms to this species, at least tentatively, owing to the fact that most of them are immature, only a few being found to contain eggs. The latter in a much collapsed condition when in oil of cedar were 0·042 mm. in length. The general features are shown in Fig. 22, which is of that from the intestine of the Bass (35.6mm. long) above. The capacious anterior sucker, which occupies the whole of the diameter of the anterior end, is truncate forward and flattened ventrally, the two surfaces meeting at right angles. Its aperture opens on both surfaces, but most of it is directed ventrally. The oral sucker is situated in the mid-ventral surface and leads by a short, forwardly directed oesophagus into a comparatively small, ellipsoidal intestine which extends "in front and behind the mouth." The ovary is on the right side, behind the oral sucker, while the testes lie "in a line behind the ovary," directed obliquely with reference to the longitudinal axis of the body. The large penis-sac on the left side of and behind the testes opens on the ventral surface some distance from the posterior tip where the opening of the excretory system is located. The vitellaria are lateral to the intestine.

What were considered to be early stages of this species were found in small, elongated and transparent cysts, averaging $0 \cdot 33 \times 0 \cdot 15$mm., in the muscles of young *M. dolomieu* and *Ambloplites rupestris*, associated with encysted *Cryptogonimus chyli*. They were also found in the muscles of young *Perca flavescens* and a Minnow, the species of which was not determined at the time of making the dissection. The largest, when removed from the cysts, very closely resemble the smallest of those found free in the slime of the stomach, intestines or coeca of the above-mentioned hosts. The smallest (Fig. 23) are very simple in structure, most of the body being occupied by a large opaque-white mass (in fresh material) with an apparent appendage towards one end at the side. In sections the former was found to be the intestine, while the latter is the beginning of the penis-sac and not the first appearances of the excretory vesicles, as might be expected from a comparison with encysted *C. chyli*. The intestine is lined with cubical, nucleated cells, and connects by a thin-walled, short oesophagus with the very small oral sucker, which with the anterior sucker can be faintly seen in living examples, especially from a lateral view. The excretory system appears in sections at this stage as an extremely thin-walled tube, extending from a point at about the level of the oral sucker to the posterior tip of the body where it opens by a minute pore. No certain indications of the extension of this tube are to be seen in the anterior parts of the body where in the adult it is well developed "between the vitellaria." Later stages show that the process of development involves a gradual enlargement of the suckers, the anterior much more rapidly than the oral, and of the penis-sac, and the appearance of the anlagen of the genital glands, accompanied by an absolute reduction in the size of the intestine, c.f. Figs. 22 and 23, both of which are drawn to the same scale. The largest specimen removed from its cyst shows only the beginnings of the reproductive organs and the intestine reduced to about half the size seen in the adult.

From these facts it is evident that, whatever may be the fate of the miracidium up to the earliest stage described above, the species reaches its final hosts through smaller fish which are taken as food.

28. *Distomum* sp. larv.

Encysted in the muscles of *Perca flavescens.*

Eleven pigmented cysts removed from the flesh of a young Perch were found to contain larval distomes, showing an anterior sucker, prepharynx, small pharynx, short oesophagus and forked intestine. A ventral sucker could not be seen. The probable anlagen of the testes appeared as two clear areas spearated by a transverse bar of opaque-white material and situated in the posterior half of the body. The body was covered, over the anterior end at least, with minute spines running in two diagonal directions. The cysts, themselves (Fig. 24), are ellipsoidal in shape but somewhat flattened in the directions of two circular openings, one on each side, which lead into the interior. The diameter of this cavity is smaller than the outer on account of the very thick walls, composed of a hard transparent substance covered over with a thin transparent membrane in which the black pigment flecks are located.

29. *Cercaria* sp.?

Encysted in the skin of a Minnow, species not determined.

Numerous black cysts resembling those just described (Fig. 25) were found to contain cercariae provided with appendages. A well developed oral sucker and pharynx, but no traces of oesophagus nor intestinal coeca were to be seen. The ventral sucker (Fig. 26B) was best seen from a lateral view. In Fig. 26A it is much enlarged, probably owing to injury in the removal of the worm from the cyst followed by the imbibition of water by the very delicate tissues. The short conical tip of the appendage was seen to be retractile. Owing to the extreme difficulty in removing these worms without injury from the hard and very small cysts, nothing further on their anatomy was recorded, excepting that a system of opaque-white and granular lines (represented dark in the figure), much resembling those seen in *Diplostomum cuticola*, probably constitutes the excretory system.

I have also noticed that practically all of the small species of fishes together with the young and not a few adults of the larger species are more or less infected with this kind of cyst, which statement applies particularly to those frequenting the shallow weedy bays and shores; but apart from the above case I have not investigated the disease.

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University of Toronto,
May 21, 1915.

WORKS CITED.

(1) Cort, W. W.; Notes on the Trematode Genus Clinostomum, in: *Trans. Amer. Micr. Soc.*, Vol. XXXII, No. 3, July 1913, pp. 169-182.

(2) Darr, A.; Ueber zwei Fasciolidengattungen, in: *Zeit. f. Wiss. Zool.*, Bd. 71, 1902, pp. 644-701.

(3) Diesing, K. M.; Revisionen der Myzhelminthen, Abtheilung Trematoden, in: *Sitzbr. d. K. Ak. d. Wiss., Math-Naturw. Classe*, Wien, Bd. 32, 1858, pp. 307-390.

(4) Goldberger, J.; Some known and three new endoparasitic Trematodes from American Fresh-water Fish, in: *Hygienic Lab., Public Health and Marine Hospital Service of United States*, Wash., Bull. No. 71, pp. 7-35.

(5) Goto, S.; Studies on the Ectoparasitic Trematodes of Japan, in: *Journ. of Coll. of Science of Japan*, Vol. 8, 1895, pp. 1-273.

(6) ————; Notes on some Exotic Species of Ectoparasitic Trematodes, in: *Ibid.*, Vol. 12, 1898-1900, pp. 263-295.

(7) Kathariner, L.; Die Gattung Gyrodactylus v. Nord., in: *Arbeiten aus dem Zool-Zoot. Inst. in Wurzburg*, Bd. 10, 1895, pp. 125-164.

(8) Lander, C. H.; The Anatomy of Hemiurus crenatus (Rud.) Luehe, an appendiculate Trematode, in: *Bull. Mus. Comp. Zool., Harvard College*, Vol. 45, No. 1, 1904.

(9) Linton, E.; Parasites of Fishes of the Wood's Hole Region, in: *Bull. U.S. Fish Comm.*, Vol. XIX, 1899, pp. 405-492.

(10) ————; Fish Parasites Collected at Wood's Hole, in: *Ibid.*, pp. 267-394.

(11) ————; Notes on Trematode Parasites of Fishes, in: *Proc. U.S. Nat. Mus.*, Vol. XX, 1897, pp. 507-548.

(12) ————; Parasites of Fishes of Beaufort, North Carolina, in: *Bull. of Bureau of Fisheries, U.S.*, Vol. XXIV, 1904, pp. 321-428.

(13) ————; Tocotrema lingua (Creplin), the Adult Stage of a Skin Parasite of the Cunner and other Fishes of the Wood's Hole Region, in: *Journal of Parasitology*, Vol. I, No. 3, March 1915, pp. 128-134.

(14) Looss, A.; Beiträge zur Systematic der Distomen—Zur Kenntniss der Familie Hemiuridae, in: *Zool. Jahrb.*, Bd. 26, Systematik, 1908, pp. 64-180.

(15) Monticelli, F. S.; Osservazioni intorno ad alcune forme del Gen. Aploblema Dujard., in; *Atti Accad. Scienze Torino*, Vol. 26, 1890-91, pp. 496-524.

(16) Odhner, T.; Revision einiger Arten der Distomengattung Allocreadium Lss., in: *Zool. Jahrb.*, Bd. 14, Syst., 1901, pp. 483-520.

(17) ————; Mitheil. zur Kennt. d. Distomen, I, in: *Centrlb. f. Bakt. u. s. w.*, Bd. XXXI, pp. 58-69.

(18) ————; Zum Naturlichen System der digenen Trematoden, IV, in; *Zool. Anz.*, Bd. 38, 1911, pp. 513-531.

(19) Olsson, P.; Bidrag till Skandinaviens Helminthfauna, in: *Kong. Svensk. Vet.-Akad., Handl.*, Bd. 14, N.F., 1875, pp. 1-33.

(20) Osborn, H. L.; Bunodera cornuta, sp. nov.: A new Parasite from the Crayfish and certain fishes of Lake Chautauqua, N.Y., in: *Biol. Bull.*, Vol. V, 1903, pp. 63-73.

(21) ———; On the Structure of Cryptogonimus chyli, an aberrant Distome, from Fishes of Michigan and New York, in: *Journ. Exp. Zool.*, Vol. 9, 1910, pp. 517-36.

(22) Pratt, H. S.; A Contribution to the Life-History and Anatomy of the Appendiculate Distomes, in: *Zool. Jahrb.*, Bd. 11, Anat., 1898, pp. 351-88.

(23) ———; Synopses of North American Invertebrates, XII, The Trematodes, Pt. 1, in: *American Naturalist*, Vol. XXXIV, 1900, pp. 645-62.

(24) ———; Ibid., Pt. II, in: *Ibid.*, Vol. XXXVI, 1902, pp. 887-910.

(25) Stafford, J.; Some New and Undescribed Trematodes, in: *Zool, Jahrb.*, Bd. 13, Syst., 1900, pp. 399-414

(26) ———; Trematodes from Canadian Fishes, in: *Zool. Anz.*, Bd. XXVII, 1904, pp. 481-95.

(27) Wedl, C.; Anatomische Beobachtungen ueber Trematoden, in: *Sitzbr. d. K. Akd. Wiss., Math.-Naturw. Classe*, Wien, Bd. 26, 1857, pp. 241-78.

(28) Wegener, G.; Die Ektoparasiten der Fische Ostpreussens, *Aus dem Zool. Mus. d. Univ. z. Königsberg i. Pr.*, Inaug. Diss., 1910.

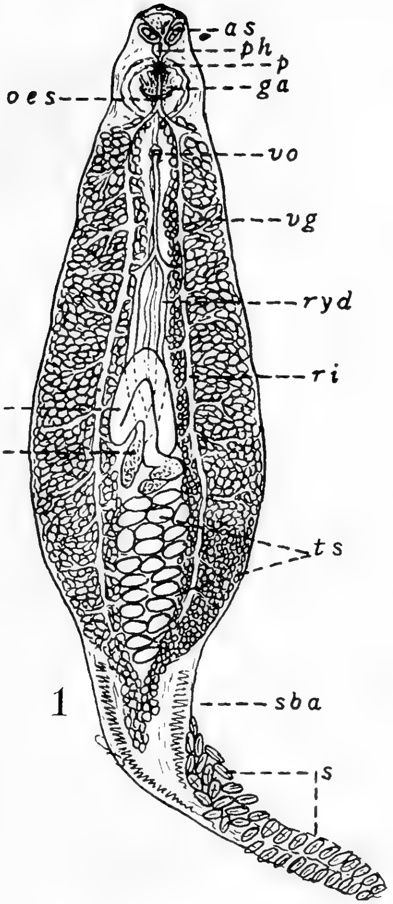
(29) Wilhelmi, J.; Fauna u. Flora des Golfes von Neapel, Tricladen, Bd. 32, 1909.

(30) Willey, A.: Notes on the Plankton collected across the mouth of the St. Croix River opposite to the Biological Station at St. Andrews, New Brunswick, in July and August, 1912, in: *Proc. Zool. Soc. London*, June 1913, pp. 283-292.

Explanation of Figures.

All figures were drawn with the assistance of an Abbé camera-lucida from transparent preparations in oil of cedar-wood.

ac, acetabulum.
as, anterior sucker.
cyd, common yolk duct.
e, eyes.
exv, excretory vesicle.
ga, genital atrium.
gp, gonopore.
ic, intestinal coecum.
lyd, left yolk duct.
m, mouth.
oes, oesophagus.
ov, ovary.
pd, posterior disc.
ph, pharynx.
ps, penis-sac.
ri, right intestinal coecum.
ryd, right yolk duct.
sba, sucker-bearing appendage.
ts, testes.
ut, uterus.
vd, vas deferens.
vg, vitelline glands.
vo, vaginal opening.
yr, yolk reservoir.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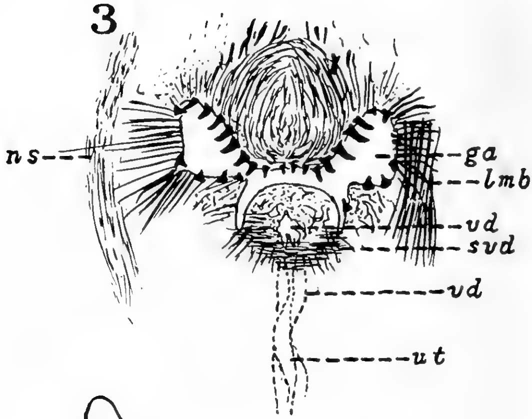
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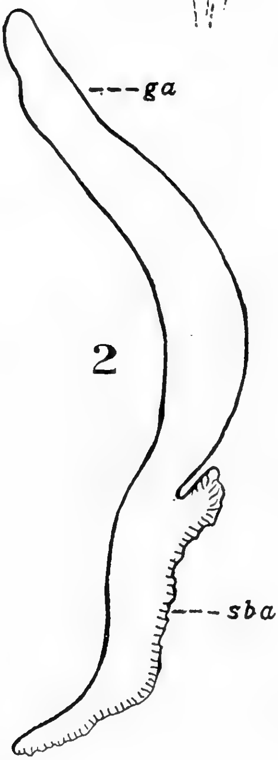
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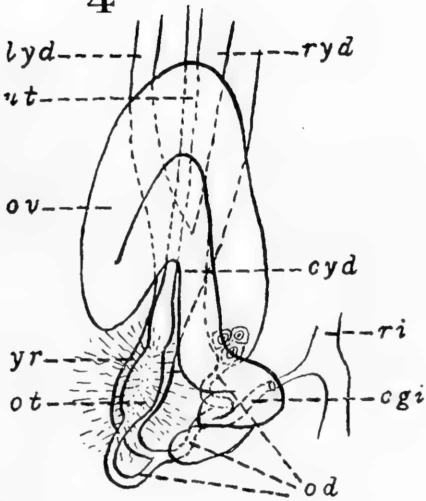
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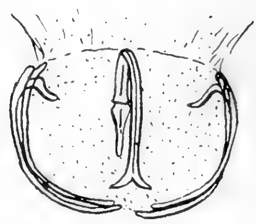

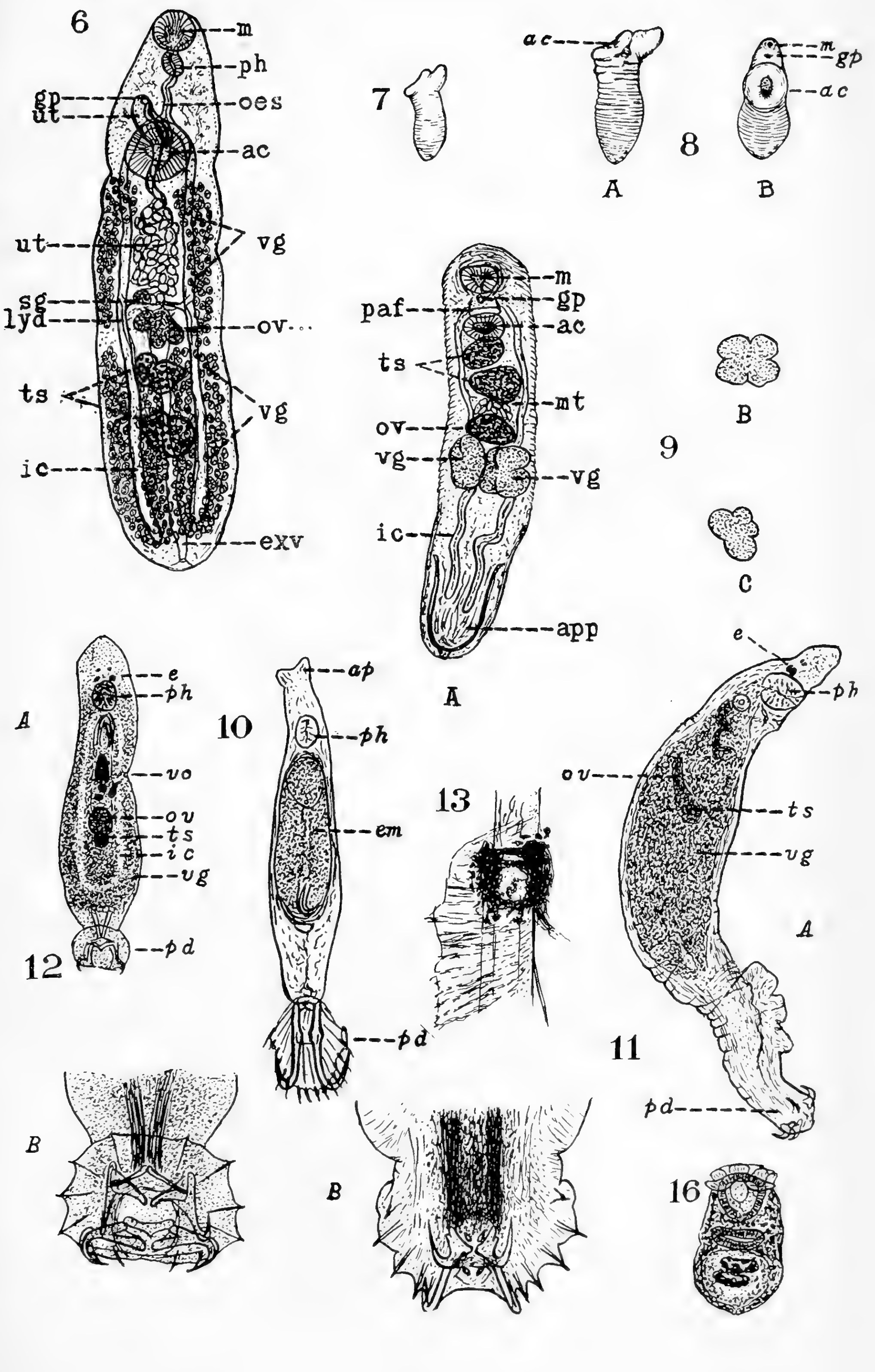
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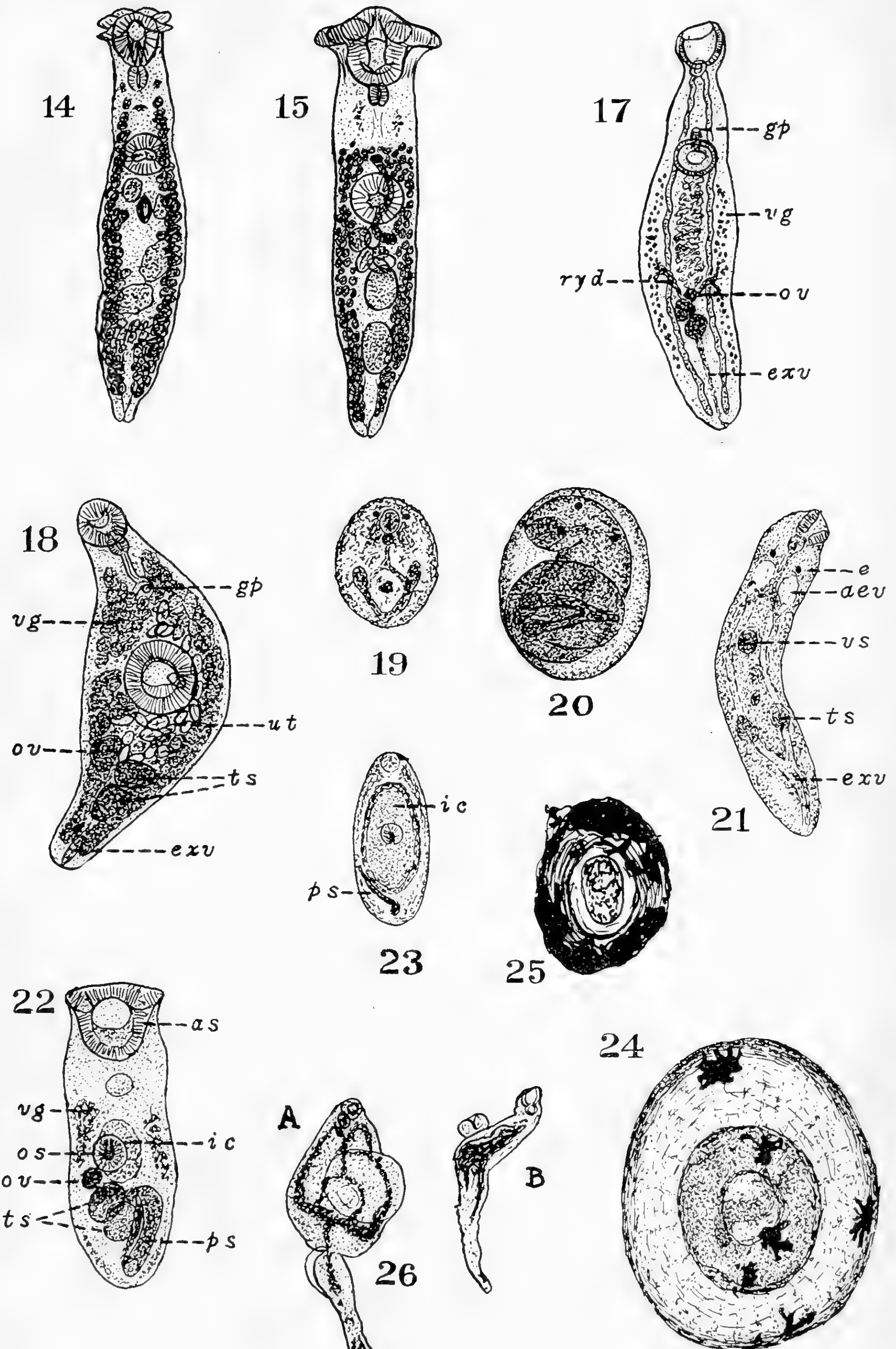
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PLATE I.

Fig. 1. Dorsal view of *Microcotyle poronoti*: *p*, pigment fleck; *s*, posterior suckers, ×30.

Fig. 2. Outline view of same from the right side, ×30.

Fig. 3. Coronal section through genital atrium: *ns*, nerve strand; *lmb*, longitudinal body muscles; *svd*, sphincter of vas deferens, ×200.

Fig. 4. Dorsal view of ovary and ducts in the immediate neighbourhood: *ot*, ootype; *cgi*, canalis genito-intestinalis; *od*, oviduct, ×85.

Fig. 5. Enlarged view of a posterior sucker, ×500.

PLATE II.

Fig. 6. Dorsal view of *Sinistroporus simplex*: *sg*, shell gland, ×25.

Fig. 7. Left lateral view of a 13·5mm. specimen of *Hirudinella clavata*, ×1.

Fig. 8. A, left lateral view, B, ventral, of largest specimen of same species, ×1.

Fig. 9. A, ventral view of *Brachyphallus crenatus*: *paf*, preacetabular fossa; *mt*, metraterm; *app*, appendage, B, the left vitelline gland, seen from the left side, C, right, seen from the right side, ×60.

Fig. 10. Ventral view of *Gyrodactylus medius*: *ap*, anterior papilla; *em*, embryo, ×100.

Fig. 11. A, *Ancyrocephalus paradoxus*, seen obliquely from the right side; B, ventral view of posterior disc, respectively ×100 and ×300.

Fig. 12. A, *Ancyrocephalus cruciatus*, ventral view; B, same of posterior disc, respectively ×100 and 300.

Fig. 13. Cyst of *Tocotrema lingua*, from gills of Sea-Raven, × ?

Fig. 16. Small encysted *Crepidostomun laureatum* from nymph of *Hexagenia*, ×100.

PLATE III.

Fig. 14. An example of the same species from *Boleosoma nigrum*, ventral view, ×50.

Fig. 15. Ventral view of a small *Crepidostomum cornutum* from *Ambloplites rupestris*, ×50.

Fig. 17. Ventral view of *Azygia acuminata*, ×6.

Fig. 18. Same of *Allocreadium commune* from gall-bladder of *Notropis cornutus*, ×55.

Fig. 19. Very young encysted *Cryptogonimus chyli* from young *M. dolomieu*, ×100.

Fig. 20. Older specimen of same inside of cyst, ×100.

Fig. 21. One of the largest removed from cysts: *aev*, anterior expansion of excretory vesicle; *vs*, ventral suckers, ×100.

Fig. 22. Ventral view of *Gasterostomum pusillum* from intestine of small Small-mouthed Black Bass: *os*, oral sucker, ×100.

Fig. 23. Same of a very young encysted specimen of same species, ×100.

Fig. 24. Cyst containing larval distome from muscles of Yellow Perch, × ?

Fig. 25. Cyst containing *Cercaria* sp. ? from skin of a Minnow, sp. ?, × ?

Fig. 26. A, ventral view of the worm removed from the cyst; B, left lateral view of same, × ?

A Study of some Organisms which produce black fields in Aesculin-bilesalt media.

By F. C. HARRISON and J. VANDERLECK, Macdonald College, P.Q.

(Read May Meeting, 1915).

In the summer of 1913 samples of milk obtained from more than a thousand different dealers or farmers in the province of Quebec were analysed. Nine plates were made from each sample—3 aesculin-bilesalt-agar plates (Note 1); 3 litmus-beef-peptone-lactose agar plates; and 3 beef-peptone-litmus-lactose gelatine plates.

A large number of colonies were selected from all of the above plates to test the reliability of aesculin-bilesalt-agar plates for the identification of the colon-aerogenes group. These colonies may be grouped as follows:—

Selection 1. Colonies producing black or brown fields on aesculin plates.

" 2. Colonies producing very faint black or brown fields on aesculin plates.

" 3. Colonies, resembling those of the colon-aerogenes group on the aesculin plates, but failing to produce coloured fields.

" 4. Colonies on litmus-lactose agar resembling those of the colon-aerogenes group.

" 5. Colonies on litmus-lactose agar resembling those of the colon-aerogenes group but producing neutral or alkaline fields.

All agar plates were incubated at 37°C. for 48 hours, and counted. As a rule, these plates were at once cleaned, but a few were kept at room temperature for several days and from these a number of atypical colonies were isolated.

Over 600 pure cultures were isolated from the plates for further study, and all were transferred to tubes of sterile litmus milk (Note 2) and incubated at 37°C. After 24 hours 214 tubes showed strong gas production and acidity without coagulation. These tubes were presumed to contain cultures of the colon-aerogenes group. As a further safeguard 61 tubes were selected at random and transferred to the usual test media. Without exception, the tested cultures belonged to the colon-aerogenes group.

The 214 cultures, mentioned above, were plated again on aesculin-bilesalt agar and all produced the characteristic black or brown fields. These fields differed according as they were surface or deep colonies and as they represent all the various types of colonies found in the colon-aerogenes group, their appearance and descriptions are given in Plate I.

These 214 cultures were originally obtained as follows:—

177 were selected from aesculin plates. All produced black or brown fields. These belong to selection 1.

37 were selected from litmus-lactose-agar plates, as resembling typical colon-aerogenes colonies. These belong to selection 4.

The remaining 384 milk tubes were incubated again for 24 hours at 37°C. and were then sorted as follow:—

A. 16 tubes, strong gas production, acid, without coagulation.

B. 94 tubes, strong gas production, acid and coagulation.

C. 7 tubes, strong gas production, coagulation and complete reduction of the litmus.

D. 12 tubes, gas production, alkaline without coagulation.

E. 32 tubes. Alkaline.

F. 56 tubes, alkaline and marked digestion.

G. 87 tubes. Acid without coagulation.

H. 55 tubes. Various changes not mentioned above.

K. 27 tubes. No change in milk, although bacteria were demonstrated in large numbers.

L. 10 tubes. No bacteria could be found in spite of repeated re-inoculations.

The tubes mentioned under A, B and C, 16, 94 and 7 in number were plated on aesculin-bilesalt agar.

Only black or brown colonies developed. All these cultures were isolated from the original aesculin-bilesalt-agar plates. It was interesting to note that the cultures of B and C formed, as a rule, large brown slimy colonies surrounded by a brown field, and it is probable that these organisms belonged to the aerogenes type. These 117 organisms were considered to belong to the colon-aerogenes group.

The 12 tubes of D gave white colonies without field when plated on aesculin agar, and were originally from selection 5.

The 32 tubes of E were plated on aesculin agar and to our surprise six showed a heavy slimy growth, with large dark brown field, and would have been taken for aerogenes colonies.

The dark brown colonies on these six plates were isolated and reinoculated into litmus milk, and produced the alkaline reaction already mentioned. These six cultures had been obtained under selection 1, and the remaining 26 under selection 5.

The 56 tubes of F plated on aesculin-bilesalt-agar did not produce coloured fields and were the colourless colonies of selection 3.

Of the 87 tubes of G, 22 have black fields on aesculin plates. These organisms were obtained from selection 1. The remaining 65 colonies were from selections 3 and 4.

The 55 tubes of H, showing various changes were plated on aesculin agar. After 48 hours' incubation at 37°C. 4 plates developed black colonies. When the remaining plates were kept at room temperature for 6 days, 7 more developed black colonies. These eleven plates were further investigated.

The 37 tubes collected under K and L had no importance; they produced colourless colonies on the aesculin plates. Altogether 17 colonies were left for further investigation, viz., 6 from Group E and 11 from Group H. Some of these as mentioned above took considerable time to develop black colonies on the aesculin plates. These cultures behaved on aesculin as follows:—

Cultures, *125*, *171*, *174*, *175*, *293*, *358* made black colonies at 37°C. in 24 hours.

Cultures *109*, *294*, *381*, *441* made black colonies at 37°C. in 48 hours.

Cultures *336*, *300*, *304*, *314*, *338*, *437*, *600* did not produce coloured colonies at 37°C. in 4 days, but produced black colonies at 20°C. in 7 days.

These cultures would not have appeared in the usual routine examination of the milk, but they are included here because they have been mentioned by other investigators as impairing the reliability of aesculin media as a test for the colon-aerogenes group.

We may add that many of the 600 colonies were selected because they seemed to be slightly atypical, and yet we found that there were only 10 exceptions, a percentage of 1·5 of all the colonies tested, and a percentage of 0·03 of the colonies on the plates from which these 600 were isolated.

These 17 organisms were tested to ascertain the optimum temperature for their development, with the following results:—

Organism	37°C.	24°C.	14°C.
152	xx	xx	x
171	xx	xxx	xx
174	x	xxx	xx
175	xx	xx	x
293	xxx	xx	x
358	xx	xxx	x
109	xx	xxx	xx
294	xx	xxx	x
381	xx	xx	x
441	x	xxx	xx
336	xx	xxx	xx
300	x	xx	x
304	xx	xx	x
314	xx	xxx	xx
338	x	xxx	xx
437	?	xxx	x
600	x	xx	x

xxx abundant; xx moderate; x slight.

Except *293* all organisms grew better at the temperature of 24°C. and a number grew well below 14°C.

A record has been kept of the source of the milk from which the different organisms were obtained and this record is given in the following tables, also the appearance of the original colony isolated.

TABLE I.

DESCRIPTION OF COLONIES.

Serial number	Form	Centre	Periphery	Surface	Elevation	Margin	Field	Index number
381	Round	Black	Light brown diffused	Smooth, shiny	Raised	Entire	Black	City 147
358	Round	Black	Brown	Smooth, shiny	Flat	Entire	Black	R. 209
152	Small, round	Brown	Light brown	Smooth	Raised	Entire	Brown	City 88
171	Round	Black	Black	Smooth	Flat	Entire	Light brown halo	R. 136
174	Elliptical	Black	Grey	Smooth	Flat	Entire	Black	R. 143
338	Round	Black, large	Brown	Smooth, shiny	Flat	Entire	Brown	R. 178
293	Round	Light brown umbilicate	Bluish white	Smooth	Raised	Entire	Brown	R. 197
600	—	Brown or	Black	—	—	—	Black	R. 375
294	Round	Light brown, elliptical	Iridescent	Smooth	Raised	Entire	Brown	R. 197
441		Brown or	Black	—	—	—	Black	R. 212
304	Round	Brown	Iridescent	Smooth	Flat	Entire	Brown	R. 204
437	—	Brown or	Black	—	—	—	Brown	R. 222
336	Round	Black	Black	Smooth, shiny	Raised	Entire	Black	R. 178
175	Punctiform	Brown, depressed	Light brown	Rough, brittle	Raised	Entire	Black	R. 155
314	Round	Brown	Light brown, diffused	Smooth, shiny	Raised	Entire	Brown	R. 170
109	—	Brown or	Black	—	—	—	Brown	—
300	Round	Brown	Black brown, diffused	Smooth, shiny	Raised	Entire	Black	R. 204

TABLE II.

ORIGIN OF SAMPLES.

Organism.	Index number.	Address.	B. Coli.	Total acid on agar.	Acid on gelatine
152	City 88	101 Windsor St	64·000	11,000·000	90%
171	R. 136	Lancaster	1,700	500,000	25%
174	R. 143	Lancaster	600	400,000	75%
175	R. 155	Lancaster	800	300,000	70%
293	R. 197	Huntingdon	1,100	600,000	56%
358	R. 209	Huntingdon	2,230	250,000	15%
109	R. 87	Chesterville	5,000	350,000	4%
294	R. 196	Huntingdon	1,100	600,000	56%
381	City 147	Pt. St. Charles	18,600	2,000,000	90%
441	R. 212	Terrebonne	6,000	500,000	22%
336	R. 178	Huntingdon	1,360	200,000	78%
300	R. 204	"	760	50,000	30%
304	R. 204	"	760	50,000	30%
314	R. 170	"	560	100,000	55%
338	R. 178	"	1,360	200,000	78%
437	R. 222	Terrebonne	19,100	1,300,000	65%
600	R. 375	Huntingdon	1,760	800,000	5%

Looking over the tables it appears that 8 of the 17 atypical organisms were isolated from Huntingdon milk. In order to follow up the matter 10 more samples of Huntingdon milk were analysed with the following results.

TABLE III.

SAMPLES OF MILK OBTAINED FROM HUNTINGDON, 2.

Sample.	Index letter.	Colon aerogenes group on aesculin.	
		24 hours.	48 hours.
1	D.D	100	115
2	J.G.	40,000	47,000
3	W.G.R	3,900	4,200
4	A.Mc	1,800	1,900
5	T.S.	8,000	8,300
6	D.L.	70,000	80,000
7	R.B.B.	10,000	11,000
8	R.C.	500	520
9	A.L.	10,000	24,000
10	J.D.	4,000	4,200

From each plate a number of doubtful colonies were inoculated into litmus milk. By doubtful colonies we mean colonies which gave a light brown or hazy or faintly coloured field. The following results were obtained:—

No. of Sample.	No. of Colonies inoculated into milk.	Results.
1	6	6 acid and gas in 24 hours
2	1	1 " " " " " "
3	10	10 " " " " " "
4	6	6 " " " " " "
5	9	9 " " " " " "
6	10	10 " " " " " "
7	10	10 " " " " " "
8	3	3 " " " " " "
9	5	1 " " " 4 no change
10	5	1 " " " 4 " "

The 8 tubes which were unchanged after 24 hours coagulated in 48 hours, were plated on aesculin and gave distinct black colonies, but these colonies transferred to litmus milk coagulated the milk with an acid reaction followed by digestion of the casein. These 8 organisms are described later on and represent only one species indicated provisionally as 1H. It differs from the 17 varieties described above and in order to obtain a definite idea of its numerical prevalence in milk other samples were taken from the farmers A.L. and J.D. who supplied the samples 9 and 10. The sample A.L. was diluted 2,000 times and 1 c.c. poured into each of 10 aesculin plates and the sample J.D. was diluted 200 times and 1 c.c. of the dilution poured into each of 10 plates. After 48 hours' incubation at 37°C. the following numbers of black colonies appeared:—

Sample A. L.	Colonies with large fields,	4, 1, 7, 6, 8, 5, 7, 3, 3, 4
	" " small "	1, 6, 10, 10.
Sample J.D.	" " large "	6, 8, 9, 6, 5, 6, 8, 6, 4, 7.
	" " small "	13, 19, 3, 7, 6, 29, 7, 75, 9, 5.

All large black or brown colonies were transferred to litmus milk and kept at 37°C. and also 10 small colonies from each sample were put in litmus milk..

After 18 hours' incubation the results were as follows:—

Large colonies, *A.L.* 46 inoculated tubes all gave acid and gas.
" " *J.D.* 69 " " 67 " " " "
2 showed acid and gas after 4 days . These two, transferred to fresh litmus milk gave acid and gas in 16 hours.

Of the small colonies, all produced acid but none developed gas in 24 hours.

Sample *A.L.* 3 produced gas in 3 days.
3 " " 4 "
4 did not produce in 5 days.

These four were re-inoculated into fresh litmus milk and gave gas and acid in 16 hours.

Sample *J.D.* 4 produced gas after 3 days.
6 did not produce gas in 6 days.

These six transferred to fresh litmus milk gave gas and acid in 16 hours.

Hence our conclusions are that of the 135 black colonies tested, all gave strong gas and acidity without coagulation in litmus milk, which is taken as presumptive evidence that the organism belongs to the colon-aerogenes group.

Further, we conclude that these small colonies represent colon-aerogenes organisms in a weakened condition, which regain their activity when grown for some days in sterile milk. Although no exceptions were found we consider this result valuable as it shows the reliability of the aesculin test in this detailed analysis.

References.

Harrison, F. C., Savage, A. and Sadler, W. The Milk Supply of Montreal. Macdonald College Bulletin. September, 1914.

Klotz, Oscar, and Rankin, A. C. The reaction of various bacteria upon Aesculin agar. The Journal of Infectious Diseases. Vol. VII. Jan. 15th, 1910. pp. 67-72.

Harrison, F. C., and Vanderleck, J. Aesculin Bilesalt media for the isolation of B. coli and B. typhosus. Proceedings and Transactions of the Royal Society of Canada, 1909. Vol. III, section IV.

Harrison, F. C., and Vanderleck, J. Aesculin Bilesalt media for water analysis. Centralblatt fur Bakteriologie. II Abt. 22 pp. 547-551. 1909.

Note 1.

Trans. Royal Society of Canada.

Section IV, 1909, page 147.

Aesculin Bilesalt Media for the Isolation of B. Coli and B. typhosus.

Preparation of Aesculin-Bilesalt Agar.

The directions for making a litre of aesculin-bilesalt agar are as follow:—

Boil until dissolved 15 grams of agar, 2·5 grams commercial bilesalt and 10 grams peptone (Witte) in 1,000 c.c. of distilled water. Neutralise with a normal solution of sodium hydrate. Cool below 60°C., add the whites of two eggs or a sufficient quantity of a solution of albumen, bring to the boil and filter as soon as the albumen has coagulated properly. Try the acidity and neutralise if necessary, and then add to the clear hot filtrate 1 gram aesculin (Merck) and 1 gram iron citrate scales (Merck) After these substances are dissolved test the acidity with decinormal soda solution. It will be found to be about +0·6 as a solution of 1 gram iron citrate scales in 1,000 c.c. water gives an acidity of + 0·56. In case the acidity is too high add alkali until the reaction is +0·6 and if the acidity is too low add more iron citrate until their reaction is +0·6.

NOTE 2.

Sterile litmus milk is prepared as follows:—

Twenty grams of blue litmus (Kahlbaum) are dissolved in 1,000 c.c. water and sterilised. Of this solution enough is added to separated milk to give it a distinct blue colour after the material is put in tubes. As a rule 40 c.c. litmus solution to a litre of separated milk will be required.

EXPLANATION OF DRAWINGS.

PLATE I.—COLON-AEROGENES GROUP.

Surface Colonies.

1. Small, round black, surface smooth, margin entire, raised, medium blackened. There was considerable difference in intensity of field. In some cases field was so faint that it was hardly visible.
2. Small, round, black centre, periphery brown, surface smooth, margin entire raised, medium blackened.
3. Large, slimy, round, dirty grey, periphery brown, margin entire, raised, medium blackened.
4. Large, slimy, round, brown, surface smooth, margin entire, raised, medium browned.
5. Large, slimy, round, dark grey, margin entire, raised, medium browned.

Deep Colonies.

6. Small, round, black, margin entire, medium blackened.
7. Small, round, brown, margin entire.
8. Small, round, black, margin entire, light brown halo.
9. Small, elliptical, red brown, margin entire.
10. Small, elliptical, black, margin entire, medium browned.

PLATE 2.

293, 152, 381, Surface colony. Large, round, colourless, watery, margin entire, surface smooth, light brown field surrounded by a halo of black crystals.
Deep Colony. Small, round, black, no fields but the colony is surrounded by a halo of black and white crystals.

171, 174. Surface colony. Large, round, watery, bluish white, faint brown field.
Deep colony. Small, black, lenticular, faint brown field. In the field appear large numbers of white crystals.

175. Surface colony. Large, round, watery, colourless, black centre, field black.
Deep colony. Small, black, lenticular, field black.

358. Surface colony. Large, round, watery, colourless, red-brown centre. field transparent red brown, which in turn is surrounded by black field.
Deep colony. Punctiform, black, field black, some black crystals.

Note.—No attempt has been made to indicate the intensity of the colouring of colonies and fields, there being a considerable variation in colonies of one and the same organism.

PLATE 3.

109. Surface colony. Large, round, colourless, red-brown centre, field black brown.
Deep colony. Small, black, halo of black crystals, no field.

294. Surface colony. Small, round, watery, black centre, field light brown.
Deep colony. Punctiform, black, halo of white crystals, no field.

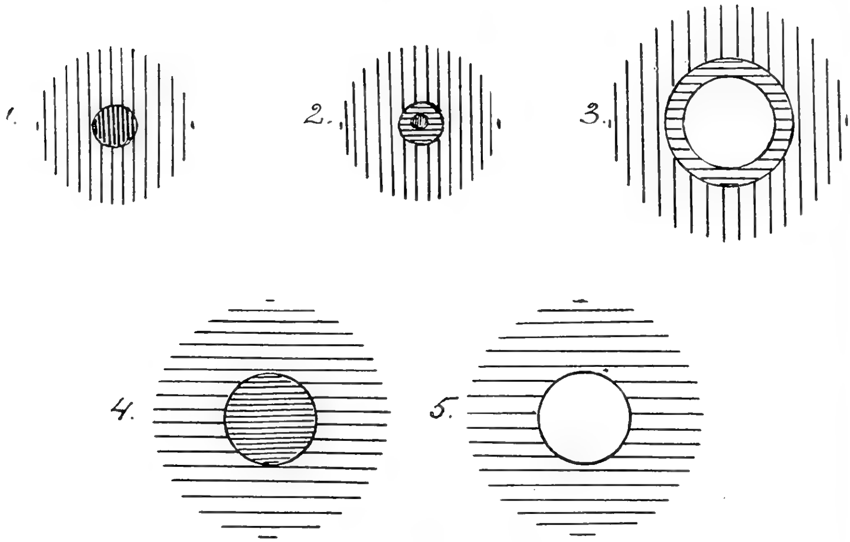
441. Surface colony. Round, dirty white, faint black field,
Deep colony. Small, lenticular black, faint black field.

H1. Surface colony. Large, round, slimy, brown, field black.
Deep colony. Small, lenticular, black, field black.

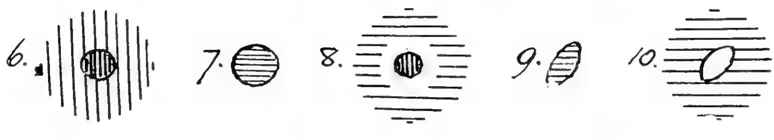
Serial number		381	358	152	171	174	338	293	600	294	441	304	437	336	175	314	109	300	H1
Morphology	Bacterium	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
	Short, thick rods	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
	Motility	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−
	Gram stain	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−
Agar stroke	Growth	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Abundant
	Form of growth	Filiform	Filiform	Filiform	Filiform	Filiform	Filiform	Filifrom	Filiform	Filiform	Filiform	Filiform	Filiform	Filiform	Filiform	Filiform	Echinulate	Filiform	Echinate
	Elevation	Flat	Flat	Flat	Raised	Flat	Flat	Flat	Flat	Flat	Flat	Flat	Raised	Raised	Raised	Flat	Flat	Raised	Flat
	Lustre	Glistening	Glistening	Glistening	Glistening	Glistening	Glistening	Glistening	Glistening	Glistening	Glistening	Glistening	Glistening	Glistening	Dull	Glistening	Glistening	Glistening	Glistening
	Topography	Smooth	Smooth	Smooth	Smooth	Smooth	Smooth	Smooth	Smooth	Smooth	Smooth	Smooth	Smooth	Smooth	Rugose	Smooth	Smooth	Smooth	Smooth
	Optical characters	Opaque	Opaque	Opaque	Opaque	Opaque	Opaque	Opaque	Opaque	Opaque	Opaque	Opaque	Opaque	Opaque	Opaque	Translucent	Translucent	Opaque	Translucent
	Chromogenesis	Bluish white	Bluish white	Bluish white	White	White	Yellow white	White yellow	Blue white	Blue white	White	Yellow white	White	Yellow	Yellow	Yellow white	Yellow white	White	Greyish white
	Odour	None	None	Weak	Weak	?	?	None	Weak	Strong	Weak	?	Strong	Strong	Strong	Strong	Strong	Strong	?
	Consistency	Membraneous	Membraneous	Butyrous	Butyrous	Butyrous	Butyrous	Butyrous	Membraneous	Membraneous	Butyrous	Butyrous	Slimy	Very slimy	Membraneous	Butyrous	Butyrous	Butyrous	Butyrous
	Medium	Unchanged	Unchanged	Unchanged	Unchanged	Unchanged	Unchanged	Unchanged	Unchanged	Unchanged	Unchanged	Unchanged	Unchanged	Unchanged	Unchanged	Unchanged	Unchanged	Unchanged	Unchanged
Potato	Growth	Moderate	Abundant	Abundant	Abundant	Abundant	Scant	Moderate	Abundant	Slight	Abundant	Moderate	None	Moderate	Moderate	Scanty	Scanty	Moderate	Moderate
	Form of growth	Echinulate	Echinulate	Filiform	Echinulate	Echinulate	Filiform	Spreading	Echinulate	Filiform	Echinulate	Spreading	−	Filiform	Filiform	Filiform	Filiform	Echinulate	Echinulate
	Elevation	Flat	Raised	Raised	Raised	Raised	Flat	Flat	Flat	Flat	Raised	Flat	−	Flat	Flat	Flat	Flat	Flat	Raised
	Lustre	Glistening	Glistening	Glistening	Glistening	Glistening	Glistening	Glistening	Glistening	Dull	Dull	Glistening	−	Dry glistening	Glistening	Glistening	Glistening	Glistening	Glistening
	Topography	Smooth	Smooth	Smooth	Contoured	Smooth	Smooth	Smooth	Smooth	Smooth	Contoured	Smooth	−	Smooth	Smooth	Smooth	Smooth	Smooth	Rugose
	Chromogenesis	Yellow white	White	White	White	Dirty white	Dirty yellow	Yellow	Yellow white	Yellow	Yellow white	Yellow	−	Yellow	Yellow	Yellow	Dirty White	White	Dirty White
	Odour	None	Weak	None	Strong	Strong	None	Strong	None	None	None	Strong	−	None	Strong	None	None	Weak	?
	Consistency	Butyrous	Butyrous	Butyrous	Butyrous	Butyrous	Butyrous	Butyrous	Butyrous	Butyrous	Membraneous	Butyrous	−	Slimy	Butyrous	Butyrus	Slimy	Slimy	Butyrous
	Medium	Unchanged	Unchanged	Unchanged	Unchanged	Unchanged	Unchanged	Unchanged	Unchanged	Unchanged	Unchanged	Unchanged	−	Unchanged	Unchanged	Unchanged	Unchanged	Unchanged	Unchanged
Nutrient broth	Surface growth	−	−	−	+Flocculent	−	−	−	−	−	−	−	−	−	−	−	−	−	−
	Clouding	+	+	+	+	+	+	+	+	−	+	+	−	+	+	+	+	+	+
	Odour	?	−	−	−	−	−	−	−	?	−	−	−	+	+	+	+	?	
	Sediment	−	Flaky (slight)	−	−	Flaky +	−	−	−	Flaky +	Flaky +	−	Flaky (slight)	Viscid +	Flaky +	Viscid +	Viscid +	Flaky +	−
Milk	Clearing without coag.	No change five days	No change five days	No change five days	−	−	No change five days	No change five days	No change five days	No change five days	No change five days	−	No change five days	No change five days	No change five dazs	No change five days	No change five days	No change five days	Prompt
	Coagulation				Prompt	Prompt						Prompt							first day
	Extrusion of whey				2 days	2 days						2 days							Slowly
	Coagulem peptonized				Weak acid	−						−							Acid-alkaline
	Reaction				−	Weak acid						Weak acid							−
	Consistency				−														−
	Medium				−	−						−							−
	Lab. ferment				−	−						−							
Litmus milk	Acidity	Alkaline	Alkaline	Alkaline	Acid coag. Alk. digestion	Acid coag. Alk. digestion	Alkaline	Weak	Alkaline	Alkaline	Alkaline	Alkaline	No change	Alkaline	No change	Alkaline	Weak acid	−	Strong
	Reduction	−	−	−			−	−	−	−	−	−		−	−	−	−	Slight	−
	Gas	−	−	−			−	Strong, 4 days	−	−	−	−		−		−	−	−	Medium
Dunham Solution.	Indol.	−	−	−	−	−	+	−	−	−	−	+	−	+	−	+ Weak	+	−	−
Nitrate Broth	Nitrite.	Weak	Weak	Weak	None	Strong	Weak	None	Strong	?	Weak	Strong	?	Strong	?	Weak	Medium	Medium	Strong
	Nitrate	Strong	Strong	Strong	Strong	Strong	Strong	Strong	Strong	Strong	Strong	Strong	Strong	Strong	Strong	Strong	Strong	Strong	Weak
	Ammonia	Strong	Fairly strong	None	Strong	Fairly strong	Medium	Medium	None	Medium	None	Weak	Weak	Medium	?	Weak	Weak	None	Weak
Agar colonies	Growth	Rapid	Rapid	Rapid	Rapid	Rapid	Rapid	Rapid	Medium	Slow	Slow	Slow	Slow	Slow	Slow	Slow	Moderate	Slow	Medium
	Form	Irregular	Irregular	Irregular	Irregular	Irregular	Round	Round	Round	Punctiform	Punctiform	Punctiform	Punctiform	Round	Round	Round	Round	Punctiform	Round
	Surface	Smooth	Smooth	Smooth	Smooth	Smooth	Smooth	Smooth	Smooth	Smooth	Smooth	Smooth	Smooth	Smooth	Smooth	Smooth	Smooth	Smooth	Smooth
	Elevation	Convex	Convex	Convex	Convex	Convex	Convex	Convex	Convex	Convex	Raised	Raised	Raised	Raised	Raised	Umbonate	Raised	Convex	Convex
	Edge	Entire	Entire	Entire	Entire	Entire	Entire	Entire	Entire	Entire	Undulate	Undulate	Undulate	Entire	Entire	Entire	Entire	Entire	Entire
	Internal struct.	Granular	Granular	Granular	Granular	Granular	Granular	Granular	Amorphous	Amorphous	Amorphous	Amorphous	Amorphous	Amorphous	Amorphous	Amorphous	Amorphous	Amorphous	Granular
Gelatine stab.	Growth	Uniform	Uniform	Uniform	Uniform	Uniform	Uniform	Uniform	Uniform	Uniform	Uniform	Uniform	Uniform	Uniform	Uniform	Uniform	Uniform	Uniform	Uniform
	Line of puncture	Filiform	Filiform	Filiform	Filiform	Filiform	Filiform	Filiform	Filiform	Filiform	Filiform	Filiform	Filiform	Filiform	Filiform	Filiform	Filiform	Filiform	Filiform
	Liquefaction	None	None	None	Crateriform	Crateriform	None	Slight	None	None	None	None	None	None	None	None	Crateriform	None	Stratiform
	Medium	Unchanged	Unchanged	Unchanged	Unchanged	Unchanged	Unchanged	Unchanged	Unchanged	Unchanged	Unchanged	Unchanged	Unchanged	Unchanged	Unchanged	Unchanged	Unchanged	Unchanged	Unchanged
Gelatine colonies	Growth	Slow	Slow	Slow	Slow	Moderate	None	Moderate	Slow	Slow	Slow	Slow	Slow	Microscopical	Slow	Microscopical	Slow	Slow	Medium
	Form	Punctiform	Round	Round	Punctiform	Crateriform	−	Round	Round	Round	Irregular	Punctiform	Round	−	Round	−	−	Round	Punctiform
	Elevation	Convex	Convex	Convex	−	Sediment	−	Convex	Convex	Convex	Raised	Convex	Flat	−	Convex	−	−	Convex	−
	Edge	Entire	Entire	Entire	−	−	−	Entire	Entire	Entire	Lobate	Entire	Undulate	None	Undulate	−	−	Entire	Spreading
	Liquefaction	None	None	None	Quick	Slow	−	None	None	None	None	None	None	None	None	None	Quick	None	Crateriform
Fermentation tubes	Glucose (24 hours)	−	−	−	?	?	+	+ Strong	−	−	−	−	−	−	−	−	−	−	−
	48 "	−	−	−	+	+?	+	+	−	−	−	−	−	−	−	−	−	?	−?
	Saccharose, 24 hours	−	−	−	−	−	−	Trace	−	−	−	−	−	−	−	−	−	−	+
	48 "	−	−	−	−	−	−	+	−	−	−	−	−	−	−	−	−	−	+
	Lactose, 24 hours	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−
	48 "	−	−	−	−	−	−	?	−	−	−	−	−	−	−	−	−	−	−

Colon-Aerogenes Group.

Surface Colonies.



Deep Colonies.



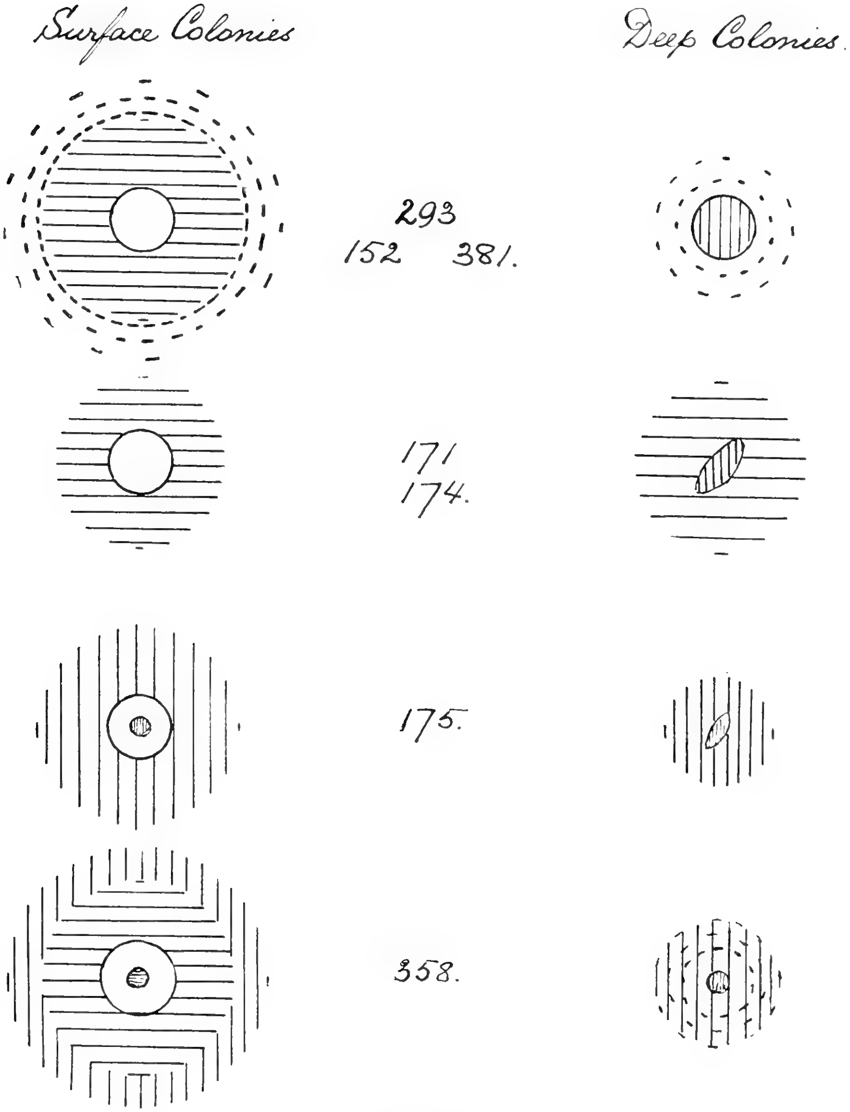


Plate 2.

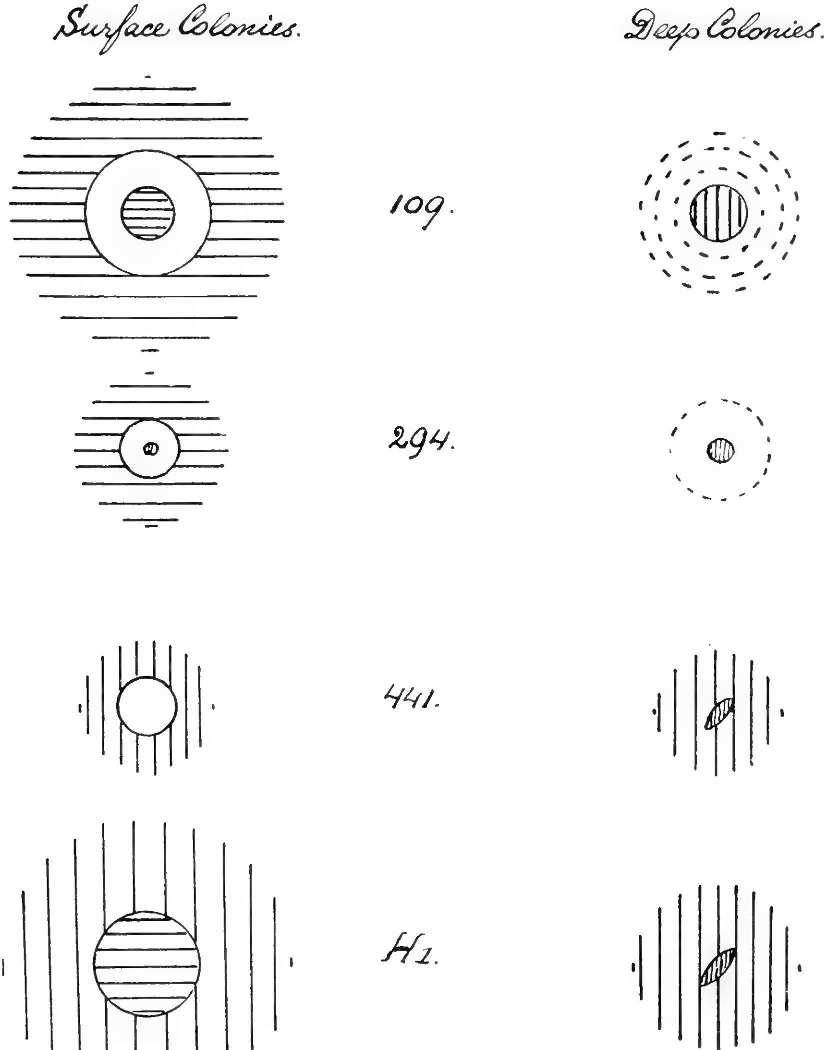


Plate 3.

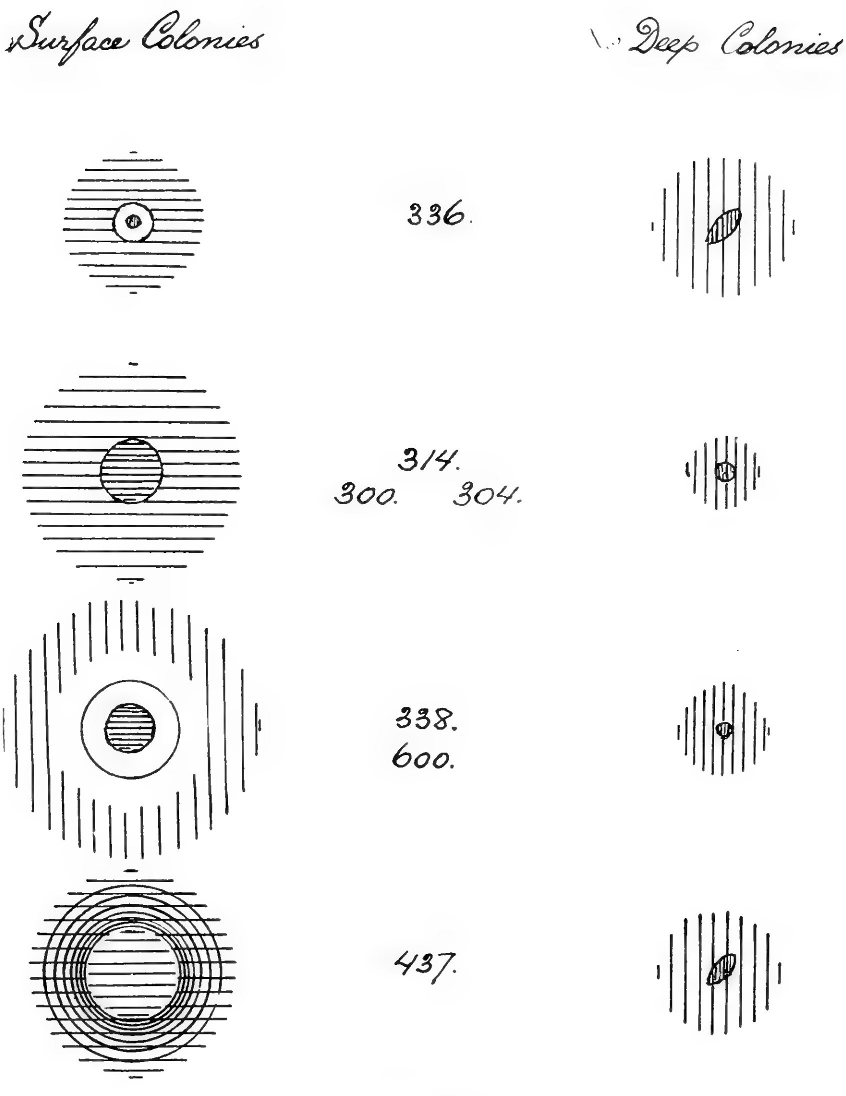


Plate 4.

PLATE 4.

236. *Surface colony.* White, round, black centre, margin entire, surface smooth, light brown field.
Deep colony. Small, lenticular, black, black field.

314, 300, 304. *Surface colony.* Light brown, round, margin entire, surface smooth, large black-brown field.
Deep colony. Punctiform, black, faint black field.

338, 600. *Surface colony.* Large, round, colourless, black-brown centre. Colony surrounded by field of white crystals and round the latter field is a black field.
Deep colony. Punctiform black, black field.

437. *Surface colony.* Round, watery, light brown, field black brown gradually diffusing in the agar medium.
Deep colony. Lenticular, black, black field.

Nitro-Cultures and their Commercial Application.

By F. C. HARRISON, D.Sc., F.R.S.C.

(Read 25th May, 1915.)

At the 1906 meeting of the Royal Society of Canada, the writer and Mr. B. Barlow presented a paper on the "Nodule Organism of Leguminosae,—its Isolation, Cultivation, Identification and Commercial Application." Much of this work was of scientific interest; but the economic and practical side was emphasised. The writer desires, at this time, to review the commercial applications of the methods originated in 1905, and give some additional data on the method of growing the nodule organism for commercial purposes.

The methods as published in the Transactions of this Society were worked out in 1904 and 1905. In 1905 two hundred and forty-six cultures were distributed to Experiment Stations and farmers with the request that they be given a trial and a report sent as to their success or failure. Sixty-seven per cent of favourable reports were received, which encouraged us to publish the data we had accumulated, and a short bulletin entitled "Co-operative Experiments with Nodule Forming Bacteria." Since the introduction of these cultures in 1906 a number of firms in the United States have manufactured and distributed nitro-cultures according to the methods published in the paper presented to the Royal Society in 1906. Some of these firms are the Earp Thomas Farmogerm Company; The Standard Seed and Soil Inoculation Company, Troy, N.Y.; The Standard Nitrogerm Company, Glen Ridge, N.Y.; The Albert Dickenson Seed Company, Chicago; and, quite recently, Prof. F. Edwards has resigned his professorship at the Ontario Agricultural College and gone into the business of manufacturing nitro-cultures at Lansing, Mich.

The Ontario Agricultural College has been sending out cultures for ten years; during this time about 28,000 cultures were distributed, sufficient to inoculate as many bushels of seed. The average of reported favourable results was 82·7% for alfalfa, and 76% for red clover.

A few years ago we were asked to supply cultures for the provinces of Nova Scotia and New Brunswick, and in the last three years we have supplied from the laboratory at Macdonald College about 4,000 cultures.

The writer has not been able to obtain exact figures from all of the companies in the United States, but has received information from some of them. A conservative estimate, based on the facts supplied, points to the production of about 50,000 cultures a year in the United States.

These cultures have been examined by a number of the United States Experiment Stations, with good results (4) (5) (6).

In Europe, a modification of the culture called "Nitragin," first introduced by Nobbe and Hiltner, has been used with varying success. Grabner and von Feilitzen have reported feeble or unsatisfactory results.

Another culture, named nitro-bacterine, and introduced by Bottomley, was exploited by the Stead publication *The Review of Reviews*. Conflicting reports of this culture are published. Grandeau and others report total failure with this culture; on the other hand some English reports are more favourable.

The original medium used for the growth of "Nitro-culture" consisted of commercial maltose, hardwood ashes, and agar; later this was modified and dipotassium phosphate was used instead of the ashes. Both these gave good results; but now and again some variety of *Ps. radicicola* did not seem to grow well on these media, hence a number of experiments with other media were undertaken.

Ashby's agar, wood ash agar and dipotassium phosphate agar with the addition of various sugars were compared in the first series of experiments.

	1% Comm. Maltose	1% C.P. Maltose	1% Sacch-arose	1% Dex-trin	Comm. malt. ½ Sacch. ½	Mannite
Ashby's Agar.						
Vetch	xxxxx	xxx	xxxx	xxxx	xxxx	xx
	xxx	xxx	xxxx	xxxx	xxxx	xx
Alsike	xxxx	xxxx	xxxx	xxxx	xxxx	xxx
	xxxx	xxxx	*xxxx	xx	xx	xx
Alfalfa	xxx	xxx	xxx	xxx	xxxx	xxx
	xxx	xxx	xxx	xxx	xxxx	xxx
Soy	xxx	xxx	xxx	xxx	xxx	x
	xx	x	xx	xx	xx	x
Red Clover	xxx	xx	xxx	xxx	xx	x
	xx	x	xx	x	x	x
Wood Ash Agar						
Vetch	0	0	xxxx	xxxx	xx	
	0	0	* xxxx	xx	x	xx
Alsike	x	x	xxxx	xxxx	x	xxxxx
	x	x	*xxxx	xx	00	xxx
Alfalfa	0	x	xxx	xxxx	xxx	xxxxx
	0	x	*xxxx	xxx	x	*xxxxx
Red Clover	0	x	xxxx	xxx	x	xx
	0	x	*xx	x	x	x
Soy	xxx	xxx	xxx	xx	x	xx
	xx	xx	xx	xx	0	xx
Di-Potass. Phosphate Agar						
Vetch	0	0	xxx	*xxxxx	xx	
	0	0	xx	xxx	xx	
Alsike	x	x	xx	xxxx	xx	
	x	x	xx	xx	xx	
Alfalfa	x	0	xxx	xxx	xxx	
	x	0	xxx	xxx	xxx	
Soy	xxx	xxx	xxx	xxx	xx	
	x	x	xx	xx	x	
Red Clover	x	0	xxx	xx	x	
	0	0	xx	x	xx	

*Best growth of series.

Growth	x
Moderate Growth	xx
Spreading but thin	xxx
Thick but not spreading	xxxx
Thick and spreading	xxxxx

Bottom row of symbols—7 days' growth.
Top row of symbols—14 days' growth.
Room temp.

Comparing all these cultures, the best growths as judged by myself and independently by one of my assistants, Mr. W. Sadler, were—the alsike culture on saccharose Ashby, the vetch culture on dextrine dipotass, phosphate, and the alfalfa, soy and red clover on wood ash agar. The vetch growth on wood ash agar was little inferior to that on the dextrine agar.

As the wood ash medium and the Ashby medium seemed to be far superior to the di-potass. phosphate a combination of both was tried, equal parts of Ashby's and wood ash media being mixed together.

	Saccharose 1%	Dextrin 1%	Maltose 1%	Mannite 1%
Vetch	xxxxx	xxxxx	x	xxxxx
	xxxxx	xxxx	x	xxxx
Alsike	xxxx	xxxx		xxxxx
	xxxx	xx	x	xx
Alfalfa		xxx		xxxxx
	xxxx	xxx	x	xxx
Soy	xxx	xxx		
	xx	xx	0	x
Red Clover		xxx		xxx
	xx	x	x	x

Growth	x	Bottom row symbols—6 days' growth.
Moderate growth	xx	Room temp. 65–70 F.
Spreading but thin	xxx	Top row of symbols—14 days' growth,
Thick but not spreading	xxxx	Room temp. 65–70 F.
Thick and spreading	xxxxx	

Mannite gave the best results with the red clover variety; but as a whole the saccharose gave the best growths. The addition of mannite to the media seemed to give an early start to the organisms and in subsequent lots of media a small quantity of mannite mixed with saccharose was used with excellent results.

For the last two years we have used 1 per cent saccharose and $\frac{1}{8}$ per cent mannite with good results. Growth starts quickly, becomes thick and spreads rapidly to the sides of the bottle. The red clover organism grows less fast, however, and does not form such a thick layer.

As a result of these experiments the medium used for our culture is made as follows: Three solutions are prepared—

A.—75 grams of agar are dissolved in 3,000 c.c. of water, by placing in the autoclav at 10-15 lbs. pressure.

B.—25 grams of hard wood ashes are boiled in 1,000 c.c. of water and filtered.

C.— ·5 gram of acid potassium phosphate,
·5 gram of magnesium sulphate,
·5 gram sodium chloride,
·25 gram calcium sulphate,
6·25 grams of calcium carbonate

are dissolved in the order named in 1,000 c.c. of hot water (about 80°C.)

The three solutions, A B and C are mixed and 87·5 grams saccharose and 12·5 grams of mannite are added. The resulting 5 litres of medium are filled into ounce and a half wide mouth Blake bottles, plugged with cotton. These bottles when filled are sterilised in the autoclay at a pressure not exceeding 10 lbs. On removal, the bottles are sloped, and inoculated by means of a pipette. About 2 c.c. of a suspension of the desired organism is run into each bottle. The bottles are kept in a sloped position, and incubated at 25°C. for about a week, when they are ready for distribution.

REFERENCES.

Harrison & Barlow. Transactions of the Royal Society of Canada. Second series, 1906-07. Vol. XII, Sect. 4, p. 157-237.

Harrison & Barlow. Co-operative experiments with Nodule forming bacteria. Bull. 148, Ont. Agr. College, Toronto, March, 1906.

Edwards, S. F. & Barlow, B. Legume Bacteria. Bull. 169, Ontario Dept. of Agr., Toronto, 1909.

Lipman, J. G. Tests of Commercial Cultures for Soil Inoculation. Bull. 227. New Jersey Expt. Station, New Brunswick, 1910 (satisfactory returns from Farmogerm.)

Starnes, H. N. Some Field Notes on Soil Inoculation. Bull. 71, Georgia Expt. Station. Experiment Ga., 1905.

Harding, H. A. and Prucha, M. J. The Quality of Commercial Cultures for Legumes. Bull. 270, New York Expt. Station, Geneva, N.Y. 1905.

Grandeau, L. Journal Agr. Prat. N. Ser. 18. 1909. No. 45, page 625 and Nitro-bacterine.

Grabner, E. Journal Landw. 57 (1909) No. 3, page 217-223.

Feilitzen, H. Von. Centralblatt fur Backt. 2Abt. 26 (1910) p. 345-352.

Review of Reviews. Nitro-bacterine. Vol. XL, No. 238., Oct. 1909.

A Contribution to a Knowledge of Canadian Ticks.

By C. GORDON HEWITT, D.Sc.,

Dominion Entomologist, Ottawa.

(Read 25th May, 1915.)

During recent years our knowledge of the biology and distribution of the ticks has greatly increased owing to the discovery of the economic importance of this group as carriers of certain serious diseases to man and domesticated animals. In North America we have the North American Fever Tick *Margaropus annulatus* Say, the well known disseminator of splenitic or Texas fever of cattle, which is credited with an annual loss of about fifty million dollars to the cattle industry of the southern States, and the Rocky Mountain Spotted Fever Tick, *Dermacentor venustus*, the responsible agent for this human disease which has a high rate of mortality.

With the exception of the work of Dr. Seymour Hadwen, Assistant Pathologist of the Health of Animals Branch of the Dominion Department of Agriculture and, to a lesser extent, of myself, no serious attempt has been made to study the ticks occurring in Canada. The present account has been prepared with a view to bringing together the hitherto unpublished results of my own work, and those of Hadwen, together with such scattered references as I have been able to find. It is hoped that this information will constitute a basis for further work, and that the comparative meagreness of the records will stimulate others to add to our knowledge of a group which offers problems of unusual interest.

Except where it is otherwise stated the records in the following account are mine. Hadwen has studied the life-histories of a number of the species and in such cases his results have been given in full or summarized.

Family ARGASIDAE

Ornithodoros megnini Dugres. The Spinose Ear Tick.
(Pl. I, Fig. 1.)

The capture of this species on jack rabbits on October 2, 1912, by Dr. A. Watson at Lethbridge, Alta., is recorded by Hadwen (1913). This is an unusual record, as the tick is generally found on the ears of cattle horses and dogs and occasionally on man. It has not been recorded previously north of Oregon and Idaho.

Family IXODIDAE

Ixodes angustus Neumann

LOCALITIES.

Jeffrey, N. B. (Coll. C. H. McNutt, x-1908 from a mouse)

Hadwen (1912) gives the following localities: Mount Lehman, B.C., Duncans, B.C.

Banks (1908) gives: Masset, B.C. (Coll. Keen).

Nuttall and Warburton (1911) give: Chilliwack, B.C. (Coll. III-1900).

HOSTS.

Mouse.

Hadwen (*l.c.*) records the following hosts: Squirrels, *Sciurus douglasii* and *S.h. vancouverensis;* rabbit (*L. americanus*); rats and mice.

Nuttall and Warburton (*l.c.*) record a female from *Tamias townsendi*, (Chilliwack, B.C.).

LIFE-HISTORY.

This species was found by Hadwen to occur in all stages on squirrels at Duncans, B.C. These animals appear to be infested with about the same number of ticks throughout the year. During 1910 and 1911 he was able to study its life-history. The male and female ticks were seldom found on the same host and Hadwen believes that copulation takes place almost wholly in the squirrels' nests or on the ground; the restricted movements of the host would not render the latter situation impossible. The following is a summary of Hadwen's observations:

	Average of
Gorged female:	
Oviposition began at	16 days
Larvae hatched at	73 "
Larvae fed on rabbit:	
Average time of feeding	2·5 "
Ecdysis, larvae issue as nymphs	61 "
Nymphs fed on rabbit:	
Average time of feeding	2·5 "
Ecdysis, nymphs issue as adults	29 "
Adults attach and remain for	7 "
Allowance for hardening of skin after ecdysis and	

time in waiting for host, ten days at each stage.............................. 30 days

221 days

These observations show that it is possible for *I. angustus* to pass through the various stages of its development in seven months.

Ixodes auritulus Neumann

LOCALITY.

Hawden (1914) records the species from Masset, Queen Charlotte Islands, B.C.

HOSTS.

The following hosts in the above locality are recorded by Hawden (*l.c.*):

Queen Charlotte Jay *Cyanocitta stelleri carlottae.*

Alaska Bald Eagle *Haliæetus leucocephalus alascanus.*

It is interesting to note that the previous records of this species (Nuttall and Warburton 1911) are from the Straits of Magellan and Tierra del Fuego, South America, the hosts in both cases being birds.

Ixodes hexagonus Leech

LOCALITY.

Hadwen gives Mount Lehman, B.C. (Coll. 27-I-1911).

HOSTS.

Weasel (Hadwen 1912).

Banks (1908) records the occurrence in Kansas of this species on sheep, with which animals it may have been introduced. He also records specimens from the rabbit. Nuttall and Warburton (1911) record *Sciurus* sp. as a host in California.

Ixodes hexagonus, var. *cookei* Packard

LOCALITIES.

Calabogie, Ont. (Coll. R. M. Reid, v-1908, on dog).

Hadwen collected this species at Mount Lehman, B.C., on dog in 1913.

Banks (1908) gives Guelph, Ont. (Coll. T. D. Jarvis).

HOSTS.

Dog.

This species appears to be identical with the variety *longispinosus* of Neumann (1901) whose specimens were found on the following hosts in the United States: *Lutra*, *Mustela*, sheep (Texas); *Sper-*

mophilus, cat, (Maine); fox, (Colorado); weasel, porcupine and marmot.[1]

Ixodes marxi Banks

LOCALITY.

Banks (1908) gives the following locality: Guelph, Ont. (Coll. T. D. Jarvis).

HOSTS.

Banks states that this species usually occurs on red squirrel, but he also records the fox as a host .

The male of this species has not been described.

Ixodes pratti, Banks

LOCALITY.

Hadwen (1912, 1914) gives the following:

Milk River, Alta. (Coll. A. Watson, VII-1911).

HOSTS.

The following hosts are given by Hadwen (*l.c.*):

Dog and cat (1911).

Horse (1913).

Ixodes ricinus L.
(Pl. I, Fig. 2.)

LOCALITIES.

Specimens have been received from the following localities:

Vancouver, B.C. (Coll. G. W. Boggs, 1907).

Nanaimo, B.C. (Coll. H. Skinner, on dog, 10–VIII–1912).

Hadwen (1912-1914) gives the following localities:

Shawinigan Lake, B.C. (11-XI-1910); Victoria, B.C. (30–VIII–1912); Goldstream, B.C. (1–II–1912); all coll. E. M. Anderson from dog and man. Duncans, B.C. (Coll. S.H. 18–XII–1912) from *Odocoileus columbianum;* Maple Bay, B.C. (Coll. E. M. Anderson, 25–XII–1910; D. Ashby, 19–III–1914; and S.H. 15–XI–1912).

HOSTS.

Dog, man.

Hadwen, (*l.c.*) records:

[1] Since the above was written I have received a specimen of *I. hexagonus* var. *cookei* Pack. through the kindness of Dr. E. M. Walker to whom it was sent by Dr. P. E. Rochon, Clarence Creek, Ont. It was found fixed in the skin of a woman over the right breast where it had been for several months. At first she thought it was a wart on account of its small size when first noticed. It eventually became detached when full grown and engorged and was then noticed by the woman, for the first time, to be alive.

Dog, man and deer (*O. columbianum*).

Nuttall and Warburton (1911), in addition to the above hosts, give records of the following hosts for *I. ricinus* in North America: *Felis concolor, Felis pardalis, Bos taurus, Lepus sylvaticus*, grey fox, wild cat, opossum, ground squirrels and mouse.

Banks (1908) records specimens in the Marx collections from Kansas on sheep and from Texas on cattle and suggests that they were possibly introduced into this continent with their hosts.

Ixodes texanus Banks

LOCALITIES.

Hadwen (1912, 1914) gives:

Mount Lehman, B.C. (Coll. 16–I–1910), and Bella Coola, B.C., Agassiz, B.C. (6–VII–1912).

HOSTS

Hadwen (1912) records the following:

Raccoon (*Procyon lotor*),
Squirrel (*Scuirus h. douglasii*).

Haemaphysalis cinnabarina Koch

(Pl. I, Figs. 3 and 4.)

(SYNONYMY.—Dr. S. Hadwen advises me that Prof. Nuttall in a letter to him states that *Haemaphysalis punctata* C. and F. now becomes *H. cinnabarina* Koch, 1844, as this latter name has priority over *H. chordeilis* Packard. The types are in the Berlin Museum. Neuman placed this species as a synonym of *H. leporis-palustris* but it is of course distinct.)

LOCALITIES

Specimens have been received from the following localities:

Winnipeg, Man. (Received from Vet. Insp. General, coll. on cattle in abattoir, 18–VIII–1913, and 23–IX–1913).

Aweme, Man. (Coll. N. Criddle, 16–VIII–1914, and 5–IX–1914, on cow.)

(Coll. N. Criddle, 2–X–1914 on *Pediœcetes phasianellus campestris* Ridgw.

A larval *Haemaphysalis*, probably *cinnabarina*, was collected by N. Criddle, 24–X–1914 on *Tympanuchus americanus* (Reich.) Ridgw.

Kleena Kleene, Tatla Lake, B.C. (S. H. Colwell, 2–V–1915, on head of rabbit.)

Hadwen (1912, 1914) gives the following locality:

Manitoba (Coll. by J. D. Ross on many occasions).

Hosts.

Cattle. Sharp-tailed grouse (*Pediœcetes phasianellus* Ridgw.)

Larvae probably of this species from Prairie hen (*Tympanuchus americanus* (Reich.) Ridgw.)

Hunter and Bishopp (1910) state that this species has been recorded as causing the death of young turkeys in Vermont.

Haemaphysalis expositicius Koch.

One lot of engorged females of this species has been received from Winnipeg, Man., September, 1911.

Haemaphysalis leporis-palustris Packard. The Rabbit Tick.

Localities.

Specimens were collected by me at Aweme, Man. 15–IX–1913 on rabbit. This species has also been received from Jeffrey Corner, Kings Co., N.B. (Coll. C. H. McNutt, 20–VI–1911).

Hadwen (1912, 1914) gives the following localities:

Aweme, Man.; Prince Albert, Sask. (Coll. F. Torrance 8–VI–1914); Mount Lehman, B.C.; Agassiz, B.C., Nelson, B.C., Peardonville, B.C.

Hosts.

Rabbit (*Lepus americanus*).

Banks (1908) states that the young ticks are taken upon such ground inhabiting birds as quail, lark, etc.

Life Cycle.

Hadwen (1912) gives the following notes on the life cycle:

Engorged females collected	Oviposition began	Eggs hatched
May 13, 1910.	June 1, 1910.	July 18, 1910.
May 17, 1910.	May 25, 1910.	Did not hatch.
July 17, 1911.	July 23, 1911.	Sept. 6, 1911.

The larvæ from the last experiment were still alive on February 9, 1912. They were placed on a tame rabbit April 12, 1912, and the gorged larvæ came off the rabbit from April 17 to April 19. Twelve gorged nymphs were taken from rabbit (Coll. N. Criddle, Aweme, Man.), July 17, 1911; 4 hatched August 15, 1911. 32 nymphs collected off rabbit (Aweme, Man.), July 17, 1911, were placed on a tame rabbit. On July 29 or 30 four were gorged; two hatched September 21, 1911, and one hatched September 26, 1911.

On May 18, 1912, Hadwen (1914) collected 87 males and 21 females off rabbit. This record indicates that the sexes copulate on the host, as no copulation was observed when the ticks were afterwards kept together in a large glass container.

This tick is one of the most widely distributed species. Hunter and Bishopp (1910) state that the U.S. Bureau of Entomology has a record of 1,033 ticks of this species having been taken on two rabibts in western Montana. I have found them almost equally abundant on rabbits in Manitoba. They are usually attached about the rabbit's ears and head and their numbers may be sufficiently great to weaken the host and render its capture by other animals more easy.

Amblyomma americanum L. The Lone Star Tick.

LOCALITY.

Aweme, Man.

The capture of this species by Mr. Norman Criddle in the above locality in southern Manitoba as recorded by Hadwen (1912) is of interest as it had not been collected north of Illinois and Michigan on the central part of the continent according to the distribution map of Hooker, Bishopp and Wood (1912), who also state that the Marx collection contains one unengorged female from Labrador.

Dermacentor albipictus Packard.
(Pl. II, Figs. 5 and 6).

LOCALITIES.

Specimens have been received from the following localities:

Peniac (York Co.) N.B. (Coll. W. Wade, on horse, 15–v–1915).

Hudson Heights, Que. (Coll. A. E. Moore, 21–IV–1911, on elk imported from Wyoming.)

Riding Mountains, Man. 4–XII–1911, on moose.

Windermere, B.C. (Coll. E. D. Ellis, 8–IV–1913).

Gateway, B.C. (Coll. K. R. Foster, 13–II–1912, on horses from Montana).

Okanagan Falls, B.C. (Coll. Parham Bros, 13–IV–1915).

Huntingdon, B.C. (Coll. Vet. Inspect. Ransom, 15–IV–1911).

Crawford Bay, B.C. (Coll. W. W. Mooney, 22–I–1912).

Hadwen (1912) gives the following localities:

Huntingdon, B.C.; Peardonville (Vancouver Island), B.C., Lilloet, B.C.

The type specimens in the Museum of Comparative Zoology, Cambridge, Mass., are from Nova Scotia and were taken from Moose.

HOSTS.

The following hosts have been recorded:

Moose, elk and horse.

Hadwen (1912) records:

Cattle, horse, mule and deer (*Odocoileus hemionus* and *O. columbianum*).

This is a common species throughout the northern United States and its distribution covers the breadth of Canada. The capture at Hudson Heights, Que. (near Montreal) of specimens on elk imported from the state of Wyoming is an indication of the possibilities of artificial dissemination. These elks were imported in the fall of 1910 and were one year old.

This species of tick does not drop off its host to moult. The records of capture indicate that it is found on the host animals chiefly during the winter and spring months. It is the chief "wood tick" of the early spring.

Dermacentor albipictus is not generally considered to be a tick of economic importance, but that this may be an incorrect attitude to assume towards the species is indicated by the following statement made by Bishopp and Wood (1913) in discussing its economic importance: "During these investigations we have found the tick to be an important pest of horses and cattle during the autumn, winter and early spring. The tick is much more severe on horses than cattle, mainly owing to the preference shown for the former animal as a host. Reports have been received from California, Montana and Oregon, stating that horses and colts become very weak and that colts not infrequently succumb if the ticks are not promptly killed. During the spring, in territory infested by the Rocky Mountain Spotted Fever tick (*Dermacentor venustus*), the combined attack of these two species, together with a shortage of feed, often causes the death of numbers of horses where they are not properly cared for."

SUMMARY OF LIFE-HISTORY.

The non-parasitic portion of the life-history commences in the spring when the engorged fertilised female drops off the host to oviposit. Detached females forwarded to me from British Columbia in 1911 commenced to oviposit indoors in April, each female depositing from 3,000 to 5,000 eggs during the succeeding months of May and

June.[1] The larvae began to emerge in July. Bishopp and Wood (*l.c.*) found the pre-oviposition period ranged from 7 to 134 days, the incubation period from 33 to 71 days and the longevity of the larvae from 50 to at least 346 days. The combined periods from the dropping off from the host of the engorged females to the death of the last larva, or the whole non-parasitic period, ranges normally from 159 to at least 479 days. The larvae attach themselves to their host during the autumn, winter and spring months.

Dermacentor variabilis Say

LOCALITIES.

Banks (1908) states "specimens come from many places in the Eastern United States, from Labrador to Florida and Texas."

Hadwen (1912) received specimens from Aweme, Man. (Coll. N. Criddle, 2–VI–1910).

HOSTS.

Hadwen (*l.c.* and 1913) records its occurrence on the following hosts:

Dog, cattle, horses, man.

Banks (*l.c.*) states that it has been taken from a great variety of animals including man, but that it seems to prefer dogs and cattle to smaller animals, which he suggests is due to the fact that the freshly moulted individuals climb up several feet from the ground in wait for a host.

SEASONAL HISTORY AND LIFE CYCLE.

From 1910 to 1912 Hadwen (1912 and 1913) attempted to rear this species through its various stages on tame rabbits and succeeded in 1911 and 1912. In Manitoba most of the engorged females were collected in June; the earliest specimen was captured (by Mr. Norman Criddle at Aweme, Man.) on May 25th and the latest on July 17th. As soon as the warm weather follows the disappearance of the snow the adults are found everywhere and are very annoying to man and beast. As in the case of *D. albipictus* and *D. venustus* the partly engorged females are remarkably tenacious of life in comparison with the fully gorged and ungorged females.

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[1]Misfortune constantly attended my life-history experiments, on this species and *D. venustus*. In the summer of 1910 detailed notes of the life-history studies of *D. albipictus* were lost during my absence, having apparently been swept off my table into a waste-paper basket; perhaps fate was a more able judge than I of their worth! When similar studies were being made in 1912 of *D. venustus* the carelessness of an unknown person caused the wholesale escape of ticks in my room and necessitated the closing down of the experiment.

D. variabilis is a three-host tick. The life cycle appears to start in the spring with the adult female and to be carried as far as the nymphal moult during the summer and autumn and the winter is probably passed in this stage, the adults emerging in the spring. Under laboratory conditions Hadwen found that about 210 days were required for adults to issue, reckoning from the time when the gorged mother tick abandoned the host, and without taking into account the variable period of time which the tick may have to wait for a host when unfed.

Hadwen (1912) found that the females oviposited at the following times:

Engorged females collected	Oviposition began	Eggs hatched
June 2, 1910	June 18, 1910	Aug. 8, 1910.
" 19, "	July 1–4, "	" 21, "
" 19, "	" 1–4, "	" 22, "
May 25, 1911	June 22, 1911	Eggs not hatched.
June 25, "	July 5, "	Aug. 26, 1911,
July 6, "	" 16, "	" " "
" 6, "	" 16, "	" " "

The complete life cycle of the last mentioned specimens was obtained under laboratory conditions and was as follows:

Engorged ♀ from dog	July 6, 1911		
Oviposition began	July 16, 1911	Average number of days	10
Eggs hatched	Aug 26, 1911	" " " "	41
Larva placed on rabbit	Feb. 10, 1912		
Came off gorged	Feb. 13–16, 1912	" " " "	4½
Larvae moulted and nymphs emerged	Apr. 30 to May 13, 1912	" " " "	84
Nymphs put on rabbit	May 9-13, 1912		
Came off gorged	May 14-20, 1912	" " " "	6
Adults emerged	June 20–27, 1912	" " " "	35
			180½

Dermacentor venustus Banks. The Rocky Mountain Spotted Fever Tick.

(Pl. II, Figs. 7 and 8; Pl. III, Figs. 9 to 12).

In view of the possible occurrence of Rocky Mountain spotted fever in Canada, and the fact that with the exception of a single recorded capture of *D. venustus* at Kaslo, B.C., no knowledge was available at that time concerning the distribution of this tick in Canada, an investigation was commenced by me in 1911. The Veterinary Director General of the Department of Agriculture, Dr. J. G. Rutherford, C.M.G., most kindly assisted me by sending to all the Veterinary Inspectors of the Department in western Canada a letter that I drafted requesting specimens of ticks. I also sent the same letter to Farmers' Institutes in British Columbia and Alberta and others who might be able to assist. These requests resulted in the receipt not only of specimens of *D. venustus* but of other species also. In this matter Mr. J. W. Cockle of Kaslo, B.C., was particularly active and helpful, for which assistance I am extremely grateful. The result of this inquiry which is now given showed that *D. venustus* is generally distributed throughout southeastern British Columbia and in the adjacent portion of Southern Alberta. The greatest number of records were received from the Kootenay region. Further studies would no doubt extend the known area of distribution.

LOCALITIES.

Specimens were received from the following localities:

Bridesville, B.C. (Coll. W. Thompson, 17–IV–1912).

Keremeos, B.C. (Coll. W. Thompson, 29–V–1912, on horses imported from the state of Washington and proceeding to the Peace River district, Alta., also collected 10–VI–1912).

Ymir, B.C. (Coll. J. W. Cockle, IV–1912).

Kaslo, B.C. (Coll. J. W. Cockle, 6–V–1912).

Crawford Bay, B.C. (Coll. W. W. Mooney, 6, IV. 1912).

Cranbrook, B.C. (Coll. J. H. McClure, 6–V–1912 at 3,500 feet altitude, attached to a woman's arm; also coll. S. MacDonald, 19–VI–1912).

Wattsburg, B.C. (Coll. Miss Watts, 16–V–1912).

Penticton, B.C. (IV–1910).

Nelson, B.C. (Coll. J. W. Frank, VI–1912; also coll. J. W. Cockle, 15–V–1912).

Pincher Creek, Alta. (Sent by D. Warnock, 5,000 ft. altitude).

Hadwen (1912) has also recorded this species from the following localities:

Kaslo, B.C.; Pilot Bay, B.C.; Osoyoos, B.C.; Merritt, B.C.; Huntingdon, B.C., and Treesbank, Manitoba, where it was collected by N. Criddle.)

HOSTS.

The specimens received by me had been taken from the following hosts:

Horse, man, grizzly bear and mountain sheep.

Hadwen (1912) records the following hosts:

Cattle, horses, man, rabbit and squirrel.

NOTES ON DISTRIBUTION OF *D. venustus.*

The frequent capture by the veterinary inspectors of the Department of Agriculture of this species on horses imported into Canada from the infested states to the south of the international boundary indicates a common means of introduction of this species into distant localities in which it may not already occur. Nor is the possibility of the introduction of infected ticks too remote to be refused consideration.

The following notes have been selected from the letters accompanying specimens of *D. venustus:*

"These ticks produce intense irritation and cause those affected to break out in pimples. They are very plentiful all through that district (Ymir, B.C., which is south of Nelson, B.C.) as many as sixty having been removed from the clothing and person of one man after a tramp through the bush. There appears to be no bad fever resulting from this infection." (J. W. Cockle).

Miss Watts (Wattsburg, B.C.) found the specimens in climbing a mountain and reported that they were rather numerous in 1912, especially near cedar woods.

S. MacDonald, when sending *D. venustus* from Cranbrook, B.C., wrote: "I am sending you . . . what is known as 'Wood Tick.' From inquiries several people claim them to be a cause of blood-poisoning, while some even claim they cause spinal meningitis. I can give you a little experience of my own. One got on my boy ten years old and bit him about six inches below the neck, two inches from the spinal centre; it had penetrated under the skin and looked like a blister. I raised the body inserting coal oil which caused it to come out. The common theory is that you cannot pull them out without leaving a part of the head in, which causes the poisoning".

Dr. Warnock sent specimens some of which were taken from a horse about twenty-five miles south-west of Pincher Creek, Alta. Of other specimens he wrote: "The others, Mr. Riviere, Game Guardian, picked from his clothes while patrolling the mountains. Mr. Riviere informs me he could get many from mountain sheep, goat and deer were it not close season." This was in July, 1912.

J. H. McClure wrote (July 28th, 1912), "A young lady who works for us took this one off her arm. It was hard at work and was removed with difficulty."

ECONOMIC IMPORTANCE OF *D. venustus.*

Inasmuch as this species is responsible for the transmission of the disease known as Rocky Mountain spotted fever which has a high percentage of mortality in the northwestern United States, particularly in the Bitter Root Valley of the State of Montana, its presence in western Canada and the danger of the introduction of infected ticks on mammals are questions of no little importance. So far as my own inquiries are concerned no evidence has been obtained of the presence in Canada of any cases of this disease. Since 1912, however, reports have been received of the occurrence of the bites of this species causing petechial outbreaks on the body and paralytic symptoms in children.[1] Hadwen (1913) reported the occurrence of "Tick Paralysis" in sheep in British Columbia. The occurrence of this paralysis in man was investigated by Todd, who published a preliminary account of the results of his enquiry in 1912. In 1914 Todd communicated to this Society a more complete account of his inquiries and of experiments which he had carried on, which account he has since published and it constitutes the most complete record we have of this peculiar trouble. Nuttall (1914) has also collected further records. These papers bring together practically all the evidence regarding the occurrence of paralytic symptoms in man, sheep and dogs resulting from the bites of this species and this evidence therefore need not be reviewed here. The evidence shows that more than one species of tick may produce these paralytic symptoms and that *D. venustus* is able to produce paralysis in lambs and in a puppy under laboratory conditions. A case was brought to my notice of the production of temporary paralysis in a child in Nelson, B.C., by *D. venustus* from which paralysis the child recovered, as is usually the case, after the removal of the tick which was attached to the back of the neck. This temporary paralysis which is reported to prove fatal if the tick is not removed, is distinct from the paralysis characteristic of acute poliomyelitis.

Summary of Life Cycle of *D. venustus*.

Experiments of the life-history of this species were begun in 1912 but an accident in my laboratory and absence in England prevented any satisfactory progress being made beyond obtaining data on the oviposition and length of egg stage. Fertile eggs, however, were forwarded to Prof. Nuttall who succeeded in rearing the adults (see Nuttall, 1915). The following account is based on the investigations of Hadwen (1913), Hunter and Bishopp (1911) and Nuttall (*l.c.*) and my own fragmentary records:

Dermacentor venustus requires three hosts upon which to feed in the larval or nymphal and adult stages. These stages remain on

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[1]Ann. Rep. Dominion Entomologist, Year ending March 31, 1913, in Rept. Dominion Experimental Farms, Dept. Agriculture, Ottawa, p. 512.

the host for the following periods: Larva, 2–8 days; nymph, 4–11 days; the adult female feeds from 5–15 days, the male feeds from 3–4 days before seeking the female. *Metamorphosis* from egg to larva lasts in Montana from 14–25 days; from larva to nymph in British Columbia 24–38 days; from nymph to adult from a minimum of 12 days to a maximum of 170 days in Montana, or 32 days in summer and 84–94 days in winter in British Columbia. *Oviposition*, reckoned from the day the female abandons the host, begins in Montana 6–13 days in warm weather and 41 days when it is cool. The female may survive 1–14 days after the eggs are laid. The number of eggs laid by one female may vary from 2,500 to 7,140, 4,000 being about the usual number. *Longevity.* Unfed larval ticks usually die in 30 days, but they may survive up to 117 days; unfed nymphs may live over 300 days; adults captured in the spring on vegetation survived unfed for 413 days, after fasting for 365 days they readily attached themselves to a host. The life cycle may be completed in 68 days under most favourable conditions; the time usually required is 2 years, but 3 years may be required. The *seasonal history* in Montana is as follows: the unfed nymphs and adults hibernate; they find hosts from March to July, during which time they attack man; the females which feed in the spring lay eggs which lead to adults in September. Nymphs occur on small wild mammals in March to July inclusive. These individuals hibernate as unfed adults. The adults occur on large wild and domesticated animals and on man, but the immature stages rarely if ever occur on other than small animals.

Literature.

The following list contains certain works additional to those referred to in the text with a view to assisting those desiring further information on North American ticks.

Banks, N. A Revision of the Ixodoidea or Ticks of the United States. U. S. Dept. Agriculture, Bur. Ent., Tech. Ser. Bull. No. 15, 61 pp., 10 pls. 1908.

Bishopp, F. C. and H. P. Wood. The Biology of Some North American Ticks of the Genus *Dermacentor*. Parasitology. Vol. 6, pp. 153-187, 1 fig., 3, pls., 1913.

Hadwen, S. On "Tick Paralysis" in Sheep and Man following bites of *Dermacentor venustus*, with notes on the Biology of the Tick." Parasitology, Vol. 6, No. 3, pp. 283-297. October, 1913.

Hadwen, S. and Nuttall, G. H. F. Experimental "Tick Paralysis" on the Dog. Parasitology, Vol. 6, No. 3, pp. 298-301, Oct. 1913.

Hadwen, S. Reports of the Veterinary Director General, Department of Agriculture, Ottawa, Canada, for the Years ending March 31st, 1912, 1913 and 1914 respectively. In Report for 1912, see pp. 93-99; in Report for 1913, see p. 80.

Hewitt, C. G. Reports of the Dominion Entomologist, Department of Agriculture, Ottawa, Canada, for the Years ending March 31st, 1911 (pp. 225-226); 1912 (p. 183); 1913 (p. 512.)

Hooker, W. A., Bishopp, F. C., and Wood, H. P. The Life-History and Bionomics of some North American Ticks, U. S. Dept. Agric., Bur. Ent., Bull. No. 106, 239 pp., 17 figs., 15 pls., 1912.

Hunter, W. D., and Bishopp, F. C. The Rocky Mountain Spotted Fever Tick, with special reference to the problem of its control in the Bitter Root Valley in Montana. U. S. Dept. Agric., Bur. Ent., Bull. No. 105, 47 pp., 3 pls., 3 figs 1911.

Nuttall, G. H. F. "Tick Paralysis" in Man and Animals. Further published records with comments. Parasitology, Vol. 7, No. 1, pp. 95-104, May, 1914.

Nuttall, G. H. F. Observations on the Biology of Ixodidae, Part II. Parasitology, Vol. 7, No. 4, pp. 408-456, March, 1915.

Nuttall, G. H. F. and Warburton, C. Ticks. A monograph of the Ixodidae. Part I. Argasidae. pp. 1-104, 144 figs., pls. I-III. 1908. Part II. Ixodidae. pp. 105-348, figs. 115-307. Pls. IV-VII. 1911.

Todd, J. L. Tick Bite in British Columbia. Canadian Medical Assn. Journ., Dec., 1912. (Reprint, 2 pp.)

Todd, J. L. Tick Paralysis. Journ. Parasitology, vol. 1, pp. 55-64, Dec. 1914.

Illustrations.

Map showing the Distribution of the Rocky Mountain Spotted Fever Tick *Dermacentor venustus* in western Canada as recorded up to May, 1915.

Plate I.

Fig. 1. *Ornithoderos megnini.* Dorsal aspect.
Fig. 2. *Ixodes ricinus.* Engorged female; dorsal aspect.
Fig. 3. *Haemaphysalis cinnabarina.* Engorged female; dorsal aspect.
Fig. 4. *H. cinnabarina.* Engorged female still attached.

Plate II.

Fig. 5. *Dermacentor albipictus.* Engorged female; dorsal aspect.
Fig. 6. *D. albipictus.* Male; dorsal aspect.
Fig. 7. *Dermacentor venustus.* Engorged female; dorsal aspect.
Fig. 8. *D. venustus.* Engorged female; ventral aspect.

Plate III.

Fig. 9. *Dermacentor venustus.* Unengorged female; dorsal aspect.
Fig. 10. *D. venustus.* Unengorged female; ventral aspect.
Fig. 11. *D. venustus.* Male; dorsal aspect.
Fig. 12. *D. venustus.* Male; ventral aspect.

Distribution of Rocky Mountain Spotted Fever Tick (*Dermacentor venustus*) in Western Canada as recorded up to May 1915.

PLATE I

Fig. 1

Fig. 2

Fig. 3

Fig. 4

PLATE II

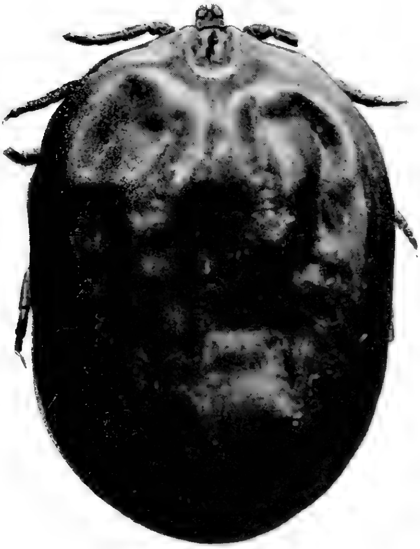

Fig. 5

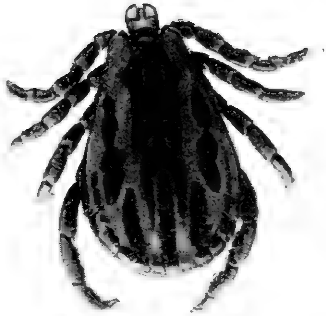

Fig. 6

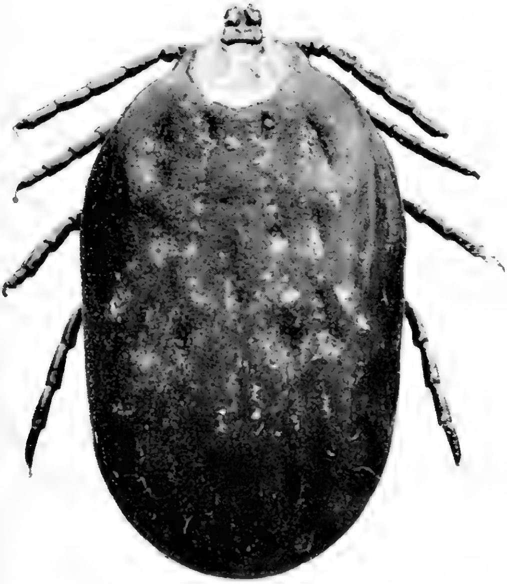

Fig. 7

Fig. 8

PLATE III

Fig. 9

Fig. 10

Fig. 11

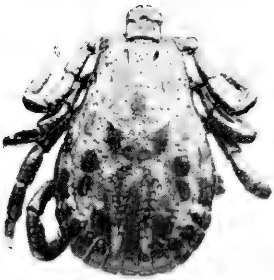

Fig. 12

Metallogenetic Epochs in the Pre-Cambrian of Ontario.

By WILLET G. MILLER, F.R.S.C., and CYRIL W. KNIGHT.

(Read May Meeting, 1915.)

A few years ago Waldemar Lindgren in an instructive paper gave what he called "an epitome of the principal epochs of the segregation of metals over our continent.[1]" He showed that North American "metalliferous deposits have been formed [at various epochs] since the earliest times of geological history." The deposits are grouped by him under the headings pre-Cambrian, Palæozoic, and so forth.

In describing the pre-Cambrian deposits, Lindgren said: "The pre-Cambrian period embraces a very long time and many differing epochs of ore formation; but for our present purposes it will be necessary to consider it as a whole."

During the last decade, owing to the great progress that has been made in the production of metals in Ontario, special facilities have been provided for the study of pre-Cambrian rocks. Our information has been much increased concerning the age relations of the rocks that represent various epochs of this great period, and the ore deposits that are associated with them. It has seemed to the authors that it might now be of interest to present a more detailed classification, than that of Lindgren, of the pre-Cambrian ore deposits of the Province, showing the various metallogenetic epochs into which the period may be divided. In no other part of the continent, or of the world, has the pre-Cambrian proved to be of greater economic interest, and in no other country are these rocks known to be represented by more important metallogenetic epochs. The variety of metals produced here is greater than elsewhere. The Province has not only the world's greatest deposits of nickel, among which have been developed mines that compare favorably in economic importance with those of any other metals found elsewhere, but the gold mines and the cobalt-silver areas are also recognized as being among the greatest of the world.

From the following table it will be seen that there have been at least four great metallogenetic epochs during the pre-Cambrian period in Ontario—Grenville, Algoman, Animikean and Keweenawan. A fifth epoch of minor importance should probably be added to repre-

[1]Jour. Can. Mining Inst., 1909, pp. 102–113.

sent the ore bodies associated with the basic intrusives that preceded the intrusion of the Algoman granite and followed the deposition of the Timiskamian sediments. There is proof that many important ore deposits have been removed by erosion, and it seems not unlikely that the rocks of certain epochs, not now productive, contained deposits which have disappeared through the removal of vast thicknesses of material.

Since the authors have given elsewhere an explanation of the nomenclature employed in the table, it is not necessary to deal in this paper with the names applied to the various subdivisions of the pre-Cambrian.[1]

Certain metals may occur in economic quantities in more epochs than the table shows that they do, the authors not having been able to determine definitely the age relations of some deposits.

Age Classification of Ontario Ore Deposits.

Keweenawan—Epoch, following basic intrusions, of (a) Silver, cobalt, nickel and arsenic at Cobalt and elsewhere, (b) Nickel and copper at Sudbury, and copper elsewhere. Certain gold deposits, not now productive, appear to belong to this epoch.

Animikean—Epoch of deposition of "iron formation" as a chemical precipitate.

Algoman—Epoch, following granite intrusions, of gold at Porcupine and at many other localities, and of auriferous mispickel. Deposits of galena, zinc blende, fluorite and other minerals also appear to have been derived from the granites, but some of them were not formed till post pre-Cambrian time. Preceding the intrusion of the Algoman granites, basic intrusives, that appear to be of post-Timiskamian age, gave rise to nickel and titaniferous and non-titaniferous magnetite deposits and chromite.

Timiskamian—Epoch of minor deposition of "iron formation" as a chemical precipitate.

Laurentian—Granite intrusions probably gave rise to ore deposits which have been removed by excessive erosion as is known to be the case with deposits of later origin.

Loganian:

Grenville—Epoch of deposition of extensive "iron formation" as a chemical precipitate among other sediments.

Keewatin—Composed largely of basic volcanic rocks.

Sequence of Intrusion and Metal Deposition.

The table brings out an interesting alternation of intrusion and sedimentation, and the importance of the igneous rocks in the formation of ore deposits. It will be seen that there are broadly five great epochs of igneous activity, basic and acid rocks alternating; viz., (1) Keewatin, basic; (2) Laurentian, acidic; (3) pre-Algoman, basic; (4) Algoman, acidic; (5) Keweenawan basic, passing in places into a considerable

[1] Ont. Bur. Mines, Vol. XXII, Part 2, pp. 123 et seq., and Geol. Soc. Am., 1914, abstract.

volume of acidic varieties.[1] The pre-Algoman basic rocks are of greater volume and wider extent than they are usually recognized to be since they are frequently wrongly classed as Keewatin. These basic rocks are represented by the sudburite of the Sudbury area, by the lamprophyres of Cobalt and elsewhere, and apparently by the basic rocks of the townships of Dundonald, Reaume and others where associated with them are nickeliferous pyrrhotite and chromite.

Owing to erosion, the sequence of metal deposition shown in the table is doubtless incomplete. Iron formation occurs in three epochs, the Grenville-Keewatin, Animikean and Timiskamian, but is of economic importance only in the former two. Certain deposits of

[1]Granites later in age than the Keweenawan are known in the Sudbury area and elsewhere, and their volume is greater than it is usually considered to be.

titaniferous and non-titaniferous magnetites, not now being worked, are associated with basic intrusives that appear to be of pre-Algoman age. Arsenic occurs in two epochs and has been produced in economic quantities from the rocks of both. In so far as is known, gold occurs in economic quantity only in the Algoman, although small quantities are obtained in refining the copper-nickel ores, and certain auriferous quartz deposits, not now productive, appear to be genetically connected with Keweenawan intrusives. Nickel, as has been shown in the preceding table, was deposited in economic quantities in two epochs. Cobalt, silver and copper are produced only from deposits of Keweenawan age. Platinum, palladium, mercury and other metals are found in small quantities with Keweenawan ores.[1] Zinc and lead have been mined in the Province, but the age relations of some of the deposits are in doubt.

THE KEWEENAWAN—The basic rocks that are classed as of Keweenawan age are found in numerous localities as dykes, sills and flows over a vast region in that part of the protaxis occupied byOntario, Michigan and adjoining territory; in so far as can be determined at present these rocks are also found far to the northeast in the former territory of Ungava, now part of Quebec, and to the far northwest in the Coppermine River basin and northward to the Arctic coast.

In Michigan and in the Coppermine River country these basic intrusives and extrusives are considered to be genetically connected with depositsof native copper. In Ontario, along the north shore of Lake Huron, the Keweenawan intrusives appear to have given rise to the deposits of copper pyrites, while at Sudbury the copper-nickel ores and at Cobalt the silver-cobalt veins have been shown to be genetically connected with them.

While it is not the intention in this paper to go into detailed descriptions, there are a few facts relating to the ores that are genetically connected with the Keweenawan basic intrusives that should be emphasized; viz.: (1) They contain the greatest known quantities of the two magnetic metals cobalt and nickel, and a high percentage of the third element iron; (2) The deposits are widespread. In the region surrounding Cobalt, silver-cobalt veins are found here and there over an area at least 5,000 square miles in extent. Beyond this region cobalt ores are associated with these rocks in the township of Otter, north of Lake Huron, and in small quantities along the shore of the lake opposite Desbarats. Similar ores have been found on

[1]At the present rate of production, (1915), the precious metal contents of the Sudbury copper-nickel mattes will represent yearly probably at least 3,000 ounces of gold, 110,000 of silver, 6,000 of platinum and 9,000 of palladium; but there is loss in refining.

Michipicoten island in Lake Superior and in the area tributary to Port Arthur, 500 miles distant from Cobalt. With the effusive rocks of Michipicoten island is also found native copper under conditions similar to those of Michigan and the Coppermine River region; (3) Some of these ores, those of Sudbury, are considered by certain authors to be a direct segregation from the magma, while the cobalt-silver deposits are less direct, having been deposited from aqueous solutions, although a few veins partake to some extent of the character of deposits formed by segregation from a molten magma.[1]

THE ANIMIKEAN—Interbedded with the Animikean clastic sediments are vast quantities of iron formation, a chemical deposit. Through the action of aqueous solutions concentration of the iron has taken place, giving rise to ore bodies of economic importance.

While the iron deposits of Ontario in the Animikie series of the north shore of Lake Superior have not proved to be of much economic value, across the international boundary in Minnesota they are represented by the great Mesabi ore bodies.

THE ALGOMAN—Gold deposits, that are found in numerous localities in the Province, from the Quebec boundary on the east to that of Manitoba on the west, are, in many cases at least, genetically connected with granites to which the name Algoman is applied. In a few cases the granites are represented by more basic rocks. The gold occurs in quartz veins, being associated usually with iron pyrites, but occasionally the ore carries considerable arsenical pyrites or mispickel. Certain of these veins have been worked as a source of arsenic. There are thus two epochs in which arsenic has been deposited in economic quantities, the Algoman and the Keweenawan, represented by the cobalt-silver arsenical ores of Cobalt

The gold deposits are found chiefly in Keewatin schists, but a few occur in Timiskamian clastic rocks. It is worthy of note that the only gold deposits of the Province that have been proved to be of great economic importance are found in, or in the vicinity of, these Timiskamian fragmental rocks.

Most of the gold, at least, in the important deposits belongs to a later generation than the mass of the veins, having been deposited after the veins were disturbed and fractured.

Basic intrusives that appear to immediately precede the Algoman granite are genetically connected with important nickeliferous pyrrhotite deposits in the township of Dundonald and with small deposits of chromite and pyrrhotite that have not proved to be of economic value in the township of Reaume. These intrusives have not been

[1] Ont. Bureau of Mines, Vol. XIX, Part 2.

definitely proved to be later in age than the Timiskamian sediments but they appear to be so. If this is their age, they correspond chronologically with the lamprophyre dykes of Cobalt and elsewhere and with the sudburite of Sudbury. Basic rocks genetically connected with titaniferous and certain non-titaniferous magnetites appear to be of the same age.

As in the case of arsenic, there are thus two epochs of nickel deposition in Ontario, the Keweenawan and that described in the preceding paragraph.

Basic rocks contemporaneous with sudburite are more widespread in the Province than they are generally recognized to be, as they have frequently been classed as of Keewatin age. No age name has been applied to these rocks.

THE TIMISKAMIAN—No ore deposits are known to have been formed during Timiskamian times in Ontario. It may be added that on the United States side of Lake Superior, rocks that appear to be of Timiskamian age contain extensive deposits of iron formation with which are associated ore bodies of commercial importance.

Erosion has removed by far the greater part of the Timiskamian rocks that once were widespread in Ontario, and it is possible that ore deposits of this epoch have also been destroyed.

THE LAURENTIAN—No ore bodies that are genetically connected with Laurentian granite and gneiss are known to occur in the Province; but as rocks of this epoch that are now exposed at the surface represent originally deep-seated material, from above which thousands of feet have been eroded, it is impossible to say that ore bodies of Laurentian age have not been destroyed.

THE GRENVILLE AND KEEWATIN—Iron formation representing chiefly chemical deposits laid down during Keewatin-Grenville times is widely distributed. In fact, it may be said that there is scarcely a locality in the Province where Keewatin rocks are found from which iron formation is absent. The iron formation usually consists of interbanded silica and iron ore, magnetite or hematite, but at times there is considerable siderite or iron carbonate. Through the action of aqueous solutions on the iron formation, workable deposits of ore have been produced at various localities.

EROSION OF ORE DEPOSITS

Nearly all the ore deposits of the Province have been subjected to excessive erosion. The few exceptions that are known are represented by so-called "blind" veins or those that do not come to the present surface, such as a small number of silver veins at Cobalt.

While it is not possible to determine the total amount of erosion to which the pre-Cambrian surface has been subjected during various epochs, since the Keewatin-Grenville rocks appeared above the surface of the primeval ocean, it can be proved to be enormous.

In pre-Timiskamian times the Keewatin-Grenville rocks were eroded to a great depth, as is shown by the thickness of the Timiskamian sediments, and the deep-seated Laurentian was exposed at the surface.

Again, in the epoch that gave rise to the Animikean sediments, erosion of all the older series was excessive and long continued. The folded Timiskamian fragmental rocks were cut down until they were represented merely by comparatively narrow belts in certain localities, while over large areas no remnant of them remained. During this epoch the Keewatin, Grenville and Laurentian again were subjected to great erosion.

In post-Animikean and pre-Palæozoic times there was a great erosion epoch. This is shown, for instance, by the outliers of the Cobalt series, and the intrusives that penetrated it.

Since Palæozoic times there has been again much erosion, and Cambrian, Silurian and Devonian strata have been removed over vast areas, exposing the underlying pre-Cambrian.

That many ore deposits of various ages have been destroyed during the several epochs of erosion is evident. Two or three hundred feet more of erosion would have left comparatively little, for example, of the Cobalt silver deposits, of which doubtless more has been eroded than has been mined, or of the great Mesabi iron deposits of Minnesota.

In considering the relation of ore deposits to erosion in the pre-Cambrian of Ontario it appears that workable ore deposits are confined comparatively near the surface of the earth.

Complete erosion of certain series of rocks, it would seem, may account for the absence of ore deposits in some countries where the pre-Cambrian, although occurring in considerable volume, is barren. For instance, in the northwest highlands of Scotland there is evidence that fragmental series, probably corresponding to the Timiskamian and Animikean of Ontario, were completely eroded before the deposition of the Torridonian which is considered to represent the Ontario Keweenawan. If we except the Moine or Eastern schists, the age relations of which are doubtful, the rocks now remaining in the Scottish pre-Cambrian appear to represent the Keewatin and Grenville, with the deeply eroded roots of intrusives, and the Keweenawan. If all the sedimentary series that lie between the Keewatin-Grenville and the Keweenawan had been removed by erosion in Ontario there would be nothing left of the ore bodies that are now found enclosed in Timiskamian and Animikean rocks or in the intrusives associated with them, and the deposits of whatever age enclosed in the Keewatin and Grenville would also have largely disappeared.

Faulting and folding have preserved parts of ore bodies that otherwise would have been completely destroyed by erosion. This is well illustrated by the Cobalt Lake fault, where silver veins have been protected on the down-throw side of the fault. Had it not been for this fault and others associated with it, practically all the ore that has been mined in the vicinity of the fault and to the west of it would have been removed. Folding at Kirkland lake and Porcupine has preserved comparatively narrow synclinal belts of Timiskamian sediments and the weathered Keewatin rocks that immediately underlie them, and at one time formed the surface of the earth. There is no reason for believing that erosion has been less in the two localities mentioned than elsewhere in the pre-Cambrian; but probably the character of the rocks, all of which were at one time, before folding took place, subjected to surface influences, has a bearing on the formation of openings and the deposition of ores. The gold deposits are found both in the Timiskamian sediments and in the Keewatin, the more schistose and more highly altered varieties of the latter group appearing to be the more important from the economic point of view.

Relative Economic Importance of Various Epochs.

The following table gives the value of the metallic production of Ontario for the year 1913, classified according to age and origin. Considerable nickel, cobalt and arsenic in the Cobalt ores are not represented in the table, nothing being received for them by the mines. A comparatively small quantity of the nickel and copper in the table should be credited to the deposit in Dundonald township that is associated with the basic eruptives of pre-Algoman and probably post-Timiskamian age.

It should be understood that the ages given for the deposits do not refer to secondary concentration, as, for instance, in the case of iron ores, but to the epoch in which the metals were first deposited.

METAL PRODUCTION OF ONTARIO, 1913

Keweenawan	
Silver	$16,987,377
Copper	3,952,522
Nickel	14,903,032
Cobalt	525,028
Cobalt and Nickel, mixed	90,266
Arsenic	101,463
	$36,559,688
Animikean	
Iron ore	Nil
Algoman	
Gold	$ 4,543,690
Timiskamian	
Iron ore	Nil
Laurentian	
	Nil
Keewatin-Grenville	
Iron ore	237,976
Iron, pig	957,174
	$1,195,150

While at present there is no production of iron ore from deposits of Animikean or Timiskamian age in Ontario, millions of tons are mined from deposits of these epochs in the State of Michigan.

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SECTION IV

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Bibliography of Canadian Botany for the year 1914.

By A. H. MacKay, LL.D.

(Read by Title, May 27, 1915).

ABRAMS, LEROY.

"*Uva-ursi*". (Includes Canadian species and habitats.) N. Am. Flora XXIX: 1: 92-101, 31 Aug. 1914, New York Bot. Gar.

ARTHUR, JOSEPH CHARLES.
KERN, FRANK DUNN.

"North American species of *Peridermium* on Pine". (References to Canadian species and work). Mycologia VI: 109-138, N. Y. Bot. Gar. May, 1914.

BLAKE, S. F.

"A new *Cochlearia* from Newfoundland." (*C. cyclocarpa.*) Rhodora XVI: 135, 136. July, 1914.

BRITTON, N. L.

"Charles Budd Robinson." (Nova Scotian botanist, killed when exploring the flora of Amboyna in the Malay Archipelago, 5 Dec., 1913.) Jour. N. Y. Bot. Gar. XV: 106, May, 1914.

BRITTON, NATHANIEL LORD.

"*Clethraceae*". (Includes Canadian species and habitats.) N. Am. Flora XXIX: 1: 3-31, Aug. 1914. New York Bot. Gar.

BUTTERS, F. K.

"Some peculiar cases of plant distribution in the Selkirk Mountains, British Columbia." Minn. Bot. Studies 3 and 4: 313-331, fig.1. 1914.

CAMERON, A. T.

"The Distribution of Iodine in Plants and Animal Tissue." (Iodine from 0·002 to 0·2 per cent found in all red, brown and green Algae examined —from the Pacific Coast Biological Station.) Roy. Soc. Canada III: VIII: Sec. IV: 7-10, May, 1914.

CAMPBELL, R. H.

"Report of the Director of Forestry, 1913, Canada." (Containing 10 sub-reports and 27 illustrations forming Part VI. Ann. Rep. Dept. Interior, Can., 1913.) Pp. 136, Govt. Bureau, Ottawa, 1914.

CAMPBELL, R. H.
"Manitoba—A Forest Province." (Cir. 7, Forestry Branch, Canada.) Pp. 16, Ottawa, 1914.

CAMPBELL, R. H.
"Report, Director Forestry, 1913." (Part V. Ann. Rep. Dept. Interior.) Pp. 136 with many photogravures, Ottawa, 1914.

CHAPAIS, J. C.
"Le Cystope Blanc." (The Shepherds' Purse, *Capsella bursa-pastoris*, injurious as an host of the fungus *Cystopus candidus*.) Nat. Can. XL: 168-170, May, 1914, Quebec.

CLARK, GEO. H.
MALTE, M. OSCAR.
CRIDDLE, NORMAN.
"Fodder and Pasture Plants." (A comparison volume to Weeds in Canada, 50 cents, from Superintendent of Stationery, Ottawa.) Reviewed in Ott. Nat. XXVIII: 40, May, 1914.

COLLINS, F. S.
"The marine algae of Vancouver Island." Canada Geol. Surv. Vic. Mem. Museum Bull. 1: 99-137, Oct., 1913.

DAVIDSON, J.
"First annual report of the botanical office of the Province of British Columbia, 1913": 01-030, f. 1-37, 1914.

DE WOLFE, L. A.
(In Educational Review, 1914.)

"Winter plants for summer gardens."	No. 320,	pp.	154-5,	Jan.
" " " " "	" 321,	"	180,	Feb.
"Botany" (for schools)	" 322,	"	202-3,	Mar.
" "	" 323,	"	230,	Apr.
" "	" 324,	"	252,	May.
"Botany of a Blueberry Trip"	" 328,	"	60-1,	Sept.
"Apple Picking"	" 329,	"	86-7	Oct.
"Materials to aid Nature Teaching"	" 330,	"	110-1,	Nov.
"Nature Topics for Winter Months"	" 331,	"	136-8,	Dec.

(Saint John, N.B.)

EDDY, E. D.
"Annual Report of the Ottawa Field Naturalists' Club, 1913-14." (Contains lists of papers read, lectures and excursions during the year.) Ott. Nat. XXVIII: 1-11,Apr. 1914.

EVANS, ALEXANDER W.
"Notes on New England *Hepaticae*, XI." (References to Canadian species and habitats.) Rhodora XVI: 62-76, Apr., 1914.

Experimental Farms, Canada.
"Reports to Parliament for year ended 31 March, 1914." (Report of the Director, J. H. Grisdale, pp. 1-83; Field Husbandry, pp. 141-292; Chemistry pp. 85-135. Horticulture by W. T. Macoun, etc., pp. 483-736. Cereals by Chas. E. Saunders, etc., pp. 751-828. Botany by H. T. Gussow, pp. 831-841, and W. A. McCubbin, pp. 841-849. Forage Plants, pp. 881-950. Tobacco, pp. 995-1023.) Appendix to Rep. Min. Agric., Ottawa, 1915.

Farwell, Oliver A.
"The correct name for the hemlock spruce." Bull. Torr. Bot. Club. XLI: 621-629, Dec., 1914.

Ford, Wm. W.
Clark, Ernest D.
"A consideration of the properties of poisonous fungi." (Species common to Canada considered.) Mycologia VI: 167-191. N. Y. Bot. Gar., July, 1914.

Forresters' Club, Toronto University.
"Silvical characteristics of Canadian Trees." (Fifty-six species are discussed.) Pp. 63, Toronto, 1914.

Fraser, W. P.
"Notes on *Uredinopsis mirabilis* and other rusts." (5 species with cultures described, from Nova Scotia to British Columbia.) Mycologia VI: 25-28, N. Y. Bot. Gar. Jan., 1914.

Fraser, W. P.
"Notes of some plant diseases of 1913." (Ann. Rep. Quebec Soc. for the Protection of Plants from Insects and Fungous diseases.) VI: 45, 50, Illustrated, 1914.

Fraser, W. P.
"Storage rots of potatoes and other vegetables." Ann. Rep. Quebec Soc. Protect. Pl. from Insects and Fungi VI: 50, 51, 1914.

Freeborn, S. G.
"Variety in Oats." (Quality, strain and variety with special reference to Ontario.) O. A. C. Review XXVII: 49, 50, Nov., 1914, Guelph, Ontario.

Fry, H. S.
"The physiology of sap flow." (With special reference to the sugar maple.) O.A.C. Review XXVI: 347-357. Apr., 1914. Guelph, Ontario.

FERNALD, M. L.
LONG, BAYARD.

"The American varieties of *Potentilla palustris*." (References to Canadian forms and habitats.) Rhodora: 5-11, 1 pl. (4f), Jan., 1914.

FERNALD, M. L.

"The Alpine bearberries and the generic status of Arctous." (References to Canadian species and habitats.) Rhodora XVI: 21-33, Feb., 1914.

FERNALD, M. L.

"The North American representative of *Arenaria ciliata*." (References to Canadian forms and habitats.) Rhodora XVI: 43, 44, Feb., 1914.

FERNALD, M. L.

"Some annual halophytic asters of the maritime provinces." (New species *Asterlaurentinus* and Var. *magdalensis*, and *Aster subulatus* Michx., Var. *obtusifolius*.) Rhodora XVI: 57-61, 1 pl. Apr., 1914.

FERNALD, M. L.

"Three lupines naturalized in Eastern Canada and Newfoundland." (*Lupinus albicaulis* Dougl., *L. nootkatensis* Donn. and *L. polyphyllus* Lindl.) Rhodora XVI: 92-94, May, 1914.

FERNALD, M. L.

"Some Antennarias of Northeastern America." (New species and varieties, Eastern Quebec, Newfoundland, and Labrador: *A. pygamaea*, *A. straminea*, *A. subviscosa*, *A. canadensis* Greene, var. *spathulata; A. neodioca* Greene, var. *rupicola; A. petaloidea* Fernald, var. *subcorymbosa*.) Rhodora XVI: 129-134, July, 1914.

FERNALD, M. L.

"The American variations of *Stellaria borealis*." (Five varieties, of which four are Canadian as well as the type species.) Rhodora XVI: 144-151, Aug., 1914.

FERNALD, M. L.

"The variations of *Ranunculus cymbalaria*." (References to Canadian species and habitats.) Rhodora XVI: 160-163. Sept., 1914.

FERNALD, M. L.

"The West Virginian variety of *Polygonum cilinode*." (References to Canadian habitats.) Rhodora XVI: 165, 166, Sept., 1914.

FERNALD, M. L.

"The glabrous-leaved sweet gale." (*Myrica gale L.*, var. *subglabra* n. comb. Widely distributed from Labrador to Lake Huron.) Rhodora XVI: 167, Sept., 1914.

FERNALD, M. L.

"Some willows of boreal America." (Eight new species and varieties.) Rhodora XVI: 169-179, Oct., 1914.

FERNALD, M. L.

"A new maritime Polygonum from Nova Scotia." (*P. acadiense* on the Bras d'Or Lakes with *P. Raii* Bab., at Grand Narrows.) Rhodora XVI: 187-189, Nov., 1914.

FERNALD, M. L.

"A northern variety of *Aster linarifolius*." (var. *Victorinii*, River Ste. Anne, etc., Quebec.) Rhodora XVI: 192-194, Nov., 1914.

FERNALD, M. L.

"Two Newfoundland Antennarias." (*Spathulata* and *albicans*.) Rhodora XVI: 196,197, Nov., 1914.

FERNALD, M. L.
MACBRIDE, J. FRANCIS.

"The North American variations of *Arctostaphylos uva-ursi*." (Varieties *coactilis* and *adenotricha*, from Newfoundland to British Columbia.) Rhodora XVI: 211-213, Dec., 1914.

FERNALD, M. L.

"The western variety of *Maianthemum canadense*." (var. *interius* is pubescent—found in O., Man., Sask., Alberta, S. Dakota, Wisconsin and Illinois.) Rhodora XVI: 210, 211, Dec., 1914.

FERNALD, M. L.

"The genus *Ruppia* in eastern North America." (*R. maritima* L. and 9 varieties.) Rhodora XVI: 119-127, 1 pl., July, 1914.

FERNALD, M. L.
ST. JOHN, HAROLD.

"*Nymphaea variegata* or *N. Americana*?" (Both, the former is the northern form, the latter is the more appropriate name for old *N. advena*.) Rhodora XVI: 137-141, Aug., 1914.

FERNHLD, M. L.
ST. JOHN, HAROLD.

"The varieties of *Hieracium scabrum*." (*leucocaule* in Nova Scotia, *tonsum* in Quebec and Ontario, *intonsum* in Illinois.) Rhodora XVI: 181-183, Oct., 1914.

GATES, R. R.
THOMAS, NESTA.

"A cytological study of *Oenothera* mut. *lata* and *OE* mut. *semilata* in relation to mutation." (Their characters are constantly associated with the presence of 15 chromosomes even when combined with other characters derived from 14 chromosome individuals.) Quart. Jour. Micros. Sci. LIX: 523-571 with 10 pls. Feb., 1914.

Graham, G. H.
"Bark Disease of the Chestnut in British Columbia." (*Endothia parasitica* parasitic on *Castanea dentata.* F. H. Faul collaborator.) Forestry Quart. XII: 201-203, June, 1914.

Greene, E. L.
"*Myosurus* in Canada—I." Ottawa Nat. XXVIII: 85-87, Oct., 1914.

Gussow, H. T.
"Tri-septate spores in *Claviceps.*" Phytopathology IV: 386, Oct., 1914.

Gussow, H. T.
"The systematic position of the organism of the common potato scale." Science II. XXXIX: 431-433, March, 1914.

Hall, Harvey Munroe.
"*Baeria*" and "*Lasthenia.*" (Includes Canadian species and habitats.) N. Am. Flora XXXIV: 1: 76-80, 31 Dec., 1914. New York Bot. Gar.

Henry, J. K.
"A new form of *Pyrola bracteata.* Torreya XIV: 32, Feb., 1914.

Henry, J. K.
"*Salix Hookeriana*, Barratt." (Abundant in low grounds on Fraser River, B.C., and in Vancouver Island. Flowers in March. Reference to other species.) Ott. Nat. XXVII: 155, 156, Feb., 1914.

Henry, J. K.
"Two British Columbia Notes." (One on *Rhododendron albiflorum poikilon*, forma *nova.*) Torreya XIV: 45, 46, 2 pls., 1 f. May, 1914.

Holzinger, John M.
"*Hypoterygium Japonicum* Mitt., in North America." (The same as *H. canadense* Kindberg, Queen Charlotte Island.) Bryol XVII: 44, 45, 1 pl. May, 1914.

Howe, R. Heber.
"The nomenclature of the genus *usnea* (With six plates.) Bull. Torrey. Bot. Club XLI: 371-379, July, 1914.

Howe, R. Heber.
"Some comparisons of the lichen floras of Eurasia and North America." Torreya XIV: 138-140, Aug., 1914.

Howe, R. Heber.
"North American species of the genus *Ramalina.*—Part III." (Includes Canadian species and habitats.) Bryol XVII: 1-7, 2 pl. 2 fig., Jan., 1914. Sullivant Moss Society.

"Part	IV. "	Bryol.	XVII:	17-27, 2 pls., 6 figs., Mar.
"	V.	"	"	35-40, 2 pls., 3 figs., May
"	VI.	"	"	49-55, 1 pl., 2 figs., July
"	VII.	"	"	65-69, 1 pl., 1 fig., Sept.
"	VIII.	"	"	81-87, 2 pls., 1 fig., and key, Nov.

Howe, R. H.
Warburg, J. P.
Winsor, C. P.

"The *usneas* of the world," 1752-1912, Part 1, North America." (References to Canadian species.) Proc. Thoreau Mus. Nat. Hist., 1: 15-25. 10 May, 1913, Concord, Mass., U.S.A.

Howitt, J. E.

"Notes on the apothecial stage of *Sclerotina cinerea* in Ontario." (Attacking stone-fruits in Western Ontario. Some experiments.) Ott. Nat. XXVII: 158-160, Feb., 1914.

Jeffrey, E. C.

"The Mutation Myth." Science II. XXXIX: 488-491, Apr., 1914.

Jennings, O. E.

"Notes on the Pteridophytes of the North shore of Lake Superior." Am. Fern. Jour. III: 38-47, 12 June, 1913.

Klugh, A. B.

"Nature's Diary." (A weekly column in the "Farmer's Advocate, London, Ontario, in which there is often a scientific or illustrated botanical article.) 1914.

Knowlton, Clarence H.

"New England Distribution of *Ilex opaca* and *Ilex glabra*." (References to Canadian habitats.) Rhodora XVI: 163-165, Sept., 1914.

Lamb, W. H.

"A conspectus of North American firs (exclusive of Mexico.)" Proc. Am. Soc. Forester IX: 528-538, f 10, Oct., 1914.

Le Naturaliste Canadien.

"Explorations Botaniques du Comté de Temiscouata." (In the Province of Quebec.) XLI: 11-14, July, 1914.

Le Naturaliste Canadian.

"La Protection des Plantes." (A collection of the Quebec laws for the conservation of useful plants.) XLI: 36-40, Sept., 1914.

Lloyd, Francis E.

"Abscission". (The text of a lecture—Abscission in Flowers, Fruits and Leaves—includes observations on about 30 species with special reference to the mechanism of abscissions.) Ott. Nat. XXVIII: 41-52, June, 1914. and 61-75, Aug.

Lorentz, Annie.

"Notes on Maine *Hepaticae* and their comparison with the *Hepaticae* of the Sarekgebirge." (Includes references to Canadian species and habitats.) Bryol. XVII: 28,29, Mar., 1914; 40-42, May.

MacKay, A. H.
"Bibliography of Canadian Botany for 1913." Trans. R. S. C. 3rd S., Vol. VIII, Sec. IV., pp. 25-35, Ottawa, 1914.

MacKay, A. H.
"Phenological Observations, Nova Scotia, 1914, and Instructions. Jour. Education, No. 146, pp. 173-184, Oct., 1914, Halifax, N.S.

MacKenzie, K. K.
"A new northeastern sedge." (*Carex cryptolepis.*) Torreya XIV: 155-159, Sept., 1914.

Macoun, John.
"List of Plants in flower in the vicinity of Sidney, Vancouver Island, March, 1913." (Gives the dates of nearly sixty flowerings of plants from 1st to 31st of the month.) Ott. Nat. XXVIII: 36-38, May, 1914.

Macoun, W. T.
"Summary of Results, Horticulture, 1913." (Report of the Dominion Horticulturist on work in each of the 16 or 19 stations in Canada.) Bull. 77, Hort. Agr. Ottawa, pp. 68, Feb., 1914.

Macoun, W. T.
"Apple breeding in Canada." Ann. Rep. Am. Breeders' Assoc. VIII: 479-487, 1912.

Malte, M. O.
"Summary of Results, Forage Plants, 1913." (Report of Dominion Agrostologist on work at 15 stations in Canada.) Bull. 76, Forage, Agr. Ottawa, pp. 32, Feb., 1914.

McMillan, H. R.
"Cost of Growing Timber on the Pacific Coast." Forestry Quarterly XII: pp. 432-434, Sept., 1914, Toronto.

M.-Victorin, Fr.
"Une variation méristique remarquable du *Trillium grandiflorum.*" (An abnormal specimen from St. Hilaire, P.Q. with detailed description and figure.) Naturaliste Canadien XL: 113-121, Feb., 1914, Quebec.

M.-Victorin, Fr.
"La mort d'un lac." (Observations on the exact manner of the filling up of lakes, as illustrated in the region of St. Jerome. The role of vegetation is amply described with drawing of plants, diagrams and photogravures.) Bull. Soc. Géographie de Québec VIII: 26-43, Feb., 1914, Quebec.

M.-Victorin, Fr.
"Necessité de la publication prochaine d'une flore illustrée de la province de Québec." Naturaliste Can. XL: 164-167, May, 1914, Quebec.

M.-Victorin, Fr.
"L'Anse à Persi." (Botanical and geological observations on a portion of the south coast of the St. Lawrence, in the county of Temiscouata.) Bull. Soc. Geograph. Quebec VIII: 146-159, 3 phs., 2 pls., June, 1914, Quebec.

M.-Victorin, Fr.
"A plea for the publication of a new illustrated flora of the Province of Quebec." Ott. Nat. XXVIII: 53, 54, June, 1914.

M.-Victorin, Fr.
"Lichens." (Some *Caloplaca* and *Cladonia* at Riviere-de-Loup.) Nat. Can. XLI: 14,15, July, 1914.

M.-Victorin, Fr.
"Une plante fortifiée de notre flore." (*Silene antirrhina* catching insects approaching the flower in a mucoid ring around the stems.) Nat. Can. XLI: 49-51, Oct., 1914.

M.-Victorin, Fr.
"Un problème biologique." (The effects of *schizonema laniger* on the leaves of *Crataegus*.) Nat. Can. XLI: 68,69, Nov., 1914.

Merrill, G. K.
"Lichens from Vancouver Island." (Collected near Sidney, Vancouver Island by Prof. John Macoun. Fifteen species, mostly new to Canada.) Ott. Nat. XXVIII: 33-36, May, 1914.

Merrill, E. D.
"Charles Budd Robinson, Jr." (A Nova Scotian botanist who was killed when exploring the flora of Amboyna in the Malay Archipelago, 5 Dec., 1913.) Philip. Journ. Sci. IX (Bot): 191-197, June, 1914.

Morton, B. R.
"The Care of the Woodlot." (Cir. No. 10, Forestry Branch, Canada.) pp. 16 with II photogr., Govt. Bur. Ottawa, 1914.

Murrill, William Alphonso.
"*Agaricaceae* (pars)." (Includes Canadian species and habitats.) N. Am. Flora X: 1: 1-76. 28 July, 1914, N. Y. Bot. Gar.

Murrill, William Alphonso.
"Illustrations of Fungi" (Canadian species included.) Mycologia VI: 1-4, 161-166, 221-225, N. Y. Bot. Gar. Jan., July, Sept., 1914. N. Y. Bot. Gar.

Murrill, William Alphonso.
"American Boletes." 1-40 New York, 1914.

Murrill, William Alphonso.
"Northern Polypores." 1-64, New York, 1914.

Newman, L. H.
"Principles recognized in the breeding of cereal plants at Svalof, Sweden." Ann. Rep. Breeders' Assoc. VIII: 503-507, 1912.

NEWMAN, L. H.

"Tenth Annual Report, Canadian Seed Growers' Association." Year ended March, 1914." (By the Sec. Part 1, pp. 36, Minutes of Annual Meeting. Part II, pp. 37-122. Addresses and contributions.) Several photogravures and graphic diagrams. Ottawa, 1914.

NILES, C. G.

"The North American Cypripediums." Gard. Chron. Am. XVII: 813-815, III. Feb., 1914.

OTTAWA NATURALIST (J. R. F.)

"Meetings of the Botanical Branch." (6 Dec., 1913; 20 Dec., 1913; 3 Jan., 1914.) Ott. Nat. XXVII: 140-144, Jan., 1914 (17 Jan.): 156-158, Feb. (14 Feb.): 175, 176. (By F. E. B.), 14 Nov. XXVIII: 117-119.

PEASE, ARTHUR STANLEY.

"A form of *Potentilla tridentata*." (Forma *hirsutifolia*, Quebec, Maine, N. Hampshire and Mass.) Rhodora XVI: 194, 195, Nov., 1914.

PORSILD, MORTEN P.

"The genus *Antennaria* in Greenland." (Five species with a table comparing them in nine respects.) Ottawa, Nat. XXVIII: 87-92, Oct., 1914.

ROBINSON, C. B.

"The geographic distribution of Philippine mosses." Philip. Jour. Sci. IX (Bot): 199-218, June, 1914.

RYDBURG, P. A.

"Phytogeographical notes on the Rocky Mountain region—II. Origin of the alpine flora." (References to Canadian species and habitats.) Bull. Torrey Club XLI: 89-103, Mar., 1914.

RYDBURG, P. A.

"*Pyrolaceae*". (Includes Canadian species and habitats.) N. Am. Flora XXIX: 1: 21-32, 31 Aug., 1914, New York Bot. Gar.

RYDBURG, P. A.

"Phytogeographical notes on the Rocky Mountain region-III." (Formations in the alpine zone.) Bull. Torr. Bot. Club. XLI: 459-474, Sept., 1914.

RYDBURG, P. A.

"Notes on *Rosaceae*-VII." (References to Canadian species and habitats.) Bull. Torrey Bot. Club XLI: 319-332, June, 1914, "VIII" in 483-503, Oct., 1914.

RYDBURG, P. A.

"Phytogeographical notes on the Rocky Mountain region-I: Alpine region." Bull. Torrey Club. XL: 677-686.

RYDBURG, P. A.

"*Carducaceae*" and "*Helenieae*." (Includes Canadian species and habitats.) N. Am. Flora XXXIV: 1: 1-75, 31 Dec., 1914. New York Bot. Gar.

SEAVER, FRED.
"A Preliminary study of the genus *Lamprospora*." (23 species described and keyed with references to Canadian species.) Mycologia VI: 5-24, 1 pl. 13 figs. N. Y. Bot. Gard. Jan., 1914.

SHUTT, FRANK T.
"Potash in Agriculture." (The role of potash in plants, the proportion of potash in plants, direct and indirect Canadian sources of potash as a fertilizer.) Circ. No. 7. Division of Chemistry, Experimental Farms, Dept. of Agr., Ottawa, pp. 8, 1914.

SMALL, JOHN KUNKEL.
"Order *Ericales*." (Includes Canadian species and habitats.) N. Am. Flora. XXIX: 1: p. 1. 31 Aug., 1914. New York Bot. Gar.

SMALL, JOHN KUNKEL.
"*Ericaceae*." (Includes Canadian species and habitats.) N. Am. Flora XXIX: 1: 33-102, 31 Aug., 1914, New York Bot. Gar.

SMALL, JOHN KUNKEL.
"*Monotropaceae*." (Includes Canadian species and habitats.) N. Am. Flora XXIX: 1: II-20, 31 Aug., 1914. New York Bot. Gar.

STARK, J. W.
"*Zea Mais*." (By a farmer who won the first prize.) O.A.C. Review XXVI: 386-389, 2 pls., May, 1914, Guelph, Ontario.

STOPES, M. C.
"The 'fern ledges' Carboniferous flora of St. John, New Brunswick." Canada Geol. Surv. Dept. Mines, Mem. XLI: 1-167, pl. 1-25 + f. 1-21, 1914.

VROOM, J.
"Woodland Ferns." (A popular sketch of these in New Brunswick.) Educational Review XXVIII: 1, pp. 7-9, July, and XXVIII: 3, pp. 36,37, Aug. and XXVIII: 4, pp. 61,62, Sept., 1914, Saint John, N.B.

WADDELL, JOHN.
"Rubber: wild, plantation, and synthetic." Pop. Sci. No. LXXXV: 443-456, Nov., 1914.

WILSON, G. W.
"Studies in North American *Peronosporales*—V." (A review of the genus *Phytophthora*. Mycologia VI: 54-83, 1 pl., Mar., 1914.

WILSON, W. J.
"A new species of *Lepidostrobus*." Can. Geol. Surv. Victoria Mem. Mus., Bull. L: 89-92, Oct., 1913.

WILSON, W. J.
"A new genus of dicotyledonous plant from the Tertiary of Kettle River, British Columbia." Can. Geol. Surv. Victoria Mem. Mus., Bull. 1: 87, 88, 93, pl., Oct., 1913.

Bibliography of Canadian Entomology for the year 1914.

Contributed by Rev. Prof. C. J. S. BETHUNE, D.C.L.

(Read by title, May Meeting, 1915.)

SUBJECT INDEX.

TITLES.

1. ANDERSON, E. M.
Insects collected in the Okanagan Valley, 1913. Proceedings of the British Columbia Entomological Society, No. 4, new series, pp. 54-58, 1914. (Records of a collecting trip and lists of butterflies, moths and beetles captured).

2. Banks, Nathan.
American Trichoptera—Notes and descriptions. Can. Ent., vol. 46, pp. 149-156, plates viii-x, May, 1914. (Among the new Caddice-flies described are the following Canadian species: *Limnephilus argenteus*, Nepigon, Ont.; *L. aequalis* and *secludens*, *Stenophylas hesperus* and *Anisogamus disjunctus* taken in British Columbia.)

3. Banks, Nathan.
American Trichoptera—Notes and descriptions. Can. Ent., vol. 46, pp. 201-205, plate xv, June, 1914. (Describes and figures *Rhyacophila bifila* from Vernon, B.C.; *R. bipartita*, Banff, Alberta; and *Glossosoma penitus*, Peachland, B.C.)

Ibid, pp. 252-258, plate xx, July. (Canadian forms are *Hydropsyche slossonae*, var. *recurvata* from Georgian Bay, Ont. and *Holocentropus longus* from Digby, Nova Scotia).

Ibid., pp. 261-268, August. (Describes the following Canadian new species: *Molanna flavicornis*, Winnipeg, Man.; *Oecetina interjecta*, *Leptocerus angustus*, *retactus* and *futilis*, Go Home Bay, Georgian Bay, Ont.)

4. Banks, Nathan.
New species of Psammocharidae. Journ. New York Ent. Soc., vol. 22, No. 4, pp. 300-306, Dec., 1914. (Includes one new species of Spider Wasp. *Pompiloides autumnalis*, taken at Ridgeway, Ontario).

5. Barber, H. G.
New Hemiptera—Heteroptera, with comments upon the distribution of certain known species. Journal New York Ent. Soc., Vol. 22, No. 2, pp. 164-171, June, 1914. (Includes the description of a new species, *Ceraleptus pacificus*, from examples taken on Vancouver Island, B.C., and elsewhere).

6. Beaulieu, G.
Let us instruct the Farmer. 6th Annual Report, Quebec Soc. Prot. Plants, etc., pp. 43-45, 1913,1914. (Describes the losses due to the ravages of insects and the importance of teaching the farmers how to deal with them).

7. Beaulne, J. I.
Les Coleopteres du Canada. Le Naturaliste Canadien, vol. 40, pp. 103-111, Janvier; pp. 122,123, Fevrier; pp. 152-256, Avril; pp. 171-176, Mai; pp. 177-180, Juin; vol. 41, pp. 28-31, Aout; pp. 40-48, Septembre; pp. 55-62, Octobre; pp. 71-78, Novembre; pp. 87-94, Décembre, 1914. (Gives the bibliography and distribution of the species found in Canada; the list reaches *Amara* in the Carabidae.)

8. Beaulne, J. I.
Notes on the life-history and control of the Bee-moth or Wax-worm. 6th Annual Report, Quebec Soc. Prot. Plants, etc., pp. 57-59, 1913,-1914.

9. Bethune, C. J. S.
Henry Herbert Lyman, M.A. Can. Ent., vol. 46, pp. 221-226, portrait, July, 1914. (Sketch of the life and work of the late Mr. Lyman, a former President of the Entomological Society of Ontario).

10. BETHUNE, C. J. S.
Dr. William Saunders, C.M.G. Can. Ent., vol. 46, pp. 333-336, portrait, October, 1914. (Obituary notice of one of the founders of the Entomological Society of Ontario and Director of the Experimental Farms of the Dominion).

11. BETHUNE, C. J. S.
The formation of the Entomological Society of Ontario. Address of the President at the Jubilee meeting. 44th Annual Report, Ent. Soc. Ont., pp. 37-42, 1914.

12. BETHUNE, C. J. S.
Bibliography of Canadian Entomology for 1913. Trans. Royal Society of Canada, Third Series, vol. 8, section iv, pp. 53-68, 1914.

13. BIRD, HENRY.
New Species and histories in Papaipema. Can. Ent., vol. 46, pp. 69-73, plate iii, February, 1914. (Describes *P. lysimachiae*, a species whose larva feeds in the roots of Loosestrife, and which has hitherto been confused with *P. purpurifascia*, a Columbine feeder. Both moths and their larvae are figured).

14. BLACKMORE, E. H.
Insect notes of the year in the Victoria, B.C., District. Proc. B.C. Ent. Soc., No. 4, n.s., pp. 11-14, 1914. (Records captures of Lepidoptera, especially the day-flying species.)

15. BLACKMORE, E. H.
Notes on some of the variable species of the genus Hydriomena and its allies occurring on Vancouver Island. Proc. B.C. Ent. Soc., No. 4, n.s., pp. 44-46, 1914. (A study of this group of Geometrid Moths).

16. BRITTAIN, W. H.
Insect pests of the year in the Okanagan District. Proc. B.C. Ent. Soc., No. 4, n.s., pp. 14-19, 1914. (Brief notes on a large number of injurious insects and a list of captures of Coleoptera).

17. BRITTAIN, W. H.
Preliminary note on the work of *Eriophyes* sp. upon apples, apricots and plums. Proc. B.C. Ent. Soc., No. 4, n.s., pp. 38,39. (Describes the injuries to these fruits caused by mites.)

18. BRITTAIN, W. H.
Ants as Fruit-trees pests. Proc. B.C. Ent. Soc., No. 4, n.s., p. 39, 1914. (Describes the injuries to peach blossoms caused by *Formica rufa*, subsp. *obscuripes*, which bored into the nectaries, destroying the pistil, in order to feed upon the nectar).

19. BRITTAIN, W. H.
The Control of Injurious Insects. Agricultural Gazette of Canada, vol. 1, No. 10, pp. 795-797, Oct., 1914. (Describes the work being carried on in Nova Scotia, mentioning the chief pests of the year.)

20. BRYCE, P. I.
Some beneficial Hemiptera of Quebec. 6th Annual Report, Quebec Soc. Prot. Plants, etc., pp. 52,53, 1913,1914. (A short account of some predaceous bugs).

21. BUSH, A. H.
A trip up Mount Cheam. Proc. B.C. Ent. Soc., No. 4, n.s., pp. 58-60, 1914. (Describes the flora of the mountain and gives a list of Coleptera collected in various parts of the Province).

22. BUSCK, A.
Descriptions of new Micro-Lepidoptera of Forest Trees. Proc. Ent. Soc. Washington, vol. 16, No. 4, pp. 143-150, two plates, Dec., 1914. (Includes one new species from Saskatchewan, *Evetria albicapitana*, whose larvae bore into the young branches of *Pinus divaricata*).

23. CAESAR, L.
The San Jose and Oyster-shell Scales. Ontario Agricultural College, Guelph, Bulletin 219, January, 1914, pp. 30, map and 16 figures. (A full account of the life-histories of these two destructive insects and the most effective means of control).

24. CAESAR, L.
Insects of the season in Ontario. 44th Annual Report, Ent. Soc. Ont., pp. 49-53, 1914. (Brief accounts of a large number of insects affecting Orchards, Bush fruits, Vegetable and Field Crops, Forest and Shade-trees).

25. CAESAR, L.
The Control of Injurious Insects. Agric. Gazette of Canada, vol. i, No. 10, pp. 804-809, Oct., 1914. (Describes the work being carried on in the Province of Ontario and the progress made in the warfare against insect pests).

26. CASEY, THOS. L.
Memoirs on the Coleoptera, Part V, 1914, Lancaster, Pa., 387 pages. (The contents are: I. Studies in Omus and Cicindela—two new species of the latter genus are described from Alberta and British Columbia and two others recorded from Manitoba and Alberta; II. Some observations on the Carabidae—a new subspecies of *Sphaeroderus diffractus* is described from New Brunswick; III. A revision of the Nearctic Harpalinae, pp. 45-305—new species are recorded from British Columbia, New Brunswick and Labrador, and descriptions are given of a large number of species taken in various parts of Canada; IV. A review of the genus Thyce and of the North American species of Polyphylla; V. Miscellaneous notes and new species.)

27. COCKERELL, T. D. A.
Names applied to the North American Bees of the genera Lithurgus, Anthidium and allies. Proc. U.S. Nat. Museum, vol. 47, No. 2045, pp. 87-94, May, 1914. (Lists of species with synonymy and bibliography; a few Canadian forms are included).

28. Cockle, J. W.
Snow-insects. Proc. B.C. Ent. Soc., No. 4, n.s., pp. 51,52, 1914. (An account of several species of Snow-fleas found about Kaslo, B.C.).

29. Cockle, J.W.
The mating of *Boreus californicus*. Proc. B.C. Ent. Soc., No. 4, n.s., pp. 52-54, 1914. (A detailed account of observations of the habits of this snow-flea).

30. Cockle, J. W.
The occurrence of *Rhyncholophus* sp. on Lepidoptera, observed at Kaslo, B.C. Can. Ent., vol. 46, p. 332, September, 1914. (Gives a list of Moths on which these mites were found).

31. Cosens, A.
The Gall produced by *Cystiphora Canadensis*, Felt. Can. Ent., vol. 46, p. 180, May, 1914. (The gall was found in abundance at Toronto on the radical leaves of *Prenanthes*).

32. Cosens, A.
Insects of the year in the Toronto District. 44th Annual Report, Ent. Soc. Ont., pp. 18-21, 1914. (Describes the galls made by *Saperda concolor* and gives a list of Lepidopterous gall-producers and of the larvae of moths that were common during the season; also notes on Aphids and Tussock Moths).

33. Cosens, A.
Insect Galls. 44th Annual Report, Ent. Soc. Ont., pp. 97-104, 3 plates, 1914. (Abstract of a lecture illustrated with lantern slides. The types of galls produced by Acarina and different orders of insects are described and figured).

34. Cosens, A.
Insect Galls in relation to field work in Elementary Science. The School, vol. 2, No. 7, pp. 412-417, Toronto, March, 1914.

35. Crawford, D. L.
A contribution toward a Monograph of the Homopterous insects of the family Delphacidae of North and South America. Proc. U.S. Nat. Museum, vol. 46, No. 2041, pp. 557-640, six plates, March, 1914. (A complete revision of this family which was formerly considered a sub-family of the Lantern-flies, Fulgoridae. Several Canadian species are referred to).

36. Crawford, D. L.
A Monograph of the Jumping Plant-lice, or Psyllidae, of the New World. U.S. National Museum, Bull. 85, pp. 186, thirty plates, including 541 figures, June, 1914. (Among the descriptions are a number of Canadian species belonging to the genera *Aphalara*, *Trioza* and *Psylla*).

37. Crawford, J. C.
The species of Perilampidae of America north of Mexico. Proc. Ent. Soc. Washington, vol. 16, No. 2, pp. 69-76, June, 1914. (Gives tables of

species of the Hymenopterous genera Perilampus and Chrysolampus, and includes the description of one new species, *P. canadensis*, from Canada).

38. Criddle, N.
The value of some Mammals and Birds as destroyers of noxious Insects. Ottawa Naturalist, vol. 28, pp. 119-124, December, 1914. (Describes the good work of skunks and many birds in reducing the numbers of injurious insects).

39. Cumming, M.
Report of progress in controlling the San Jose Scale and Orchard Aphids in Nova Scotia. Annual Report for 1914, Fruit Growers' Assoc. of N.S., pp. 166-176.

40. Dash, J. S.
Mites: their classification and habits, with some observations on their occurrence in the Okanagan. Proc. B.C. Ent. Soc., No. 4, n.s., pp. 71-73, 1914. (Gives an account of a number of species injurious to plants).

41. Day, G. O.
The progress of Entomology in British Columbia. Presidential address. Proc. B.C. Ent. Soc., No. 4, n.s. pp. 39-44, 1914. (An interesting account of the work of Entomologists in the Province during the last thirty years).

42. Dietz, W. G.
The Hebes group of the Dipterous genus Tipula, Linnaeus. Trans. Am. Ent. Soc. Phil., vol. 40, pp. 345-363, two plates. (Includes two new species from Canada: *T. Ottawaensis* from Ottawa and Manitoba, and *T. Criddlei* from Aweme, Man.).

43. Du Porte, E. M.
The Wavy-striped Flea-beetle, *Phyllotreta sinuata*, Steph. Can. Ent., vol. 46, pp. 433-435, figs., December, 1914. (Gives an account of the life-history of this introduced species as observed at Macdonald College, P. Que.).

44. Du Porte, E. M.
Insects of 1913. 6th Annual Report, Quebec Soc. Prot. Plants, etc., pp. 38-43, figs., 1913,1914. (Brief notes on the troublesome pests of the season).

45. Eastham, J. W.
Beneficial Insects in British Columbia, Agr. Gazette of Canada, vol. 1, No. 10, p. 818, October, 1914. (Relates that outbreaks of the Army-worm and of the Alfalfa Plusia were subdued by parasites).

46. Felt, E. P.
Hormomyia bulla, n.sp. Can. Ent., vol. 46, pp. 286,287, August, 1914. (Describes both sexes of the midge producing galls on the leaves of Helianthus recorded from Ontario).

47. FELT, E. P.
Gall Midges as Forest Insects. Ottawa Naturalist, vol. 28, pp. 76-79, Aug.-Sept., 1914. (Gives an account of the various forms of injury to forest trees caused by these insects and describes a new species of spruce-bud gall, *Rhabdophaga Swainei*, taken at Ottawa).

48. FELT, E. P.
Adaptation in the Gall Midges. 44th Annual Report, Ent. Soc. Ont., pp. 76-82, figs., 1914. (Discusses the adaptations in structure which aid the species in escaping extinction. Figures of segments of a number of antennae are given).

49. FORBES, W. T. M.
A table of the Genera of Noctuidae of North Eastern North America. Journal New York Ent. Soc., vol. 22, No. 1, p. 1-33, plate, March, 1914. (A most useful key to the genera of this difficult family of moths, nearly all of which are to be found in the eastern Provinces of Canada).

50. FORBES, W. T. M.
The North American Families of Lepidoptera. Psyche, vol. 21, No. 2, pp. 53-65, April, 1914. (A key that will be found useful by students of this order; a large proportion of the families are to be found in Canada).

51. FYLES, T. W.
Green Lanes and Byways. 44th Annual Report, Ent. Soc. Ont., pp. 43-49, 1914. (A popular account of the fauna and flora observed in lanes and country roads in England and Canada).

52. GIBSON, ARTHUR.
Les insectes les plus nuisibles à la culture des légumes. Deuxième Rapport de l'Association des Jardiniers maraichers de la Province de Québec, 1912-1913, pp. 52-71. (A general account of the chief destructive vegetable insects: cut-worms, root maggots, etc.).

53. GIBSON, ARTHUR.
A new destructive Cutworm of the genus Porosagrotis occurring in Western Canada. Jour. of Econ. Ent., vol. 7, No. 2, pp. 201-203, April, 1914. (Describes the work of *Porosagrotis orthogonia* in southern Alberta, a most destructive species, which, in 1912, destroyed over 30,000 acres of grain).

54. GIBSON, ARTHUR.
Insects of the year in the Ottawa District. 44th Annual Report, Ent. Soc. Ont., pp. 15-18, 1914. (Brief notes on species destructive to field crops, forest and shade trees, and greenhouse and garden plants, 2 figs.).

55. GIBSON, ARTHUR.
The Entomological Record for 1913. 44th Annual Report, Ent. Soc. Ont., 1914, pp. 106-129. (The thirteenth annual publication of this Record of captures of new and rare insects made by collectors throughout Canada, in the *Lepidoptera, Coleoptera, Diptera, Hymenoptera, Hemiptera, Isoptera, Archiptera, Neuroptera, Trichoptera, Odonata* and *Thysanura*. References are also given to the literature of the year).

56. Gibson, Arthur.
The Preparatory Stages of *Diacrisia kasloa*, Dyar.—Proc. B.C. Ent. Soc., No. 4, n.s., Jan., 1914, pp. 50,51. (Descriptions of the egg, larval stages and pupa).

57. Gibson, Arthur.
Insects affecting the Tomato. Farmers' Advocate, Feb., 12, 1915.

58. Gibson, Arthur.
The Injurious Flea-beetles of the Province of Quebec. 6th Annual Report, Quebec Society for Protection of Plants from Insects and Fungus Diseases, pp. 25-30, 1914. (Seven species discussed and methods of control given.)

59. Gibson, Arthur.
A New Elachistid Moth from Manitoba. Can. Ent., vol. 46, pp. 423, 424, Dec., 1914. (*Heliodines nyctaginella*, n.sp., described from Aweme, Man.).

60. Gibson, Arthur.
The Army-worm outbreak of 1914. Census and Statistics Monthly, vol. 7, No. 73, pp. 232-234, Sept., 1914. (A preliminary statement of the very serious infestation which occurred in Ontario, Quebec, New Brunswick and Nova Scotia.)

61. Gibson, Arthur.
The Burdock Gelechiid—an insect seed destroyer. Ottawa Naturalist, vol. 28, p. 96, Oct., 1914.

62. Gibson, Arthur.
The control of Insects infesting Mills and Warehouses—Agricultural Gazette of Canada, vol. 1, No. 12, Dec., 1914, pp. 961-963. (Describes experiments carried on to control such insects by superheating; fumigation with bisulphide of carbon also briefly discussed).

63. Hadwen, S.
Notes on the life-histories of Blood-sucking Diptera of British Columbia, with special reference to the Tabanidae. Proc. B.C. Ent. Soc., No. 4, n.s. pp. 46-49, 1914. (A list with data and localities of seventeen species of Tabanidae, and notes on Mosquitoes and other blood-sucking flies).

64. Hampson, Sir George F.
Catalogue of the Lepidoptera Phalaenae in the British Museum, vol. 13, Noctuidae, 609 pages, plates 222-239, 1914. (Gives the classification of the remainder of the sub-family Catocalinae and of the *Mominae* and *Phytometrinae:* 70 genera and 679 species are dealt with. The volume is of special interest to Canadians as it treats of the old genus Plusia and others represented in this country).

65. Hanham, A. W.
Sunflowers as a lure for the Plusiidae. Can. Ent., vol. 46, pp. 145-147, April, 1914. (Relates the capture of a dozen species of this family and several other moths at Sunflowers).

66. HARCOURT, G.
The Control of Injurious Insects. Agric. Gazette of Canada, vol. i, No. 10, p. 815, Oct., 1914. (States that the ravages of insects in the Province of Alberta are so slight that no official steps have been taken to control them. The only cases mentioned are Cutworms in the southern parts, and Cabbage and Onion root maggots in various places).

67. HEWITT, C. GORDON.
The occurrence of the Warble Fly (*Hypoderma bovis*. De Geer) in Canada. Can. Ent., vol. 46, pp. 1,2, 1914. (Attention is called to the occurrence of the species of *H. bovis* in Canada in addition to *H. lineata* which has been usually considered to be the only species occurring in North America).

68. HEWITT, C. GORDON.
On the predaceous habits of *Scatophaga*, a new enemy of *Musca domestica*. Can. Ent., vol. 46, 2,3, 1914. (Contains records of the capture of species of *Scatophaga* preying on *M. domestica* and other Muscid flies).

69. HEWITT, C. GORDON.
Note on the occurrence of the Felted Beech Coccus, (*Crytococcus fagi*, Baerens Dougl.) in Nova Scotia. Can. Ent., vol. 46, pp. 15, 16. (The occurrence of this European species on beech near Halifax, N.S., is recorded and remedial measures are discussed).

70. HEWITT, C. GORDON.
The Protection of Birds in and around Ottawa—Ottawa Naturalist, vol. 27, pp. 161-171, 2 figs., 3 pls., March, 1914. (An abstract of an address dealing with the economic value of the commoner species of birds occurring in the Ottawa district. Methods of encouraging and protecting our native birds are described and an announcement is made of the establishment of two bird sanctuaries at Ottawa in which nesting boxes have been distributed).

71. HEWITT, C. GORDON.
Sterility in Oats caused by Thrips. Journ. Econ. Ent., vol. 7, pp. 211-218, 1 fig., 1 pl., 1914. (Observations are recorded indicating that sterility of oats or "White-eared" conditions of the inflorescence can be produced by the Grass Thrips (*Anaphothrips striatus*).

72. HEWITT, C. GORDON.
Bibliography of Canadian Entomology for 1912—Trans. Roy. Soc. Can., III Ser., vol. 7, Sect. IV., pp. 161-173, 1914.

73. HEWITT, C. GORDON.
The occurrence of a Slug in the Human Stomach,—Parasitology, vol. 7, No. 2, 1914. (The occurrence of a species of *Limax* in the human stomach is recorded). (Non-antomological).

74. HEWITT, C. GORDON.
Further observations on the breeding habits and control of the House-fly (*Musca domestica*). Journ. Econ. Ent., vol. 7, pp. 281-289, 2 figs., 1914. (The results are given of a series of experiments on the control of

M. domestica in stable manure by means of various insecticidal substances. Notes are also given on the larval habits, etc.).

75. Hewitt, C. Gordon.
The Canadian Entomological Service—Science, vol. 39, pp. 570,571. Account also in Agricultural Gazette of Canada, vol. 1, pp. 270-274, April, 1914. (A brief history of the development of the Canadian Entomological Service from its origin in 1884 is given).

76. Hewitt, C. Gordon.
Report from the Division of Entomology for the Fiscal Year ending March 31, 1913. Ann. Rept. Dom. Experimental Farms, 1912-13, pp. 501-518, 1914. (The report contains a summary of the administrative work and the investigations carried on by the officers of the Entomological Service. The work is reported under the following sections: 1. The administration of the Destructive Insect and Pest Act, including (a) Inspection and fumigation of imported nursery stock, etc., (b) Field work against the Brown-tail Moth and parasite introduction. 2. Insects affecting field crops. 3. Insects affecting fruit crops. 4. Insects affecting forest and shade trees. 5. Insects affecting domestic animals and man. 6. Insects affecting garden and greenhouse. 7. Agriculture. 8. Miscellaneous work).

77. Hewitt, C. Gordon.
House-fly suppression with Notes on Recent Work. Bulletin Women's Municipal League of Boston, vol. 5, No. 6, pp. 9-13, May, 1913. (Abstract of an address delivered before the Women's Municipal League of Boston, Mass., bringing together the latest work on the subject).

78. Hewitt, C. Gordon.
Instructions to Importers of Trees, Plants and other Nursery Stock into Canada. Entomological Circular No. 4. Dept. of Agric., Canada, 11 pp. Also Revised Edition, 14 pp., 1914. (Contains the Destructive Insect and Pest Act, together with the Regulations under the Act governing the importation of nursery stock into Canada. The Regulations are fully explained).

79. Hewitt, C. Gordon.
The Control of Insect Pests in Manitoba, with particular reference to the Enemies of Horticulture and Forestry. Rept. 15th and 16th. Ann. Convention Manitoba Hort. and Forestry Assn., Winnipeg, pp. 101-108, 1914. (A general account of the chief insects affecting forestry and horticulture in Manitoba and their control).

80. Hewitt, C. Gordon.
Observations on the Feeding Habits of the Stable-fly (*Stomoxys calcitrans*, L.). Trans. Roy. Soc. Canada, Ser. III, vol. 8, Section IV, pp. 37-42, 1 table, 1 pl., 1914. (A record of a series of experiments on the feeding habits of *S. calcitrans* with a description of its habits in sucking and digesting blood).

81. HEWITT, C. GORDON.
The House-fly (*Musca domestica*, Linn.). Its Structure, Habits, Development, Relation to Disease and Control. pp. xvi + 382, 104 illustrations, 3 cold. plates. Cambridge Univ. Press, England, 1914. (A complete monograph on *M. domestica*).

82. HUARD, V. A.
Rapport de l'Entomologiste du Ministère de l'Agriculture pour l'année 1912-1913. Le Naturaliste Canadien, vol. 40, pp. 124-128, Février; pp. 157-160, Avril; pp. 180-191, Juin, 1914. (This first report of the Provincial Entomologist for Quebec was begun in the number of the magazine for December, 1913).

83. HUDSON, H. F.
The Chinch Bug in Ontario. Entomological Circular No. 3. Division of Entomology, Department of Agriculture, Ottawa, pp. 13, 3 figs. Feb., 1914. (Account of an infestation by this insect in the County of Middlesex, Ont., and a life-history of the bug and means of control).

84. HUDSON, H. F.
Lucilia sericata, Meigen, attacking a live calf. Can. Ent., vol. 46, p. 416, December, 1914.

85. KNAB, FREDERICK.
A new Mesembrine Fly. Can. Ent., vol. 46, pp. 325, 326, September, 1914. (Describes a Dipterous fly taken at High River, Alberta, and elsewhere).

86. LOCHHEAD, W.
Insects and Disease. President's Address. 6th Annual Report, Quebec Soc. Prot. Plants, etc., pp. 10-21, 1913-1914. (An account, with illustrations, of the transmission of diseases through the agency of insects and ticks).

87. LOCHHEAD, W.
Some useful keys to some important economic Insects. 6th Annual Report, Quebec Soc. Prot. Plants, etc., pp. 79-85, 1913-1914. (Gives keys to the chief sub-families and genera of the Coccidae and Aphididae, and a few of the genera of Carabidae, Elateridae, Chyrsomelidae and Muscidae; also to the species chiefly injurious to stored grain).

88. LOCHHEAD, W.
The Control of Injurious Insects. Agric. Gazette of Canada, vol. 1, No. 10, pp. 799-804, Oct., 1914. (Describes the work being carried on in the Province of Quebec; records the principal insects of the season and states the lesson that should be learned from the year's experience).

89. MACGILLIVRAY, A. D.
New genera and species of Tenthredinidae, a family of Hymenoptera. Can. Ent., vol. 46, pp. 103-108, March, 1914. (Includes the description of a new genus *Astochus*, and a new species *A. Fletcheri*, taken by the late Dr. James Fletcher at Kaslo, B.C.).

90. MacGillivray, A. D.
New genera and species of Sawflies.—Can. Ent., vol. 46, pp. 363-367, October, 1914. (Includes a new species, *Metallus Bethunei,* bred by Prof Caesar from a leaf-mining larva on blackberry in the Niagara fruit district).

91. MacGillivray, A. D.
The immature stages of the Tenthredinidae. 44th Annual Report, Ent. Soc. Ont., pp. 54-75, plate, 1914. (An important contribution to the knowledge of the family of Sawflies).

92. Macnamara, C.
The Snow-flea. Ottawa Naturalist, vol. 28, pp. 110-112, November, 1914. (An interesting account of these tiny insects of the sub-order Collembola observed at Arnprior, Ont., during the winter months).

93. Malloch, J. R.
American Black-flies or Buffalo Gnats. U. S. Bureau of Entomology, Technical Series, No. 26, pp. 72, six plates, April, 1914. (Several new species are described from British Columbia: *Prosimulium pleurale* and *mutatum*; *Simulium arcticum* and *hunteri*; other species are recorded from B.C., Alberta, Sask., and Labrador).

94. Matheson, R.
The San Jose Scale in Nova Scotia. Journ. Econ. Ent., vol. 7, No. 1, pp. 141-146, map, February, 1914. (Reports the discovery of the Scale in 1911 and the measures of control subsequently adopted).

95. Matheson, R.
Insects injurious to Vegetables. Annual Report of the Secretary for Agriculture, Province of Nova Scotia, for the year 1913, pp. 78-91, Halifax, 1914. (Treats of methods of control and describes briefly the most common injurious species).

96. Matheson, R.
Life-history of a Dytiscid Beetle (*Hydroporus septentrionalis*, Gyll). Can. Ent., vol. 46, pp. 37-40, plate and figures, February, 1914.

97. Matheson, R.
Life-history notes on two Coleoptera (Parnidae).—Can. Ent., vol. 46, pp. 185-189, plate xii, June, 1914. (Describes and figures the aquatic species *Psephenus Lecontei* and *Stenelmis bicarinatus* observed in Nova Scotia).

98. Matheson, R.
Notes on *Hydrophilus triangularis*, Say. Can. Ent., vol. 46, pp. 337-343, plate and figures, October, 1914. (Describes and illustrates the eggs and their cases, the larva and pupa of this large water-beetle).

99. Moorhouse, H. J.
The Control of Injurious Insects. Agric. Gazette of Canada, vol. 1, No. 10, pp. 809-812, Oct., 1914. (Gives an account of the injurious insects

of the season in Manitoba and what is being done in the Province for their control. The lessons to be learnt are briefly stated).

100. MORRIS, F. J. A.
Insects of the year in the Peterborough District. 44th Annual Report, Ent. Soc. Ont., pp. 21,22, 1914. (Notes on Tent Caterpillars, Aphids and other injurious insects; a list of the principal Lepidoptera taken at Port Hope, and a notice of the exhibits made by school children).

101. MORRIS, F. J. A.
The Chrysomelians of Ontario. Can. Ent., vol. 46, pp. 4-13, January, 1914. (Concluding portion of a paper begun in the previous volume; contains field observations in the neighbourhood of Port Hope on many species of these beetles).

102. MORRIS, F. J. A.
Chrysomelians of Ontario. 44th Annual Report, Ent. Soc. Ont., pp. 83-94, 1914. (Describes in a popular manner the various species of beetles of this family found during rambles in the neighborhood of Port Hope). Also in Can. Ent., vol. 45, pp. 384-392, November, 1913, and vol. 46, pp. 4-13, January, 1914.

103. REHN, J. A. G., and HEBARD, M.
Studies in American Tettigoniidae (Orthoptera). I. A Synopsis of the genus Scudderia. II. A Synopsis of the species of the genus Amblycorypha found in America north of Mexico. Trans. Am. Ent. Soc., Phil., vol. 40, pp. 271-344, four plates, Dec., 1914. (The keys and descriptions include the species found in Canada).

104. REHN, J. A. G., and HEBARD, M.
Studies in American Tettigoniidae (Orthoptera). III. A Synopsis of the species of the genus Neoconocephalus found in North America north of Mexico. Trans. Am. Ent. Soc., Phil., vol. 40, pp. 365-413, two plates, 12 figs., Dec., 1914. (Includes the species found in Canada).

105. ROSS, W. A.
Insects of the year in the Niagara District. 44th Annual Report, Ent. Soc. Ont., pp. 23-25, 1914. (Notes on Orchard, Greenhouse, Garden and other insect pests, and an account of experiments for destroying Sowbugs).

106. SANDERS, G. E.
The work of the Dominion Entomological Laboratory at Bridgetown, Nova Scotia. Annual Report for 1914. Fruit Growers' Assoc. of Nova Scotia. pp. 151-165. (Describes the measures employed for the control of the Brown-tail Moth, the Bud-moth and Fruit-caterpillars, and gives a life-history of the species of Xylina that has proved most injurious).

107. SCHAEFFER, CHARLES.
A short review of the North American species of Onthophagus (Coleoptera, Scarabaeidae). Journ. New York Ent. Soc., vol. 22, No. 4, pp. 290-300, Dec., 1914. (Includes a table of the species and descriptive notes; at least five of the species are taken in Canada).

108. SEVERIN, H. H. P.
A review of the work on the poisoned bait spray, dry method and mixed treatment of controlling Fruit-flies (Trypetidae). Can. Ent., vol. 46, pp. 243-246, July, 1914; ibid, pp. 277-284, figs., August; ibid, pp. 309-314, September.

109. SIMMS, H. M.
Euptoieta claudia at Montreal. Ent. News, vol. 25, No. 3, p. 109, March, 1914. (Records the capture of specimens of this butterfly which has rarely been observed in Canada).

110. SKINNER, HENRY.
Obituary notice of the late Mr. and Mrs. H. H. Lyman. Ent. News, vol. 25, No. 7, pp. 335,336, July, 1914.

111. SKINNER, HENRY.
Studies in the genus Thanaos. Trans. Am. Ent. Soc., Phil., vol. 40, pp. 195-221, 14 figures, Sept., 1914. (A revision of this difficult group of butterflies based upon studies of the genitalia, of which figures are given. Occurrence in Canada is recorded of many of the species).

112. SWAINE, J. M.
Forest Insect Conditions in British Columbia. Ent. Bull. No. 7, Div. Ent., Ottawa. (A preliminary report dealing chiefly with the destructive bark-beetles of B.C. forests and methods for their control. Many illustrations are given).

113. SWAINE, J. M.
Insects and the Forest. 6th Annual Report, Quebec Soc., Prot. of Plants, pp. 53-56, 1914. (Relates the injuries to forest trees caused by boring beetles and defoliating caterpillars).

114. SWAINE, J. M.
Forest Insect Damage in British Columbia. Rept. Forest Branch of B.C., 1913, pp. 23-27, 1914.

115. SWAINE, J. M.
Winter Control of Insects in Farm Woodlots—Agric. Gazette, pp. 861, 862, Nov., 1914.

116. TOTHILL, J. D.
List of Tachinidae from the Province of Quebec—Ottawa Naturalist, vol. 28, pp. 113-116, December, 1914. (Enumerates forty species which have so far been taken).

117. TREHERNE, R. C.
Insects economically important in the Lower Fraser Valley. Proc. B. C. Ent. Soc., No. 4, n.s., pp. 19-33, 1914. (Brief life-histories of a large number of insects affecting fruits, vegetables, greenhouse and garden plants, and methods of control).

118. Treherne, R. C.
A review of applied Entomology in British Columbia. Proc. B.C. Ent. Soc., No. 4, n.s., pp. 67-71, 1914. (A record of work done in economic entomology during the last twenty-five years).

119. Treherne, R. C.
The Strawberry Root-weevil (*Otiorhyncus ovatus*, Linn.) in British Columbia, with notes on other Insects attacking Strawberry Plants in the Lower Fraser Valley—Bull. No. 8, Division of Entomology, Experimental Farms, Ottawa, p. 44, seven figures, 1914. (Gives a full life-history and remedial measures for the Root-weevil and brief notes on other noxious insects).

120. Van Duzee, E. P.
Nomenclatural and critical notes on Hemiptera. Can. Ent. vol. 46, pp. 377-389, Nov., 1914. (Discusses the synonymy of a large number of genera and species).

121. Venables, E. P.
A note upon the food habits of adult Tenthredinidae. Can. Ent., vol. 46, p. 121, April, 1914. (Relates the feeding of the adult Sawfly, *Tenthredo variegatus*, on house-flies).

122. Venables, E. P.
Some observations on the Hymenoptera of the Okanagan. Proc. B.C. Ent. Soc., No. 4, n.s., pp. 61-63, 1914. (Records the capture of a considerable number of species and gives some observations on the doings of Ants).

123. Walker, E. M.
A new species of Orthoptera, forming a new genus and family. Can. Ent., vol. 46, pp. 93-99, plate vi, March, 1914. (Relates the discovery of a most remarkable insect which differs from all the known families of Orthoptera, while bearing resemblances to the Blattidae and Gryllidae. The author names the family *Gryloblattidae* and the genus and species *Grylloblatta campodeiformis*. Figures are given of the imago and some structural details).

124. Walker, E. M.
The known Nymphs of the Canadian species of Lestes (Odonata). Can. Ent., vol. 46, pp. 189-200, plates xiii and xiv, June, 1914. (Descriptions and figures of eight species.)

125. Walker, E. M.
New and little-known Nymphs of Canadian Odonata—Can. Ent., vol. 46, pp. 349-357, plate and figures, October, 1914. Ibid, pp. 369-377 plate, November. (An important paper describing and illustrating the nymphal stage of a large number of Dragon flies).

126. Webster, F. M.
Applied Entomology for the Farmer. 44th Annual Report, Ent. Soc. Ont., pp. 94-97, 1914. (Contrasts the conditions respecting the knowledge

and application of Economic Entomology twenty-five years ago with those of the present time).

127. WEISS, H. B.
Insects and Pain. Can. Ent., vol. 46, pp. 269-271, August, 1914. (Discusses various theories on the subject and considers that the evidence for assuming that insects do not suffer acute sensations of pain is not by any means complete).

128. WHEELER, W. M.
The American species of Myrmica allied to *M. rubida*, Latr. Psyche, vol. 21, No. 4, pp. 118-122, fig., August, 1914. (Describes two new species, making five in this group which the author forms into a sub-genus, *Oreomyrma*. A full description is given of *M. mutica*, Emery, recorded from Alberta and British Columbia as well as from several western States).

129. WILLING, T. N.
The Control of Injurious Insects. Agric. Gazette of Canada, vol. 1, No. 10, pp. 812-814, Oct., 1914. (Gives an account of recent insect injuries in the Province of Saskatchewan and of what is being done there in Ecomomic Entomology).

130. WILSON, TOM.
The Tent-caterpillar. Proc. B. C. Ent. Soc., No. 4, n.s., pp. 36-38, 1914. (Gives an account of the abundance or scarcity during the last nineteen years of the caterpillars of *Malacosoma disstria*, var. *erosa*).

131. WINN, A. F.
Notes on the eggs of *Macronoctua onusta*, Grote. Can. Ent., vol. 46, p. 296, August, 1914. (Describes the eggs of this moth and relates how and where they are laid).

132. WINSLOW, R. M.
The Insect Pests of the Year. Agric. Gazette of Canada, vol. I, No. 10, pp. 817,818, Oct., 1914. (A brief account of those unusually troublesome in British Columbia).

133. WOLLEY DOD, F. H.
Further notes on Alberta Lepidoptera. Can. Ent., vol. 46, pp. 393-403, November, 1914. (Continuation of a series of papers, the present notes numbering from 531 to 602).

ADDENDUM.

134. MORLEY, CLAUDE.
A revision of the Ichneumonidæ based on the collection in the British Museum, Part III, pp. 148, one coloured plate, 1914. (Records are given of 15 species, two of them new, from Canada). Part I appeared in 1912 and Part II in 1913.

Bibliography of Canadian Geology for 1914.

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SERIALS EXAMIEND.

Academy of Natural Sciences of Philadelphia: Proceedings, vol. 65, part 3; vol. 66, parts 1 and 2. Philadelphia, Pa.

Alpine Journal, vol. 28. London, England.

American Academy of Arts and Sciences: Proceedings, vol. 49, nos. 11-12; vol. 50, nos. 1-5. Boston, Mass.

American Ceramic Society: Transactions, vol. 16. Columbia, Ohio.

American Geographical Society: Bulletin, vol. 46. New York.

American Institute of Mining Engineers: Transactions, vol. 44. New York.

American Journal of Science, 4th series, vols. 37 and 38. New Haven, Conn.

American Museum of Natural History: Journal, vol. 14; Bulletin, vol. 33. New York.

American Peat Society: Journal, vol. 7. Toledo, Ohio.

American Philosophical Society: Proceedings, vol. 53. Philadelphia, Pa.

Annales des Mines, 11e sér., t. 5 (1-7). Paris, France.

Annals and Magazine of Natural History, Including Zoology, Botany, and Geology, 8th series, vols. 13-14. London, England.

Appalachia, vol. 13, no. 2. Boston, Mass.

Applied Science, new series, vol. 8, nos. 9-12; vol. 9, nos. 1-8. Toronto, Ont.

Association of Ontario Land Surveyors: Annual Report no. 29. Toronto, Ont.

British Association for the Advancement of Science, Report of the 83rd meeting, 1913. London, England.

British Columbia, Annual Report of the Minister of Mines for the Year Ending 31st December, 1913. Victoria, B.C.

Canada, Department of Mines, Geological Survey: Summary report for 1912; Memoirs 19, 20, 22, 23, 25, 30, 32, 36, 39, 40, 41, 42, 43, 44, 45, 47, 48, 49, 51, 52, 53, 54, 55, 61; Museum Bulletins nos. 2, 3, 4, 5, 7, 8; Prospector's Handbook 1; (Publications) 1290, 1380. Ottawa, Ont.

Canada, Department of Mines, Mines Branch: (Publications), nos. 203, 209, 222, 245, 254, 259, 262, 283, 303, 316. Ottawa, Ont.

Canadian Alpine Journal, vol. 5. Banff, Alta.

Canadian Engineer, vols. 26-27. Toronto, Ont.

Canadian Mining Institute: Bulletin, nos. 23-32. Montreal, Quebec.

Canadian Mining Journal, vol. 35. Toronto, Ont.

Canadian Peat Society: Journal, vol. 3, nos. 1-3. Ottawa, Ont.

Canadian Society of Civil Engineers: Transactions, vol. 27, part 2; vol. 28, part 1. Montreal, Que.

Centralblatt fur Mineralogie, Geologie und Paläontologie, Jahrgang, 1914, nos. 1-14. Stuttgart, Germany.

Cincinnati Society of Natural History: Journal, vol. 21, no. 4. Cincinnati, Ohio.

Coal Age, vols. 5-6. New York.

Colliery Engineer, vol. 34, nos. 6-12; vol. 35, nos. 1-5. Scranton, Pa.

Deutschen Geologischen Gesellschaft: Zeitschrift, Abhandlungen, Bd. 65, H4, Bd. 66, H.1.; Monatsberichte, Bd. 65, Nr. 8-12, Bd. 66, Nr. 1-3. Berlin, Germany.

Economic Geology, vol. 9. Lancaster, Pa.

Engineering Magazine, vol. 46, no. 5 to vol. 48, no. 3. New York.

Engineering and Mining Journal, vols. 97-98. New York.

Franklin Institute: Journal, vols. 177-178. Philadelphia, Pa.

Geographical Journal, vols. 43-44. London, England.

Geographical Society of Philadelphia: Bulletin, vol. 12. Philadelphia, Pa.

Geological Magazine, decade 6, vol. 1. London, England.

Geological Society of America: Bulletin, vol. 25. New York.

Geological Society of London: Quarterly Journal, vol. 70, parts 1-3. London, England.

Geologische and Palaeontologische Abhandlungen, Bd. 12, H.4 and 5, Bd. 13, H. 1. Jena, Germany.

Geologists Association, London: Proceedings, vol. 25. London, England.

Harvard College, Museum of Comparative Zoology; Bulletins, vol. 55, no. 3; vol. 56, no. 2; vol. 57, no. 3; vol. 58, nos. 2-11; Memoirs, vol. 44, no. 2. Cambridge, Mass.

Industrial Advocate, vol. 19, nos. 3-12; vol. 20, nos. 1-2. Halifax, N.S.

Institution of Mining and Metallurgy: Transactions, vol. 22. London, England.

Institution of Mining Engineers: Transactions, vol. 46, parts 2-5; vol. 47; vol. 48, part 1. London, England.

Journal of Geology, vol. 22. Chicago, Ill.

Lake Superior Mining Institute: Proceedings, vol. 19. Ishpeming, Mich.

Manitoba Engineer, vol. 3, no. 1. Winnipeg, Man.

Maritime Mining Record, vol. 16, nos. 13-24; vol. 17, nos. 1-12. Stellarton, N.S.

Mineralogical Magazine and Journal of the Mineralogical Society; vol. 17, no. 79. London, England.

Mining Engineering and Electrical Record, vol. 19, nos. 6-10. Vancouver, B.C.

Mining and Engineering World, vols. 40-41. Chicago, Ill.

Mining Journal, vols. 104-107. London, England.

Mining Magazine, vols. 10-11. London, England.

Mining and Scientific Press, vols. 108-109. San Francisco, Cal.

Mining Science, vols. 69-70. Denver, Col.

National Geographic Magazine, vols. 25-26. Washington, D.C.

Naturaliste Canadien, vol. 40, nos. 7-12; vol. 41, nos. 1-6. Quebec.

Nature, vol. 92, p. 497 to vol. 94, p. 526. London, England.

Neues Jahrbuch für Mineralogie, Geologie und Paläontologie: Jahrgang, 1914, Bd.1, H.1-3; Beilage-Band 37 and 38, H.1. Stuttgart, Germany.

New York Academy of Sciences: Annals, vol. 23, pp. 145-353; vol. 24, pp. 1-170. New York.

Nova Scotia, Report of the Department of Mines, 1913. Halifax, N.S.

Ohio Naturalist, vol. 14, nos. 3-5; vol. 15, nos. 1-2. Columbus, Ohio.

Ontario Bureau of Mines: Ann. Report, vol. 22, part 2; vol. 23, parts 1-2; Bulletins 18-22. Toronto, Ont.

Ottawa Naturalist, vol. 27, nos. 10-12; vol. 28, nos. 1-9. Ottawa, Ont.

Palæontographica, Bd. 61, L. 1-3; Supplement IV, Ab. 2, L.2. Stuttgart, Germany.

Quebec, Department of Colonization, Mines and Fisheries, Mines Branch: Report on mining operations in the Province of Quebec during the year 1913.

Royal Society of Canada: Proceedings and Transactions, 3rd series, vol. 7; Transactions 3rd series, vol. 8, sec. 1 and 2, pp. 1-214, sec. 3, pp. 1-98, sec. 4, pp. 1-119. Ottawa, Ont.

School of Mines Quarterly, vol. 35, nos. 2-4. New York.

Science, new series, vols. 39 and 40. New York.

Science Conspectus, vol. 4. Boston, Mass.

Scientific Laboratories of Denison University: Bulletin, vol. 17, pp. 247-373. Granville, Ohio.

Smithsonian Institution: Annual Report 1913; Miscellaneous Collections, vol. 57, no. 13; vol. 61, nos. 18, 22-25; vol. 62, nos. 2-3; vol. 63, nos. 1-10; vol. 64, nos. 1-2. Washington, D.C.

Société Géologique de Belgique: Annales t. 39, l.5; t. 40, l.3, t. 41, l.1. Liege, Belgium.

Société de Géographie de Québec: Bulletin, vol. 8. Québec, Que.

Timiskaming and Northern Ontario Railway Commission: The mining industry in that part of northern Ontario served by the Timiskaming and Northern Ontario Railway, 1913. Toronto, Ont.

United Empire, vol. 5. London, England.

United States National Museum; Proceedings, vol. 46, pp. 473-681; vol. 47, pp. 1-564; vol. 48, pp. 1-58, 115-193; Bulletins 50 (pt. 6), 83-87, 89. Washington, D.C.

Washington Academy of Sciences, vol. 4. Washington, D.C.

Zeitschrift für Krystallographie und Mineralogie: Bd. 53, H.4-6, Bd. 54, H. 1-2. Leipzig, Germany.

Zeitschrift für praktische Geologie, Jahrang 22, H.1-7. Berlin, Germany.

Bibliography.

Abbott, George.

Is "Atikokania lawsoni" a concretion?—Nature, vol. 94, pp. 477-478, 1 fig., December 31, 1914.

Adams, Frank D.

1. A graphic method of representing the chemical relations of a petrographic province.—Jour. Geol., vol. 22, no. 7, pp. 689-693, 2 figs., October-November, 1914; Abstract: Geol. Soc. Am., Bull., vol. 25, no. 1, p. 43, March, 1914.
2. History of mining in the Province (of Quebec).—Canada and Its Provinces, vol. 16, pp. 571-598, 3 pls. Publishers' Association of Canada, Limited, Toronto, 1914.
3. The national domain in Canada and its proper conservation.—Roy. Soc. Can., 3rd ser., vol. 8, pp. xxxix-lxxii, illus., 2 maps, 1914.

Alden, Wm., C.

Early Pleistocene glaciation in the Rocky Mountains of Glacier National park, Montana.—Congrès Géologique International, Compte-rendu de la XIIe session, Canada, 1913, pp. 479-484, 5 figs., 1914.

ALLAN, JOHN A.

1. Geology of Field map-area, B.C., and Alberta.—Canada, Dept. of Mines, Geol. Surv., Memoir 55, 312 pp. 21 pls., 5 figs., 1 map, 1914.
2. Rocky Mountain section between Banff, Alta., and Golden, B.C., along the Canadian Pacific railway.—Canada, Dept. of Mines, Geol. Surv., Summary Rept., 1912, pp. 165-176, 1914.

AMI, H. M.

Dr. Alfred Barlow.—Geol. Mag., decade 6, vol. 1, No. 601, pp. 335-336, July, 1914.

ANONYMOUS.

1. The Calgary oil field.—Industrial Advocate, vol. 19, no. 8, pp. 9-10, June, 1914.
   Quoted from the Financier and Bullionist of London, England.
2. The Dominion Coal Company, Limited.—Can. Min. Jour., vol. 35, no. 17, pp. 579-587, 11 figs., September 1, 1914.
3. Gold and silver mining in northern Ontario.—Can. Min. Jour., vol. 35, no. 9, pp. 298-300, 6 figs., May 1, 1914.
4. Mineral prospects on the Upper Duncan river, B.C.—Min. Eng. and Electrical Record, vol. 19, no. 6, pp. 127-128, January, 1914.
5. (Mining in) Ontario.—Min. and Eng. World, vol. 40, no. 4, pp. 211-213, January 24, 1914.
6. Petrographic range of road-building materials.—Canadian Engineer, vol. 27, no. 10, pp. 393-395, September 3, 1914.
7. Progress on the Mount Royal tunnel.—Can. Eng., vol. 26, no. 6, pp. 292-296, 5 figs., February 5, 1914.
8. Radiferous minerals in Canada.—Min. Jour., vol. 105, no. 4104, p. 374, April 18, 1914.
9. Tin in British Columbia.—Min. Eng. and Electrical Record, vol. 19, no. 6, p. 133, January, 1914.
10. Varieties of coal.—Maritime Min. Record, vol. 16, no. 17, pp. 9-11, March 11, 1914.
11. W. F. Sutton.—Can. Min. Inst., Bull. 27, pp. 49-51, 1 fig., July, 1914.

ANTEN. J.

La question de la profondeur de la zone de déformation plastique des roches et les experiences de tectonique de Max Lohest.—Soc. Geol. de Belgique, Annals, t. 40, l. 3, p. 437-446, 2 figs., December 15, 1913.

ARDAGH, E. G. R.

Analyses Ontario natural gases.—See Ellis, Bain and Ardagh.

BACH, RUDOLPH.

Ein prächtiges Dinosaurier-Exemplar.—Prometheus, Jahrgang 25, Nr. 22, pp. 347-348, 1 fig., February 28, 1914.

BAIN, J. W.

Analyses Ontario natural gaess.—See Ellis, Bain and Ardagh.

BAKER, HOWARD B.

The origin of continental forms, II.—Mich. Acad. Sc., 14th Rept., pp. 116-141, 1912.

BANCROFT, J. AUSTEN.

1. Geology of the coast and islands between the Strait of Georgia and Queen Charlotte Sound, B.C.—Canada, Dept. of Mines, Geol. Surv., Memoir 23, 152 pp., 17 pls., 5 figs., 1 diag., 1 map, 1913.
2. Preliminary report on some copper deposits of the Eastern Townships.—Quebec, Dept. of Colonization, Mines, and Fisheries, Mines Branch, Report on Mining Operations in the Province of Quebec during the year 1913, pp. 48-54, 2 figs., 1914.

BARRELL, JOSEPH.

1. The upper Devonian delta of the Appalachian geosyncline.—Am. Jour. Sc., vol. 37, no. 217, pp. 87-109, 1 fig., January; no. 219, pp. 225-253, 1 fig., March, 1914.
2. A revised geologic time-table for North America.—See Schuchert and Barrell.

BATEMAN, A. M.

1. Exploration between Lillooet and Chilko lake, British Columbia.—Canada, Dept. of Mines, Geol. Surv., Summary Rept., 1912, pp. 177-187, 1 fig., 1914.
2. Lillooet map-area, British Columbia.—Canada, Dept. of Mines, Geol. Surv., Summary Rept., 1912, pp. 188-210, 1 map, 1914.

BATHER, F. A.

Studies in *Edrioasteroidea*.—Geol. Mag., new series, decade 6, vol. 1, no. 5, pp. 193-203, 1 pl. 6 figs., May, 1914.

BELL, J. MACKINTOSH.

1. The ore deposits of Cobalt.—Min. Mag., vol. 10, no. 2, pp. 126-132, 1 pl., 3 figs., February, 1914.
2. Outlook for the mineral industry of Canada.—Abstract: Min. and Eng. World, vol. 40, no. 9, pp. 419-422, February 28, 1914.
3. The outlook for the mineral industry in north central Canada.—Abstract: Min. Jour., vol. 104, no. 4091, pp. 78-79, January 17, 1914.
4. The outlook of the mineral industry in Canada.—Inst. of Min. and Metallurgy, Trans., vol. 23, pp. 245-264, 1 fig., 1914.
5. Discussion of paper by J. B. Tyrrell on "The occurrence of gold in Ontario."—Inst. of Min. and Metallurgy, Trans., vol. 23, pp. 154-156, 1914.

BELL, ROBERT.

The Klondike gold district in the Yukon valley, Canada.—Australian Ass. Adv. Sc. Rept. of Twelfth Meeting, 1909, pp. 282-296, 1910.

BELL, W. A.

Joggins Carboniferous section, Nova Scotia.—Canada, Dept. of Mines, Geol. Surv., Summary Rept., 1912, pp. 360-371, 1914.

BERRY, EDWARD WILBER.

The affinities and distribution of the Lower Eocene flora of southeastern North America.—Am. Phil. Soc., Proc., vol. 53, no. 214, pp. 129-250, June-July, 1914.

BLACKWELDER, ELIOT.
A summary of the orogenic epochs in the geologic history of North America.—Jour. Geol., vol. 22, no. 7, pp. 633-654, October-November, 1914.

BOWEN, NORMAN L.
A geological reconnaissance of the Fraser River valley from Lytton to Vancouver, British Columbia.—Canada, Dept. of Mines, Geol. Surv., Summary Rept., 1912, pp. 108-114, 1914.

BOWLER, LOUIS P.
Oilfields of Northwest Canada.—Min. Jour., vol. 105, no. 4103, p. 344, April 11, 1914.

BRACKENBURY, C.
Notes on the rocks at Levack.—Rept. of Ont. Bur. of Mines, vol. 23, part 1, pp. 194-201, 1 fig., 1914.

BROCK, R. W.
1. Geology and economic minerals (of Canada).—The Canada Year Book, 1913, pp. 41-46, 5 figs., Ottawa, 1914.
2. The oil drilling operations near Calgary.—Can. Min. Inst., Bull. 27, pp. 18-21, July, 1914.
3. Prospecting and leasing.—Min. and Sc. Press, vol. 108, no. 14, p. 582, April 4, 1914.
4. Summary report of the Geological Survey, Department of Mines, Canada, for the calendar year 1912, 544 pp., 2 pls., 11 figs., 9 maps, 1914.

BROWN, BARNUM.
1. *Anchiceratops*, a new genus of horned Dinosaurs from the Edmonton Cretaceous of Alberta, with discussion of the origin of the Ceratopsian crest and the brain casts of *Anchiceratops* and *Trachodon*.—Am. Mus. Nat. Hist., Bull., vol. 33, pp. 539-548, 9 pls., 1 fig., October 8, 1914.
2. *Corythosaurus casuarius*, a new crested Dinosaur from the Belly River Cretaceous, with provisional classification of the family *Trachodontidae*.—Am. Mus. Nat. Hist., Bull., vol. 33, pp. 559-565, 2 pls., October 8, 1914.
3. Cretaceous Eocene correlation in New Mexico, Wyoming, Montana, Alberta.—Geol. Soc. Am., Bull., vol. 25, no. 3, pp. 355-380, September, 1914.
4. *Leptoceratops*, a new genus of *Ceratopsia* from the Edmonton Cretaceous of Alberta.—Am. Mus. Nat. Hist., Bull., vol. 33, pp. 567-580, 1 pl., 19 figs., October 8, 1914.
5. A complete skull of *Monoclonius*, from the Belly River Cretaceous of Alberta —Am. Mus. Nat. Hist., Bull., vol. 33, pp. 549-558, 3 pls., 2 figs., October 8, 1914.

BRUCE, EVEREND, L.
1. Beaver Lake mining district, Saskatchewan.—Can. Min. Jour., vol. 35, no. 15, pp. 504-505, August 1, 1914.
2. Microscopic tests on opaque minerals.—School of Mines Quarterly, vol. 35, no. 3, pp. 187-193, April, 1914.
3. The Swastika gold area.—School of Mines Quarterly, vol. 35, no. 2, pp. 154-165, January, 1914.

BUDDINGTON, ARTHUR F.

Reconnaissance of the Algonkian rocks of southeast Newfoundland.—Abstract: Geol. Soc. Am., Bull., vol. 25, no. 1, p. 40, March, 1914.

BURLING, LANCASTER, D.

1. Cambrian and related Ordovician Brachiopoda—a study of their inclosing sediments.—Geol. Soc. Am. Bull., vol. 25, no. 3, pp. 421-434, September, 1914; Abstract: Geol. Soc. Am., Bull., vol. 25, no. 1, p. 137, March, 1914.
2. Early Cambrian stratigraphy in the North American cordillera, with discussion of the *Albertella* and related faunas.—Canada, Dept. of Mines, Geol. Surv., Museum Bulletin, no. 2, Geol. Ser., no. 17, 37 pp., July 6, 1914.
3. Lower Palaeozoic section of the Alaska-Yukon boundary.—Abstract: Geol. Soc. Am., Bull., vol. 25, no. 1, p. 137, March, 1914.
4. Fossils of the Rocky Mountains park.—Canada, Dept. of Interior, Dominion Parks Branch, Handbook of the Rocky Mountains Park museum, pp. 102-104, 1914.
5. The popularization of palæontology.—Am. Ass. Mus., Proc., vol. 8, pp. 92-97, 1914.

BURROWS, A. G., AND HOPKINS, PERCY E.

The Kirkland Lake and Swastika gold areas and Maisonville, Grenfell and Eby townships.—Ontario Bureau of Mines, Annual Report, vol. 23, part 2, 39 pp., 2 maps and numerous illustrations, 1914.

BURWASH, EDWARD, M.

1. On some new species of marine invertebrates from the Cretaceous of Queen Charlotte Islands.—Roy. Soc. Can., Trans., 3rd ser., vol. 7, sec. 4, pp. 77-89, 3 pls., 1 fig., 1914.
2. Pleistocene vulcanism of the Coast range of British Columbia.—Jour. Geol., vol. 22, no. 3, pp. 260-267, 3 figs., April-May, 1914.

CADELL, H. M.

The Klondike and Yukon goldfield in 1913.—Scottish Geol. Mag., vol. 30, no. 7, pp. 337-356, numerous illustrations, July, 1914.

CAIRNES, D.D.

1. Chisana goldfields.—Can. Min. Inst., Bull., no. 24, pp. 33-64, 13 figs., 1 map, February, 1914.
2. Geology of a portion of the Yukon-Alaska boundary, between Porcupine and Yukon rivers.—Canada, Dept. of Mines, Geol. Surv., Summary Rept., 1912, pp. 9-11, 1914.
3. Geological section along the Yukon-Alaska boundary line between Yukon and Porcupine rivers.—Geol. Soc. Amer., Bull., vol. 25, no. 1, pp. 179-204, 5 pls., 1 fig., March, 1914.
4. Moose Mountain district, Southern Alberta (second edition).—Canada, Dept of Mines, Geol. Surv., Memoir 61, 62 pp., 1 fig., 2 maps, 1914.

CAMSELL, CHARLES.

1. The geology of the Bow River basin.—Canada, Dept. of Interior, Water Power Branch, Report on Bow River Power and Storage Investigations, Seasons 1911-12-13, Appendix 5, pp. 175-185, 1914.

2. The geology of certain portions of Yale district, B.C.—Canada, Dept. of Mines, Geol. Surv., Summary Report, 1912, pp. 211-220, 1914.
3. The waterways of the Mackenzie River basin.—Ottawa Naturalist, vol. 28, no. 2, pp. 21-33, May, 1914.

CANADIAN MINING JOURNAL.
Gold deposits of northern Ontario.—Can. Min. Jour., vol. 35, no. 7, pp. 217-219, April 1, 1914.

CAMPBELL, E. G.
Kirkland Lake ores.—Can. Min. Jour., vol. 35, no. 19, p. 631, October 1, 1914.

CANTLEY, C.L.
Nova Scotia iron ores.—Maritime Mining Record, vol. 16, no. 15, p. 14, February 11, 1914.

CARTWRIGHT, C. E.
The outlook for mining in British Columbia.—Can. Soc. of Civil Eng., Trans., vol. 28, part 1, pp. 122-128, 1914.

CHAMBERLAIN, ROLLIN T.
Diastrophism and the formative processes. VII Periodicity of Palaeozoic orogenic movements.—Jour. Geol. vol. 22, no. 4, pp. 315-345, May-June 1914.

CLAPP, CHARLES, H.
1. A geological reconnaissance on Graham Island, Queen Charlotte group, B.C.—Canada, Dept. of Mines, Geol. Surv., Summary Rept., 1912, pp. 12-40, 4 figs., 1914.
2. Geology of the Victoria and Saanich map-areas, Vancouver Island, B.C.—Canada, Dept. of Mines, Geol. Surv., Memoir 36, 143 pp., 18 pls., 6 figs., 4 maps, 1913.
3. Geology of the Nanaimo map-area.—Canada, Dept. of Mines, Geol. Surv., Memoir 51, 135 pp., 13 pls., 10 figs., 4 maps, 1914.
4. Geology of portions of the Sooke and Duncan map-areas, Vancouver island, British Columbia.—Canada, Dept. of Mines, Geol. Surv., Summary Rept., 1912, pp. 41-54, 1914.

COLE, ARTHUR A.
The mining industry in that part of northern Ontario served by the Timiskaming and Northern Ontario railway, calendar year 1913, 74 pp., illustrations. Timiskaming and Northern Ontario Railway Commission, 1914.

COLE, L. H.
Gypsum in Canada, its occurrence, exploitation, and technology.—Canada, Dept. of Mines, Mines Branch, (Publication) 245, 256 pp., 30 pls., 27 figs., 6 maps, 1913.

COLEMAN, A. P.
1. Cirques and U-shaped mountain valleys.—Can. Alpine Jour., vol. 5, pp. 49-52, 1913.

2. Climatic and physical conditions of the early Pre-Cambrian.—Abstract: Geol. Mag., decade 6, vol. 1, no. 10, p. 466, October, 1914.
3. Length and character of the earliest interglacial beds.—Abstract: Geol. Soc. Am., Bull., vol. 25, no. 1, p. 71, March, 1914.
4. An estimate of post-Glacial and inter-Glacial time in North America. Congrès Géologique International, Compte-rendu de la XIIe session, Canada, 1913, pp. 435-449, 1914.
5. Glaciers of the Rockies and Selkirks, 29 pp., numerous illustrations.—Canada Dept. of the Interior, Dominion Parks Branch, Ottawa.
6. The Pre-Cambrian rocks north of Lake Huron with special reference to the Sudbury series.—Rept. of Ont. Bur. of Mines, vol. 23, part 1, pp. 204-238, 18 figs., 1 map, 1914.
7. The Sudbury series and its bearing on Pre-Cambrian classification.—Congrès Géologique International, Compte-rendu de la XIIe session, Canada, 1913, pp. 387-398, 1914.

COLLINS, W. H.
1. A classification of the Pre-Cambrian formations in the region east of Lake Superior.—Congrès Géologique International, Compté-rendu de la XIIe session, Canada, 1913, pp. 399-407, 1914.
2. Geology of Onaping sheet, Ontario.—Canada, Dept. of Mines, Geol. Surv., Summary Rept., 1912, pp. 301-314, 1 fig., 1914.
3. The Huronian formations of Timiskaming region, Canada.—Canada, Dept. of Mines, Geol. Surv., Museum Bulletin no. 8, 31 pp., 1 pl., 3 figs., 1914.

CONNOR, M .F.
Some notes on rock analysis.—Congrès Géologique International, Compte-rendu de la XIIe session, Canada, 1913, pp. 885-890, 1914.

COOKE, H. C.
An exploration of the headwaters of the Broadback or Little Nottaway river, northwestern Quebec.—Canada, Dept. of Mines, Geol. Surv., Summary Rept., 1912, pp. 337-341, 1 map, 1914.

COSTE, EUGENE.
Rock disturbances theory of petroleum emanations vs. the anticlinal or structural theory of petroleum accumulations.—Am. Inst. Min. Eng., Bull. 93, pp. 2415-2431, September, 1914.

CRAIG, E. H. CUNNINGHAM.
1. The oil fields of Canada (with special reference to Alberta).—United Empire, vol. 5, no. 3, pp. 261-269, 5 figs., March, 1914.
2. Oil prospects in Alberta.—Min. Jour., vol. 104, no. 4093, pp. 118-120, January 31, 1914.

DALE, NELSON C.
Manganese deposits of Conception and Trinity bays, Newfoundland.—Abstract: Geol. Soc. Am., Bull., vol. 25, no. 1, pp. 73-74, March, 1914.

DALY, REGINALD A.

Geology of the Selkirk and Purcell mountains at the Canadian Pacific railway (main line).—Canada, Dept. of Mines, Geol. Surv., Summary Rept., 1912, pp. 156-164, 1914.

DAVIS, N. B.

1. The plasticity of clay.—Trans. Am. Ceramic Soc., vol. 16, pp. 65-79, 1914.
2. Tourmaline-bearing quartz veins.—Econ. Geol., vol. 9, no. 7, p. 689, October 1914.

DAWSON, JOHN A.

Graphite in gold ore from Kirkland Lake district, Ontario.—Can. Min. Jour., vol. 35, no. 17, p. 578, September 1, 1914.

DENIS, THEO. C.

1. The mineral industry in the Province of Quebec, 1913.—Can. Min. Jour., vol. 35, no. 2, pp. 44-45, January 15, 1914.
2. Preliminary statement of the mineral production in the Province of Quebec during 1913.—Quebec, Dept. of Colonization, Mines, and Fisheries, Mines Branch, 7 pp., 1914.
3. Quebec mineral production in 1913.—Can. Min. Inst., Bull. no. 25, pp. 16-17 April, 1914.
4. Report on mining operations in the Province of Quebec during the year 1913.—Quebec, Dept. of Colonization, Mines, and Fisheries, Mines Branch, 166 pp., illustrations, 1914.

DICK, W. J.

1. Conservation of Coal in Canada with notes on the principal coal mines.—Canada, Commission of Conservation, 212 pp., 26 pls., 2 maps, 1914.
2. Importance of bore-hole records and cappings of gas wells.—Canada, Com. of Conservation, Fifth Ann. Rept., pp. 52-65, 1914.
3. Report of the committee on minerals.—Canada, Com. of Conservation, Fifth Ann. Rept., pp. 48-52, 1914.

DICKIE, F. J.

Gold mining in the city of Edmonton, Alberta.—Can. Min. Jour., vol. 35, no. 20, p. 665, 1 fig., October 15, 1914.

DOBBS, W. S.

Geological sketch of the property of the Hayden Gold Mines, Ltd.—Min. and Sc. Press, vol. 108, no. 13, pp. 534-535, March 28, 1914.

DONKIN, HIRAM.

1. Nova Scotia (mineral production, 1913).—Can. Min. Inst., Bull., no. 25, pp. 12-13, April, 1914.
2. Report on the mines of Nova Scotia.—Nova Scotia, Report of the Dept. of Mines, 1913, 236 XVI pp., 5 pls., 1914.

DOUGLAS, GEORGE M.

Lands Forlorn, 285 pp., illustrations. G. P. Putnam's Sons, New York, 1914.

DOWLING, D. B.

1. Coal fields of Manitoba, Saskatchewan, Alberta and Eastern British Columbia (Revised Edition).—Canada, Dept. of Mines, Geol. Surv., Memoir 53, 142 pp., 9 pls., 1 map, 1914.
2. Geological notes to accompany map of Sheep River gas and oil field, Alberta. —Canada, Dept. of Mines, Geol. Surv., Memoir 52, 26 pp., 1 map, 1914.
3. Outline of the physical geography of Canada.—Dept. of Interior, Thirteenth Report of the Geographic Board of Canada, Appendix, 17 pp., 1 pl., 1 map, 1914.

DRESSER, JOHN A.

1. Asbestos in southern Quebec.—Am. Inst. Min. Eng., Bull. 93, pp. 2267-2274, September, 1914.
2. Preliminary report on the serpentine and associated rocks of southern Quebec.—Canada, Dept. of Mines, Geol. Surv., Memoir 22, 103 pp., 11 pls., 7 figs., 3 maps, 1913.

DRYSDALE, CHAS. W.

Geology of the Thompson River valley below Kamloops lake, B.C.—Canada, Dept. of Mines, Geol. Surv., Summary Rept. 1912, pp. 115-150, 1 map, 1914.

EARLE, RAYMOND BARTLETT.

The genesis of certain Palaeozoic interbedded iron ore deposits.—Annals of the N.Y. Acad. Sc., vol. 24, pp. 115-170, pl. VII-XXI, August 4, 1914.

ELLIS, W. H., BAIN, J. W., AND ARDAGH, E. G. R.

Analyses Ontario natural gases.—Rept. of Ont. Bur. of Mines, vol. 23, part 1, p. 254, 1914.

ELLSWORTH, W. E.

The Calgary-Alberta oil fields, Canada.—Min. and Eng. World, vol. 40, no. 26, pp. 1190-1196, 1234, 7 figs., June 27, 1914.

EMMENS, NEWTON W.

On the Babine Lake section, Omineca district, British Columbia.—Min. and Eng. World, vol. 41, no. 2, pp. 47-50, 4 figs., July 11, 1914.

ENGINEERING AND MINING JOURNAL.

Surprising Cobalt.—Eng. and Min. Jour., vol. 97, no. 10, p. 532, March 7, 1914.

FARIBAULT, E. R.

1. Clays in Lunenburg county, Nova Scotia.—Canada, Dept. of Mines, Geol. Surv., Summary Rept., 1912, p. 383, 1914.
2. Greenfield and Liverpool Town map-areas, Nova Scotia.—Canada, Dept. of Mines, Geol. Surv., Summary Rept., 1912, pp. 372-378, 1914.
3. Oldham gold district, Nova Scotia.—Canada, Dept. of Mines, Geol. Surv., Summary Rept., 1912, pp. 379-382, 1914.

FAY, CHARLES E.

The Canadian Rocky Mountains.—Alpina Americana no. 2, 19 pp., 9 pls., 3 maps, 1911.

Foerste, Aug. F.

1. Lorraine faunas of New York and Quebec.—Sc. Lab. of Denison Univ., Bull., vol. 17, pp. 247-338, 5 pls., March, 1914.
2. Notes on *Agelacrinidae* and *Lepadocystinae* with descriptions of *Thresherodiscus* and *Brockocystis*.—Sc. Lab. of Denison Univ., Bull., vol. 17, pp. 399-487, 6 pls., 8 figs., September, 1914.
3. The Rogers Gap fauna of Central Kentucky.—Cincinnati Society of Natural History, Journal, vol. 21, no. 4, pp. 109-156, 4 pls., May, 1914.

Ford, W. E.

Beiträge zur optischen Kenntniss der Hornblenden.—Zeitschrift für Krystallographie and Mineralogie, Bd. 54, H.1, pp. 1-16, 1914.

Gibson, Thos. W.

1. Mineral production of Ontario in 1913.—Can. Min. Inst., Bull. no. 25, pp. 18-26, April, 1913.
2. Mineral production of Ontario for 1913.—Ontario Dept. of Lands, Forests and Mines, Bur. of Mines, Bull. no. 19, 8 pp., 1914.
3. Mining in Ontario in 1913.—Eng. and Min. Jour., vol. 97, no. 2, pp. 134-135, January 10, 1914.
4. Production of metalliferous mines and works for January, February and March, 1914.—Ontario Dept. of Lands, Forests and Mines, Bureau of Mines, Bull. no. 21, 8 pp., 1914.
5. Statistical review of the mineral industry of Ontario for 1913.—Rept. of Ontario Bureau of Mines, vol. 23, part 1, pp. 1-51, 1914.
6. Twenty-third annual report of the Ontario Bureau of Mines, 1914. being volume 23, part 1, 300 pp. numerous illustrations and maps. Toronto, 1914.

Goldthwait, J. W.

1. Marine shore-lines in southeastern Quebec.—Canada, Dept. of Mines, Geol. Surv., Summary Rept., 1912, pp. 357-359, 1914.
2. Occurrence of glacial drift on the Magdalen islands.—Abstract: Geol. Soc. Am., Bull., vol. 25, no. 1, p. 84, March, 1914.
3. Supposed evidences of subsidence of the coast of New Brunswick within modern time.—Canada, Dept. of Mines, Geol. Surv., Museum Bulletin no. 2, Geol. Ser. no. 15, 23 pp., 2 figs., June 19, 1914.

Graham, R. P. D.

1. Note on the occurrence of Scorodite, etc., at Cobalt, northern Ontario, Canada.—Roy. Soc. Can., Trans., 3rd ser., vol. 7, sec. 4, pp. 19-21, 1914.
2. Yukonite, a new hydrous-arsenate of iron and calcium from Tagish lake, Yukon Territory, with a note on the associated Symplesite.—See Tyrrell and Graham.

Gray, F. W.

1. The coal trade of Nova Scotia in 1913.—Can. Min. Jour., vol. 35, no. 2, pp. 40-44, January 15, 1914.
2. Hidden coal fields.—Can. Min. Jour., vol. 35, no. 11, p. 364, June 1, 1914.

Gyula, Szadeczky.

A Kanadai XII. Nemzetközi Geologiai Kongresszus. Földtani Közlöny, XLIV kötet 1-2 füzet, pp. 1-26, 12 figs. Budapest, 1914.

HAGGEN, E. A.
History of oil development in western Canada.—Min. Eng. and Electrical Record, vol. 19, nos. 9 and 10, pp. 189-194. April and May, 1914.

HARCOURT, GEO
Economic resources of Alberta.—Canada and Its Provinces, vol. 20, pp. 583-602, 4 pls. Publishers Association of Canada, Limited, Toronto, 1914.

HARDING, W. K.
Rice Lake gold mining district, Manitoba, Canada.—Min. and Eng. World, vol. 40, no. 25, pp. 1154-1155, June 20, 1914.

HARDINGE, H. W.
Kirkland Lake district Ontario.—Eng. and Min. Jour., vol. 98, no. 14, p. 619, October 3, 1914.

HAYES, ALBERT O.
Geology of the Wabana iron ore of Newfoundland.—Abstract: Geol. Soc. Am., Bull., vol. 25, no. 1, p. 74, March, 1914.

HERZIG, C. S.
Discussion of paper by J. M. Bell on "The outlook for the mineral industry in Canada."—Inst. of Min. and Metallurgy, Trans., vol. 23, pp. 264-268, 1914.

HOPKINS, PERCY E.
The Kirkland Lake and Swastika gold areas and Maisonville, Grenfell and Eby townships.—See Burrows and Hopkins.

HORE, REGINALD E.
Tough-Oakes gold mine, Kirkland lake, Ontario.—Can. Min. Jour., vol. 35, no. 8, pp. 259-263, 11 figs., April 15, 1914.

HOWE, ERNEST.
Petrographical notes on the Sudbury nickel deposits.—Econ. Geol., vol. 9, no. 6, pp. 505-522, 1 pl., 3 figs, September, 1914.

HURJA, EMIL EDWARD.
1. Mining in the far North, Operations of Yukon Gold Company.—Min. and Sc. Press, vol. 109, no. 15, pp. 568-569, 2 figs., October 10, 1914.
2. Mining in the far North, Skagway-Whitehorse mining district.—Min. and Sc. Press, vol. 109, no. 16, pp. 609-612, 4 figs., October 17, 1914.
3. Mining in the far North, Operations of the Canadian-Klondike Gold Mining Company, Ltd.—Min. and Sc. Press, vol. 109, no. 20, pp. 769-771, 4 figs., November 14, 1914.
4. Mining in the far North, the Klondike, the Treadgold placers, and outlying districts.—Min. and Sc. Press, vol. 109, no. 22, pp. 848-850, 6 figs., November 28, 1914.

HYDE, JESSE E.

The stratigraphic relations of the Riversdale-Union and Windsor formations of Nova Scotia.—Canada, Dept. of Mines, Geol. Surv., Summary Rept., 1912, pp. 390-396, 1914.

INGALL, E. D.

Borehole records (Water, oil, etc.).—Canada, Dept. of Mines, Geol. Surv., Summary Report, 1912, pp. 415-416, 1914.

JACOBS, E.

1. British Columbia in 1913.—Can. Min. Jour., vol. 35, no. 2, pp. 46-47, January 15, 1914.
2. Coal mining in British Columbia in 1913.—Can. Min. Jour., vol. 35, no. 2, pp. 48-50, January 15, 1914.
3. Mines and Mining (in British Columbia).—Canada and Its Provinces, vol. 22, pp. 555-581, 1 pl. Publishers Association of Canada, Limited, Toronto, 1914.
4. Mining in British Columbia in 1913.—Eng. and Min. Jour., vol. 97, no. 2, pp. 135-137, 1 fig., January 10, 1914.
5. (Mining in) British Columbia.—Min. and Eng. World, vol. 40, no. 4, pp. 213-220, January 24, 1914.
6. Railways and mineral production.—Can. Min. Jour., vol. 35, no. 7, pp. 221-222, April 1, 1914.

JOHNSON, D. W.

The shoreline of Cascumpeque harbour, Prince Edward Island.—Abstract: N. Y. Acad. Sc., Annals, vol. 23, pp. 261-262, April 30, 1914.

JOHNSON, H. H.

Burnside claims.—Can. Min. Jour., vol. 35, no. 7, pp. 236-237, April, 1 1914.

JOHNSTON, R. A. A.

1. Radium, and its uses.—Canada, Dept. of Mines, Geol. Surv., Press Bulletin no. 13, April 15, 1914.
2. (Report on) Mineralogy.—Canada, Dept. of Mines, Geol. Surv., Summary Rept., 1912, pp. 411-414, 1914.

JOHNSTON, W. A.

Geology of Lake Simcoe area, Ontario: Beaverton, Sutton and Barrie sheets.—Canada, Dept. of Mines, Geol. Surv., Summary Rept., 1912, pp. 294-300, 1914.

JULIEN, ALEXIS A.

The genesis of antigorite and talc.—Annals of the N.Y. Acad. Sc., vol. 24, pp. 23-38, pl. VI, July 25, 1914.

K., V. L.

A modern text-book of geology and evolution.—Science, new ser., vol. 39, pp. 64-67, January 9, 1914.

KEELE, JOSEPH.

1. Clay and shale deposits of New Brunswick.—Canada, Dept. of Mines, Geol. Surv., Memoir 44, 94 pp., 16 pls., 7 figs., 1 map, 1914.
2. Investigation of clay resources of Quebec.—Canada, Dept. of Mines, Geol. Surv., Summary Rept., 1912, pp. 351-356, 1914.
3. Progress of investigation of clay resources.—Can. Eng., vol. 26, no. 25, pp. 885-887, 4 figs., June 18, 1914.
4. Report on the clay and shale deposits of the Western Provinces (Part 2).—See Ries and Keele.

KENDALL, J. D.

The valuation of mines.—Can. Min. Inst., Bull. 27, pp. 73-85, 6 figs., July, 1914.

KERR, J. T.

Gold at Sesekinika, Ontario.—Eng. and Min. Jour., vol. 98, no. 14, p. 600, 3 figs., October 3, 1914.

KINDLE, E. M.

1. Columnar structure in limestone.—Canada, Dept. of Mines, Geol. Surv., Museum Bulletin no. 2, Geol. Ser., no. 14, 5 pp., 2 pls., June 17, 1914.
2. A comparison of the Cambrian and Ordovician ripplemarks found at Ottawa, Canada.—Jour. Geol., vol. 22, no. 7, pp. 703-713, 6 figs., October-November, 1914.
3. An inquiry into the origin of "Batrachioides the Antiquor" of the Lockport dolomite of New York.—Geol. Mag., decade 6, vol. 1, no. 4, pp. 158-161, 2 pls., April, 1914.
4. Notes on the Oriskany sandstone and the Ohio shale of the Ontario peninsula.—Canada, Dept. of Mines, Geol. Surv., Summary Rept., 1912, pp. 286-290, 1 fig., 1914.
5. The Silurian and Devonian section of western Manitoba.—Canada, Dept. of Mines, Geol. Surv., Summary Rept., 1912, pp. 247-261, 1914.
6. What does the Medina sandstone of the Niagara section include?—Science, new ser. vol. 39, pp. 915-918, June 19, 1914.
7. Report of the Invertebrate Palaeontologist.—Canada, Dept. of Mines, Geol. Surv., Summary Rept., 1912, pp. 404-406. 1914.

KNIGHT, CYRIL, W.

The Pre-Cambrian geology of southeastern Ontario.—See Miller and Knight.

KNOWLTON, F. H.

Cretaceous-Tertiary boundary in the Rocky Mountain region.—Geol. Soc. Am., Bull., vol. 25, no. 3, pp. 325-340, September, 1914.

KRUSCH, PROF. DR.

Der XII. Internationale Geologenkongress 1913 in Canada.—Separate from der Zeitschrift f.d. Berg-, Hütten- und Salinenwesen im Preussischen Staate, 1914, 41 pp. plates 12 to 17, 20 figs.

LAMBE, LAWRENCE M.

1. Description of a new species of *Platysomus* from the neighbourhood of Banff, Alberta.—Roy. Soc. Can., Trans., vol. 8, sec. 4, pp. 17-23, 1 pl., 1 fig., 1914.
2. On new species of *Aspideretes* from the Belly River formation of Alberta, with further information regarding the structure of the carapace of *Boremys pulchra*.—Roy. Soc. Can., Trans., vol. 8, sec. 4, pp. 11-16, 1 pl., 1 fig., 1914.
3. On *Gryposaurus notabilis*, a new genus and species of Trachodont Dinosaur from the Belly River formation of Alberta, with a description of the skull of *Chasmosaurus belli*.—Ottawa Naturalist, vol. 27, no. 11, pp. 145-155, 3 pls., February, 1914.
4. On the fore-limb of a carnivorous Dinosaur from the Belly River formation of Alberta, and a new genus of *Ceratopsia* from the same horizon, with remarks on the integument of some Cretaceous herbivorous Dinosaurs.—Ottawa Naturalist, vol. 27, no. 10, pp. 129-135, 5 pls., January, 1914.
5. On a new genus and species of carnivorous dinosaur from the Belly River formation of Alberta, with a description of the skull of *Stephanosaurus marginatus* from the same horizon.—Ottawa Naturalist, vol. 28, no. 1, pp. 13-20, 1 pl., April, 1914.
6. Report of the Vertebrate Palaeontologist.—Canada, Dept. of Mines, Geol. Surv., Summary Rept., 1912, pp. 397-403, 2 pls., 1914.

LANE, A. C.

The age of the Keweenawan series.—Mich. Acad. Sc., 14th Report, pp. 107-108, 1912.

LAVOIE, G. A.

Some remarks on gas in coal.—Can. Min. Inst., Bull. no. 28, pp. 53-58, August, 1914.

LAWSON, ANDREW C.

1. The Archaean geology of Rainy lake re-studied.—Canada, Dept. of Mines, Geol. Surv., Memoir 40, 115 pp., 9 pls., 1 fig., 1 map, 1913.
2. A standard scale for the Pre-Cambrian rocks of North America.—Congrès Géologique International, Compte-rendu de la XIIe session, Canada, 1913, pp. 349-370, 1914.

LEITH, C. K.

1. Pre-Cambrian correlation from a Lake Superior standpoint.—Congrès Géologique International, Compte-rendu de la XIIe session, Canada, 1913, pp. 409-421, 1914.
2. Relations of the plane of unconformity at the base of the Cambrian to terrestrial deposition in late Pre-Cambrian time.—Congrès Géologique International, Compte-rendu de la XIIe session, Canada, 1913, pp. 335-337, 1914.

LEROY, O. E.

Mother Lode and Sunset mines, Boundary district, B.C.—Canada, Dept. of Mines, Geol. Surv., Memoir 19, 56 pp., 5 pls., 3 figs., 2 maps, 1913.

LETT, STEPHEN J.

Discussion of a paper by J. B. Tyrrell on "The occurrence of gold in Ontario."—Inst. of Min. and Metallurgy, Trans., vol. 23, pp. 156-158, 1914.

LEVERETT, Frank.

1. Correlation of Lake Agassiz with glacial lakes in Great Lakes basins.—Abstract: Mich. Acad. Sc. 14th Rept., p. 115, 1912.
2. Notes concerning the features of St. Joseph island, Lake Huron, Ontario.—Canada, Dept. of Mines, Geol. Surv., Summary Rept., 1912, pp. 271-274, 1 fig., 1914.

LINDEMAN, E.

1. Magnetite occurrences near Calabogie, Renfrew county, Ontario.—Canada, Dept. of Mines, Mines Branch, (Publication) no. 254, 16 pp., 1 fig., 5 maps, 1914.
2. Moose Mountain iron-bearing district, Ontario.—Canada, Dept. of Mines, Mines Branch, (Publication) no. 303, 14 pp., 2 figs., 8 maps, 1914.

LIVERMORE, ROBERT.

Draining Kerr lake, Cobalt district, Ontario.—Can. Min. Inst., Bull. no. 28, pp. 101-119, 8 figs., August, 1914.

LODGE, MATTHEW.

Gas and oil fields of New Brunswick.—Can. Min. Jour., vol. 35, no. 6, pp. 200-204, 4 figs., March 15, 1914. Reprinted from the Journal of Commerce, Montreal, February 14, 1914.

McCONNELL, R. G.

1. Geological section along the Grand Trunk Pacific railway from Prince Rupert to Aldermere, B.C.—Canada, Dept. of Mines, Geol. Surv., Summary Rept., 1912, pp. 55-62, 1914.
2. Portions of Portland Canal and Skeena mining division, Skeena district, B.C.—Canada, Dept. of Mines, Geol. Surv., Memoir 32, 101 pp., 7 pls., 3 figs., 2 diags., 2 maps, 1913.
3. Princess Royal Island, B.C.—Canada, Dept. of Mines, Geol. Surv., Summary Rept., 1912, pp. 63-67, 1 fig., 1914.
4. Texada island, B.C.—Canada, Dept. of Mines, Geol. Surv., Summary Rept., 1912, p. 68, 1914.

McINNES, WILLIAM.

The basins of Nelson and Churchill rivers.—Canada, Dept. of Mines, Geol. Surv., Memoir 30, 146 pp., 19 pls., 1 map, 1913.

MACKENZIE, J. D.

1. The Crowsnest volcanics.—Canada, Dept. of Mines, Geol. Surv., Museum Bulletin no. 4, 37 pp., 1 pl., 1 fig., November 19, 1914.
2. South Fork coal area, Oldman river, Alberta.—Canada, Dept. of Mines, Geol. Surv., Summary Rept., 1912, pp. 235-246, 1 map, 1914.
3. The Queen Charlotte islands.—Science Conspectus, vol. 4, no. 1, pp. 14-23, 8 figs., 1914.

MACLEAN, T. A.

Lode mining in Yukon: an investigation of quartz deposits in the Klondike division.—Canada, Dept. of Mines, Mines Branch, (Publication) no. 222, 214 pp., 40 pls., 35 figs., 6 maps, 1914.

McLeish, John.

1. Annual report on the mineral production of Canada during the calendar year 1912.—Canada, Dept. of Mines, Mines Branch, (Publication) 262, 339 pp., 1914.
2. The mineral production of Canada in 1913.—Can. Min. Inst., Bull. no. 25, pp. 26-46, April, 1914.
3. Preliminary report on the mineral production of Canada during the calendar year 1913.—Canada, Dept. of Mines, Mines Branch, (Publication) no. 283, 21 pp., 1914.
4. The production of coal and coke in Canada during the calendar year 1913.—Canada, Dept. of Mines, Mines Branch, (Publication) 316, 40 pp., 1 fig., 1914.

Malcolm, Wyatt.

1. Gold fields of Nova Scotia.—Canada, Dept. of Mines, Geol. Surv., Memoir 20, 331 pp., 42 pls., 24 figs., 2 maps, 1912.
2. Notes on radium-bearing minerals.—Canada, Dept. of Mines, Geol. Surv., Prospector's Handbook no. 1, 26 pp., 1914.

Malloch, G. S.

1. The Groundhog coal field, B.C.—Canada, Dept. of Mines, Geol. Surv., Summary Rept., 1912, pp. 69-101, 1 map, 1914.
2. Metalliferous deposits in the vicinity of Hazelton, B.C.—Canada, Dept. of Mines, Geol. Surv., Summary Rept., 1912, pp. 102-107, 1914.

Matthew, G. F.

The physics of the Cambrian formation in Eastern Canada, and the peculiarities of its faunas.—Roy. Soc. Can., Trans., vol. 8, sec. 4, pp. 69-85, September, 1914.

Matthew, W. D.

Evidence of the Paleocene vertebrate fauna on the Cretaceous—Tertiary problem.—Geol. Soc. Am., Bull. vol. 25, no. 3, pp. 381-402, 3 figs., September, 1914.

Means, A. H.

Tourmaline bearing gold quartz veins of the Michipicoten district, Ontario.—Econ. Geol., vol. 9, no. 2, pp. 122-135, 5 figs., March, 1914.

Mickle, G. R.

1. The chemical composition of natural gas found in Ontario.—Rept. of Ont. Bur. of Mines, vol. 23, part 1, pp. 237-246, 3 figs., 1914.
2. Composition of natural gas.—Rept. of Ont. Bur. of Mines, vol. 23, part 1, pp. 255-273, 3 figs., 1914.

Miller, W. G.

1. Ontario's mineral industry.—Canada and Its Provinces, vol. 18, pp. 613-645, 2 pls. 3 figs. Publisher's Association of Canada, Limited, Toronto, 1914.
2. Prefatory note to Dr. Coleman's paper (on the Pre-Cambrian rocks north of Lake Huron with special reference to the Sudbury series).—Rept. of Ont. Bur. of Mines, vol. 23, part 1, pp. 202-203, 1914.

MILLER, WILLET, G., and KNIGHT, CYRIL, W.
The Pre-Cambrian geology of southeastern Ontario.—Bureau of Mines (Ont.) Annual Rept., vol. 22, part 2, 151 pp., numerous illustrations and maps, 1914.

MILLER, WILLIAM J.
The geological history of New York state.—New York State Museum Bull. 168, 130 pp., 52 pls., 40 figs., 1914.

MILLIS, JOHN.
What was the cause of the eskers?—Science, vol. 39, no. 997, pp. 208-209, February 6, 1913.

MINING MAGAZINE.
1. Cobalt.—Min. Mag., vol. 11, no. 1, pp. 14-16, 1 fig., July, 1914.
2. Kirkland Lake flotations.—Min. Mag., vol. 10, no. 2, pp. 90-91, February, 1914.

MOORE, E. S.
1. Hydrothermal alteration of granite.—Economic Geology, vol. 9, no. 4, pp. 392-395, June, 1914.
2. Region east of the south end of Lake Winnipeg.—Canada, Dept. of Mines, Geol. Surv., Summary Rept., 1912, pp. 262-270, 1 map, 1914.
3. A visit to some Pacific coast mines.—Can. Min. Jour., vol. 34, no. 1, pp. 5-8, 4 figs., January 1, 1914.

NATTRESS, THOMAS.
Additional notes on the geology of the Detroit River area.—Mich. Acad. Sc., 14th Rept., pp. 109-113, 3 pls., 1912.

NEWCOMBE, C. F.
Pleistocene raised beaches at Victoria, B.C.—Ottawa Naturalist, vol. 28, no. 8, pp. 107-110, 2 figs., November, 1914.

NATURE.
Geology in North America.—Nature, vol. 92, no. 2309, pp. 618-621, 2 figs., January 29, 1914.

NICKLES, JOHN M.
Bibliography of North American geology for 1913 with subject index.—U. S. Geol. Surv., Bull. 584, 183 pp., 1914.

NIMMO, J. V.
The Canadian Northern Pacific railway.—Can. Soc. of Civil Eng., Trans., vol. 28, part 1, pp. 359-371, 1 pl., 1914.

NORDENSKJOLD, OTTO.
Le Labrador.—Soc. de Geog. de Québec, Bull., vol. 8, no. 5, pp. 293-296, September and October, 1914.

O'CONNELL, MARJORIE.
Revision of the genus *Zaphrentis*.—Annals of N. Y. Acad. Sc., vol. 23, pp. 177-192, February 25, 1914.

ODELL, C. M.

1. Initial proceedings in opening up a coal mine.—Can. Soc. Civil Eng., Trans., vol. 28, part 1, pp. 115-120, 4 pls., 1914.
2. Opening Nova Scotia coal mines.—Colliery Engineer, vol. 34, no. 10, pp. 595-598, 5 figs., May, 1914; Can. Min. Jour., vol. 35, no. 13, pp. 441-442, July 1, 1914.

O'NEAL, FRANK E.

1. Coal fields of Jasper park, Alberta.—Colliery Engineer, vol. 34, no. 7, pp. 399-402, 7 figs., February, 1914.
2. The Smoky River coal field.—Colliery Engineer, vol. 34, no. 6, pp. 346-347, January, 1914.

O'NEILL, J. J.

St. Hilaire (Belœil) and Rougemont mountains, Quebec.—Canada, Dept. of Mines, Geol. Surv., Memoir 43, 108 pp., 1 map, 1914.

OSBORN, HENRY FAIRFIELD.

Close of the Cretaceous and opening of Eocene time in North America.—Geol. Soc. Am., Bull., vol. 25, no. 3, pp. 321-323, September, 1914.

PARKS, WM. A.,

Report on the building and ornamental stones of Canada, vol. 2, Maritime Provinces.—Canada, Dept. of Mines, Mines Branch, (Publication) 203, 264 pp. 45 pls., 9 figs., 1914.

PAYNE, HENRY M.

Coal mining in Yukon Territory.—Colliery Engineer, vol. 35, no. 3, pp. 133-135, 4 figs., October, 1914.

PREST, WALTER H.

The gold fields of Nova Scotia.—Industrial Advocate, vol. 19, no. 3, pp. 5-8, 2 figs.; no. 4, pp. 5-9, 6 figs.; no. 5, pp. 5-9, 3 figs.; no. 6, pp. 5-7, 2 figs.; no. 7, pp. 5-8, 11 figs.; no. 8, pp. 5-8, 4 figs.; no. 9, pp. 5-8, 3 figs.; no. 10, pp. 5-8; 1914.

RAYMOND, PERCY E.

1. A *Beatricea*-like organism from the Middle Ordovician.—Canada, Dept. of Mines, Geol. Surv., Mus. Bull. 5, 19 pp., 4 pls., 1914.
2. The succession of faunas at Lévis, P.Q.—Am. Jour. Sc., vol. 38, pp. 523-530, December, 1914.
3. The Trenton group in Ontario and Quebec.—Canada, Dept. of Mines, Geol. Surv., Summary Rept., 1912, pp. 342-350, 1914.
4. Notes on the ontogeny of *Isotelus gigas* Dekay.—Harvard Coll., Mus. Comp. Zool., Bull. 58, no. 5, pp. 247-263, 3 pls., 7 figs., April, 1914.
5. Notes on the ontogeny of *Paradoxides*, with the description of a new species from Braintree, Mass.—Harvard Coll., Mus. Comp. Zool., Bull. 58, no. 4, pp. 225-244, 1 pl., 3 figs., April, 1914.

RICKARD, T. A.

Persistence of ore in depth.—Inst. Min. and Metallurgy, Bulletin no. 122, pp. 1-44, November 12th; Bulletin No. 123, pp. 3-9, December 10th, 1914.

RIES, HEINRICH.

1. Clay investigations in western Canada.—Canada, Dept. of Mines, Geol. Surv., Summary Report., 1912, pp. 229-233, 1914.
2. Clay and shale deposits of the Western Provinces, (Part 3.)—Canada, Dept. of Mines, Geol. Surv., Memoir 47, 73 pp., 11 pls., 8 figs., 1914.

RIES, HEINRICH AND KEELE, JOSEPH.

Report on the clay and shale deposits of the Western Provinces, (Part 2). —Canada, Dept. of Mines, Geol. Surv., Memoir 25, 105, pp., 40 pls., 6 figs., 1913.

ROBERTS, E. I.

Pembina Coal Co., Ltd.—Colliery Engineer, vol. 35, no. 1, pp. 31-35, 5 figs., August, 1914.

ROBERTSON, WM. FLEET.

1. Preliminary review and estimate of mineral production, 1913.—British Columbia Bureau of Mines, Bulletin no. 1, 1914, 35 pp.
2. Report of (British Columbia) Bureau of Mines.—British Columbia, Annual Report of the Minister of Mines for 1913, Victoria, B.C., 457 pp., numerous illustrations and maps. 1914.

ROSE, BRUCE.

Savona map-area, British Columbia.—Canada, Dept. of Mines, Geol. Surv., Summary Rept., 1912, pp. 151-155, 1914.

ST. CLAIR, STUART.

Origin of the Sudbury ore deposits.—Min. and Sc. Press, vol. 109, no. 7, pp. 243-246, 1 fig., August 15, 1914.

SANDBERG, AUGUST.

Report on a reconnaissance along the lower Coppermine river.—Lands Forlorn, Appendix B., pp. 277-285, 2 figs., 2 maps. G. P. Putnam's Sons, New York. 1914.

SCHOFIELD, S. J.

1. The origin of granite (micropegmatite) in the Purcell sills.—Canada, Dept. of Mines, Geol. Surv., Mus. Bull. no. 2, Geol. Series 13, 32 pp., 1 pl., 4 figs., June 5, 1914.
2. The origin of the Rocky Mountains.—Science Conspectus, vol. 4, no. 5, pp. 122-128, 3 figs., 1914.
3. The Pre-Cambrian (Beltian) rocks of southeastern British Columbia and their correlation.—Canada, Dept. of Mines, Geol. Surv., Museum Bulletin no. 2, Geol. Ser. no. 16, 13 pp., 1 fig., July 3, 1914.
4. Reconnaissance in East Kootenay, British Columbia.—Canada, Dept. of Mines, Geol. Surv., Summary Report, 1912, pp. 221-228, 1 map, 1914.
5. Minerals of the Rocky mountains park.—Canada, Dept. of Interior, Dominion Parks Branch, Hand-book of the Rocky Mountains Park museum, p. 100, 1914.
6. Rocks of the Rocky Mountains park.—Canada, Dept. of Interior, Dominion Parks Branch, Hand-book of the Rocky Mountains Park museum, p. 101, 1914.

SCHUCHERT, CHARLES.

1. Medina and Cataract formations of the Siluric of New York and Ontario. —Geol. Soc. Am., Bull., vol. 25, no. 3, pp. 277-320, 2 pls., 1 fig., September, 1914.
2. Notes on Arctic Paleozoic fossils.—Am. Jour. Sc., vol. 38, pp. 467-477, November, 1914.
3. Climates of geologic time.—Carnegie Inst. Washington, Publication no. 192, pp. 265-298, 4 figs., 1914.
4. The delimitation of the geologic periods illustrated by the palægeography of North America.—Congrès Géologique International, Compte-rendu de la XIIe session, Canada, 1913, pp. 555-591, 2 pls., 1914.

SCHUCHERT, CHARLES AND BARRELL, JOSEPH.

A revised geologic time-table for North America.—Am.Jour. Sc., 4th ser., vol. 38, pp. 1-27, 2 figs., July, 1914.

SCOTT, M. BROWN, JR.

Discussion of paper by J. B. Tyrrell on "The occurrence of gold in Ontario.—Inst. Min. and Metallurgy, Trans., vol. 23, pp. 158-159, 1914.

SEDERHOLM, J. J.

Some proposals concerning the nomenclature of the Pre-Cambrian, etc.—Congrès Géologique International, Compte-rendu de la XIIe session, Canada, 1913, pp. 381-385, 1914.

SEXTON, F. H.

Mines and mining in the Maritime Provinces.—Canada and Its Provinces, vol. 14, pp. 671-700. Publishers' Association of Canada, Limited, Toronto, 1913.

SHERZER, W. H.

Geological report of Wayne county.—Mich. Geol. and Biol. Survey, Publication 12, Geol. Ser. 9, 388 pp., 32 pls., 22 figs., 1913.

SMITH, JAMES PERRIN.

The Middle Triassic marine invertebrate faunas of North America.—United States Geol. Surv., Professional Paper 83, 254 pp., 99 pls., 1914.

SPEARMAN, CHAS.

Microscopic characters of the ore deposits and rocks of the Kirkland Lake district, Ontario.—Can. Min. Jour., vol. 35, no. 10, pp. 329-332, 11 figs., May 15, 1914.

SPENCER, J. W.

Cause of the postglacial deformation of the Ontario region.—Abstract: Geol. Soc. Am., Bull., vol. 25, no. 1, pp. 65-66, March, 1914.

STANSFIELD, J.

On a new mode of occurrence of scapolite.—Am. Jour. Sc., 4th ser., vol. 38, pp. 37-40, July, 1914.

STANTON, TIMOTHY W.
Boundary between Cretaceous and Tertiary in North America as indicated by stratigraphy and invertebrate faunas.—Geol. Soc. Am., Bull., vol. 25, no. 3, pp. 341-354, September, 1914.

STAUFFER, CLINTON R.
Stratigraphy of southwestern Ontario.—Canada, Dept. of Mines, Geol. Surv., Summary Rept., 1912, pp. 291-293, 1914.

STEFANSSON, V.
Stefansson's expedition.—Am. Geog. Soc., Bull., vol. 46, no. 3, pp. 184-191, 1 fig., March, 1914.

STERNBERG, CHARLES H.
Notes on the fossil vertebrates collected on the Cope expedition to the Judith River and Cow Island beds, Montana.—Science, new series, vol. 40, pp. 134-135, July 24, 1914.

STIRLING, JOHN T.
Alberta coal statistics, 1913.—Can. Min. Inst., Bull. no. 25, pp. 13-15, April, 1914.

STOPES, MARIE C.
The "Fern Ledges" Carboniferous flora of St. John, New Brunswick.—Canada, Dept. of Mines, Geol. Surv., Memoir 41, 167 pp., 25 pls., 21 figs., 1914.

SUTHERLAND, T. F.
Mines of Ontario.—Rept. of Ont. Bur. of Mines, vol. 23, part 1, pp. 110-193, 39 figs., 1914.

TAYLOR, FRANK B.
Time measures in the Niagara gorge and their application to Great Lake history.—Abstract: Geol. Soc. Am., Bull., vol. 25, no. 1, pp. 35-36, March, 1914.

T. A.
Gold in Ontario.—United Empire, vol. 5, no. 1 pp. 78-80, January, 1914.

THOMAS, KIRBY.
The Sudbury nickel district of Ontario.—Eng. and Min. Jour., vol. 97, no. 2, pp. 152-154, 1 fig., January 10, 1914.

THOMPSON, NICOLL.
Iron and steel industry for British Columbia.—Min. Eng., and Electrical Record, vol. 19, nos. 9-10, pp. 198-201, April and May, 1914.

THOMPSON, ARTHUR PERRY.
On the relation of pyrrhotite to chalcopyrite and other sulphides.—Econ. Geol., vol. 9, no. 2, pp. 153-174, 20 figs., March, 1914.

TWENHOFEL, W. H.

The Anticosti Island faunas.—Canada, Dept. of Mines, Geol. Surv., Mus. Bulletin no. 3, 39 pp., 1 pl., October 30, 1914.

TYRRELL, J. B.

1. The Northwest Territories.—Canada and Its Provinces, vol. 22, pp. 639-660, 4 pls. Publishers' Association of Canada, Limited, Toronto, 1914.
2. The Patrician glacier south of Hudson Bay.—Congrès Géologique International, Compte-rendu de la XIIe session, Canada, 1913, pp. 523-534, 1 fig., 1914.
3. The Yukon Territory.—Canada and Its Provinces, vol. 22, pp. 585-636, 1 pl. Publishers' Association of Canada, Limited, Toronto, 1914.
4. The occurrence of gold in Ontario.—Inst. Min. and Metallurgy, Trans., vol. 23, pp. 143-154, 159-162, 1 fig., 1914.
5. Artesian water in Manitoba.—Can. Engineer, vol. 26, pp. 574-575, April 9, 1914.

TYRRELL, J. B., and GRAHAM, R. P. D.

Yukonite, a new hydrous arsenate of iron and calcium, from Tagish lake, Yukon Territory; with a note on the associated Symplesite.—Roy. Soc. Can., Trans., 3rd ser., vol. 7, sec. 4, pp. 13-18, 1914.

UGLOW, W. L.

"Secondary silicate zones": a reply to criticisms by J. F. Kemp and C. A. Stewart.—Econ. Geol., vol. 9, no. 2., pp. 175-183, March, 1914.

ULRICH, E. O.

The Ordovician-Silurian boundary.—Congrès Géologique International, Compte-rendu de la XIIe session, Canada, 1913, pp. 593-667, 8 maps, 1914.

UPHAM, WARREN.

1. Fields of outflow of the North American ice-sheet.—Congrès Géologique International, Compte-rendu de la XXIe session, Canada, 1913, pp. 515-522, 1914.
2. The Sangamon Interglacial state in Minnesota and westward.—Congrès Géologique International, Compte-rendu de la XIIe session, Canada, 1913, pp. 455-466, 1914.

VAN INGEN, GILBERT.

Cambrian and Ordovician faunas of southeastern Newfoundland.—Abstract: Geol. Soc. Am., Bull., vol. 25, no. 1, p. 138, March, 1914.

VAUX, MARY M.

Observations on glaciers.—Can. Alpine Jour., vol. 5, pp. 59-61, 1913.

VICTORIN, FRERE M.

1. L'Anse à Persi.—Société de Géographie de Québec, Bull., vol. 8, no. 3, pp. 146-159, 4 pls., May and June, 1914.
2. La mort d'un lac.—Société de Géographie de Québec, Bull., vol. 8, no. 1, pp. 26-43, 9 figs., January and February, 1914.

VON ENGELN, O. D.

Effects of continental glaciation on agriculture.—Am. Geog. Soc., Bull., vol. 46, no. 4, pp. 241-264, no. 5, pp. 336-355, 6 figs., April.

VON HUENE, F. R.

1. The Dinosaurs not a natural order.—Am. Jour. Sc., vol. 38, pp. 145-146, August, 1914.
2. Nachtrage zu meinen früheren Beschreibungen triassischer Saurischia.—Geologische und Palaeontologische Abhandlungen Bd. 13, H.1., pp. 69-82, 56 figs., 1914.
3. Uber die Zweistämmigkeit der Dinosaurier, mit Beiträgen zur Kenntnis einiger Schädel.—Neues Jahrbuch für Mineralogie, Geologie und Paläontologie Beilage-band 37, Heft 3, pp. 577-589, plates 7-12, May 18, 1914.
4. Das naturliche System der Saurischia.—Centralblatt für Mineralogie, Geologie und Paläontologie, pp. 154-158, 1 fig., March 1, 1914.

VON LOZINSKI, W.

Uber erdgeschichtliche Kalteperioden.—Congrès Géologique International, Compte-rendu de la XIIe session, Canada, 1913, pp. 489-514, 1 fig., 1914.

WALCOTT, CHARLES D.

1. Cambrian geology and palaeontology III, no. 2. Pre-Cambrian Algonkian algal flora.—Smithsonian Misc. Coll, vol. 64, no. 2, pp. 79-156, pls. 4-23, July 22, 1914.
2. *Dikelocephalus* and other genera of the *Dikelocephalinae.*—Smithsonian Misc. Coll., vol. 57, no. 13, pp. 345-412, pls. 60-70, figs. 13-20, April 4, 1914.

WALKER, T. L.

1. Temiskamite, a new nickel arsenide from Ontario.—Am. Jour. Sc., vol. 37, no. 218, pp. 170-172, 1 fig., February, 1914; Abstract: Geol. Soc., Am., Bull., vol. 25, no. 1, p. 76, March, 1914.
2. Crystallography, an outline of the geometrical properties of crystals, 204 pp., 5 pls., numerous figs. McGraw-Hill Book Company, New York, 1914.

WALLACE, R. C.

1. A contribution to the study of dolomitization.—Roy. Soc. Can., Trans., 3rd ser., vol. 7, sec. 4, pp. 139-149, 6 figs., 1914.
2. Gypsum and anhydrite in genetic relationship.—Geol. Mag., decade 6, vol. 1, no. 6, pp. 271-276, June, 1914.
3. New Manitoba and its mineral possibilities.—Manitoba Engineer, vol. 3, no. 1, pp. 17-21, March, 1914.
4. A physico-chemical contribution to the study of dolomitization.—Congrès Géologique International, Compte-rendu de la XIIe session, Canada, 1913, pp. 875-884, 6 figs., 1914.

WHEELER, ARTHUR O.

Motion of the Yoho glacier.—Can. Alpine Jour., vol. 5, pp. 53-58, 1913.

WHITE, JAMES.

Alfred E. Barlow.—Can. Min. Inst., Bull. 27, pp. 51-54, July, 1914.

WIELAND, G. R.
A study of some American fossil Cycads. Part 7.—Further notes on disk structure.—Am. Jour. Sc., vol. 38, pp. 117-136, 9 figs., August, 1914.

WILLIAMS, MERTON Y.
1. Sections illustrating the lower part of the Silurian system of southwestern Ontario.—Abstract: Geol. Soc. Am., Bull., vol. 25, no. 1, pp. 40-41, March, 1914.
2. The Silurian of Manitoulin island and western Ontario.—Canada, Dept. of Mines, Geol. Surv., Summary Rept., 1912, pp. 275-281, 1914.
3. Thedford and vicinity.—Canada, Dept. of Mines, Geol. Surv., Summary Rept., 1912, pp. 282-285, 1914.

WILLISTON, SAMUEL WENDELL.
Water reptiles of the past and present, 251 pp., 131 figs. University of Chicago Press, Chicago. 1914.

WILSON, ALICE E.
A preliminary study of the variations of the plications of *Parastrophia hemiplicata*, Hall.—Canada, Dept. of Mines, Geol. Surv., Museum Bulletin no. 2, Geol. Ser. no. 18, 9 pp., 1 pl., July 11, 1914.

WILSON, M. E.
1. A geological reconnaissance from Lake Kipawa via Grand Lake Victoria to Kanikawinika island, Bell river, Quebec.—Canada, Dept. of Mines, Geol. Surv., Summary Rept., 1912, pp. 315-336, 1 fig., 1 map, 1914.
2. Kewagama Lake map-area, Quebec.—Canada, Dept. of Mines, Geol. Surv., Memoir 39, 139 pp., 29 pls., 9 figs., 1 map, 1913.

WILSON, RIDGWAY R.
Folded and faulted zones in the Crowsnest Pass district and their operative effect upon economic mining.—Can. Min. Inst., Bull. no. 28, pp. 27-31, 4 figs., August, 1914.

WILSON, W. J.
Palaeobotany.—Canada, Dept. of Mines, Geol. Surv., Summary Rept., 1912, pp. 407-410, 1914.

WOLFF, WILHELM.
Glazialgeologische Exkursionen des XII Internationalen Geologenkongresses zu Toronto, 1913.—Centralblatt für Mineralogie, Geologie und Paläontologie, no. 11, pp. 334-350; no. 12, pp. 374-384; no. 13, pp. 405-416; no. 14, pp. 431-443, 2 figs., 1914.

WOODMAN, J. E.
Interbedded iron ores of Nova Scotia: Abstract.—N.Y. Acad. Sc., Annals. vol. 23, p. 274, April 30, 1914.

WOOLSEY, W. J.
Asbestos resources of the Thetford area.—Can. Min. Inst., Bull. 27, pp. 103-106, 2 figs., July, 1914.

WRIGHT, G. FREDERICK.

1. Age of the Don River glacial deposits, Toronto, Ontario.—Geol. Soc. Am., Bull., vol. 25, no. 2, pp. 205-214, 3 figs., June, 1914.
2. Age of the glacial deposits in the Don valley, Toronto, Ontario.—Abstract: Geol. Soc. Am., Bull., vol. 25, no. 1, pp. 71-73, March, 1914.

WRIGHT, W. B.

The Quaternary ice age, XXIV 464 pp., 23 pls., 155 figs. MacMillan and Co., Ltd., London, 1914.

WRIGHT, W. J.

Geology of the neighbourhood of New Ross, Lunenburg county, Nova Scotia.—Canada, Dept. of Mines, Geol. Surv., Summary Rept., 1912, pp. 384-389, 1914.

Bibliography of Canadian Zoology, 1914.

(*Exclusive of Entomology*)

By E. M. WALKER, B.A., M.B., F.R.S.C.

(Read by Title, May Meeting, 1915.)

INVERTEBRATA.

CŒLENTERATA.

FRASER, C. McLEAN.

Some Hydroids of the Vancouver Island Region.

Transactions of the Royal Society of Canada, Series iii, 1914, vol. viii, section iv, pp. 99-216, with 36 plates.

A detailed systematic account of the hydroids of this region, with keys to the genera and species and a discussion of their geographical distribution. Seven new species are described.

Notes on some Alaskan Hydroids.

Transactions of the Royal Society of Canada, Series iii, 1914, vol. viii, section iv, pp. 217-222, with 1 plate.

Notes on 15 species, of which one is described as new.

ECHINODERMATA.

VERRILL, A. E.

Monograph of the shallow-water starfishes of the North Pacific Coast from the Arctic Ocean to California.

Papers from the Harriman Alaska Expedition, 1914, vol. xiv, part i, text, 408 pp.; part ii, plates.

A valuable treatise on this group, giving detailed descriptions of all the species. It is very fully and beautifully illustrated.

KOEHLER, RENÉ.

A contribution to the study of Ophiurans of the United States National Museum.

Smithsonian Institution, U.S. National Museum, Bulletin 84, 1914, 173 pp., with 18 plates.

Ophioglypha sarsii, *O. lymani* and *Ophiactis asperula* are recorded from Canadian waters.

VERMES.

COBB, N. A.

The North American free-living fresh-water Nematodes.

Contributions to a science of Nematology, II.

Transactions of the American Microscopical Society, April, 1914, vol. xxxiii, no. 2, pp. 69-119, with plates ii-vii.

Spilophora canadensis, n. sp. and *Oncholaimus punctatus*, n. sp., are recorded from Cape Breton Island, N.S.

Cooper, A. R.

On the systematic position of Haplobothrium globuliforme Cooper.
Transactions of the Royal Society of Canada, Series iii, 1914, vol. viii, section iv, pp. 1-5.
Describes this new genus and species of Cestodes.

A new Cestode from Amia calva L.
Transactions of the Royal Canadian Institute, 1914, vol. x, pp. 81-119, with plates 5-7.

A detailed and well illustrated account of the morphology of *Haplobothrium globuliforme* Cooper.

Duff, Dorothy.

The Beaver Fluke, Amphistomum subtriquetrum Rudolphi.
Transactions of the Royal Society of Canada, Series iii, 1914, vol. viii, section iv, pp. 87-98, with 14 figures.

La Rue, George Roger.

A revision of the Cestode family Proteocephalidae.
Illinois Biological Monographs, University of Illinois Bulletin, July-October, 1914, vol. xii, no. 13, 350 pp., 16 plates.
An elaborate study of the taxonomy and host relations of this family of tape-worms.

Contains a record of *Proteocephalus pusillus* from *Cristivomer namaycush* taken from Lake Temagami, Ont.

Potts, F. A.

Polychaeta from the North-eastern Pacific: the Chaetopteridae. With an account of the phenomenon of asexual reproduction in Phyllochaetopterus and the description of two new species of Chaetopteridae from the Atlantic.

Proceedings of the Zoological Society of London, 1914, pp. 955-994, with 6 plates.

Welch, Paul Smith.

Studies on the Enchytraeidae of North America.
Bulletin of the Illinois State Laboratory of Natural History, X, March, 1914, pp. 123-212, with plates viii-xii.

Enchytraeus saxicola Eisen and *E. citrinus* Eisen are reported from Lowe Inlet, B.C.

Arthropoda.

Weckel, Ada L.

Free-swimming fresh-water Entomostraca of North America.
Transactions of the American Microscopical Society, 1914, vol. xxxiii, no. 3, pp. 165-201, with 14 text figures.
Contains a reference to *Diaptomus tenuicaudatus* Marsh from Glen Lake, Saskatchewan.

MOLLUSCA.

HANHAM, A. W.

Notes on Mollusks from British Columbia.

The Nautilus, December, 1914, vol. xxviii, no. 8, pp. 87-88.

Gives notes on nine species.

LATCHFORD, F. R.

Valvata piscinalis in Canada.

The Nautilus, May, 1914, vol. xxviii, No. 1, p. 10.

This European species was found in numbers at Humber Bay, Toronto, Ont.

NYLANDER, OLAF O.

Distribution of some fresh-water shells of the St. John's River Valley in Maine, New Brunswick and Quebec.

The Nautilus, April, 1914, vol. xxvii, No. 12, pp. 139-141.

Gives notes on the distribution of 18 species of fresh-water and 7 species of land mollusca.

ORTMANN, A. E.

Studies in Najades.

The Nautilus, June, 1914, vol. xxviii, No. 2, pp. 20-22.

Idem, July, 1914, vol. xxviii, No. 3, pp. 28-34.

Idem, August, 1914, vol. xxviii, No. 4, pp. 41-47.

Idem, October, 1914, vol. xxviii, No. 6, pp. 65-69.

Records *Anodonta marginata* Say from Six Mile Lake, Silver Islet, Thunder Cape, Ont.

SIMPSON, CHARLES TORREY.

A descriptive catalogue of the Naiades or pearly fresh-water mussels.

Bryant Walker, Detroit, Mich., 1914, xi + 1540 pp.

Contains full descriptions of all North American species, including many from Canadian localities.

STAFFORD, J.

The native oyster of British Columbia.

Report of the Commissioner of Fisheries for the Province of British Columbia for 1913. Victoria, 1914, pp. R79-R102, with 2 plates.

THOMPSON, W. F.

Report on the shell-fish beds of British Columbia.

Report of the Commissioner of Fisheries for the Province of British Columbia for 1913. Victoria, 1914, pp. R103-R125, with 3 plates.

Report on the Abalone of British Columbia (Haliotis gigantea Chemnitz).

Report of the Commissioner of Fisheries for the Province of British Columbia for 1913. Victoria, 1914, pp. R126-R130, with 2 plates.

VANATTA, E. G.

Land and fresh-water shells from eastern Canada.

Proceedings of the Academy of Natural Sciences of Philadelphia, March, 1914, vol. lxxi, part 1, pp. 222-226.

Gives notes on 41 species from the Magdalen Islands, Que., and Prince Edward Island. One new species is described, viz.: *Succinea bayardi*, n. sp.

VERTEBRATA.

Pisces (Fishes).

Gilbert, C. H.

Contributions to the life-history of the Sock-eye Salmon. (No. 1).

Report of the Commissioner of Fisheries for the Province of British Columbia for 1913. Victoria, 1914, pp. R53-R78, with 13 plates.

Halkett, Andrew.

The Red Canadian Trout (Salvelinus marstoni).

Le Naturaliste Canadien, July, 1914, vol. xli (xxi of 2nd Series), No. 1, pp. 3-4.

Contains notes on the specific characters, coloration and distribution of this fish.

Naturaliste Canadien, Le (Editorial).

Salmo salar ouananiche M'C.

August, 1914, vol. xli (xxi of 2nd Series), No. 2, pp. 20-24.

Regan, C. Tate.

The systematic arrangement of the fishes of the family Salmonidae.

Annals and Magazine of Natural History, 1914, vol. xiii, pp. 405-408. Contains references to Canadian species. The generic names *Cristivomer* and *Oncorhynchus* are discarded, the former being placed in the synonymy of *Salvelinus*, the latter in that of *Salmo*.

Smith, Harlan I.

Fish of the Rocky Mountains Park.

Handbook of the Rocky Mountains Park Museum. Dominion Parks Branch, Department of the Interior, Canada, 1914, pp. 86-89.

Gives a partial list, with notes, of the fish occurring in the Rocky Mountains Park, and a catalogue of the specimens in the Museum. Notes by J. T. N. (John Treadwell Nichols).

Aves (Birds).

Anderson, E. M.

Report on birds collected and observed during April, May and June, 1913, in the Okanagan Valley, from Okanagan Landing south to Osoyoos Lake.

Report of the Provincial Museum for the year 1913. Province of British Columbia. Victoria, 1914, pp. G 7-G 16, with 3 plates.

An annotated list of 129 species of Birds.

Bird-lore (Editorial).

Note on the Acadian and Hudsonian Chickadees (No title).

January-February, 1914, vol. xvi, No. 1, p. 58.

A Co-operative Study of Bird Migration.

May-June, 1914, vol. xvi, No. 3, pp. 180-185.

Includes data from Yarmouth and Antigonish, N.S., and Kingston, Ont.

CHAPMAN, FRANK M.

Notes on the plumage of North American Sparrows, twenty-fifth paper. Bird-lore, January-February, 1914, vol. xvi, No. 1, pp. 24-25, with coloured frontispiece.
Describes the plumage of the Redpoll, Holboell's Redpoll, the Hoary Redpoll, the Purple Finch and the California Purple Finch.

Notes on the plumage of North American Sparrows. Twenty-sixth paper.
Idem, March-April, 1915. vol. xvi, No. 2, p. 107, with coloured frontispiece.
Describes the plumage of Cassin's Purple Finch and the House Finch.

Notes on the plumage of North American Sparrows. Thirtieth paper. Idem, November-December, 1914, vol. xvi, No. 6, pp. 442-443, with coloured frontispiece.
Describes the plumage of the Slate-coloured Junco, White-winged Junco, Cardina Junco, Shufeldt's Junco, Thurber's Junco, and the Point Pinos Junco.

Bird-lore's Fourteenth Christmas Census.
Bird-lore, January-February, 1914, vol. xvi, No. 1, pp. 26-50. Includes data from Yarmouth, N.S., London, Millbrook and Port Dover, Ont., Lashburn, Sask., and Okanagan Landing, B.C.

COOKE, W. W.

The migration of North American Sparrows. Twenty-sixth paper. Bird-lore, January-February, 1914, vol. xvi, No. 1, pp. 19-23. Discusses the migration of the Redpoll, Hoary Redpoll and the Purple Finch.

The migration of North American Sparrows. Twenty-seventh paper. Idem, March-April, 1914, vol. xvi, No. 2, pp. 105-106.
Discusses the migration of the California Purple Finch, Cassin's Finch and the House Finch.

The migration of North American Sparrows. Thirty-first paper.
Idem, November-December, 1914, vol. xvi, No. 6, pp. 438-442, with coloured frontispiece.
Discusses the migration of the White-winged Junco, Slate-coloured Junco and the Oregon Junco.

Distribution and migration of North American rails and their allies. Bulletin of the United States Department of Agriculture, No. 128, September 25, 1914, pp. 1-50.
Gives extensive notes on the breeding range, winter and migration ranges, etc., and 19 maps showing the distribution of the various species, many of which occur in Canada.

CORNISH, G. A.

Nature study lessons for teachers and students. Bird studies.
Dominion Book Co., Toronto, xv + 96 pp. with numerous illustrations, including 11 coloured plates.

CORNISH, G. A.

This excellent little book contains 30 lessons on a number of our common birds, their habits, nests, food, migration, etc. Each lesson gives a series of observations to be made by the student, the answers to which are included in the information for the teacher.

CRIDDLE, STUART.

Bird notes from Aweme, Manitoba.

The Ottawa Naturalist, January, 1914, vol. xxvii, No. x, p. 144.

Reports a late southward migration of the Lapland Longspur, probably due to mild weather and lack of snow.

CROSSA, GUS.

Notes from Alberta, Canada.

The Oologist, March, 1914, vol. xxxi, No. 3, pp. 54-56.

Gives brief notes on a number of species of birds observed at Pigeon Lake, Alta., about 60 miles southwest of Edmonton.

D. B.

Notes on the quail.

The Ottawa Naturalist, December, 1914, vol. xxviii, No. 9, pp. 124-126.

Gives notes on the habits of the American Quail with suggestions for its conservation.

DE MIKLOS, M. E.

Protection of birds.

Commission of Conservation, Canada, 1914, Rep. 5th Annual Meeting, pp. 218-234.

Discusses the importance to agriculture of the protection of birds and the various ways by which their natural increase is counteracted. Also considers means of prevention of wilful destruction of birds by man and gives an outline of the protective legislation of various countries.

DIONNÉ, C. E.

Le pigeon voyageur existe-t-il encore?

Le Naturaliste Canadien, July, 1914, vol. xli (xxi of 2nd. Series), No. 1, pp. 1-2.

A pair of these birds were said to have been observed by M. A. Lalonde in the vicinity of Oka, Que.

MORT DE LA DERNIÈRE TOURTE.

Le Naturaliste Canadien, September, 1914, vol. xli (xxi of 2nd Series), No. 3, pp. 33-34.

Notes on the death of the last Passenger Pigeon at the Zoological Gardens, Cincinnati, O.

EDUCATIONAL REVIEW, THE (Editorial)

Winter Birds.

April, 1914, No. 323, pp. 233, 234. St. John's, N.B.

Reports received from various parts of Nova Scotia.

FARLEY, F. L.

Note on the American Magpie (Pica pica hudsonica).

The Ottawa Naturalist, January, 1914, vol. xxvii, No. X, p. 139.

Gives notes on the distribution of this bird in Canada and cites instances of its occurrence in several localities in Alberta.

Winter notes on Alberta hawks and owls.

The Ottawa Naturalist, April, 1914, vol. xxviii, No. 1, p. 11.

FLEMING, J. H.

An abnormal rose-breasted grosbeak.

The Auk, January, 1914, vol. xxxi, No. 1 p. 102.

Describes a peculiarly coloured female of *Zamelodia ludoviciana* taken at Sand Lake, Parry Sound District, Ont.

GERALD, GEORGE E.

Nest of the Ruby-throated Hummingbird.

The Oologist, August, 1914, vol. xxxi, No. 5, pp. 150, 151.

Describes a nest of this bird observed in Muskoka, Ont.

Nesting of the Whip-poor-will.

The Oologist, August, 1914, vol. xxxi, No. 8, p. 151.

Observations on a nest of this bird found in Muskoka, Ont.

GOWANLOCK, J. NELSON.

The grackle as a nest-robber.

Bird-lore, May-June, 1914, vol. xvi, No. 3, pp. 187, 188.

A bronzed grackle observed repeatedly feeding on eggs and nestlings of English sparrows, on a street in Winnipeg, Man.

HASKELL, WILLIAM S.

Protection of migratory birds.

Commission of Conservation, Canada, 1914, Rep. 5th Annual Meeting, pp. 66-73, with 4 plates.

Describes the national movement for the conservation of wild life in the United States.

HEWITT, C. GORDON.

The protection of birds in and around Ottawa.

The Ottawa Naturalist, March, 1914, vol. xxvii, No. 12, pp. 161-171.

Discusses the general question of the value of protecting birds, the economic value of certain common species, and describes the efforts that are being made for the protection of native birds around Ottawa.

H. G. P.

Notes on birds—Spring migrants.

The Educational Review, July, 1914, vol. xxviii, No. 1, p 1.7, St. John, N.B.

Notes on birds observed in New Brunswick and Nova Scotia.

KERMODE, F. and ANDERSON, E. M.

Report on birds collected and observed during September, 1913, on Atlin Lake, from Atlin to south end of the Lake.

Report of the Provincial Museum for the year 1913, Province of British Columbia. Victoria, 1914, pp. G. 19-G. 21.

An annotated list of 35 species.

LEWIS, HARRISON F.

Breeding of the Red-winged Blackbird (Agelaius phoeniceus phoeniceus) in Nova Scotia.

The Auk, October, 1914, vol. xxxi, No. 4, pp. 537, 538.

Describes the finding of a nest of this bird in a swamp near Antigonish, N.S.

A problem in food-supply and distribution.

Bird-lore, March-April, 1914, vol. xvi, No. 2, p. 113.

Suggests the possibility of a northward migration in winter of Red-breasted Nuthatches and Crossbills in order to obtain a more abundant food-supply.

MACCLEMENT, W. T.

The New Canadian Bird Book.

Dominion Book Company, Toronto, 1914, xvi+ 324 pp., with 60 full-page coloured illustrations.

Contains a key to the orders and families of Canadian birds, and short descriptions of all the specie with notes on their habits and distribution.

McLEOD, J. R.

Cowbird's Eggs.

The Oologist, June, 1914, vol. xxxi, No. 6, p. 128.

Notes the plentiful occurrence of eggs of this bird in Middlesex Co., Ont., during 10 successive years, and cites two cases in which more than one cow-bird's egg were found in the same nest. Also notes successive laying of three eggs in one nest of the Chestnut-sided Warbler.

NORMAN, ERNEST S.

Gavia imber (Loon).

The Oologist, September, 1914, vol. xxxi, No. 9, pp. 173, 174.

Describes the finding of a loon's nest on the shore of Stony Lake, Northern Manitoba.

OBERHOLSER, HARRY C.

A monograph of the genus Chordeiles Swainson, type of a new family of goatsuckers.

Smithsonian Institution, U.S. National Museum, Bulletin 86, 1914, pp. 1-123, with 5 plates.

Two forms are included in the Canadian fauna, viz. *C. virginianus virginianus* and *C. virginianus hesperis.*

PIERS, HARRY.

The occurrence of European birds in Nova Scotia.

Transactions of the Nova Scotia Institute of Science, June 25, 1914, vol. xiii, part 2, pp. 228-239.

PIERS, HARRY.

The following birds are noted: The European Widgeon, European Teal, Corn Crake, Curlew Sandpiper, Green Sandpiper, Ruff, Whimbrel, Lapwing and Greenland Wheatear.

REINECKE, OTTOMAN.

Semipalmated Sandpiper.

The Oologist, October, 1914, vol. xxxi, No. 10, pp. 181-183.

Three or four flocks of this bird were observed on the north side of Lake Erie, about 18 miles from Buffalo.

The Whistling Swan.

The Oologist, December, 1914, vol. xxxi, No. 12, pp. 230, 231.

Describes how these birds, during their northward migration, are frequently carried over Niagara Falls to their destruction, while resting on the river at night.

ROGERS, CHARLES H.

A coöperative study of bird migration.

Bird-lore, July-August, 1914, vol. xvi, No. 4, pp. 270-274.

Gives data from Antigonish, N.S., and Reaboro, Ont.

SAUNDERS, W. E.

The Tufted Tit—a new record for Canada.

The Auk, July, 1914, vol. xxxi, No. 3, p. 402.

Records the finding of Two Tufted Tits (*Bæolophus bicolor*) at Point Pelee, Ont.

The problem of bird encouragement.

The Ottawa Naturalist, October, 1914, vol. xxviii, No. 7, pp. 81-85.

Gives suggestions for the establishment of bird reserves and directions for planting them with shrubs, vines, etc., and for their proper care.

SMITH, HARLAN I.

Birds of the Rocky Mountains Park.

Handbook of the Rocky Mountains Park Museum. Dominion Parks Branch, Department of the Interior, Canada, 1914, pp. 35-85.

An annotated list of birds found in the Rocky Mountains Park and catalogue of specimens in the Museum.

TAVERNER, P. A.

A new subspecies of Dendrapagus (Dendrapagus obscurus flemingi) from southern Yukon Territory.

The Auk, July, 1914, vol. xxxi, No. 3, pp. 385-388.

Describes this new subspecies and records from British Columbia, Mackenzie, Yukon Territory, Montana and Idaho.

A new species of Dendrapagus (Dendrapagus obscurus flemingi) from southern Yukon Territory.

Geological Survey, Department of Mines, Canada. Museum Bulletin No. 7, Biological Series, No. 4, December, 1914, pp. 1-4.

TOWNSEND, CHARLES WENDELL.

A plea for the conservation of the Eider.

The Auk, January, 1914, vol. xxxi, No. 1, pp. 14-21.

Describes the wholesale destruction of the eggs of this bird by fishermen and Indians on the coasts of Labrador, Newfoundland and Nova Scotia, and suggests methods for its protection.

WRIGHT, ALBERT HAZEN.

Early records of the Wild Turkey, Part II.

The Auk, October, 1914, vol. xxxi, No. 4, pp. 463-473.

Contains references to early methods of capture in Canada.

YOUNG, C. J.

The Cardinal Grosbeak in winter in Northumberland County, Ontario.

The Ottawa Naturalist, June-July, 1914, vol. xxviii, Nos. 3 and 4, p. 55.

YOUNG, JOHN P.

Fall migration at Cobourg, Ontario.

Bird-lore, September-October, 1914, vol. xvi, No. 5, pp. 356, 357.

Contains a list of birds observed at this locality on October 4, 1913.

MAMMALIA.

ANDERSON, E. M.

Mammals collected in the Okanagan Valley, April, May and June, 1913.

Report of the Provincial Museum for the year 1913. Province of British Columbia, Victoria, 1914, pp. G. 18, G. 19.

An annotated list of 16 species of mammals and 5 species of reptiles.

HOLLISTER, N.

A systematic account of the Grasshopper Mice.

Proceedings of the United States National Museum, October, 1914, vol. xlvii, No. 2057, pp. 427-489, with 3 text figures (maps, showing distribution of the various species and subspecies) and one plate. *Onchomys leucogaster missouriensis* (Audubon and Bachman) is recorded from Saskatchewan.

JONES, J. WALTER.

Fur-farming in Canada.

Commission of Conservation, Canada, 1914, 257 pp., with 21 full-page illustrations from photographs and 7 maps showing the distribution in Canada of the North American red foxes, raccoons, American martens, skunks, muskrats and beaver.

KERMODE, F. and ANDERSON, E. M.

Mammals collected in the Atlin District, September, 1913.

Report of the Provincial Museum for the year 1913. Province of British Columbia. Victoria, 1914, p. 621.

Seven species are listed.

NEWCOMBE, C. F. and NEWCOMBE, W. A.

Sea-lions on the coast of British Columbia.

Report of the Commissioner of Fisheries for the Province of British Columbia for 1913, pp. R 131-R 145, with 16 plates.

SMITH, HARLAN I.

Mammals of the Rocky Mountains Park.

Handbook of the Rocky Mountains Park Museum, Dominion Parks Branch, Department of the Interior, Canada, 1914, pp. 10-34. Gives notes on the habits of the various species of mammals found in the Park and a catalogue of the specimens in the Museum.

WILLEY, ARTHUR.

The blastocyst and placenta of the beaver.

Quarterly Journal of Microscopical Science, New Series, June, 1914. No. 238, (vol. 60, part 2), pp. 175-259, with plates 14-21.

MISCELLANEOUS.

ANONYMOUS ("X").

Expériences d'animaux endormis par le froid, puis revivifiés.

Le Naturaliste Canadien, December, 1914, vol. xli (xxi of 2nd Series), No. 6, pp. 81-83.

CRIDDLE, NORMAN.

The value of some mammals and birds as destroyers of noxious insects.

The Ottawa Naturalist, December, 1914, vol. xxviii, No. 9, pp. 119-124.

CAMERON, A. T.

The iodine content of the thyroid and of some branchial cleft organs.

Journal of Biological Chemistry, January, 1914, vol. xvi, No. 4, pp. 465-473.

The distribution of iodine in plant and animal tissues.

Transactions of the Royal Society of Canada, Series III, 1914, vol. viii, Section iv, pp. 7-10.

FRASER, C. MCLEAN.

Marine Biology in British Columbia.

Papers read before the British Columbia Academy of Science, 1910-1913, Vancouver, 1914, pp. 49-60.

Pacific Coast Biological Station, Departure Bay, B.C.

Transactions of the First Annual Meeting of the Pacific Fisheries Society, 1914, pp. 1-9.

KERMODE, Francis.

Provincial Museum Report for the year 1913.

Province of British Columbia. Victoria, B.C., 1914, pp. G 5, G 6.

PERRY, H. G.

Nature Study of Animals.

The Educational Review, St. John, N.B. January, 1914, No. 320, pp. 155-157.

Idem, February, 1914, No. 321, pp. 180-182.

Idem, March, 1914, No. 322, pp. 203-205.

Idem, April, 1914, No. 323, pp. 231-233.

Idem, May, 1914, No. 324, pp. 253-254.

Idem, July, 1914, No. 326, pp. 14-16.

Idem, August, 1914, No. 327, pp. 34-36.

Idem, September, 1914, No. 328, pp. 58-60.

Idem, October, 1914, No. 329, pp. 82-84.

Idem, November, 1914, No. 330, pp. 106-108.

Idem, December, 1914, No. 331, pp. 130-132.

Each article is well illustrated.

SUPERINTENDENT, GAME AND FISHERIES DEPARTMENT.

Seventh Annual Report of the Game and Fisheries Department, Toronto, 1913 (1914), 148 pp.

Contains information on the abundance or scarcity of fish, birds and mammals in various parts of Ontario. Includes also coloured illustrations of the Canada Grouse, Wood Duck, Lake Trout and Rock Bass.

TAVERNER, P. A.

Geological Survey Museum Work on Point Pelee, Ontario.

The Ottawa Naturalist, November, 1914, vol. xxviii, No. 8, pp. 97-105.

Contains notes on birds, reptiles and mammals observed at this locality.

APPENDIX.

CORT, WILLIAM WALTER.

Notes on the Trematode genus Clinostomum.

Transactions of the American Microscopical Society, July, 1913, vol. xxxii, No. 3, pp. 169-182, with plate ix.

Contains references to *C. marginatum* and *C. attenuatum* from Go Home Bay, Ontario.

HARRIS, D. FRASER.

Notes on a gastrolith found in a moose.

Transactions of the Nova Scotia Institute of Science, 1913, vol. xiii, part 3, pp. 242,243.