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THE OTTAWA FIELD-NATURALISTS' CLUB, 1897-1898.

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THE OTTAWA NATURALIST.

VOL. XI. OTTAWA, APRIL, 1897. NO. 1.

ANNUAL REPORT OF THE OTTAWA FIELD-NATURALISTS' CLUB, 1896-97.

The Council elected by you on the 17th March, 1896, now submits for your consideration the following as its account of the Club's work during the year 1896-97 :

The number of members at present on the roll is 248.

Fourteen meetings of the Council were held during the year. At the first of these, according to custom, Leaders in the several branches, viz. : Geology, Botany, Entomology, Ornithology, Conchology and Zoology, were appointed, besides an Editor and Associate-Editors for the publication of the OTTAWA NATURALIST.

At the invitation of the Royal Society of Canada to send a delegate, our President, Mr. Shutt, was chosen to represent us. At its meeting he presented the annual account of the work of the Club, which will be found incorporated in the Royal Society of Canada's Transactions.

Under the auspices of the Club, three General Excursions were held during the summer.

The first was to Chelsea on Saturday 23rd May, 1896, and a full account of this excursion can be read in the June number of the NATURALIST. The second was to Rockland on the 20th June, of which a full account is published in the July number of the NATURALIST. The third was on the 26th September to Galetta and Marshall's Bay on the Mississippi and Ottawa rivers, respectively, of which a full account is recorded in the October number of the NATURALIST.

Besides the General Excursion, a number of Sub-excursions were held on Saturday afternoons, and proved to be of great interest to those who attended them.

THE OTTAWA NATURALIST, the official organ of the Club has been under the editorship of Dr. Ami, with a staff of associate editors. This periodical will compare favourably with other publications of the kind, its articles being of a varied character, thoroughly scientific in tone, yet popular enough to meet the tastes of all students of Natural History who peruse its pages.

The Library—mostly made up of valuable exchanges from other clubs or societies—has been under the management of Mr. Sinclair. The work devolving upon the Librarian has of late increased to such an extent that the appointment of an Assistant Librarian is desirable.

During the absence of the Secretary from the Capital, in an official capacity, Miss Marion Whyte kindly and efficiently performed the work of that officer.

Jointly with the Literary and Scientific Society the Club held seven soirees during the winter months, and by the kind permission of the Ottawa Teachers' Association, a lecture by Prof. Cox, of McGill University, entitled: "Electrical Discharges in High Vacua," was incorporated in the series.

The seven soirees in their course were as follows:—

Nov. 19, 1896.—Conversazione—Exhibition of microscopical objects, specimens of natural history and lantern slides. Short addresses were delivered by Mr. Shutt, President of the Club; Mr. Klotz, President of the Literary and Scientific Society; Dr. MacCabe, Principal of the Normal School; and Mr. Macdougall, President of the Ottawa Teachers' Association.

Dec. 17.—A lecture entitled: "Goethe," by Prof. L. R. Gregor, of McGill University.

Jan. 14, 1897.—A lecture entitled: "Under the Midnight Sun—A Trip to Iceland" (with original sciopticon views), by Prof. Mavor, of Toronto University.

Jan. 21.—Addresses on "Recent Explorations in Canada," by Dr. G. M. Dawson, Dr. Robert Bell, Mr. J. B. Tyrrell and Mr. A. P. Low.

Feb. 4.—A lecture entitled: "Lyrical poetry of the Elizabethans. by Mr. D. C. Scott.

Mar. 4.—A lecture entitled: "Weather," by Mr. Otto J. Klotz.

Mar. 11.—A lecture entitled: "Fruit and Fruit Districts of Canada" (illustrated), by Mr. John Craig. His Excellency the Governor General was present at this lecture and took part in the discussion that followed.

A lecture by Dr. Macphail, of the University of Bishop's College, Montreal, on "The American Lobster," postponed from 18th February, was delivered on Thursday, 18th March. The lecture was illustrated with lantern slides and specimens.

On the resolution of the Council, the collection of mounted birds, &c., in the glass case in the Normal School were named by the leaders of the Ornithological branch.

A memorial to the Hon. Minister of Education was drawn up by a Committee, appointed by the Council, and then signed by members of the Council and members of the Club, asking for a grant of $300 annually towards the publication of the NATURALIST.

The thanks of the Club are due to Dr. MacCabe, Principal of the Normal School, and to the Minister of Education for their courteous kindness in granting the use of the Assembly Hall for the course of lectures, and to Dr. MacCabe for the use of a room for the Council meetings.

One word in conclusion which is really in the interest of the Club. Many of the members are still in arrears in the payment of their annual fee, and such are therefore urged without further delay to hand the amount due to the Treasurer, and thus remove from the Club what otherwise will be a blemish as it begins another year of its history.

ANDREW HALKETT, *Secretary.*

FRANK T. SHUTT, *President.*

TREASURER'S STATEMENT.

RECEIPTS.

Balance on hand March 18th 1896		$ 25 19
Members fees, current year	$126 00	
" " arrears	36 50	
" " in advance	11 00	
		173 50
Naturalists sold		1 61
Advertisements in *Naturalist*		88 25
Authors' extras		26 85
Excursions		10 80
Total receipts		$326 20

EXPENSES.

Printing *Naturalist*, 9 mos	$216 45	
Engraving	2 50	
Postage	16 22	
Mailing and wrapping	9 75	
		$244 92
Soirées and Lectures:		
Circulars, postcards, notices, &c	$10 75	
Lantern, door-keeper, &c	14 35	
		25 10
General postage		7 60
Stationery		1 38
Printing authors' extras		14 55
Sundries		7 05
Total expenses		$300 60
Cash on hand		25 60
		$326 20

Audited and found correct, March 18th, 1897.

(Sgd.) J. BALLANTYNE, R. B. WHYTE, } *Auditors.*

REPORT OF THE ENTOMOLOGICAL BRANCH,

To the Council of the Ottawa Field-Naturalists' Club :

The Leaders have much pleasure in presenting the following brief report on the work of the year 1896-97.

COLEOPTERA.—The species belonging to this order are now so well represented in our collections that many additions cannot be expected, except as the result of very careful and special collecting in such families as the Dytiscidæ and Hydrophilidæ, which are chiefly aquatic forms, or the Staphylinidæ, many of which live in, or upon, decaying vegetable matter or fungi. A few additions to our list are, however, annually made, even in the groups which have been more fully worked up, and occasionally some very rare species is accidently obtained. From time to time our territory is reached by insects, either American or foreign, which have gradually spread from more distant points. Some of these species multiply very rapidly, and thus may, in a few years after the first individuals are noticed, become quite abundant. Such has been the case with *Aphodius prodromus* Brahm., mentioned in previous reports, and which is now everywhere met with. Another instance is *Sphæridium scarabæoides* Linn., first found at Casselman in May 1895, and which Mr. Simpson last summer found to be abundant at King's Mere. It is somewhat curious that, though so plentiful there, careful search in the more immediate vicinity of the city has failed to produce specimens. A pretty little steel-blue weevil was last summer observed for the first time, viz., *Cetorhynchus cyanipennis* Germ. This species appears to have been first noticed in America about ten years ago (Entomologica Americana Vol. V., p. 57.) but it must now be somewhat widely distributed as a specimen taken at Toronto was received for examination. In Ottawa it has occurred upon garden-cress. A rare beetle picked up on the railway track near Casselman is *Hylecœtus lugubris*

Say, belonging to the family Lymexylidæ, of which no representative had previously been recorded within our district.

On referring to Henshaw's check-list of N. A. Coleoptera, it appears that there are still thirteen families of which no examples have yet been captured here. Several of these families are, however, represented by single species, and altogether furnish only about thirty forms. Many of these are southern or western, but a few may be found to occur here if collecting is carefully continued. Unfortunately at present the collectors are few in number, and unable throughout the season to devote to collecting the time necessary to assure the capture of species which may occur only for brief periods, or in very small numbers. Mr. Simpson last summer collected assiduously at King's Mere, and was rewarded by many fine species, such as the beautiful longicorns *Purpuricenus humeralis* Fab. and *Anthophilax malachiticus* Hald. He obtained also additional specimens of the interesting and somewhat rare staphylinid, *Lomechusa cava* Lec., a dweller in ants' nests, and many other members of the same family, of which some have been determined by Mr. Wickham, and several additions thereby made to our lists. Many undetermined species in nearly all families are still in our collections, and there still remains plenty of work for local Coleopterists.

Among the eminent entomologists who for many years rendered invaluable assistance, none did so more willingly or more painstakingly than Dr. John Hamilton, of Allegheny, Pa., who recently died in Florida. He was one of the foremost of American Coleopterists and the author of numerous valuable contributions to the leading entomological publications. Many of these dealt with Canadian insects, and special attention was given by him to the geographical distribution of northern species. He was also a very careful and industrious collector, as is well evidenced by almost his latest production, a Catalogue

of the Coleoptera of South-western Pennsylvania (1895). The species enumerated therein numbered 2,153 and were mostly from the neighbourhood of Allegheny. His death will be sincerely regretted throughout the entomological world.

LEPIDOPTERA.—Moths and butterflies were abundant during the past summer, and although no new Diurnals were added to the local list, good series were obtained of some desirable species. The native white butterfly *Pieris oleracea* in the form *hiemalis* which flies at the end of May was remarkably abundant in Clarke's wood near the Experimental Farm. The Camberwell Beauty, *Vanessa antiopa*, was injuriously abundant in many places around the city upon elm trees and willows. The Semicolon Butterfly, *Grapta interrogationis*, also appeared in unusual numbers this year, the caterpillars being found everywhere on elm trees. The Spring Azure, *Lycæna Lucia*, a pretty little blue butterfly, was noted laying its eggs on the flowers of *Viburnum lantana*, an introduced ornamental European shrub. This was of interest because the same butterfly has previously been recorded as ovipositing at Ottawa on the flowers of *Viburnum pubescens* an unusual food plant.

Some nice captures were made in the shape of rare moths. Specimens of *Amphion nessus* and *Dolba Hylæus* were taken by Mr. C. Young at Meech's Lake, and a most interesting capture was reported by Mr. Harry May of the Imperial Moth, *Eacles Imperialis*. The latter collector among other good things took several specimens of the lovely Luna Moth. On May 2nd a fine specimen of the beautiful and active little moth *Brephos infans* was taken flying along a road at Rockcliffe.

Breeding experiments have been continued by members of the section, with useful results. A fine female *Paonias excæcatus* was bred from eggs laid by a female sent from St. Elmo, B.C. Eggs of the very rare butterfly *Erebia discoidalis* were sent from Olds, N.W.T., by Mr. T. N. Willing, and the whole life history,

with the exception of the pupa, has been secured from these eggs. Mr. Willing also sent eggs of *Argynnis Freya* from which Mr. Scudder reared the larvæ to the last stage in Boston, U.S., but unfortunately they then all died. It is hoped that future experiments with these species will be more successful.

HYMENOPTERA.—Satisfactory advance has been made in our knowledge of such members of this order as inhabit this region, and the number of forms which have been collected exceeds probably even that of our Coleoptera, the smaller parasitic species being remarkably numerous. Collections during the past summer were not so extensive as in some former seasons, but such an amount of undetermined and unarranged material has accumulated in our cabinets that there has been no lack of forms to study and to profitably employ the winter evenings. A preliminary list has been prepared of the species belonging to the family Proctotrypidæ ; the first portion of which was printed in the December issue of the OTTAWA NATURALIST, while the remainder is now in type and will appear in the March number. These minute insects have in the past been greatly unmolested by Canadian collectors, so that new and interesting species have proved very numerous, as will be seen by the list which contains in all over 150 species. A case is exhibited this evening containing examples of all the species except such as are known only by type speeimens in the collection of Mr. Ashmead, who has described nearly all the species. It will we observed that these insects are all very small, and with few exceptions require a microscopical examination for their indentification. They are all parasitic in their mode of life, infesting the eggs and larvæ of other insects, but only a small proportion of the species has yet been bred, so we have yet to ascertain upon what insects many of the most common species are parasites.

One very remarkable instance of the manner in which such minute parasites destroy other insects has been recorded in a

recent Bulletin (No. 7, New Series) of the Division of Entomology of the U. S. Dept. of Agric. The author, Mr. L. O. Howard, under the title "A Case of Excessive Parasitism," relates the fate of some scale-insects, *Lecanium fletcheri* Cockerell, which had been obtained in June upon one of the cedar hedges at the Ottawa Experimental Farm. From 80 scales there were obtained 127 parasites; others, however, had previously issued so that 97½ per cent. of the scales were infested. Six species of intruders werere presented, viz :—*Coccophagus cognatus* How., *C. fletcheri* n. sp., *Aphycus pulvinaria* How., *Encyrtus flavus* How., *Chiloneurus albicornis* How., and *Blastothrix longipennis* How. Other scale-insects, such as the Elm Lecanium, have also been found very much infested by similar tiny foes, by which the balance of Nature is kept finely adjusted, and the spread of the very injurious scales is rapidly checked. A very interesting little Braconid has again been rared from puparia of a small fly named *Phytomyza geanulis* Loew. The larvæ of this fly are miners in the leaves of our common Columbine (*Aquilegia Canadensis*) and much disfigure them by causing large white irregular streaks and blotches. Mr. Ashmead, who found the parasite to be undescribed has named it *Mesora phytomyzæ* and will publish its description in his forthcoming monograph of the Braconidæ.

MISCELLANEOUS.—In other orders little or no work, at least of a systematic nature, has been done, but the Leaders have endeavoured to make arrangements by which these, at present, neglected groups may receive more attention and may have the species belonging to them gradually collected and determined. This must be done if the Club desires to fulfill the object for which it was specially organised, viz., the accumulation and publication of a full knowledge of the geology, flora and fauna of the district.

Injurious insects in the Ottawa district were not particularly noticeable during last year. Cabbage and radish maggots were

probably the species most complained of. The army-worm, which last year did serious damage to crops in almost every county of Ontario, was at Ottawa only represented by a few of the moths taken by collectors. In other districts they are reported as having occurred in myriads. A local outbreak of the Tussock moth on the shade trees of Toronto created much interest. In was not a new attack, having been watched by the Leaders from time to time for the last ten years when passing through Toronto to attend the annual meeting of the Entomological Society of Ontario. The sudden increase in the numbers, however, attracted the attention of the City Council, and mainly through the energy of Alderman John Hallam, steps have been taken to destroy the eggs during this winter. In this way there is no doubt the beautiful shade trees for which Toronto is celebrated will be saved.

Among interesting insects sent in for identification, mention may be made, as illustrating unexpected foods for insects, of a small beetle received from Mr. E. Carew Gibson, of Victoria, B.C. This is *Trigonogenius faretus* and was found feeding in both the larval and perfect form in a tin of Cayenne pepper. Another species with the same habits, *Sitodrepa panicea*, called the bread beetle, was also received a few years ago from Mr J. F. Whiteaves of the Geological Survey.

Lasioderma serricorne, the cigarette beetle, as its common name indicates, has has a penchant for chewing tobacco and is occasionally very injurious in cigar and cigarette factories.

Among general work done during the year may be mentioned the determination of specimens sent in by collectors in various localities from Newfoundland to British Columbia ; work which, although it occupies time which might be given to the study of our own insects, is cheerfully performed in order to encourage those taking up entomology. A considerable knowledge is at the same time attained of the distribution of our insects.

Two short lists of Ottawa spiders have been published, as a commencement toward a knowledge of our clever little spinners, whose habits are well deserving of study, and will be found to vary greatly in different groups.

No collections have been entered for the prize which was offered by the Council at the opening of the season as a stimulus toward collecting by our younger members.

In conclusion we desire to acknowledge the receipt from our learned corresponding member, Miss E. A. Ormerod, of her Twentieth Report, which is a most valuable and interesting record of her observations upon Injurious Insects in Great Britain during the year 1896. Her work is of a most instructive and admirable character.

W. H. HARRINGTON,
J. FLETCHER,
W. SIMPSON.

17th March, 1897.

REPORT OF THE GEOLOGICAL BRANCH OF THE OTTAWA FIELD NATURALISTS' CLUB FOR 1896-97.

To the Council of the Ottawa Field-Naturalists Club :

In presenting the fifteenth Annual Report of this Branch of the Club's work for 1896-97, your leaders have to announce that considerable progress has been made and renewed vigour is evident from the number of papers written on the geology of this district and also from the interest manifest whenever excursions or sub-excursions of the Club are held.

During the early part of the season a number of geological sub-excursions were held to objective points about the Capital on both sides of the Ottawa River. The quarries and cuttings along the railroad track in Hull, Que., were visited, and an interesting series of fossils obtained. Upwards of thirty species were recorded from the "dump" along the Aylmer electric road.

Your leaders also report special interest taken in the geological section at the three general excursions of the Club held during the year.

Chelsea, Que.—The first place visited was Chelsea, Que., a station along the Ottawa & Gatineau Valley Railway. Both Dr. Ami and Mr. W. J. Wilson were present and took part in the discussions and gave addresses after the day's outing on re-assembling in Gilmour's Grove. The marine shells of the terraces which flank the Laurentide hills at this point were carefully described and specimens of *Saxicava rugosa*, *Macoma fragilis* and *Balanus crenatus*, were exhibited and distributed to many who were not fortunate enongh to join the geologists. General notes on the Archæan rocks were also given by the leaders. The altitude of the Chelsea station, above tide or sea level is feet, and the marine shells came from about the same level.

Rockland Quarries.—The second general excursion of the Club was essentially a geological one, when the Rockland quarries were visited. Messrs. D. B. Dowling and W. J. Wilson, of the Geological staff, led the party and answered the various questions put to them by the members and excursionists present. The large amount of rock-material excavated from the quarries was greatly admired and the large and beautiful blocks of fine-grained and compact limestone were examined. To Mr. A. Stewart and W. C. Edwards, Esq., M.P., the Club again owes a debt of gratitude for favours received during the day ; to Mr. Edwards for kindly placing his steamer at the disposal of our Club *gratis*, and to Mr. Stewart for permission to inspect his quarries as well as for refreshments served to all on arriving at the quarries.

Galetta, Ont.—This excursion was truly a naturalists' field-day, and the results of the geological researches have already been embodied in the OTTAWA NATURALIST, Vol. X, No. 7, p. 142, for October, 1896, so that it will not be necessary to go into any further details at this time.

During the month of October a very interesting and never-

to-be-forgotten excursion to Besserer's Grove was held in search of Pleistocene fossils, nodules, &c., in the marine clays of that locality. Dr. Adams's geology class, at McGill, was in attendance, and a number of local geologists were also present.

Numerous and fine specimens of *Mallotus villosus* were obtained, besides numerous fragments of plants, *Equiseta*, *Populus balsamifera*, *Fucu sdigitatus*, Penhallow, besides mollusca: *Macoma fragilis*, *Saxicava rugosa*, *Natica affinis*, and *Leda (Portlandia) arctica*, Gray. Some of the undetermined plant material has been laid aside for future examination by Prof. Penhallow, of McGill University.

In the foregoing volume of THE OTTAWA NATURALIST, published during the season of 1896-97, and elsewhere, several interesting papers were published or noted as bearing upon the geology of Ottawa and vicinity, Prominent amongst these is a very interesting paper on "The Geology along the Ottawa and Parry Sound Railway," by Dr. R. W. Ells.* In this paper Dr. Ells has described the leading geographical features of a new tract of country that has been but recently opened to excursionists and travellers, and we trust that this excellent contribution to the geological history of the eastern section of the Parry Sound Railway will be followed by another upon the western seetion, which no doubt includes great many points of paramount interest both from an economic and a scientific standpoint, as the rock-formations belong to what has been termed the great "Archæan Complex."

Principal Dresser's paper on the "Petrography of some of the rocks of Chelsea, Que.," is also an important contribution to the geological fund of knowledge of that interesting series of Archæan rocks associated with the old "Ottawa gneiss."

H. M. AMI,
R. W. ELLS,
W. F. FERRIER, } *Leaders.*

*OTTAWA NATURALIST, Vol. X, No. 9, pp. 165-173, Ottawa, December, 1896.

CONTRIBUTION TO THE PALÆONOLOGY OF THE POST-PLIOCENE DEPOSITS OF THE OTTAWA VALLEY.

By HENRY M. AMI, M.A., D.Sc.

In connection with the Pleistocene fossils of the Ottawa district, the writer has brought together a few notes which may be deemed of service to those who wish to carry on further investigations in this promising field. The evidences of fossil marine organisms in the sands, clays and gravels about Ottawa are as follows :—

(1) In his "*Contributions to the Pleistocene flora of Canada*"* Prof. D. P. Penhallow has noted the occurrence of many species of trees and plants in the concretionary nodules found in the marine clays of Green's Creek, Besserers, &c., in the Leda Clay formation (Pleistocene) of the Ottawa Valley. From the collections of nodules recently made at Besserer's Grove and sent to Prof. Penhallow for examination he has recognised the following interesting flora as may be also gathered from a letter by Dr. Penhallow.

1. Betula lutea.
2. Cyperaceæ.
3. Equisetum limosum.
4. Fucus digitatus.
5. Hypnum fluitans.
6. Populus balsamifera.
7. " grandidentata.
8. Potamogeton perfoliatus.
9. " pusillus.
10. " rutilans.
11. Potentilla Anserina.
12. Vallisneria sp.
13. Typha latifolia (?).

(2) In "*Geological History of Plants*"† Sir William Dawson has recorded the following species of fossil plants from the nodules found at Green's Creek by himself and other collectors :

1. Potentilla Canadensis.
2. Drosera rotundifolia.
3. Acer spicatum.
4. Gaylussaccia resinosa.
5. Populus balsamifera.
6. Thuja occidentalis.
7. Potamogeton perfoliatus.
8. " pusillus.
9. Equisetum scirpoides.
10. Fontinalis, sp.
11. Fucus or Ulva, sp.
12. Carices and Gramineæ, several species.

Regarding these plants Sir William argues (p. 232) : "I regard the plants above-mentioned as probably belonging to the

*Trans. Royal Soc. Canada, Vol. II, New Series, Sect. IV, pp. 59-77, Ottawa, 1896.

†Intern. Scientific Series, Vol. LVI, 1892.

period of greatest refrigeration of which we have any evidence," and then goes on to say : " of course, not including that mythical period of universal incasement in ice of which I have elsewhere endeavoured to show in so far as Canada is concerned, there is no evidence whatever."

(3) From Green's Creek Prof. Penhallow records the following species of fossil plants (pp. 74 and 76, loc. cit. supra.)

1. Acer saccharinum.
2. Algæ sp.
3. Brasenia peltata.
4. Bromus ciliatus.
5. Cyperaceæ.
6. Carex Magellanica.
7. Drosera rotundifolia.
8. Equisetum limosum.
9. Equisetum scirpoides.
10. Equisetum sylvaticum.
11. Fontinalis ? sp.
12. Fucus digitatus.
13. Gaylussaccea resinosa.
14. Gramineæ, sp.
15. Oryzopsis asperifolia.
16. Populus balsamifera.
17. Populus grandidentata.
18. Potamogeton pectinatus.
19. Potamogeton perfoliatus.
20. Potamogeton pusillus.
21. Potamogeton rutilans.
22. Potentilla Anserina.

Taking these lists and putting them together we have altogether a series of no less than twenty-six species of fossil plants from the calcareous nodules of Green's Creek and Besserers, a few miles below Ottawa City.

We are confident in stating that this number will probably be doubled before many years if the members of the Geological section of the Club make it a point to visit the localities in question and obtain more material. We have a number of other collections which have afforded the following species.

(4) STEWART'S COLLECTION—A.--Collected along the banks of Green's Creek, near the bridge at Cyrville, Russell, Ontario, by John Stewart, 1893.

1. Saxicava rugosa, L.
2. Leda (Portlandia) arctica, Gray.
3. Balanus crenatus, Bruguière.
4. Mallotus villosus, Cuvier.

B.—Collected along the banks of Green's Creek and the Ottawa River near the mouth of the Creek, Gloucester, Russell County, Ont. John Stewart, 1893.

1. Macoma fragilis, Fabricius.
2. Saxicava rugosa Linn.
3. Leda (Portlandia) arctica gray.
4. Cylichna alba or C. minuta.
5. Balanus crenatus, Bruguière.
6. Mallotus villosus, Cuvier.
7. Cottus uncinatus, Reinhardt.

(5) *Graham's Brickyard, Ottawa East*, collected by H. M. Ami, 1893.

1. Macoma fragilis, Fabricius.
2. Macoma calcarea? Chemnitz.
3. Leda (Portlandia) arctica, Gray.
4. Cylichna alba, Brown.
5. Balanus crenatus, Bruguière.
6. Natica affinis, Gmelin.

(6) Nepean, Ont. right bank of the Rideau River and Canal, Manotick Road. Collected by R. H. Campbell, 1891-92.

1. Macoma fragilis, Fabricius.
2. Saxicava rugosa, Linnæus.
3. Saxicava rugosa, var.
4. Mytilus edulis, Linn. (Very abundant).
5. Balanus crenatus, Bruguière. A large variety of this species or a form intermediate between B. crenatus and B. Hameri.

(7) About two miles from Metcalfe, Ontario, collectedb y G. H. Wilson, Ottawa, August 20th, 1895.

1. Macoma fragilis, Fabricius.
2. Balanus crenatus, Bruguière.
3. Mytilus edulis, Linn.

(8) MacGregor's Lake, two miles north of Perkin's Mills, Que. 450 above sea level, collected by Dr. Ells, 1893.

1. Saxicava rugosa, Linn.—In great numbers, and with a remarkably thick test.

(9) Near Cantley, Que.: collected by Dr. R. W. Ells, 1893.

1. Macoma fragilis, Fabricius.
2. Saxicava rugosa, Liun.
3. Leda (Portlandia) arctica, Gray.

(10) *Besserer's Grove, shore of Ottawa River in calcareous nodules Ontario side.* Collected by Dr. R. W. Ells, 1893.

1. Mallotus villosus, Cuvier.
2. Leda (Portlandia) arctica, Gray.
3. Saxicava rugosa, Linnæus.
4. Populus balsamifera.

And a number of other fossil plants which are no doubt similar to these described by Prof. Penhallow from the same locality.

(11) *Chelsea, Que., about 1500 paces north of Chelsea Station along the Ottawa and Gatineau Valley Railway*, May 26th, 1894. Collected by members of the Ottawa Field-Naturalists' Club.

1. Macoma fragilis, Fabricius.
2. Saxicava rugosa, Linnæus.
3. Balanus crenatus, Bruguière.

(12) *Carp Station, Ottawa, Arnprior & Parry Sound Railway, Carp Village, Ontario.* In a coarse, stratified gravel deposit. Collected by H M. Ami, 1894.

1. Saxicava rugosa, Linnæus.
2. Macoma fragilis, Fabricius.
3. Balanus crenatus, Bruguière.

(13) *Odell's brickyard, Ottawa East, in the Leda clay formation.* Collected by W. S. Odell, Esq., H. M. Ami etc. 1889-1896.

1. Craniella Logani, Dawson sp.
2. Thuja occidentalis.—Branches of the cedar tree fairly well preserved.
3. Macoma fragilis, Fabricius.
4. Saxicava rugosa. Linnæus.
5. Polystomella crispa.
6. Dentalina sp.
7. Nonionina sp.
8. Discorbina sp., and other species of foraminiferæ.

In the Geology of Canada 1863, the chapter on "Superficial Geology" contains interesting remarks upon the post-tertiary formations of the Ottawa Valley, and amongst the species of fossil organisms recorded on pp. 916-917, from Green's Creek* are the following: †

(14) Green's Creek, Ottawa River, collected by members of the Geol. Survey Staff.

1. Cyclopterus lumpus.
2. Cottus sp.
3. Tellina Grœnlandica (Macoma fragilis)
4. Saxicava rugosa, L.
5. Drosera rotundifolia.
6. Trifolium repens.
7. Potentilla Norvegica.
8. Potentilla tridentata.
9. Potentilla Canadensis.
10. Arctostaphylos uva-ursi.
11. Populus balsamifera.
12. Potamogeton perfoliatus.
13. Potamogeton natans.
14. Mallotus villosus.**

(15) At Grenville, on the Lower Ottawa, 120 feet above the level of the sea, the following species were found and are recorded on p. 917 of the "Geology of Canada," 1863:

1. Saxicava rugosa,
2. Tellina Grœnlandica (Macoma fragilis).
3. Balanus Hameri.
4. Balanus crenatus.

(16) Amongst the earliest records of discoveries of fossils in the Ottawa Valley is that of a species *Phoca*, bones of which were

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* Green's Creek enters the Ottawa at 118 feet above sea-level.

† Many of which were recorded from observations made by Principal (now Sir Wm.) Dawson. To these may be added a species of Gasterosteus, sp. indt.

** Also found at Lake Chaudiere, 183 ft. above tide; on the Madawaska, 206 ft. above tide, and at Fort Coulonge, 365 ft. above tide.

found by the late Mr. E. Billings and sent to Prof. Leidy, of Philadelphia, who described the same and illustrated them in the Proceedings of the Academy of Sciences for 1856.* The bones of the posterior extremeties discovered were also figured in Vol. 1 of the Canadian Naturalist and Geologist, by Mr. Billings. There is also a portion of the pelorcard of a *Phoca* in the collections of the Geological Survey.

Feather of Bird.—Several feathers of birds have been found during the past sixteen years.

In 1881, the Marquis of Lorne, presented to the Geological Museum at Ottawa a magnificent specimen of fossil feather, (genus and species of the bird unknown), and since then several specimens were collected and recorded by the writer from the nodules of the clays both at Green's Creek or along the Ottawa River at Besserers.

(17) Wright's brick-clay pits, north of Moore's property, Aylmer Road, Tétreauville, Que., collected by H. M. Ami and Ruggles Wright, 1889.

In a sandy layer about 30 feet below the surface of the ground in hill side :

1. Saxicava rugosa.
2. Phoca sp. probably young of Phoca vitulina.

Amongst the specimens recently acquired by the Peter Redpath Museum from the Pleistocene of the Ottawa Valley is that of a portion of the lower jaw of a young seal, *Pagophilus Grænlandicus.* This species was recorded in the Report of the Geol. Branch for 1893-94,† and formed part of the collection of fossil organic remains which Sir James Grant had in his possession.

(18) *Dundas Co., Ont.*—Found in the front part of lot 9, concession V., township of Matilda. Collected by members of the Iroquois High School Natural Science Association, 1895-1896 :

1. Macoma fragilis Fabricius.
2. Saxicava rugosa Linnæus.

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* See also Can. Nat. & Geol. 1858, paper by Principal J. Wm. Dawson "On the newer Pliocene and post-pliocene deposits of the vicinity of Montreal, with notices of fossils recently discovered in them."

† Ottawa Naturalist, Vol. VIII., No. 7, pp. 103-104, Ottawa, Oct., 1894.

This record from Dundas is, as far as we know, the most westerly one made of the occurrence of marine shells from raised beaches along the valley of the St. Lawrence between Montreal and Kingston ; but bones of the *Beluga Vermontana* (a white whale) have been recorded from near Cornwall and in the Rivière Beaudette gravel beds.

(19) At the last locality mentioned, the late N. J. Giroux obtained the following species of marine organisms :

1. Macoma fragilis, Fabricius.
2. Macoma calcarea, Chemnitz.
3. Saxicava rugosa, Linnæus.
4. Leda (Portlandia) arctica, Gray.
5. Balanus crenatus, Burguière.
6. Balanus Hameri, very large and fine individuals in a beautiful state of preservation.

(20) *Fossil Insects.*—Green's Creek and Besserer's Grove, Ottawa River, in calcareous nodules :

1. Tenebrio calculensis, Scudder.
2. Byrrhus Ottawaensis, Scudder.
3. Formax ledensis, Scudder.
4. Phryganea ejecta, Scudder.

Of these, No. 3 was collected at Green's Creek by Sir Wm. Dawson, and Nos. 1, 2, and 4 were obtained in nodules from the same locality by the writer.

Further researches will no doubt reveal an interesting insect fauna. So far, all our fossil insects from Green's Creek are forms which are not known as existing species to-day.

The foregoing species were found in the marine beds of the Ottawa or St. Lawrence valleys ; but amongst the newer overlying deposits—of fresh water and estuarine origin,—marl deposits form a conspicuous and interesting group, and hold fossil shells, &c.

Among the interesting species recorded from shell-marl deposits in the Ottawa Valley are the following :

(21) Lake Clear, near Eganville,* Ontario.

1. Physa heterostropha.
2. Planorbis campanulatus.
3. Planorbis bicarinatus.
4. Paludina decisa.
5. Cyclas orbicularis.
6. Unio complanatus.
7. Anodon fluviatilis.

* Report of Progress, Geol. Surv. Can., p. 149, Montreal, 1857.

(22) Hemlock Lake, New Edinburgh, east of Ottawa, Ontario. Collected by H. M. Ami, 1881 :

1. Valvata tricarinata.
2. Amnicola porata.
3. Physa heterostropha.
4. Planorbis campanulatus.
5. Planorbis bicarinatus.
6. Planorbis parvus.
7. Limnæa galbana, Binney. An extinct species.
8. Limnæa stagnalis.
9. Limnæa desidiosa.
10. Mesodon albolabris.
11. Mesodon albolabris var dentifera.
12. Mesodon Sayi.
13. Patula alternata.
14. Hyalina indentata.
15. Hyalima arborca.
16. Conulus fulvus.
17. Pisidium abditum.

These shells are found imbedded in a soft white calcareo-argillaceous matrix which has been utilized in the manufacture of white brick in the Ottawa Valley.

THE LATE PROFESSOR GEORGES VILLE.

It is with sincere regret that we chronicle the death of Professor Georges Ville, which resulted from heart disease on the 22nd February last at his home in the Jardin des Plantes Paris.

Professor Ville's life-work was the study of problems in vegetable physiology as applied to agriculture, and the success that attended his scientific investigations—and his no less scientific and eminently practical teachings—have made his name to be honorably known and revered, not only in his native country but throughout the civilized world.

Agriculture, during the past quarter of a century, has advanced greatly ; it may now rank with the sciences. This has been due to such men as Ville—men naturally endowed with the qualities of observation and research and whose minds and methods have been trained by years of careful work under the guidance of scientific principles. Georges Ville was at once strictly scientific and truly practical, and it was for that reason

his results have proved of such permanent and immediate value to agriculturists.

Ville established the value of artificial fertilizers in keeping up the fertility of soil. By trial-plot and vegetative experiments carried on in pots, he was able to demonstrate to the eye the effect, on certain soils and with certain crops, of suitable forms of nitrogen, phosphoric acid, potash and lime on plant growth, This method of making the crops show the deficiencies, or otherwise, in plant food—or, as it has been tersely put, "making the plant analyse the soil," is now recognized as the only infallible guide to rational and economic manuring—and it is in vogue wherever progress in farming is being made.

Professor Ville was born at Port Saint Esprit in 1824, and at the time of his death occupied the Chair of Vegetable Physiology in the Muséum d'Histoire Naturelle, Jardin des Plantes. He has been called the Lavoisier of Agriculture, for what that great man did for chemistry that did Ville for scientific agriculture. He has introduced exactness ; he has explained underlying principles ; he has illustrated in the most graphic ways the truths of agriculture. In this way Ville has helped farmers to help themselves, for he has shown them how their work may be carried on with true economy.

His published works are many and cover many of the branches of modern agriculture. Certainly one of his chief is "L'Analyse de la Terre par les Plantes," a classical work, giving the results of many years' careful investigation in pot experiments with various fertilizers.—F. T. S.

NOTES FOR THE MONTH OF MARCH, OTTAWA, 1897.

By H. B. SMALL, Esq.

Although March set in exceedingly cold, the generality of of the month was marked with faulty high temperature. More snow, however, fell in this district than all through the previous part of the winter. Spring birds arrived earlier than usual.

Crows.—On 6th instant, first flight of crows passed over. Although some of these birds winter around the Experimental Farm and the slaughter-houses up the Rideau river, they do not seem to extend their flight till the mild weather evidences itself, when they apparently wing their way to the ice on the Ottawa

river, where they find abundant food in the refuse deposited there.

Song sparrow.—This bird seldom appears before the 27th instant, but one was heard and afterwards seen by three different people on 18th instant, in a garden between Wilbrod and Theodore streets. In 1894 this bird was seen on March 11th, in 1895 on April 3rd, in 1896 on April 10th. Its advent depends on the weather south, and this year a warm south wind had been blowing two days and nights prior to its appearance.

Robins.—The first reliable appearance of this bird was on March 22nd, on a telegraph wire on Theodore street where it was in full song. It was reported as seen on the Glebe property, Mutchmor street, a few days prior to this, but it may have been a shrike which was mistaken for it, as my informant said it was chasing sparrows.

Thunder.—On 20th instant the first thunder shower occurred at 3 p.m., two vivid flashes of lightning and heavy peals of thunder being noticed, with a heavy down-pour like a summer shower.

Earthquake,—A heavy earthquake shock was experienced at 6 h. 2 m. p.m., felt east as far as Father Point and west in the Kingston district. Montreal seems to have felt the heaviest shock.

Grossbeak.—An unusually large number of these birds, known in England as the Hawfinch, have visited Ottawa during February and March, the attraction apparently being the abundant berries of the mountain ash, as that tree has been largely planted in grounds surrounding public buildings, and the trees are gaining maturity, the crop of berries is larger than in former years. This may account for the preponderance in the number of these birds over years ago.

Redpole.—Quite a number of these birds have been seen in in and around Ottawa during the winter. Their song is suggestive of spring, and unless the bird is seen it might easily be mistaken for one of our spring emigrants.

Purple finch.—I am not certain if a flock of birds seen in the Park one day early in March consisted of these birds, but from the notes I heard I am much inclined to think they were this finch. I could not get within sufficient distance to see them plainly, as they were very shy and took flight at approach.

Shrike or Butcher Bird.—One of these birds was seen for several days on Daly avenue, near King street, in the locality where it has appeared several winters Whether the same bird, or some of its progemy, or a fresh arrival cannot be ascertained.

Frequenting the one locality would give colour to the first theory.

Swallows.—On the 28th instant, white-breasted swallows were observed on the Ridean river, between Cummings' brigde and the falls. I could not determine whether they were the white-breasted or the bank swallow.

Bluebirds.—Although I have not seen any of them myself, I have reliable authority that they have been seen in the closing days of the month, but I could not get the actual date of their arrival. Probably 27th or 28th.—H. B. SMALL.

ORNITHOLOGY.

Nature has provided us with no more delightful or interesting objects for study than the birds. They are our "feathered poets of the grove" each with his own peculiar strain of melody; now sweet, now sad, now boisterous, now seeming to tell in long and varied song some tale that thrills us as we listen. What wonderful and beautiful markings they have! There are few who can fail to enjoy the sight of a brilliantly coloured or delicately marked bird, or when the hidden nest is found, the eggs unrivalled in colouring even by the bird which laid them. To watch them building their nests, catching their food, hopping about from branch to branch apparently with no object, or stretching their wings for a long flight, is a pleasure which can be shared by all. But half the joy is lost unless we have learned the songs and calls of the different birds; unless we recognize them whenever seen and in whatever plumage they are dressed, be it in that of the full-grown male, the less brightly marked female, the young bird, or in that of the winter season; unless we can tell them from their habit of flight even when too distant for the colour of the bird to be ascertained; or unless when we find the tiny nest in the thicket, or the large one in the lofty tree we know what bird has built the nest or what bird has laid the eggs.

It is hoped that throughout this year a greater interest will be manifested in our birds. Here is a field for the young people with untold pleasure in store for all who are eager for it. The leaders of the Club will most gladly assist any who desire to begin the study of our birds.

BIRD NOTES FOR JANUARY, FEBRUARY AND MARCH.

The following persons have kindly consented to co-operate in order to make the records of the arrivals, departures, nesting and other habits of our birds more accurate: Miss G. Harmer, Mr. H. B. Small, Mr. Geo. White, Mr. A. G. Kingston, Dr. J. Fletcher, Mr. W. A. D. Lees and Prof. J. Macoun. The assistance of all others who are interested in birds is earnestly requested.

CROW.—This is a winter bird at Ottawa. A few forsake the dense woods at intervals throughout the winter in search of food. They have been seen all winter at the Experimental Farm. A flock was observed by Mr. Small on the 6th of March, and by Mr. White on the 11th of March.

PINE GROSBEAK.—For the past few winters this bird has visited Ottawa in large nnmbers. In the opinion of Mr. Small the reason they have been so abundant of late years is that the European mountain ash, of which many have been planted about Ottawa, are now fruiting heavily, thus providing this bird with food. They seem to enjoy eating the buds of the spruce, and the fruit of the green ash at the Experimental Farm. The first flock of these birds, recorded, was one of ten seen by Mr White on the 1st of January. They were shot by Mr. G. Muirhead in the Rideau Hall grounds on the 30th of March. Dr. Fletcher contributes the following interesting notes on this bird:

"The winter of 1896-97 must undoubtedly be characterised as having been a remarkably mild one and yet the large numbers of the beautiful Pine Grosbeaks which enlivened our streets were a conspicuous feature of the season. The usual statement with regard to these birds is that they frequent cities most in cold winters. During January and February the mountain ash trees in the city attracted large flocks of these pretty, gentle birds, and, owing to their well-known tameness, which is referred to by several writers, large numbers were caught or killed by thoughtless boys and idle men. This is much to be regretted, for, although these winter visitors have a very sweet plaintive song, they are not at all suitable birds for domestication in cages. They are greedy and untidy feeders, scattering their food through the bars of their cages, and besides this they live, as a rule, only a few months in captivity, generally getting thinner and pining away during the hot summer months."

RED POLL.—This bird has been quite abundant during the months of January, February and March. They are usually seen feeding on the fruit of the birch."

WHITE-WINGED CROSS-BILL.—A flock of these birds was observed by Miss Harmer on the 5th of January, and were also noticed by her at different times throughout the the month.

The following notes on the Cedar-bird and Bohemian wax-wing have also been kindly contributed by Dr. Fletcher :—

" CEDAR WAX-WING (*Ampelis cedrorum*). In occasional years during the winter months flocks of wax-wings have been seen feeding with the Pine grosbeaks upon the mountain ash berries in Ottawa. These have been supposed to be the Bohemian wax-wing because they came in the winter time. On March 2nd, 1880, and on February 23rd, 1885, I made a note in my diary that flocks of wax-wings were seen at Stewarton, which were decidedly smaller than the Bohemian wax-wing and lacked the chestnut colour beneath the tail and the white bars on the wing, both conspicuous marks of the Bohemian wax-wing (*Ampelis garrulus*). During the present winter large flocks of wax-wings consisting of both species were abundant, from the middle of January until the beginning of April. Mr. George White having had his attention called to the matter, kindly shot some specimens of the smaller species, whieh he identified as undoubtedly true *cedroum*."

PINE SISKIN.—Quite abundant up to the end of March. One shot by Mr. G. Muirhead near Rideau Hall on the 30th of that month.

AMERICAN GOLDFINCH.--Observed by Mr. Lees during the month of January.

SHRIKE OR BUTCHER-BIRD.— One of these birds was seen by Mr. Small for several days on Daly Avenue, near King St. during the month of March. He says it has appeared in that locality for several winters.

HORNED LARK.—A small flock of horned larks was seen near the office at the Experimental Farm on the 22nd of February by Dr. J. Fletcher, Mr. H. S. Marsh and Mr. W. T. Macoun. They continued in small flocks throughout March.

PURPLE FINCH.—One was seen by Mr. White at the pump-house near Pooley's bridge, on the 2nd of March. A flock of birds which he thinks by their notes was this finch, was observed by Mr. Small in Major's Hill Park early in March. Dr. Fletcher saw them on the 5th of March.

SONG SPARROW.--The records for the arrival of this bird for the past few years as given by Mr. Small are, 1894, 11th of

March ; 1895, 3rd of April ; 1896, 10th of April ; 1897, 18th of March, which is the earliest date recorded this year, although heard by Mr. H. S. Marsh, Experimental Farm on the 17th of March, but it was not seen there until 22nd March, and by the 24th Dr. Fletcher reports it as abundant.

ROBIN.—The robin was observed by Miss Harmer, Mr. Lees, Mr. Small, and Dr. Fletcher on the 22nd of March ; the latter says that Mr. T. J. McLaughlin told him he heard one on the 21st of March.

PURPLE GRACKLE.—The earliest date is that given by Mr. White. He observed three males on the 22nd of March and females on the 29th of March. It was seen by Mr. Lees on the 23rd of March and by Dr. Fletcher on the 24th of March.

RED-WINGED BLACKBIRD.—Seen by Miss Harmer on 23rd of March, and by Dr. Fletcher on the 24th of March. Other records are some days later.

JUNCO.—First date recorded is by Dr. Fletcher on 23rd of March.

WHITE-BELLIED SWALLOW.—Both Mr. White and Mr. Small record the arrival of this bird on the 28th of March. Five were seen by Mr. White. On the 29th, Mr. Young saw a flock near Hurdman's Bridge.

VESPER SPARROW.—One specimen of this bird was seen by Dr. Fletcher at the Experimental Farm on the 23rd of March, but was not seen again until April.

WILD GOOSE —Two large flocks were seen by Mr. White passing over the city on the 31st of March. It was observed by Miss Harmer on the 1st of Aprll.

EVENING GROSBEAK.—The visit of Mr. G. Muirhead, F.R.S.E., F.Z.S, to Rideau Hall, will be remembered by all lovers of birds. While hunting for birds near Rideau Hall on the morning of the 30th of March he had the good fortune to shoot two female specimens of the rare and beautiful evening grosbeak, never before recorded at Ottawa, and but very seldom in any other part of Ontario. The usual range of this bird is "Pacific coast to Rocky Mountains ; Northern America east to Lake Superior.' Mr. Muirhead is the author of "Birds of Berwickshire," a large work in two volumes in which are given the descriptions, habits, arrivals and departures of all birds known to occur as residents, migrants, or casuals.

W. T. MACOUN,

Associate Editor.—Ornithology.

THE OTTAWA NATURALIST.

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REPORT OF THE BOTANICAL SECTION.

To the Council of the Ottawa Field-Naturalists' Club :

FIELD WORK.

In the Botanical Branch there has been some good work done. Some of the leaders have attended all the excursions and delivered addresses. Sub-excursions were also held during the spring months until the schools broke up. Two large sub-excursions of the botanical class attending the Normal School, consisting of about 60 ladies and gentlemen, were held. The first one to Rockliffe on May 9, where large collections of spring flowers were made, including *Viola Selkirkei* in splendid condition. The addresses at this outing were delivered by Dr. Fletcher and Mr. Sinclair. On the following Saturday an equally large party visited the beaver meadow at Hull, under the guidance of the President, Mr. Sinclair and Dr. Fletcher. Here they were met by Prof. Macoun, who gave an excellent address, speaking particularly of forest trees, and showing how some of the species usually troublesome to beginners could be separated and distinguished. The first excursion to Chelsea on 23rd May added one new species to our Ottawa list, *Stellaria uliginosa*, found by Dr. Fletcher in several places through Gilmour's Grove. This is thought to have been introduced ; but how such an inconspicuous plant could have been introduced and have spread so widely seems strange. A sub-excursion which was much enjoyed by a few of the members was to the Mer Bleue on May 28, when Mr. J. B. Goode, of Montreal, accompanied the party. This gentleman's success in cultivating our native orchids is well known. Fine specimens of *Arethusa bulbosa* and the rare *Listera australis* were collected. At a sub-excursion in October *Elatine*

americana was found by Prof. Macoun along the shore of the Ottawa near Tetreauville.

BOTANICAL ARBORETUM AT CENTRAL EXPERIMENTAL FARM.

A matter of much interest to the members of our club is the advantage we now have in free access to the Botanic Garden at the Central Experimental Farm. This garden is now assuming the position of a valuable educational adjunct to the City of Ottawa. Begun in 1887 by the botanist of the experimental farms, Dr. J. Fletcher, it has been added to year after year and is now well worthy of a visit by all interested in botany or gardening. It is now in charge of Mr. W. T. Macoun, the foreman of forestry, who has published several interesting notes in the OTTAWA NATURALIST. The collections have been increased from all available sources, the chief effort having been to gather together and have properly labelled a reference collection of all plants which would grow in this climate. Last year a great deal was done to get the perennial border in order and there are now no less than 907 species and varieties of perennials included in 222 genera. This number too will be very much increased next year, as seeds of nearly 400 additional species have been procured, which will be forced in the greenhouse early this spring and many of which will flower next autumn.

At the end of 1896 there were nearly 2,000 different kinds of trees and shrubs in the arboretum, most of which have been there, or in the nursery rows, for one or more winters and will probably be found hardy at Ottawa. This question will be pretty well tested by the severe winters we have experienced this year and last. Arrangements have been made for increasing several of the groups next spring. The collections of some of the groups of flowering and otherwise ornamental shrubs are now very complete, as for instance, the genus *Syringa* called in English Lilac, is represented by 88 different named forms,

Spiræa by 71, and Lonicera by 84. All the plants and trees in the arboretum and botanic garden are planted in duplicate, and records are kept of the time of planting, the source from whence derived and how they have fared from year to year. Visitors are cordially invited to visit the gardens, and Mr. Macoun will be glad to give any information concerning the plants in his charge.

An interesting botanical fact brought to the notice of the leaders during the past summer by Mr. H. B. Small was the value of the tubers of the Marsh Wound-wort (*Stachys palustris*) as a vegetable; these have been tried and found excellent, equalling in size and quality the cultivated *Stachys affinis* from Japan now cultivated to some extent in the gardens of the curious. *S. palustris* is found in abundance in Manitoba.

PRESERVE OUR BEAUTIFUL WILD FLOWERS.

The leaders of the Botanical Branch wish to direct attention to a somewhat important feature bearing upon the preservation of the flora of our fields and swamps. It is this, many species of the more beautiful and showy native flowers, notably orchids, are becoming somewhat scarce in the immediate vicinity of Ottawa, owing to the depredations of mere pot-hunting botanists. We can sympathise with those who have a genuine desire to introduce into their gardens the best types of our most ornamental wild flowers, but view with much disfavour the indiscriminate distruction of beautiful wild plants by pseudo-botanists and other people who are seized with a momentary desire to cultivate these flowers in their own gardens, but who fail, after uprooting the plants, to carry their good intentions into effect. *Cypridpedium pubescens* has become almost extinct in this locality. *C. acaule* is not to be found in Dows' swamp, where it was formerly abundant, and we might mention many other examples equally deplorable.

REGIONS NOT WELL EXPLORED.

We would draw the attention of the members of the Club to the fact that on account of transportation facilities our excur-

sions bring us each year over nearly the same ground and therefore there are other parts of the country comparatively unexplored—that is in the modern sense of the word. For instance, between Gatineau Point and Templeton there is an interesting region which has been worked but little. The locality between Billings' Bridge and Metcalfe, Dr. Fletcher reports as being but hastily worked over. The Lièvre River region offers also an interesting field to the botanist.

ADVANTAGES OF SPECIALIZING.

We would urge also that it is desirable that we should have within the Club's ranks as many specialists as possible. In the botanical field there is ample opportunity afforded for special investigation in many of its departments. The services of the specialist are now indispensable in the identification of doubtful species. The eye of the specialist notes variations and detects differences at first not apparent to the general student. Among the rich fields open for investigation are the sedges, water plants and willows. We trust that some of these botanical branches will be taken up by enthusiastic naturalists during the coming year.

Leaders in Botany, { R. B. WHYTE. JOHN CRAIG. J. M. MACOUN.

NOTES.

To the members of the Ottawa Field-Naturalists' Club and of the Ottawa Literary and Scientific Society who had the pleasure of listening to Prof. James Mavor's lecture on "Iceland," as well as to the readers of THE OTTAWA NATURALIST who were not present on that occasion, we have much pleasure in stating that a detailed account of Prof. Mavor's tours and studies in Iceland has appeared in the Transactions of the Glasgow Philosophical Society for 1890-91. The amount of valuable information contained in the very interesting and extended account of Iceland and its inhabitants cannot be overestimated. From a socialogical standpoint, Prof. Mavor's contribution to the study of Iceland, its people and their history, is one of intense interest, and will be read with delight and satisfaction.—H. M. A.

BOTANICAL NOTES.

With the breaking up of the winter many eyes are turned to the coming of the birds, the opening of the buds and the advance of spring generally, but too few record their observations. On account of this lack of making a record scarcely any two observers agree as to the lateness or earliness of any particular spring, and the writer asks that any botanical notes considered worthy of insertion should be sent to one of the editors of the NATURALIST, who will see that they are published, if deemed worthy of publication.

Two causes have power to produce an early spring with us. The chief one is a light snow fall, which requires only a few comparatively warm days to take it all off the ground. The second is the absence of severe cold at night which checks the expansion of the buds and retards the melting of the snow and the heating of the soil. Both these causes have worked together the past month and the result is an early spring without any warm days.

In noting the first appearance of flowers in the early days of spring we have always selected the same tree and for Hepaticas the same bank, so that although others may have noted things earlier our observations refer to absolute heat. Up to the present time of writing the following flowers have been seen :—

Hepatica triloba (May flower), April 7, 1897 ; April 14, 1896 ; Acer dasycarpum (Silver maple), April 8, 1897 ; April 16, 1896 ; Alnus incana (Common alder), April 11, 1897 ; April 18, 1896 ; Acer rubrum (Red Maple), April 23, delayed by cool weather ; Ulmus americana (American elm), April 23, delayed by cool weather ; Salix candida (Hoary willow), April 26 ; Populus tremuloides (American aspen), April 26 ; Populus grandidentata (Large-toothed aspen), April 26 ; Negundo aceroides (Box elder), April 27.

JOHN MACOUN.

BIRD NOTES FOR APRIL.

It is very gratifying to find that those who promised to help in making our observations of birds more reliable and complete, have heartily co-operated in the work. The result is that we are able to publish this month notes on no less than fifty-one species of birds, and we trust that throughout the summer continued interest will be manifested. Let all be accurate and certain of their records, as otherwise they will be misleading.

Downy Woodpecker—Observed by Mr. Lees on the 1st.

Blue Bird—Both Mr. White and Dr. Fletcher recorded this bird on the 2nd. The blue-bird is becoming very rare at Ottawa; it was heard at the Experimental Farm on the 5th, but has never been seen there this spring. Miss Harmer has not seen one since 1895 until this spring.

Tree Sparrow—This very pretty sparrow was quite abundant at Ottawa during the month of April. Miss Harmer recorded the arrival of this bird on the 2nd. On the 4th it was observed by Mr. Lees and Mr. White.

Meadow Lark—Was seen by Mr. H. S. Marsh on the 3rd, and by Mr. Lees on the 6th.

Cow Bird—Was seen by Mr. Lees on the 4th; by Miss Harmer on the 5th, and by Mr. White and Mr. Macoun on the 6th.

Phoebe—Observed by Miss Harmer on the 4th.

Herring Gull—Mr. White saw four on Deschenes Lake near Aylmer on the 4th. On the 6th they were seen flying over Carling's Lake near the Experimental Farm.

Vesper Sparrow—Although Dr. Fletcher reports having seen one specimen of this bird on the 23rd of March, it is not recorded again until the 5th of April, when one was heard by Miss Harmer, but not seen by her until the 8th. Other records are later.

Golden-crowned Kinglet—Observed by Mr. Lees on the 6th.

White-rumped Shrike—Observed by Miss Harmer on the 10th.

Chipping Sparrow—Miss Harmer saw this bird on the 11th of April, but the next date on which this bird was recorded was not until the 18th, when it was seen by Mr. Lees.

Red Poll—A flock of from three to four hundred was seen by Miss Harmer on the 11th.

Marsh Hawk—Seen by Mr. Lees on the 11th.

Goshawk—One specimen was observed by Mr. White on Wurtemburg street on the 11th.

Blue Heron—Seen by Mr. White on the 13th.

Yellow-bellied Woodpecker—Seen by Mr. White on the 13th.

Killdeer Plover—Miss Harmer saw this bird on the 14th; the next record is Mr. White's on the 19th.

Kingfisher—Seen by Mr. White on the 14th.

Savannah Sparrow—Observed by Mr. White and Mr. Lees on the 15th.

Wood Duck, Black Duck, Mallard, and Bufflehead—All seen by Mr. White on the 16th.

American Bittern—Seen by Mr. White on the 16th.

Golden-winged Woodpecker or Flicker—Seen by Mr. Marsh on the 16th, and by Miss Harmer on the 18th.

Brown Creeper—Seen by Dr. Fletcher on the 17th.

Barn Swallow—Seen by Mr. White and Mr. Lees on the 18th.

Fish Hawk—Seen by Mr. Lees on the 18th and by Mr. White on the 19th.

Sparrow Hawk—Seen by Mr. White on the 19th.

Pine Grosbeak, Wax-wing—Dr. Fletcher writes: "An interesting record is the following: The weather during the first part of the month and until the morning of the 19th of April, was very mild indeed. At 8 o'clock a.m. the thermometer stood at 54° Far. About that time an enormous flock of Pine Grosbeaks suddenly appeared and remained on the trees around

my house for about an hour before they flew away; with them were upwards of 100 wax-wings, which remained all that day and the next. During the morning of the 19th a high northerly wind sprang up and the thermometer ran down to 17° Far. and everything was frozen solid again as in winter. The wax-wings clustered together closely on the trees, breasting the gale in compact flocks remaining motionless for over an hour at a time."

Wilson's Thrush—Seen by Mr. White on the 21st.

Ruby-crowned Kinglet—Seen by Mr. White on the 21st.

Pewee—Seen by Mr. Small on the 21st and by Dr. Fletcher on the 24th.

Myrtle Warbler—Mr. Small observed this bird working on the elm trees on the 21st.

House Wren—Seen by Dr. Fletcher on the 21st.

Chimney Swift—Mr. White observed this bird an the 22nd and Mr. Small on the 23rd.

White throated Sparrow—This bird was seen by Mr. White on the 23rd and by Miss Harmer and Dr. Fletcher on the 25th.

Spotted Sandpiper—Seen by Mr. White on the 24th.

Great Crested Flycatcher—Seen by Miss Harmer on the 24th.

Cedar Birds and Bohemian Wax-wing—A flock of about thirty Cedar Birds was seen feeding on the fruit of the high bush cranberry at the Experimental Farm on the 24th of April by Mr. Macoun. One specimen of Bohemian wax-wing was observed with flock. Dr. Fletcher and Mr. Marsh also saw this bird. The Cedar birds fed for several days on the high bush cranberry.

Winter Wren—Prof. Macoun saw this bird in the woods near Ottawa on the 24th.

Hermit Thrush—Seen by Mr. White on the 25th.

Bank Swallow—Seen by Mr. Lees on the 25th.

Baltimore Oriole—Seen by Dr. Fletcher on the 25th.

Sharp-shinned Hawk—Mr. White is the first to record this bird on the 27th, but one was seen early in March near the Experimental Farm.

Brown Thrush—Seen by Mr. Macoun at the Experimental Farm on the 26th. Perched on the topmost bough of some tree this delightful songster filled the air with melody in the early morning during the month.

Greater Yellow Legs—Mr. White saw this bird on the 27th, and one was shot by Mr. Marsh on the 29th.

Loon—Seen by Mr. White on the 30th.

Orange Crowned Thrush—Seen by Prof. Macoun on the 30th.

Fox Sparrow—Seen by Prof. Macoun on the 30th.

Yellow-billed Cuckoo—Seen by Prof. Macoun on the 30th.

W. T. MACOUN,
Associate Editor, Ornithology.

WEATHER NOTES.

April 19.—High south warm wind all previous night culminating to heavy n.w. gale in forenoon, the thermometer falling from 50 to 34 in 30 minutes. Sharp frost set in and during night of 19th temperature fell to + 12°, with ice an inch thick on water pails next morning.

April 25.—Heavy thunderstorm at 3.15 a.m., with bright fork lightning in the south.

April 26—Heavy thunderstorm at 4.30 p.m., with bright lightning and heavy rain, turning to a downpour, gale from north and temperature + 34°.

May 1—Thunder at 6.30 a.m.

May 9—Heavy thunderstorm, dividing off north and south at 11 p.m.

May 14—Heavy thunderstorm with bright lightning at noon. Vegetation about one week in advance of ordinary season.

H. B. SMALL.

Abstract of Meteorological Observations at Ottawa for the Year 1896.

	Month.												Year.
	Jan.	Feb.	Mar.	April	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	
Average height of barometer at 32° and reduced to sea level	30.210	29.914	30.016	30.123	29.981	29.944	29.985	30.008	30.044	30.084	30.150	30.224	30 057
Highest barometer	30.732	30.720	30.730	30.629	30 431	30.257	30.365	30.360	30 421	30.661	30.739	30.969	30.969
Lowest barometer	29.612	29.068	29.379	29.567	29.497	29.573	29.565	29.660	29.414	29 606	29.412	29.442	29.068
Monthly and annual ranges	1.120	1.652	1.351	1.062	0.934	0.684	0.800	0.700	1.007	1.055	1.327	1.527	1.901
Average temperature of air (Fah.)	11.89	12.97	18.69	43.81	59.15	64.08	68.94	66.99	56.08	43.07	34 81	16.99	41.46
Difference from average	+2.29	+1.37	-2.91	+6.51	+4.65	-1.32	-0.66	+1.89	-1.12	-0.73	+3.31	+1.19	+1.21
Highest temperature	38.6	43.0	45.0	82.8	90.5	87.4	92.8	92.1	89.0	64 0	61.0	41.0	92.8
Lowest temperature	-25 0	-30.7	-9.2	13.0	37.1	42.5	43.5	41.0	30.0	25.8	8.2	-15.0	-30.7
Monthly and annual ranges	63.6	73.7	54.2	69.8	53.4	44.9	49.3	51.1	59.0	38 2	52 8	56.0	123.5
Average maximum temperature	17.8	21.4	28.0	54.5	70.7	75.2	79.5	78.6	65.9	51.0	42.2	24.9	50.8
Average minimum temperature	4.0	4.5	9.4	33.1	47.6	52.9	58.4	55.4	46.3	35.2	27.3	9.2	31.9
Average daily range	13.8	16.9	18 6	21.4	23.1	22.3	21.1	23.2	19.6	15.8	14.9	15.5	18.9
Average pressure of vapour	0.077	0.085	0.099	0.240	0.451	0.434	0.498	0.472	0.357	0.215	0.178	0.096	0.267
Average humidity of the air	89	84	79	75	79	66	67	67	75	76	83	83	77
Average temperature of dew point	11.0	12.0	17.4	39.2	56.1	55.1	58.9	57.4	49.7	36.4	31.6	16.5	36.8
Amount of rain in inches	0.00	0 22	1.32	0.57	2.26	3.34	3.04	3.91	3.42	1.07	1.79	R	20.94
Difference from average	-0.55	-0.24	+0.48	-0.95	-0.17	+0.40	-0.12	+0.78	+0.84	-1 32	+0.17	-0.78	-1.46
Number of days of rain	0	1	2	6	11	9	11	12	12	7	10	0	81
Amount of snow in inches	23.0	38.1	20.5	2.7	.....	.....	.....	.....	.....	1.7	5.3	12.5	103.8
Difference from average	-2.3	+16.0	+5.8	-2.0	*	.....	.....	.....	.....	+0.8	-4.1	-9.8	+4.4
Number of days of snow	8	12	9	2	.....	.....	.....	.....	.....	2	4	7	44
Percentage of sky clouded	77	65	52	50	53	45	60	54	59	63	74	60	59
Number of days completely clouded	13	11	7	1	1	2	4	3	3	5	8	8	66
Average velocity of wind (miles)	7.71	9.31	11.40	5.93	8.01	5.51	5.60	5.03	5.80	6.35	8.87	6.61	7.18
Number of auroras	1	1	3	0	0	0	0	0	0	0	0	1	6
Number of thunder storms	0	0	0	1	1	1	2	2	0	0	0	0	7
Number of fogs	0	0	0	1	0	0	0	2	1	2	0	0	6
Number of days without rain or snow	16	13	14	21	19	21	20	18	17	20	20	15	214

Days of rain and snow only reckoned when 0.01 inch or over fell.

Frequency of the Different Winds from Observations at 8 a.m., 3 and 8 p.m., Ottawa, 1896.

	N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.	Calm
January	8	7	37	2	2	8	14	10	5
February	2	7	24	3	4	12	21	13	1
March	3	9	10	3	9	13	27	19	0
April	4	7	20	7	9	10	12	7	14
May	10	4	14	5	15	15	15	11	4
June	5	6	13	4	7	15	19	13	8
July	4	1	9	3	10	19	22	25	0
August	5	3	4	1	9	15	20	18	18
September	3	5	6	7	18	14	11	20	6
October	8	22	8	6	11	19	9	10	0
November	5	21	5	7	21	14	12	5	0
December	10	13	7	10	16	14	13	10	0
Year	67	105	157	58	131	168	195	161	56

January 3—Stormiest day of year, mean velocity 27.7 miles.
" 24—Heaviest snow storm of year, depth 15 inches.
February 17—Coldest day of year, mean temperature—22°.5.
April 4—Last snow of season.
" 16—First thunder of year.
" 22—Last frost.
June 9—Heaviest rain storm of year, depth 1.97 inches.
August 11—Warmest day of year, mean temperature 80°.35.
" 16—Last thunder storm of year.
Sept. 22—First frost.
October 20—First measurable snow of season, a few flakes on 18th.
Dec. 2—First record below zero—1°.5.

ANNUAL MEETING: OTTAWA LITERARY AND SCIENTIFIC SOCIETY.

The Annual Meeting was held in the Library of the above Society on Friday evening, April 30th. The reports of the Secretary, Treasurer, Librarian, and President were presented and adopted. The finances of the Society were shown to be in a good condition, and the membership somewhat increased, now numbering about 350.

The Library and Reading Room have been more extensively used than for many years previously.

The need is felt of securing a permanent location and one convenient to the patrons of the Society—a building which might be used by other societies would be preferred. There was a general expression of opinion at this meeting that the Society should secure a suitable building, and if possible, induce kindred societies to join them in such an enterprise.

The officers elected were :—

President—Otto J. Klotz.
First Vice-President—Rev. Dr. Saunders.
Second Vice-President—W. D. LeSueur.
Secretary—O. J. Jolliffe.
Treasurer—W. J. Barrett.
Curator—J. H. Bronskill.

Members of the Council :—

M. J. Gorman.
Lt.-Col. J. Pennington MacPherson.
J. Ballantyne.

O. J. JOLIFFE,
Secretary.

Ottawa, May 25th, 1897.

Correction.—"*The Lyrical Poetry of the Elizabethans*," was the exact title of Mr. Duncan C. Scott's paper presented on Feb. 4th, 1897, at the course of lectures given under the auspices of the Ottawa Literary and Scientific Society. In the March issue of the OTTAWA NATURALIST (p. 226) another title was given.

"WEATHER."

By Otto J. Klotz, D.L.S.
President of the Ottawa Literary and Scientific Society.

The mathematician's definition of weather would be differentiated climate, and of climate integrated weather. A boy at school once gave the explanation that weather lasted only for a few days, while climate lasts all the time.

Of all phenomena in nature undoubtedly the varying daily atmospheric conditions were the first to attract the attention of primeval man.

Meteorology is the science which treats of the conditions of the atmosphere, its changes in condition, and the causes which give rise to these conditions and changes. It may be said to be the youngest of the sciences and awaiting much developement; but the consciousness of knowing what we do not know, is knowledge too.

The discovery of the law of gravitation has enabled the astronomer to marshal the celestial bodies, but for the meteorologist such a universal law, explaining all the atmospheric movements, must be denied. Prediction is a natural sequence to the discovery of nature's laws, and in this respect astronomy furnishes us with its crowning glory. The conditions presented in meteorology are subject and due to so many modifying influences that the problem becomes highly complex and has taxed the minds of the ablest physicists. The too patent benefit resulting from weather predictions has enlisted public support and stimulated investigators in unraveling the intricacies of atmospheric phenomena. The ultimate result of all science must tend towards the amelioration and benefit of mankind. In this field meteorology already has and will yet have a greater *role*. However, any theory of weather predictions based on other than sound reasonings and accurate study of physics must be considered one of the worst forms of empiricism.

For the study of phenomena accurate observations are necessary. In meteorology we have to deal not with one phenomenon but with many, each adding its quota to form the aggregate which we term weather. As the instruments used for observing the phenomena are fairly familiar to you I will confine my remarks to a few salient points. The instrument of first importance is the barometer, by means of which the pressure of the atmosphere is measured ; we might call it the lead line or sounding rod of the atmospheric ocean. Although there are the two forms of barometer—mercurial and aneroid—yet for accurate and precise work the former only is used. Air, in common with all other forms of matter, is acted on by the attraction of gravity, and consequently possesses weight. The pressure of the air is a necessary consequence of its weight, and is equal, at the level of the sea, to about fifteen pounds to the square inch.

If we take a glass tube of about three and a-half feet in length, filled with mercury, and hermetically sealed at one end, while the other end is bent like a syphon, or is inverted into a cistern of mercury, we have a means of measuring the pressure of the atmosphere and its consequent fluctuations. Here in Ottawa, less than 200 feet above mean sea level, we are subject on all sides to a pressure of nearly 15 lbs. to the square inch to prevent us from bursting, which we undoubtedly would, were that pressure removed.

The barometer responds to the fluctuations and pulsations of the atmospheric pressure.

Suppose now we have taken barometric readings at the same absolute time at various stations from Halifax to Vancouver ; these readings, although correct, would not give us the true measure for comparison of the various pressures, from the fact that they would not be taken from the same plane—the level of the sea—to which all observations must be reduced before comparisons can be instituted and inferences drawn. The fluctuations of the atmosphere make themselves felt on our Great

Lakes as shown on tide guages. In passing, it may be mentioned that both solar and lunar tides are observable too on the lakes. A high barometer at one end of the lake would tend to press the water towards the other end and consequently raise it there. Besides the readings of the barometer at stated intervals there is a continuous record made too by means of photograph at the chief meteorological observatories. The instrument is then called a barograph.

Let me tell you of an interesting record of the barograph at Toronto on August 27th, 1883. You all recollect the frightful cataclysm of Krakatoa, a small island in the strait of Sunda between Sumatra and Java. In this catastrophe over 30,000 lives were lost, and the eruption was followed by extraordinary atmospheric phenomena—notably the peculiar red sunsets of the following year—visible over the whole globe and attributed to the presence of volcanic dust. As soon as the news reached England—science ever on the alert—the Director at Kew immediately sent to the various head meteorological stations in the numerous colonies for the barograph record of that and succeeding days. That terrific and awful explosion launched an atmospheric wave on its journey around the world, which not ouly recorded its passage at Toronto, but after its concussion, presumably at the antipodal point of Krakatoa, left its record on its return, on the mercurial column, and a second rebound too was recorded. I had the pleasure of examining the original record at Toronto. From an examination of this record I infer that the atmospheric wave must have travelled at the enormous rate of about 800 miles an hour, being about the velocity of sound.

The thermometers ordinary used for exact observation are the dry, wet, maximum and minimum. The wet thermometer is only a dry bulb covered with soft muslin well wet with rain or clear water drawn from an attached cup by a wick, and is used

for determining the relative humidity of the atmosphere. Evidently, the drier the atmosphere, the greater will be the evaporation from the muslin, and the heat necessary for evaporation is abstracted from the mercury bulb, with a consequent fall in temperature. From the difference in temperature of the dry and wet thermometers a measure of the relative humidity of the air is obtained.

The instruments used for recording the wind are ; the vane, for direction ; the anemometer, for velocity and the anemograph, which registers both direction and velocity. Add to the instruments named the hygrometer and rain guage and we have the necessary ones for a meteorological station.

When from any cause the air at any part of the atmosphere is cooled below its dew point, a portion of the vapour suspended in it becomes condensed and converted into minute drops of water, forming what is called a fog, or a cloud, according as the condensation takes place near the ground or in some higher region. The numberless forms of clouds make it difficult to so classify and name them as to secure easy recognition and ensure uniformity of record. The classification introduced at the beginning of the century obtains to the present day. In it three simple or primary and four compound forms are recognized. The cirrus is the high fleecy cloud ; the cumulus of moderately low elevation and its simpler form the shape of conical heaps rising from a horizontal base ; the stratus is the lowest of all, generally gray masses or sheets of clouds with ill defined outlines. The compound ones fall intermediate between the primary ones described. The highest cirrus cloud recently measured at Toronto was about seven miles high, while some European observers claim to have obtained fully double that height. Observations on the motions of upper clouds are of great importance, since from these movements can be gleaned the only possible information as to the prevailing direction of

the upper air currents. At the late international meteorological congress held at Paris it was decided to make cloud measurements during the coming year. At each international bureau, daily if possible, two observers at the same instant from fixed points, being at the ends of a measured base line, take observations on the same point of a cloud, and within two minutes again on the same point. This is about the longest time that a given point will remain identifiable.

In another manner the nature of the upper strata of the atmosphere is being explored by means of kites. They are flown tandem, i.e., several kites on one string or rather fine steel wire, as the latter is far more suitable. Self registering instruments are attached to the kites.

Of the observed phenomena of the dynamics of the atmosphere up to the last century none impressed itself so much on physicists as being subject to law as the "Trade Winds." Experience had shown navigators that once they got their ships into the paths of these regular winds, they could be depended on with almost as much confidence as we now place in steam. The primary cause of the atmospheric motions is the unequal distribution of the temperature on the earth's surface produced by the solar heat. We know from observations that there is a large, but not constant, difference in the temperatures of the air at the poles and equator, amounting, at an elevation of but a few feet above the earth's surface, to about 81° F. for the average for the entire year. The heating up of the air at the equator causes its expansion, and consequent increase of bulk, but does not increase its weight or pressure at the earth's surface, it does however elevate the successive isobaric surfaces, i.e. surfaces of equal pressure, and this causes differences of level or gradients, which cannot exist in fluids without a motion ensuing in the direction of the lowest level. The levels of these gradients are measured with our atmospheric sounding rod, the barometer.

From the greater heat at the equator the mass of air there rises to a greater altitude than at the pole, and in consequence we have a current of air in the upper regions moving from the equator to the pole. But just as soon as this flow has commenced there is a decrease in the actual weight of the atmosphere at the equator, and a counter current sets in along the surface of the earth from the pole towards the equator. Vertical currents connect these two horizontal currents ; the one at the equator being ascending and that in the region of the pole descending.

From the revolution of the earth on its axis, there is a force arising from this rotation which causes a free moving body to depart to the right of its original direction in the northern hemisphere, and to the left in the southern hemisphere. It is this condition which mainly gives to the existing circulation of the atmosphere its complex character. In the vertically moving air masses dynamic heating and cooling take place as a consequence of the compression and expansion of the air. We have in British Columbia and extending to the east slope of the Rocky Mountains a phenomenon—the Chinook wind—dependent on this property. The Chinook is similar to the Foehn of the Alps. Dry air in passing over a mountain range would not differ in temperature on the two sides of the range. As the air ascended it would be cooled dynamically. As it descended it would be warmed just as much. But if the air is moist, in ascending it cools, and the moisture is condensed and falls as rain or snow. The latent heat released by the condensation raises the temperature of the air, and in descending to other side of the mountain it is warmed up dynamically still more. This is the action of the Chinook wind and the explanation of its warmth and dryness, the moist warm winds from the Pacific being aspecially favorable for its creation.

Atmospheric disturbances are easily divided into two classes—cyclonic or low area storms, and anti- cyclonic or high

area storms. By a cyclonic storm is not necessarily meant a cyclone or a hurricane, but simply a storm characterized by an atmospheric pressure below the average, and having a wind system blowing spirally inward, as do the winds of a genuine cyclone. The fluctuations of the atmospheric pressure as indicated by the barometer amount to about four inches. The position of these areas of high and low barometer, especially the latter, is the chief factor in weather forecasts.

The circulating air-currents at the surface of the earth move contrary to the hands of a watch. From this cyclonic action the phenomenon so often observed of the wind blowing in an opposite direction before and after the passing of a storm becomes obvious. In the area of low barometer we have an ascending current of warm air around which gyrates the anti-cyclone of cold air with an inflow at the earth's surface. Although far the greater part of the action of all and the whole of some storms takes place within a mile of the surface of the earth, yet the movement of upper clouds and occasional attendant peculiar phenomena indicate quite clearly that the origin and most important phases of atmospheric changes must be assigned to the upper strata of the air. The formation of depression or low area is probably due to precipitation or formation of cloud, or is at least very closely related in some way to the condensation of aqueous vapour. The motion of the low area probably depends on the prevailing direction of motion in the great body of upper air in the vicinity of the low area.

By plotting the isobars of mean annual pressure over the northern hemisphere two areas of low barometer are found, one over Iceland and the other over Bering Sea. The one over Iceland is the one towards which our Canadian barometric gradients flow. An area of low barometer may be looked upon as a vast caldron towards which and into which the atmosphere is flowing. From this analogy we can see in a measure how the atmospheric currents flowing over Canada toward the sink hole, so to

speak, about Iceland behave, and it is this secondary or gyratory motion especially that gives us storms. It appears that the valley of the St. Lawrence has the largest number of the storms of any section of the globe, i.e. areas of high and low barometer passing over it. The greater number of American storms originate in the Saskatchewan country or on the south-eastern slope of the Rocky Mountains. A minor number are developed in the Caribbean Sea and the Gulf of Mexico. Our worst storms in summer are traceable to Texas, whereas the winter ones come mostly from the North-west. The Rocky Mountains are such a barrier that it is seldom that a storm of the Pacific crosses them and reaches us. The ultimate course of low area storms is somewhat north of east. The number of well defined low area storms which cross the United States and Canada average eight in each month from May to August inclusive ; nine from September to November and in April ; eleven in February, March and December, and twelve in January. The average velocity of low area storms fluctuates for the different months between 25 and 38 miles per hour, the maximum being in January. To summarize, low area storms have a wind circulation inward and upward, are elliptical in form, are characterized in their eastern quadrants by cloudy weather, southerly and easterly winds, precipitation, temperature oppressive in summer, and abnormally high in winter, falling barometer, increasing humidity ; and are followed by clearing weather, rising barometer, decreasing humidity, and falling temperature in the western quadrants.

Areas of high barometer, or anti-cyclones, in which the barometric pressures are defined by isobars successively higher toward the centre, are about forty per cent. less frequent than low area storms. In winter the advance of these high areas, though always attended by a decided fall in temperature, is for the most part characterized by clear skies, by calms near the centre and light or fresh winds on the outskirts of the area. This condition of affairs permits rapid nocturnal radiation and tends to lower the temperature of the air at the centre of an anti-cyclone.

(To be continued.)

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"WEATHER."

BY OTTO J. KLOTZ,
President of the Ottawa Literary and Scientific Society.

(Continued from the May number.)

The North-West is the breeding ground of our "cold waves." In connection with anti-cyclones there prevail, however, from time to time, especially in the winter months, severe storms of wind, either with or without snow. When accompanied by snow they are popularly known as blizzards. It may be interesting to state in connection with the etymology of this word, that among one of the first to mention the blizzard was Henry Ellis, who made a voyage to Hudson's Bay in the ship "California" in the year 1746 and wintered near York Factory. In addition to regular storms of low and high barometer, there are other atmospheric disturbances, generally known as local storms, such as hail, thunder and dust storms. From the concentric layers which a hailstone usually presents, when cut in two, one infers a growing process in which the stone passes at least as many times as it has separate layers from a stratum of air having a high temperature to one having a correspondingly low one. This process would involve a vortex motion, in which the stone is alternately drawn in and thrown out of the vortex and finally, by increasing weight, falls to the earth. It is well known that hailstorms follow a path whose breadth is very narrow compared with its length. In thunderstorms we have another element—electricity—entering our meteorological phenomena. It has been shown that the geological character of the soil has much to do with the frequency of lightning strokes, the proportions being one for a chalk bed, seven for clay, nine for sand, and twenty-two for loam. Oaks are most often and beeches least often struck, and nearly always in the clear or at the forest's edge. The risk of houses being struck increases with segregation and height, and is five times greater in the country than in the city districts. In very dry countries during the rainless season local whirlwinds occasionally pass over limited sections, the disturbance being similar to that of a feeble tornado. The haze peculiar to the season known as Indian

summer is simply a dry fog where the impurities in the atmosphere remain a long time owing to the absence of rain. The greater part of the impurities are from forest fires.

Of atmospheric optics a few words may be said. Of these the most familiar phenomenon is the rainbow. It is simply a color sensation due to the double refraction and reflection of the sun's rays by globules of water situate in the surface of a cone of which the eye is the apex. The higher the sun the lower the bow, and the greatest bow possible is a semi-circle, when the sun is just rising or setting. Theoretically no two observers see the same rainbow, for the bow has no real or material existence.

Rings around the sun and moon are divided into two classes—the corona of small diameter and the halo of greater diameter. The corona is a diffraction phenomenon, while the halo is due to reflection and refraction of the light by the ice crystals or ice needles in the higher regions of the cirrus clouds. There is a great variety in the distribution of halos—sometimes the rings are wholly separate and sometimes they intersect. The points of intersection are usually more or less light patches, and are called mock suns, or sun dogs or parhelia ; for the moon, paraselenae.

When one layer of air lies in contact with another of different temperature and density, the bounding surface between the two, if sharply defined will reflect light perfectly and hence images of objects become visible. This phenomenon is called mirage, and I have frequently seen it in the Alaskan archipelago and less frequently on the plains of our North-west.

There is no problem in the wide range of science in the public eye that admits of so ready solution as weather. Is is the pseudo-scientist, the charlatan—who surrounds himself with a halo of scientific terms, favorite ones being opposition and conjunction of planets—writes of astronomical computations, et cetera, that misleads the public through his bold and at times

alarm-spreading prognostications. The scientist, with his able army of assistants spread over a continent, dares scarcely predict 48 hours in advance, yet the charlatan, scorning observations, with one bound leaps over weeks and even months and there plants his weather signal. Let us turn for a moment to some of the superstitions and fallacies regarding weather. As far back as 1508, not long after the invention of printing, a book was published in Germany under the title of the "Bauern Practik" or "Husbandsman's Practice," as its translation was known in England. It taught the farmer, the sailor, all, indeed, who were interested in the weather what would be its character, not only for the coming year, but in all future years. Christmas is the chief radiant point upon which the prognostications depend. Plenty, peace, war, drought, rain, honey, wine, corn, follow according as Christmas is fine or cloudy, and if the sun rises obscured or if he sets obscured, or if Christmas falls on a Sunday or some other day of the week and so on. In a less degree the 12 days following Christmas, i.e., to Epiphany, had a mystic influence on future weather and affairs of life.

There are said to be forty weather saints, among the most prominent of whom is undoubtedly St. Swithin, whose day is July 15th, and the superstition is that if it should rain on that day it will rain for forty days after. In order to see this belief fulfilled I would suggest migration to southeastern Alaska, where forty, fifty or sixty days' rain can be had on short notice.

Of the heavenly bodies for forecasting the weather the moon has ever held pre-eminently first place not only by the people but by the self constituted prophets, who, under the protecting shield of astronomy, profess to have framed infallible rules for the weather as judged from the ever varying position of the sun, moon and planets.

By careful examination of thousands of accurate barometric observations distributed over the globe we find that whatever

so-called reason, analogy and common sense may seem to dictate, the facts will not follow in the path marked out for them; and the atmospheric tides refuse to ebb and flow, except in a most infinitesimal degree, quite disproportioned to their supposed moving forces.

Fallacies about the moon are numerous, such as that the full moon clears away the clouds; that you should only sow beans or cut down trees in the wane of the moon; kill hogs and beef when the moon is waxing; set fence posts when she is waning so as to draw down and not heave; that to see the old moon in the arms of the new brings on rain, as also the halo rain or snow, and so forth.

About the sun also there are many fallacies, and ever since the discovery that the spots which appear on his surface have a period of greatest and least frequency, there have been theorists in shoals who have sought to prove that this fact rules the weather. It has undoubtedly been found that the frequency o sun spots and the variations of the magnetic needle are intimately connected; and it is almost equally well established that the aurora appears in some sort of sympathy with the sun spot variations. But this, up to the present, is as far as we can get in this direction, for our weather seems to have no definite relation to these changes.

It has often been stated that the noise of cannon will produce rain, and that great battles in consequence of the introduction of gunpowder have been followed by rain, but this opinion is not proved by facts.

So firmly and widely rooted is the belief in the practicability of weather forecasting, that separate bureaus for this purpose have been formed and are maintained at public expense in Great Britain, the United States, France, Germany, Italy, Russia, Algeria, Australia, India and Japan. Other nations, such as Sweden, Holland and Switzerland, co-operate with and share the expenses and benefits of other larger countries

We in Canada have not a separate weather bureau, the Meteorological Service being under the Marine and Fisheries Department. However, it is very efficient and compares favorably with the best anywhere. The proof of this statement rests on the fact of the very high percentage of weather forecasts that are subsequently verified.

In passing, let me say that the head office of the Meteorological Service should be in Ottawa, where the head offices of all other branches of the public service are. There is no doubt that its efficiency could thereby be increased, and we would simply be following what other countries have done and found advantageous. In England London, (Kew) ; in the United States, Washington ; in France, Paris ; in Russia, St. Petersburg, are the central stations. The idea entertained in some quarters that it should be at some port on account of the shipping interests, to give warning to vessels, is not sound. What above all things the central station requires is a good telegraph service, in the first place to receive the bi-daily weather reports from all over the continent, and in the second place to send out in all directions the weather forecasts. A good telegraph service being granted our weather office might be in Muskoka, however, as before stated, for administrative purposes, it should be in close touch with the Department to which it belongs, and hence in Ottawa.

All skilled meteorologists realize how comparatively local are weather conditions and how impossible it is at times to make prediction for a definite period with any feeling of certainty. The forecaster, then, has to bear in mind that weather conditions are largely local, due to topographical features already spoken of, and so must study with such fact prominently in view the configuration aud physical outlines of a country which have such important bearings on the development, progress and movement of storms as to render it essential that the predictor shall have

the country, as it were, actually before his eye, instead of the flat map on which the data are charted.

The official may know and predict accurately the general direction in which a storm will move, and yet in thickly populated parts, as western Ontario, the passage of a storm only twenty miles to the northward or the southward of the point fixed in advance by the forecaster will result in weather conditions which must disappoint thousands of people who are interested therein. The narrow difference of a few miles in predicting twenty-four hours in advance the path of a storm which travels 600 or 700 miles daily is almost infinitesimal as regards the storm itself, and yet it is sufficient to produce cold northerly winds, with snow, in place of warm southerly winds, with rain, or vice versa.

The introduction of the telegraph made it possible to collect meteorological data from a large section of conntry in time to make it of use in following the weather changes over a whole region at the time the events are actually taking place, and also to transmit storm warnings in advance of the approach of a storm. The telegraph is to the meteorologist what the telescope is to the astronomer. Thus we follow the movement of cyclones and anti-cyclones and their accompanying weather conditions across the country in much the same manner that we can follow the movements of a railroad train if we know its time and place of starting, and its route and speed. But the cyclones or storms vary so much in intensity, in the paths which they take, and in their velocity of movement, that their positions and conditions can usually be foretold only day by day. Once having fixed the position of a cyclone or anti-cyclone with regard to any place, we know the general weather conditions at that place as shown by the dlstribution of the meteorological elements in cyclones and anti-cyclones.

The daily weather maps are prepared in the following

manner:—There are distributed over the United States and Canada about one hundred and forty first-class stations, i.e., such that report twice daily, at 8 a.m. and 8 p.m., eastern standard time, to Washington and Toronto. Let this be clearly understood that over the continent, from the Atlantic to the Pacific, from Manitoba to Texas, twice daily at the same absolute instant, the meteorological phenomena are noted and are immediately wired to Washington and Toronto, which mutually send data received. Each central office has then a meteorological photograph, so to speak, of the continent. The skill of a weather predictor arises largely from his alert comprehensiveness of mind, accurate and retentive memory, phlegmatic but confident temperament, and long experince in connection with the discussion of storms for the section of the globe and the period of the year for which he predicts. The first of these qualities enables him instantly to grasp the situation and promptly draw correct general inferences from slight indications; the second renders it possible for him to recall, with their sequences, similar weather conditions—a very important matter—when they are typical; the third enables him to maintain unimpaired his confidence in his own ability and judgment when he has made a series of unsuccessful predictions. Experience, the last but not least, is most necessary, since the attendant circumstances of storms change so materially, even from one season of a year to another, that a forecaster skilled in summer storms may fail at first in discussing those of the winter.

Let us consider briefly the value of forecasts. We will be within bounds if we make the sweeping statement that every individual is either directly or indirectly benefited by the forecasts. The value of the forecast in agriculture is self evident, and at times of harvest, when the labors of a year may be wasted in a day, the importance of the forecast is strikingly noticeable. The value of the weather bulletin is in direct proortion to its distribution and receipt by those interested. From

the very nature of farming, the necessary isolation of a farmer he will always be at a more or less disadvantage in obtaining the daily predictions compared for instance with another very interested party—the ship captain, who, when in port, is in direct contact with the telegraph service and weather bureau, and can govern his departure accordingly. Bankers and brokers appreciate and watch closely the forecasts. Obviously whatever affects crops, commerce, or business and industry affects them. Commission merchants and shippers of produce of a perishable nature find the forecasts of the greatest assistance. In maintaining equable and comfortable temperatures in large office buildings, for example, the predictions are of the greatest value if intelligently read.

In no branch of human affairs can the value of forecasts be so readily expressed in dollars as in shipping. For here we can easily find out at any time the number of vessels in port, and the number detained by storm warning from going to sea and exposing themselves to the furies of storms and tornados with possible utter destruction. The annual saving in this way to navigation on this continent runs into the millions, and in this interest alone the cost or outlay of the meteorological service is returned manifold. Frost warnings are of great importance. Thus, during the latter part of the season of 1891, just at harvest time, when the wheat crop of Northern Dakota and Northern Minnesota required a week or ten days to mature, extensive preparations were made by farmers to avert injury from frost. Material for smudge fires was collected and made ready to be fired upon receipt of the frost warning. Through the co-operation of the telegraph companies the warnings were widely disseminated and at the proper time the fires were lighted, and many million bushels of wheat saved. This was in the far north. In the far south in the same season 75 per cent. of the vegetable and fruit crop was protected by smudge fires kindled at the

approach of cold weather. Cattle men in the west find the warnings of great value. Cranberry growers as a class have special warnings sent to them. Within the last year or so, in the fall of the year with the approach of winter, the Washington office issues a chart showing the snow line or the southerly limit where the snow has fallen. With this information in hand the wholesale dealer in rubber shoes or other footwear directs his commercial travellers where to go in order to meet with most success. The Director of the Weather Bureau at Washington told me recently of the great favor this addition of snow line on the charts found in commercial centres.

Ice men, especially those farther south than Ottawa, where the boreal fruit does not obtain such large dimensions, know of the practical value of forecasts, as for instance in 1891 they harvested their ice before it had reached the average thickness because of warning of a thaw. Enough of references have been given to show the great pecuniary value of forecasts. The Meteorological Service is essentially a paying investment by the Government.

At the close of the lecture Mr. Klotz had some weather maps, kindly loaned by Mr. R. F. Stupart, Director of the Meteorological Service, thrown on to the screen. By means of the map, isobars were explained, together with the areas of high and low barometer; several storms were traced in their daily course across the continent, disappearing in the Atlantic. A West India hurricane was traced up the Atlantic coast.

In speaking of rain the leturerer said that all available records of precipitation had been unable to verify the belief held by some that deforestation affected the annual rainfall. If it is affected the effect is wholly masked by other and greater influences. However, deforestation shows its effects markedly in other directions, especially in floods and in local climatic conditions.

The graphic representations given greatly elucidated much of the subject treated in the lecture, especially with reference to the method of making the daily forecasts or "Probs."

References:—

GREELY: American Weather.
WALDO: Meteorology.
INWARDS: Presidential Address.

BIRD NOTES FOR MAY.

During the month of May many of our most beautiful birds make their first appearance ; the warblers, especially in the early part of the month, arriving in considerable numbers and variety. Those birds which come in the early spring have made their nests and are now busy rearing their young, and in some cases the latter have already flown. Mr. White reports that the young of the robin and the purple grackle were able to fly on the 29th, and young tree swallows, golden-winged wood-peckers, and blue-birds would probably leave the nests a few days later. Forty-one different species of birds have been observed this month :

White-crowned Sparrow—One seen by Professor Macoun on the 3rd. The next record is the 9th, when it was seen by Miss Harmer ; it also appeared in flocks at the Experimental Farm on that date. Mr. Kingston saw it first on the 10th and last on the 16th.

Purple Martin—Mr. Kingston, whose report was received too late for the last number, saw this bird on the 24th of April. It was next seen by Mr. Lees and Mr. White on the 3rd.

Wild Goose—Miss Harmer reports this bird as being still here on the 3rd.

Least Fly-catcher—Seen by Mr. Lees on the 6th.

Pied-billed Grebe—Seen by Mr. White on the 8th.

Wilson's Snipe—Seen by Mr. White on the 8th.

King-bird—Seen by Mr. Kingston on the 9th and by Mr. White on the 10th.

Summer Warbler—Miss Harmer, Mr. White, and Mr. Macoun saw this bird on the 9th, and Mr. Lees on the 10th.

Black and White Warbler—Seen by Mr. Kingston and Mr. Macoun on the 9th and by Mr. White on the 10th.

Rose-breasted Grosbeak—Seen by Mr. Kingston on the 9th.

Broad-winged Hawk—Seen by Mr. White on the 9th. Mr.

Kingston saw this bird on the 16th of April, but his record was received too late for the May number.

Goldfinch—Mr. White saw this in full breeding plumage on the 9th.

Night Hawk—Heard by Mr. Small on the 9th, but not seen until the 16th by Mr. Kingston.

Wood Thrush—Seen by Mr. White on the 9th.

Red-breasted Nuhatch—Seen by Mr. Kingston on the 9th.

Rusty Grackle—Seen by Mr. Kingston on the 9th.

Yellow Palm Warbler—Seen by Mr. Kingston on the 9th.

Blackburnian Warbler—Seen by Mr. Kingston on the 9th. Mr. White and Mr. Lees both saw this bird on the 10th. Mr. Lees reports that he saw several in the shade trees in different parts of the city, and Mr. Kingston says that they were unusually abundant this year.

Black-throated Blue Warbler—Seen by Mr. Kingston on the 9th, and by Miss Harmer and Mr. Lees on the 10th.

Whip-Poor-Will—Seen by Miss Harmer on the 10th.

Oven Bird—Seen by Mr. White on the 10th.

Black-throated Green Warbler—Seen by Mr. White on the 10th.

Chestnut-sided Warbler—Seen by Mr. White on the 10th.

Magnolia Warbler—Seen by Miss Harmer on the 10th.

Nashville Warbler—Seen by Mr. White on the 10th.

Parula Warbler—Seen by Mr. White on the 10th.

Baltimore Oriole—This bird was seen by Dr. Fletcher on the 25th of April, but was not observed by Mr. Kingston until the 9th, and by Miss Harmer, Mr. Lees, Mr. White, and Mr. Macoun on the 10th. Mr. Small saw it on the 11th.

Ruby-throated Humming Bird—This beautiful little bird was first seen by Miss Harmer on the 10th. During the latter half of May it was quite abundant at the Experimental Farm, the large number of flowering shrubs and plants offering special attractions.

Olive-backed Thrush—Seen by Mr. White on the 10th.

Warbling Vireo—Seen by Mr. Lees on the 10th.

Red-necked Grebe—Seen by Mr. White on the 10th, a male bird being in full breeding plumage.

Red-eyed Vireo—Seen by Mr. Kingston on the 11th.

Cat Bird—Seen by Mr. White on the 11th, and by Mr. Lees and Mr. Macoun on the 12th.

Pine Finch—Mr. White saw four of this winter bird on the 11th, and Mr. Kingston saw it on the 16th.

Bobolink—Seen by Miss Harmer on the 12th.

Red-headed Woodpecker—Seen by Miss Harmer on the 15th.

Redstart—Seen by Miss Harmer on the 15th.

Maryland Yellowthroat—Seen by Mr. Lees on the 17th.

Mourning Warbler—Seen by Mr. White on the 20th.

Bay-breasted Warbler—Seen by Mr. White on the 20th.

Cape May Warbler—Seen by Mr. White on the 20th.

Wilson's Warbler—Seen by Mr. White on the 20th.

Canada Ruffed Grouse—Seen by Mr. Kingston on the 22nd.

Traill's Fly-catcher—Seen by Mr. White on the 22nd.

Swamp Sparrow—Seen by Mr. Lees on the 23rd.

Black-poll Warbler—Seen by Mr. White on the 23rd, and by Miss Harmer on the 25th.

Canadian Warbler—Seen by Mr. White on the 27th.

Black-billed Cuckoo—Seen by Mr. White on the 27th.

Olive-sided Fly-catcher—Seen by Mr. Kingston on the 27th.

NESTING OF BIRDS.

But few notes have been received regarding the nesting of birds. At the Experimental Farm we have twenty or more species breeding this summer. On the 17th Mr. Craig found a nest of the Brown Thrush in a Norway spruce hedge with four eggs in it. The brown thrush has been a regular visitor to the farm for several years. Meadow-larks, bobolinks, and vesper

sparrows are breeding in the meadows, while the forest belts and ornamental trees and shrubs afford very suitable nesting places for a considerable number of other species. Miss Harmer sends the following notes :—

"A chipping sparrow has built its nest in an old Christmas tree that stands in a corner near the door of a house where a family of young children run in and out, even flying unto her nest, with three eggs, when they are near.

"I found a song sparrow's nest at the end of a tunnel six or seven inches long, made by burrowing under some long dead grass which formed a roof that looked almost rain-proof over the nest with young."

W. T. MACOUN,
Associate Editor, Ornithology.

CARP CULTURE.

In driving through the township of Louth, near St. Catharines, Ont., a short time ago I was much interested in observing a well stocked fish pond on the fruit farm of Mr. J. H. Broderick. The pond though artificial, is situated in a natural depression near the bed of a small brook. The construction was in a measure accidental and came about in this wise some years ago, Mr. Broderick allowed a company of gas prospectors to make borings at this place. As a result of the borings water flowed more freely than gas, although the latter was obtained in sufficient volume to supply fuel to Mr. Broderick's house. The flow of water being constant an area of about 1-10 of acre was excavated and dammed. The subterranean supply of water of a temperature some degrees above freezing prevents the formation of thick ice in winter and obviates danger to fish life from severe frost. Four years ago Mr. Broderick stocked his pond with 60 individuals of the carp tribe (*Cyprinus*). He

states that the stock was about evenly divided as to numbers among the three so-called varieties: Leather, Scale, and Mirror. (Are these recognized varieties?) The increase since that time has been remarkable. The water is now fairly alive with fishes of various sizes. Mr. Broderick occasionally entertains his friends by feeding his pets with large slices of bread (without butter). This food is actively contested for by dozens of the smaller members of his fish family till the dimensions of the large pieces have been somewhat reduced, when they suddenly disappear from sight, being carried below, by a two or three pound veteran representing one of the pioneer settlers of the pond. Mr. Broderick does not claim that the carp is equal to pickerel as a table fish, but says that it is much superior to the common sucker in this respect. These fishes have not been fed regularly and long intervals occasionally elapse, when they are entirely dependent for food upon their own foraging efforts.

J. CRAIG.

FIELD DAY AT CHELSEA.

On May 22nd the club held its first excursion of the season. Some difficulty is always experienced in selecting suitable ground for the first outing. Chelsea, on account of its elevated woods with sheltered southern exposures, offers special inducements to the botanist. It was therefore chosen for this reason and owing to the fact that it is easily reached by the Gatineau Valley Railway. This excursion, like others held by the club to Chelsea was very successful. It was attended by about 190 adults and 80 children. The President, Prof. Prince was in charge.

Among the leaders who gave short addresses before leaving the grounds were Dr. Fletcher, entomology; Mr. Kingston, ornithology; Mr. R. B. Whyte and Prof. Macoun, botany; Mr.

Wilson (Geological Survey), geology ; Mr. Cowley (Collegiate Institute), "educational value of field day excursions."

A gratifying feature of this excursion lay in the fact that it was largely attended by students of the various educational institutions of the city. The Collegiate Institute and the Normal School were well represented as well as Coligny College and the Harmon School.—J. C.

THE SIXTY-SEVENTH ANNUAL MEETING OF THE BRITISH ASSOCIATION

TO BE HELD IN TORONTO AUGUST 18–25, 1897.

The executive of the British Association for the advancement of Science has again decided to hold one of its yearly meetings in Canada. Upwards of 500 men are expected to come from Great Britain and Ireland for the meeting to be held in Toronto in August, which promises to bc one of the most successful ever held. Lord Lister, Surgeon Extraordinary to the Queen, is the retiring President. He will be succeeded by Sir John Evans, one of the world's most famous anthropologists and a noted antiquarian. Lord Kelvin, better known on this side of the Atlantic by the name of Sir William Thompson, Sir Wm. Turner, Profs. Poulton, Oxford ; Ramsay, London ; Michael Foster, Cambridge ; Marshall Ward, Cambridge ; Bower, Glasgow ; Profs. Miall, Farmer, Ayrton, Scott, Unwin, Milne, Sclater, and a host of other noted men have signified their intention of being present. Besides these it is expected there will be at least 1,500 others, partly from Canada, partly from the United States, and partly from the continent of Europe. The University buildings in Toronto and the Legislative Assembly Room, together with Massey Hall and other buildings will be the centre of the meetings. The following are the sections represented :—Mathematical, physical, anthropological, chemical, geographical, zoological, botanical, economic science, mechanical and geological.

Public meetings will be held in Massey Music Hall and lectures by Sir John Evans, Prof. W. A. Roberts Austen, Prof. Forbes, and Prof. Milne.

A number of interesting excursions have been organized to places of interest, including the largest cities and Niagara, Muskoka and the Rocky Mountains.

The local arrangements are in the hands of a number of efficient committees, Dr. A. B. Macallum, Mr. B. E. Walker, Prof. R. Ramsay Wright and a host of others, taking an active part in the preliminary work which involves much labour and preparation. There is no doubt that the meeting will be an exceptionally interesting and important one, judging from the programme and papers, as well as from the list of those who are in charge of the various sections.

Ottawa ought to send a large contingent to the B. A. meetings in Toronto. Several members of our various scientific bodies and departments at Ottawa have signified their intention of being present, and everyone interested in the advancement of science in Ottawa ought to join the Association either as a regular member or as an associate member. Ladies as well as gentlemen may become members of the British Association for the Advancement of Science.

H. M. A.

OBITUARY NOTICES.

THE LATE N. J. GIROUX, C.E., F.G.S.A.

The following sketch of the life and work of the late N. J. Giroux, C.E., F.G.S.A., a talented member of the Field Naturalists' Club, appeared in the pages of the Bull. Geol. Soc. Am., vol. 8. For many years Mr. Giroux acted as assistant to Dr. Ells, of the Geological Survey, to whose pen geologists and the members of the club are indebted for the following notice:

"It is with feelings of very deep regret that we have to

announce the somewhat sudden death of one of our members, Mr. N. J. Giroux, of the Canadian Geological Survey, Ottawa, which occurred at his father's house in River Beaudette, Province of Quebec, on the 30th day of November, 1896. Mr. Giroux was held in high esteem by all his confreres on the staff, and aside from the general feeling of regret at his unexpected death, his loss at this time is especially unfortunate, since the results of his last two years' work in the interesting area between the lower Ottawa and the Saint Lawrence, in the study of which he has recently been engaged, were nearly ready for publication and would have made a very valuable contribution to our knowledge of this interesting field, both as regards the distribution and the fossil contents of the Paleozoic formations of the Ottawa basin.

Mr. Giroux was born at River Beaudette on October 22, 1859. He graduated from l'Ecole Polytechnique, Montreal, in affiliation with Laval University, in 1880, taking the degree of C.E. from that institution and the gold medal for standing in his year. After a year in the North-west Territories, in connection with the Dominion Lands Survey, he was engaged as assistant engineer on the Grenville Canal, leaving that work in 1883 to join the staff of the Geological Survey of Canada as assistant to Dr. Ells. In this capacity he did much excellent work for some years, and in 1890 took charge of surveys in the rough countries north of the Saint Lawrence, in the vicinity of the Saint Maurice waters. After three years in this arduous field he took charge of his last field of work, to the south of the lower Ottawa river, which he was rapidly bringing to completion when his labours were cut short by his death.

Mr. Giroux's principal publications have appeared in his summary reports of progress, which are issued in connection with the annual reports of the Geological Survey. The five volumes, 1891–1897, contain his writings. Among other papers is

one on the serpentines of Canada in the Transactions of the Ottawa Naturalist ; but he had laid well the foundations for an active and useful life, which would doubtless have been productive of valuable results to the scientific world, and his death is therefore regarded as a very serious loss to the field staff of the Geological Survey of Canada."

THE LATE PROF. E. D. COPE, OF PHILADELPHIA.

Edward Drinker Cope, Ph. D., &c., &c., the widely known naturalist and palæontologist, professor of comparative anatomy at the University of Pennsylvania, died at his home, 2102 Pine street, Philadelphia, on the 12th of April, 1897. For the last two weeks of his life Prof. Cope was confined to his bed, gradually, but surely succumbing to that fell malady, Bright's disease, of which he had been a victim for some years.

He was born in Philadelphia, July 28th, 1840, was educated at Westtown Academy and at the University of Pennsylvania. In 1869, in America, and in 1863 and in 1864 in Europe, he made a special study of comparative anatomy. In 1864 he became professor of natural science in Haverford College, resigning three years later, owing to failing health. From this on he was associated with the scientific work in connection with the geographical and geological surveys and researches of the territories, &c. He described nearly 1000 new species of *extinct*, and he is reputed to have described as many *recent* vertebrata. For many years Prof. Cope was curator and secretary of the Academy of Science, Philadelphia, and occupied several scientific and responsible positions for the State. In 1879 he received the Bigsby medal, in 1884 he was elected vice-president of the A.A.A.S. In 1889 he became professor of geology and palæontology in the School of Biology in the university, succeeding Prof. Howells, a position which he held up to the time of his death.

Prof. Cope has contributed about 100 papers to the Amer. Phil. Society, to the Academy of Sciences, to the National Museum,

and the publication, the *American Naturalist*, was essentially Prof. Cope's magazine. Aside from this he has written upwards of 350 papers which form a systematic record of the development of palæontology of the United States. Among his larger works are: (1) "Systematic Arrangement of the Lacertilia and Ophidia;" (2) "History of the Cetacea of the East North American Coast;" (3) "Synopsis of the Extinct Cetacea of the United States;" (4) "Systematic Arrangement of the Extinct Batrachia, Reptilia, and Aves of North America;" (5) "Systematic Relations of the Fishes;" (6) "Systematic Arrangement Relations of the tailed Batrachia;" (7) "Extinct Vertebrata of the Eocene Formation of Wyoming;" (8) "Cretaceous Vertebrata of the West;" (9) "Tertiary Vertebrata."

To the theory of evolution Prof. Cope has made important contributions, amongst which are: (*a*) "On the Origin of Genera;" (*b*) "Hypothesis of Evolution, Physical and Metaphysical;" (*c*) "Evolution and its Consequences;" (*d*) "Method of Creation of Organic Types;" (*e*) "Origin of Man and other Vertebrata;" (*f*) "The Origin of the Fittest," &c., &c

H. M. AMI

Ottawa, May, 1897.

NOTES FOR THE MONTH OF MAY.

Flying Ants—On the morning of 12th June myriads of flying ants suddenly made their appearance in various parts of the city, none having been seen previous to that date. They matted in large patches on fence posts, on the edge of the sidewalks, and on bare spots where any flat dry substance was to be found. The fence posts along Cartier Square were covered, and whether from the chill of the previous night or from other causes they appeared numbed and indisposed to fly. Any protruberance seemed to attract them. I did not notice any birds disposed to

feed on them. Will some of our local entomologists give their ideas respecting this sudden incursion of these insects?

Earthquake—A heavy earthquake shock occurred on the night of 20th May at 10.15 p.m., followed by a lighter shock about 11.

Aurora—There has been a marked absence of aurora for many weeks, an unusual occurrence. Dr. Veeder, of Lyons, N.Y., the authority on auroras, gives the monthly recurrence of the aurora 26 or 27 days apart, and says when no auroras are visible there is a manifest increase in thunder or other storms, as though they had taken the auroras place, and disturbances of the earth currents, known as magnetic storms, occur, even the solid crust of the earth receiving impulses that cause tremors, and earthquakes when the conditions are favourable, because of instability existing therein.

H. B. SMALL.

July Excursion—At the last meeting of the Council it was decided to have an excursion this month (July). Final arrangements as to date and place have not as yet been made, but the Committee expects to be in a position to make an announcement within a few days.

Editorial Note—In the unavoidable absence from the city of Dr. Ami, the editorial work of the current issue has been assumed by Mr. F. T. Shutt.

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FRUIT GROWING IN CANADA,*

BY

JOHN CRAIG,
HORTICULTURIST.

Central Experimental Farm, Ottawa.

I wish to speak of the fruit and fruit districts of Canada as these cover the whole, or practically the whole, of Canadian horticulture. The term "horticulture" embraces not only the cultivation, but the amelioration of fruits, plants and vegetables, so that the field occupied by the subject under discussion is exceedingly wide. As originally used, the term horticulture, applied to the cultivation of fruits, flowers and vegetables within circumscribed enclosures, commonly called gardens. Thus we find that the English word garden is derived from the Anglo-Saxon *gyrden*, to gird or enclose. In like manner the derivation of orchard is found in *ortgeard*, an enclosure for fruit trees, and again *wyrt geard*, a garden for the cultivation of vegetables or herbs.

It is difficult to discuss the status of fruit growing in Canada to-day without glancing at the evolution of the art—as it was for centuries previous to the application and study of principles, which raised it to the dignity of a science—not only in Canada, but in the mother countries, for both are intimately connected. There has, and probably always will be, some controversy between botanical and horticultural historians regarding the relative antiquity of the two rural and venerable arts, agriculture and horticulture—one side claiming that since agricul-

*An address delivered before the Field-Naturalists' Club, March 11th, 1897.

ture, or the cultivation of cereals as it was undoubtedly restricted to in our early civilization, provides food in sufficient quantities and adapted to the use of man, that it should be considered the parent of horticulture ; while those on the other side, take the ground that historically,at least,agriculture appears in the natural course of events to have been evolved from the art of gardening, and claim that the latter, therefore, should enjoy the distinction of parentage.

EVOLUTION OF HORTICULTURE.

It would seem reasonable to suppose, however, that at first there was little dfferentiation. That those plants, cereal or fruit-bearing, which most readily yielded food and supplied the wants of man were used at first, and cultivated later—contemporaneously. We should remember, as DeCandolle points out, that "between the custom of gathering wild fruits, grain and roots, and that of the regular cultivation of the plants which produce them, there are several steps." The history of the cultivation of those plants which have ministered to the wants of man as food producing agents is most interesting. This history is given by Alphonse de Candolle in his "Origin of Cultivated Plants." To those interested in the evolution of agriculture, I would recommend this work as a reference book and one filled with a vast array of historical facts. If we cannot claim for horticulture, priority over agricultune with satisfactory assurance, we can at least claim that it is what we may term the fine art of common life, because it supplies luxuries—and luxuries within the reach of all. In this way it is eminently republican.

The causes which have in the past promoted on the one hand, or retarded on the other, the cultivation of a particular plant have been various. If easily grown and yielding a product which was,or soon became a necessity, its propagation and popularity was assured. "In the same way* the various causes which favour or

*De Condolle.

obstruct the beginnings of agriculture, explain why certain regions have been for thousands of years peopled by husbandmen, while others are still inhabited by nomadic tribes." Strenuous and perservering efforts, though probably not always well directed, were made in prehistoric times—as in our own age —to grow those plants which yielded in greatest abundance and with least outlay of labour (men like to live without working when they can) products that supplied pressing wants. In this way we find that maize, wheat, the sweet potato and tobacco were widely diffused before the historical period. The Chinese Emperor Chenming instituted a ceremony 2700 B.C. at which seed of five useful plants were sown each year, viz., rice, sweet potato, wheat and two kinds of millet. As those species which were cultivated easiest, outstripped their fellows in the race, so in regard to localities, those sections or regions, which offered least resistance to the rude efforts of the early cultivator became agricultural or horticultural centres, from which after the advent of civilization, seeds, plants and *culture* flowed out in diverging lines. With the history of the civilization of the old world is most intimately wrapped up the progress of horticultural development. This is absolutely true when applied to the colonization of the new world.

CLIMATE AS AFFECTING PLANT GROWTH.

Among the factors bearing upon the horticulture of any country it is readily seen that climate exercises the most potent influence in determining the range and character of the fruits it is possible to cultivate, and the fact that our fruit lists have greatly changed during the last half century is no doubt owing as much to modified climatic conditions, as to the difference in methods of propagation and due also possibly to the fact that among fruit growers there has been of late a keener discernment in regard to quality in fruits.

In the early history of the province, when the forest primaeval covered our hills and valleys and shed abroad its bene-

ficent blessings in the form of *evener* distribution of moisture and *evener* radiation of heat, there is little reason to doubt that with this almost complete covering of verdure acting as a modifier of extremes in a measure—in the same manner as large bodies of water—there would prevail more equable climatic conditions and a more favourable era to the longevity of classes of trees and fruits more or less susceptible to climatic extremes. So climate may be considered the regulator and restrictor of varieties and in all horticultural operations whether our energies and faculties are applied to the production of, or the trial of a new fruit, it is of prime importance to know something of its probable inherent qualities, acquired from climatic situation, and perpetuated by heredity. Turning to another phase of the question, we should not forget that with perhaps slightly changed climatic conditions, brought about by the operations of the agriculturalist, come greatly altered soil conditions, the extent of whose influence upon plant growth we are apt to under estimate. Woody growth produced by virgin soils is very different in its capacity to withstand cold, to that produced by soils first depleted of their natural store of plant food by cultivation and then enriched by artificial fertillzers ; and so it happens that we find many of the fruits successfully cultivated by our forefathers, do not succeed in the same localities at the present time. It would be interesting in this connection, and in view of the fact that we are indebted to England for so many horticultural treasures, to trace the influence of the Roman, Saxon and Norman conquests upon English horticulture and the important mission filled by the Roman monks in the same connection, but I must without further preamble come nearer home and consider the condition and status of Canadian fruit growing.

SOURCES OF CANADIAN FRUITS.

Whence came our fruits ?

They came, undoubtedly, with our first colonists ; whether the peasant of Normandy, the Puritan, the Scotchman, the

Englishman or the Irishman. Unfortunately. the early history of fruit growing is in each of the provinces wrapped in more or less obscurity. It has been the fashion in the past, that while political and social events were recorded with precision and accuracy, the introduction of important agricultural and horticultural factors bearing upon the happiness and welfare of the human race have been entirely overlooked, unrecorded, and their influence thus under estimated. How much do we owe to the person who was instrumental in bringing from the orchards of Normandy the seed which produced our unrivalled Fameuse. Who can estimate the value of that apple in ministering to the wants of the poor, in supplying a luxury to the rich, and acting as a colonization agent for us in the mother countries. As with the origin of the Fameuse, so with many other fruits—we find ourselves without definite information regarding their early history. These fruits came as seeds with the early settlers,—who cleared the forest, who faced privation from lack of food, danger from the Indian who lived by the chase—but remained as useful fruit-bearing trees to lend a semblance or likeness of the home in the new land, to that across the seas.

Reproduction in early days—fortunately for the welfare and successful evolution of a race of hardy fruits—was by nature's method, through the seed. By means of this agency, assisted by another force operating silently but unceasingly—natural selection, or the survival of the fittest—many of our fruits have been produced. The Fameuse and St. Lawrence,—two grand Canadian apples,--the Newton Pippin and Baldwin are familiar samples. The following is the inscription upon a monument in Massachusetts—the ouly one of its kind as far as I am aware in the world—: *"This pillar, erected in 1895 by the Rumford Hisiorical Association, incorporated April 28th, 1877, marks the estate where in 1793 Samuel Thompson, Esq., while locating the line of the

*Address by C. C. James before Entomological Society of Ontario, Nov. 1896.

Middlesex canal, discovered the Pecker apple tree, later named the Baldwin."

The apple trees that were grown from seed planted by the early settlers and cultivated by the pioneers, in many instances proved long lived, some reaching the age of 200 years, or more. These trees attained great size and bore immense crops of what was termed natural fruit. Even now we find in the older portions of the province isolated individuals and remnants of these early plantings ; among them, fruits possibly not always of high flavour but frequently surpassing in keeping properties any of the propagated varieties now common to the district.

Mr. Hadwen, an eminent pomologist of Massachutts, says : "The process of degeneration or decay of the apple seems to be less rapid than that of the pear Out of 60 varieties mostly of American origin, grown fifty years ago, more than 40 are still cultivated and esteemed. There is little doubt that the now almost universal practice of propagating by grafting and budding has more directly affected the longevity of our large fruits than any other factor, though the change is less marked, as already stated, in the case of the apple than with the pear and peach." At the same time we have all had reason to notice how much disappointment frequently arises in our attempts to multiply the individuals of a seedling of special merit by the usual methods, grafting and budding. However healthy, vigorous and profilic the original tree may be there is no absolute assurance that when grafted either upon the root or top of another individual, it will maintain all its original and desirable characteristics. As some trees are sensative in this direction, so again others are apparently entirely oblivious to congeniality of stock and root, sustaining their own strong individuality through life despite varying soil and climatic conditions. The Duchess of Oldenburg, a Russian apple, is an excellent example of this class, bearing freely and regularly wherever planted.

BOTANICAL POSITION.

A glance at the botanical position of some of our leading fruits—Canadian fruits, at least—may be of interest. We see at once that to the Rose family we are indebted for nearly all our tree fruits, as the apple, the pear, plum, cherry, the peach and its smooth-skinned sister, the apricot, in addition to the king of of small fruits, the strawberry, and the members of the genus Rubus,—the brambles and raspberries.

Pyrus malus, L. with *P. prunifolia*, L. both European, are the parents of the cultivated forms of the apples of to-day. By comparing a ruddy specimen of the Emperor Alexander with a small specimen of the Siberian crab, we may obtain an idea of the improvement which has taken place in apples since the inhabitants of the Lake Dwellings of Switzerland cultivated pomaceous fruits. The native crab of America, *Pyrus coronaria*, L. is beautiful in blossom, hardy in tree, but thus far incorrigibly astringent in fruit However, over 80 per cent of our apples are of American origin that is to say the seed which produced them was planted in American soil. Nature has not dealt generously with us in matter of peaches, cherries and pears, all indigenous to Europe, not found wild in America ; but man has by seedling production developed varieties well adapted to the vicissitudes of our varying climate.

NATIVE FRUITS.

Remarkable progress has been made during the last half century in the development of native fruits. By looking at the evolution of the American grape, a prominent example is afforded. It is but a little over 60 years since Catawba, the first selection from the wild *Vitis Labrusca* L. of the south was made. But it is since the advent of the Concord, "the grape for the million," about 40 years ago, that varieties have multiplied with such astonishing rapidity, till at the present time they are numbered by the hundreds. Another example may be cited in the native plums

of America, *P. Americana*, Marshall *P. Chicasa*, Michx with subspecies. Thirty years ago, the progeny of *P. domestica* L. (the gage and egg type) of Europe were entirely relied upon. Now we have fully 300 varieties, pure or cross-bred, developed from selected varieties of our native species. These are destined in the future, by reason of hardiness and vigour, to supply the wants of settlers in the interior of our great country and in parts little more than explored at the present time. Within a century there have come to Canadian fruit growers, native plums, grapes, gooseberries, raspberries, cranberries, mulberries, pecans and chestnuts—and I had almost forgotten persimmons, a favourite with our coloured brethren in the south. These latter we do not expect to be widely planted in our day.

FRUITS STRUCTURALLY CONSIDERED.

The structural part of fruits is extremely interesting, as recording the remarkable modifications brought about by cultivation, as well as affording a glimpse of the analogy existing between the various organs and parts of the plants.

In horticulture we deal with those fruits called by the botanist, fleshy or indehiscent fruits. There is a disagreement between botanists and fruit consumers in regard to the use of the term "fruit," It is a disagreement between science and sentiment. Speaking botanically and technically, the seed is the fruit. Poetically and practically, the fruit is that which we eat. However, those plants yielding fleshy fruits are those which concern the horticulturist. This fleshiness is brought about by an abnormal development of the parenchyma. The ovary results from the transformation of a leaf, made up of the epidermal coverings, the endocarp and pericarp, enclosing the mesocarp. These parts may be traced in the structure of *pomes*, or *berries*, as styled by some botanists, as well as in the stone fruits, or drupes. Examining an apple we find that it results

from the ripening of an inferior and compound ovary, with five carpels, orginally free. It is wrapped like the fruit of the rose by an expansion of the floral receptacle, This covering becomes fleshy and succulent like the ovary with which it is joined, of which the endocarp alone lining the hollows of the five cells is thin and cartilagenous. The endocarp, as Figuier points out, forms that part which sticks out between the teeth, when we eat an apple. In the case of the orange we have a cnrions modification. The external yellow skin represents the epicarp ; the white spongy matter, the mesocarp ; the thin membrane lining the quarters, the endocarp, while the edible part exists as an accessory to the pericarp. Turning to the drupes, the peach, cherry and plum result from the ripening of a superior ovary. We find first, in the waxy skin of the plum, the epicarp ; in the pulpy succulent flesh, the mesocarp, and in the woody kernels, the endocarp. A knowledge of the nature of each fruit, the conditions surrounding the development of its acids and aromatic flavours is essential to their proper and satisfactory preservation. This touches the broader and commercial economics of the industry.

FRUIT DISTRICTS OE CANADA.—MARITIME PROVINCES.

Prince Edward Island.—We find on the Island still a few of the old French orchards of apples and cherries. Rural husbandry has, however, been of a specialized kind, and up to a few years ago little was done outside of potato growing and horse raising. A deep interest in dairying and fruit growing has recently been awakened. The advantages of the Island from the standpoint of the fruit producer are many and weighty. Among these are natural underdrainage in many parts, an equable climate and proximity to the European market. Cherries have been cultivated with success since the advent of the first settlers. They belong to the Kentish type and ripen a month later than do the same varieties grown in Eastern Ontario.

Cranberry culture is being extended in the inland marsh lands. The fruit is shipped to England. There is undoubtedly a future for cherry, apple, plum, pear and small fruit growing on the Island ; a few large orchards are already established and are bearing satisfactorily. The fruit keeps particularly well.

Nova Scotia.—The Dominion owes very much to this province for the good pioneer work done in advertising the fruit-growing capabilities of Canada in the European markets. The best advertisement that could be given by any country was afforded by the magnificent display of fruit made by the Province of Nova Scotia through its Fruit Growers' Association at the Indian and Colonial Exhibition in London in 1886.

As early as the middle of last century, the Acadian French, who then peopled Kings and Annapolis counties, cultivated apples and pears with great auccess. When these lands fell into the hands of the Connecticut and English immigrants in 1760, old pear and apple trees were found in many places, some of the latter existing at the present day. It must not be supposed that the apple growing of Nova Scotia is restricted to the Annapolis Valley. The fertile valleys of the Cornwallis and Gaspereaux rivers are equally well adapted and equally productive. The protection afforded by low parallel lines of hills, known as the North and South Mountain ranges, sheds a beneficient influence much appreciated by the fruit growers of these regions. The numerous bays and inlets assist in equalizing temperatures and exercise a marked influence upon the longevity—which is proverbial—of the apple trees in this region.

The soil consists of sand, sandy loam and clay, overlying a sandstone formation. The enormous rise and fall of the tides, from time immemorial have worn away soil and rocks and produce those rich and extensive deposits constituting the present marsh and dyked lands. These marsh lands serve the pnrpose

purpose of supplying an abundant annual supply of herbage, in addition to yielding an inexhaustible store of cheap natural fertilizer used by fruit growers with great advantage upon the upland orchard areas. The more favourable portions of the province produce apples of the finest quality, plums, pears and small fruits in fair quantity and of good quality. The early ripening varieties of peaches may, and are being cultivated with success in the open. This branch of the industry is developing rapidly. Another branch of the industry unknown to commerce ten years ago, is now rapidly assuming important proportions. I refer to cranberry culture. In 1890 some 400 barrels were harvested. Last year the output reached 2,000 barrels The total orchard area of the province is estimated at 75,000 acres. The marketable crop of apples amounted last year to over 500,000 barrels,nearly all exported to Britain. The cultivated orchard area was increased this year by 5,000 acres. The names of Col. John Burbidge,—introducer of the well known Nonpariel Russet,—Dr. Samuel Willoughby, Ezekiel Calkin, Dr. Inglis—first Bishop of Nova Scotia, who brought to the Valley Yellow Bellefleur, where it was named Bishop's Pippin, in consequence,—Hon. Charles Ramage Prescott—who imported Ribston Pippin and the famous *Gravenstein*, which he fruited in 1838,—Dr. C. C. Hamilton—the founder and first President of the Provincial Society—are all names that should be handed down to history, and are those whose good deeds will live after them, for is it not true that he who originates or introduces a new and valuable fruit suited to general cultivation, is as much a benefactor to mankind as he who discovers a new principle in science, which increases the comfort and happiness of the race?

The fruit growers of the province are intelligent and energetic. The establishment of a School of Horticulture at Wolfville, the only one of its kind in America, is but an evidence of the progressive spirit of the people. There is still a large amount of unoccupied fruit land in the province.

New Brunswick.—The climate of this province favours a mixed husbandry. Wild raspberries, strawberries, blueberries and cranberries grow in profusion and have to some extent hindered their cultivation. Apples may be grown successfully for home use in nearly all parts. Large commercial orchards are in bearing and others are being planted in the valley of the St. John River. The fruit harvest is later than in Nova Scotia. New Brunswickers are,therefore,enabled to place their berries upon the Boston market at a time when competition from other quarters is light in these classes of fruits. Bright minds are at work in the province. What to grow and how to grow it are questions receiving earnest attention.

Quebec.—The climatic conditions in Eastern Quebec approach quite closely those obtaining in many parts of New Brunswick We find the principal fruit areas lying along the south side of that great artery of commerce, the St. Lawrence River. Here and there, not on the low clay flats, but on the higher middle elevations with gravelly subsoil affording natural drainage, we find orchards made up of the La Belle, Fameuse, Pomme Grise and St. Laurent—truly Canadian and truly delicious apples. It seems to be a principle in plant growth, especially in apple development, that the farther north a given variety may be grown to successful fruitage, the finer in quality will be the product. So it is with our Canadian Spys, Fameuse, Gravenstein and King—and what of our North-west and No. 1 hard wheat?

In L'Islet county, about 70 miles north-east of the city of Quebec, plum growing has become a specialized industry, during its gradual evolution covering a period of 100 or more years. The Reine Claude de Montmorency is delicious and peculiar to the region. The Damson plum trees grow in stocky form and produce all out of prodortion to their size. The Kentish cherry has through heredity developed hardy forms well adapted to its new home and ripens its fruit a month later than the same variety grown at Ottawa.

Coming up the St. Lawrence we might profitably look through the old gardens in the suburbs of Quebec. We might not find apples of gold, and melting pears such as are described in poetic sentence by the author of *Le chien d'Or*, but we shall find that even on the heavy clay loams of this region, apples and plums are produced of good quality and in fair quantity. The Island of Montreal is undoubtedly the cradle of the fruit industry of the province. The ground, now covered by many of those majestic achitectural structures so beautifully situated around the base of old Mount Royal, was once occupied by monuments in the form of fruitful apple and pear trees reared by the efforts of man and nature, not so imposing in appearance, though hardly less beautiful, but perhaps more useful in effect and beneficial in influence than piles of granite, sandstone, or marble. On the Island of Montreal we find a truly intensive style of fruit growing ; apples and pears are staples. Strawberries, gooseberries and other small fruits are extensively cultivated. Convenient market facilities, both at home and abroad, assist the fruit grower. About the foot-hills of those curious out-croppings of the Vermont mountains that we find in the Richlieu Valley and in the Eastern Townships—localities peopled by U. E. Loyalists—fruit growing is a leading branch of rural labour. The number of varieties peculiar to a locality is an indication in fruit growing of the relative antiquity of the industry. Here we find our native Canada Baldwin and our Winter St. Lawrence. Beloeil, Rougemont and Abbotsford, are well known to Quebec fruit growers as the homes of progressive horticulturalists, and the name of the late Charles Gibb of Abbotsford is well known throughout the continent as a fruit-grower and a philanthropist. The fruit area along the New York boundary line is rapidly extending, Apples, plums, pears and grapes here reward the efforts of the fruit grower with abundant crops. The scene in Montreal along the docks last autumn when apples by the thousands of barrels were going out by steamer was indicative of the extent of the indnstry.

Ontario.—A hasty description of fruit growing in this province would easily occupy the whole time at my disposal this evening. We shall first look at some of the older fruit growing sections. Along the banks of the Detroit river in the extreme south-west are gigantic pear trees. These are from seed planted probably by French missionaries. One of the oldest is said to date from 1705. Legend also states that a a colonist brought from his European home three pear seeds in his vest pocket and planted them near Amherstburg. These grew, bore fruit, the seed of which produced the picturesque old trees marking the landscape of this region at the present day. The trees are productive, but the fruit is not valuable. The planting of apple orchards began in this region about the year 1784. Since that time grape growing has assumed enormous proportions. The entire peninsula between Lake St. Claire and Lake Erie, composed of the counties of Essex, Kent and Pelee Island, are especially favoured climatically, for the production of grapes and peaches. The manufacture of wine is a business of growing importance. On Pelee Island there are 350 acres of vineyards. This Island has probably the highest mean temperature of any point in Canada. North of Pelee Island is a peach section—rapidly becoming recognized as one of the best in Canada. The industry is not more than 20 years old, yet in 1894 a single station, Leamington, shipped 35,000 baskets of peaches. Last year that number was probably doubled. It is estimated that nearly half a million peach trees were planted last spring in this section ; this year the area planted will nearly equal that of 1896. Land values are increasing in this section.

Along the south side of the Georgian Bay, in the valley of the Beaver River, we find one of the finest plum growing sections of Canada. Disease of the trees is practically unknown. In 1894 a carload of plums was shipped every day for three

weeks from Thornbury. Mr. C. C. James, Deputy of Agriculture of the Province, says : "There are those who would rather possess a plum orchard in Beaver Valley than an orange grove in California." The apple region of Lake Huron is well known to buyers who cater to the demands of the European markets. The handsome appearance and fine qualities of the fruit are duly recognized. This region produces from 300,000 to 500,000 barrels of apples per annum. The staple varieties of this region are Spy, Baldwin and Greening.

Travelling eastward along the north shore of Lake Erie, we come to another famous fruit growing region—the Niagara Peninsula. This is one of the oldest fruit growing sections of the country. Here, between 1780-90, the U. E. Loyalists received grants of land from King George, and sowed seeds of apples brought from their homes in the United States. Here, we are told, that John Smith, in the early part of this century, offered to sell his claim to 200 acres of land for a cow, but found no buyer. This land is now valued at $300 to $500 per acre. The improvement of native fruits by grafting and by the introduction of foreign varieties began about 1830. Since then the development has been amazingly rapid. Electric cars run every hour past the doors of the fruit growers between Hamilton and Grimsby ; telephones connect their homes and bring daily market reports. During the shipping season, a fruit train leaving Niagara Falls daily and running to Hamilton, carries away such peaches, plums, cherries, grapes, pears and berries as are not shipped by boat from Hamilton or St. Catharines. A single firm paid $3,000 for fruit baskets in 1894, these cost from $3 to $4 per hundred. Wine making is also an important industry. The old town of Niagara-on-the- Lake is the shipping point for a splendid peach section. In 1894 300,000 baskets, mainly peaches, were sent out from this port. It is worthy of mention that figs and black Hamburg grapes, both grown and ripened in the open

air, were shown in Philadelphia in 1876 and in Chicago 1893 by Henry Pafford, Esq., for many years mayor of the town of Niagara.

Crossing Lake Ontario to Toronto and travelling eastward, we pass through a favoured pear growing region, but one producing also fine apples and plums. The Peninsula of Prince Edward county is deservedly famous for the apples it produces. Northern Spy, King and Fameuse are staples and grow to great perfection. The growing of garden varieties of pease for seed and canning purposes is a specialized industry in this county and one which yields an estimated annual revenue of about $200,000 to the farmers of the county. From Kingston to Montreal along the river is also a region producing fine apples, plums ard berries. Mr. C. C. James, Deputy Minister of Agriculeure for Ontario, gives the following estimated statistics regarding fruits and fruit areas in the province in 1895. Area in orchard, garden and vineyard, 320,122 acres ; number of apple trees of bearing age, 5,913,906 ; young trees not bearing, 3,548,-053 ; yield of apples in 1896 estimated to be 55,895,755, or about 20 million barrels. Fairly complete statistics covering the fruit resources of the province may be found in Bulletin No. 92, Department of Agriculture, Toronto. I have given more space—and for obvious reasons—to Ontario than to the provinces eastward. The fruit possibilities of the province are great and are being rapidly developed by progressive and intelligent orchardists.

Manitoba and the North-West Territories.—As far as the tree fruits are concerned, those which can be grown successfully in these regions without extraordinary care have yet to be produced. A few apples and crabs have reached fruiting age in Southern Manitoba. The seeds of these should be carefully planted in the hope of securing therefrom hardier forms. Berries of all kinds may be grown by the exercise of judgment, skill and perseverance. Some of the native fruits are

being cultivated and appreciated, among these are gooseberries, currants and juneberries. Wheat is king here—long may he reign—surrounded by lesser lights in the factors that compose a successful and profitable mixed husbandry.

British Columbia.—I approach a description of the fruit resources of this province with a diffidence born of lack of personal knowledge,increased by a feeling of the extraordinary possibilities of its deltas, its coast line, its valleys, its benches, its irrigated lands. Great climatic variation means a corresponding widening of the possibilities of fruit culture, and there is here undoubtedly a more extended range of thermometric variation and atmospheric moisture, than is found in any other province of the Dominion. That fruit of fine quality can be grown and is being increasingly cultivated is evidenced by the magnificent plums, pears and apples shown by the Superintendent, Mr. Thos. A. Sharpe, of the British Columbia Experimental Farm at the leading exhibitions of Ontario last autumn. That apples of surpassing size and of great beauty are grown is attested by the fact that British Columbia won and held the distinction for some time at the World's Fair of having the largest apple on exhibition, and may I venture to add that she can also claim the proud distinction of numbering among her landed proprietors the Earl of Aberdeen His Excellency the Governor General of Canada, and the largest orchardist in the Dominion. The value of His Excellency's extensive orchard situated at Vernon in the Okanagan district, to the province from the standpoint of a stupendous object lesson, comprising as it does some 200 acres of fruits, together with its colonizing influence, may not be over estimated. Pears, plums and apples are grown with great success in the Okanagan valley. Speaking of the best fruit lands of the province, a pioneer fruit grower, Mr. E. Hutcherson. of Ladners, says : "Some of the best fruit lands are to be found along the monntains and foothills on either side of the numerous valleys of the province."

This is particularly true of the region along the Fraser River between Chilliwack and Hope. Briefly, the region along the Fraser River from Agassiz to the coast is one abundantly supplied with water and now producing large quantities of plums, pears, apples and berries. Some of the interior valleys are eminently adapted to the requirements of the tenderest tree fruits. Peaches are being successfully cultivated here and there, on the bench lands.

The climate of parts of the Okanagan Valley is described by those who have studied it carefully as approaching perfection. At Vernon fruit growers, stimulated by the example of His Excellency, are planting fruit trees extensively. With irrigation the upper plateaux and interior regions are proving wonderfully fertile and productive, and with this life-sustaining agent the possibilities of fruit growing in the province would appear to widen as we advance. The increased interest in mining will in time re-act favourably upon the fruit interests of the province. With favovrable freight rates, should not the fruit growers of British Columbia supply the homes of the rancher and farmer throughout the vast area between the Rocky Mountains in the West, and the Red River in the East, with this flower of commodities? And is he not in a position, at the Western Gateway, if supplied with proper shipping facilities, to give of his plenty to his cousins in Australia during their season of scarcity.

Did time admit, I would like to speak of the canning industry of Canada, the evaporating industry, and the great nursery interests of the Dominion. It might interest you to know that a single canning establishment in Prince Edward county made a shipment last year of canned fruit and vegetables put up in one factory, consisting of a complete train of cars, which steamed away to supply settlers in the Western prairie provinces with the good things of life, concentrated and properly conserved.

Most powerful among the factors which have assisted the development of fruit growing in Canada, are those organizations known as Association's of Fruit Growers. Nova Scotia, New Brunswick, Quebec, Ontario, British Columbia, and, lately, Prince Edward Island, have each a provincial organization composed of the best men. It is to the credit of the several provincial governments that the good work of these societies is in the main wisely assisted. In the volumes of the reports of these societies are chronicled the histories of provincial fruit development. The progress of less than a century has been marvellous. The trend of the age in fruit growing as in other industries is towards specialism. The fruit grower is yielding to the impulse. We are now growing fruits especially for canning, for home use, for keeping, and for carrying. We are finding the areas best adapted to the production of particular varieties and profiting by this experience. Lastly, we are uniting science with practice in studying principles and in applying methods which will produce better fruit than heretofore at less cost, thus ministering to the wants of the poor, as well as to the rich, and by so doing adding the wealth to of our land and increasing the sum total of human happiness.

The President (Mr. Shutt) in conveying the thanks of the Club to the lecturer, said that the intensely interesting and instructive lecture that they had, had, the pleasure of listening to was one that might well serve as a type of those most useful addresses which treat of the practical or economical, as well as the more strictly scientific aspect, of the subject. There was probably no one in Canada, he said, who by reason of his official position and the wide experience which it afforded, was so able as Mr. Craig to impart reliable information regarding fruit culture in the various parts of the Dominion.

They were especially honoured, the President remarked, by

the presence of His Excellency the Governor General, who, he need not remind the audience, was Patron of the Field-Naturalists' Club. This was the third lecture of the present course that His Excellency had attended, and the Club was particularly gratified by the interest that he was showing in the work of the society. His Excellency had not only a general interest in all the important industries of Canada, bnt a particular one in fruit culture and its possibilities in the Dominion. It was well known that His Excellency was an extensive fruit grower in British Columbia, and he (the President) felt sure that those assembled would be very much pleased if His Excellency would address them on the subject that they had had brought before them this evening.

The Governor General, then, rising amid applause, spoke as follows :

It is not surprising that the lecture af this evening has been followed with much and attention, for the subject treated is one of much importance, and has been dealt with in a practical and interesting manner. I was struck by the following among other points alluded to, namely, where Mr. Craig spoke of successful fruit culture in Canada, and of the export of Canadian fruits to Europe furnishing an excellent emigration agency. There can be no doubt at all—and it is well to keep it in view—that a supply of first-class fruit, such as Canada is well capable of producing, for the markets, for instance, of Great Britain, will always be particularly valuable as representing the resources and capabilities of the soil of this land. Even apart from the business aspect of the matter, fruit culture has an attraction of its own. It is a branch of botanical science ; and it occupies and requires attention and care of one kind and another throughout the year. I speak to some extent from personal experience, as I may claim to be a Canadian fruit grower (applause), though other duties and avocations render it necessary that I should carry on the work to a large extent by deputy. However, I have at least sufficient practical experience in the matter to make me

aware how easy it is to allow a fruit farm *not* to pay ; in other words, to realize, and it may be to impress upon others who intend to follow the pursuit, the necessity of unremitting care and vigilance in the selection of trees, in the planting, in subsequent attention in the matter of spraying, so as to destroy the voracious pests which are ever ready to appreciate good fruit ; and furthermore, the equally all-important matter of skilful and judicious packing, in order to secure success, which however may surely be obtained in due time by perseverance and skill.

I think we may feel that Mr. Craig, although he dealt with various classes of fruit culture, and various districts in the Dominion, displayed a judicious impartiality. That is a quality which of course always appeals to a Governor General. Mr. Craig did perhaps indicate a leaning, if anything, towards the Spy and the Baldwin ; but I am sure he would not go so far as a worthy fruit grower who at an Association meeting remarked that if he had a hundred trees to plant, he would select Baldwins for ninety-nine of the lot. "May I ask," said another member, "what variety the gentleman would select for the hundredth tree?" "A Baldwin, sir."

His Excellency concluded by saying some kind things in reference to the work of the Experimental Farm officers and by expressing appreciation of the service rendered to the public by the Ottawa Field-Naturalists' Club in providing the valuable series of lectures of which the one we have had the pleasure of hearing to-night was a typical example. He wished the Clnb continued success in the future.

PREVENTION OF CRUELTY TO BIRDS, ANIMALS AND FISH.

At a meeting of the Hintonburg branch of the S.P.C. held in the Town Hall there on the 23rd of June, several members of the Field Naturalists' Club gave short addresses, bearing especially on the prevention of cruelty to birds, animals and fish. Prof. Prince dwelt especially on the preservation of fish and the necessity of protecting them when spawning. Mr. W. T. Macoun spoke of the necessity of training the boys from childhood to not injure the birds and instanced the large number of birds nesting at the Experimental Farm, where they were partly protected and afforded places for nesting. Mr. A. G. Kingston spoke of the intense interest in the study of our birds and how much of the delight was lost unless we know them whenever seen or heard. Mr. J. Ballantyne's remarks were principally about animals, and he gave some interesting facts regarding the habits of some of them, and dwelt on the necessity of their being protected. Dr. J. Fletcher showed that many birds which were generally considered very destructive, really did more good to man than harm. He condemned the cageing of wild birds, saying that in nearly every instance they died. Mr. W. A. D. Lees touched on the legal aspect of the question showing how the law it exercised could convict all who shot or trapped birds or took their eggs. He also spoke of the delight of watching and listening to the birds in their haunts.

W. T. M.

BIRD NOTES FOR JUNE.

No new arrivals were recorded during the month except the Pine Warbler. Since the first notes were published in the April number, records have been taken of 116 species of birds. A few notes have been received this month, principally on the

nesting of birds. We are indebted to Mr. White for the following :

Wilson's Warbler.—Still here on the 5th.

Pine Warbler.—Seen at Rockliffe on the 6th.

Mourning Warbler.—Seen building nest on the 6th.

Loon.—A nest of this bird was found on the 21st at Lake of Islands, Gatineau, containing two eggs ; the nest was principally remarkable for its absence. The eggs were within six inches of the water, on the bare ground. The old birds were quite tame.

Phoebe.—A nest of the phoebe was found on the 21st containing five eggs. It was built on the end of a log projecting over a cliff near Lake of Islands.

House Wren.—Young birds were flying on the 22nd.

At the Experimental Farm there have been about twenty species of birds breeding during the summer. The increase in the number of cat-birds building on the farm was noticeable this year. The shrubs are now so large that they have a better opportunity of hiding their nests. Another nest of the brown thrush with four eggs, was found on the 18th by Mr. Macoun, in a large pile of brush, about eight feet from the ground. This was about one month later than the first nest discovered.

W. T. MACOUN.
Associate Editor, Ornithology.

EXCURSION TO THE PICKANOCK.

The Field Naturalists' Club have had many profitable and enjoyable excursions to several points along the Gatineau, but on the 20th of June old fields were left behind, as, by a special train, a party consisting of 47 adults and five children travelled up the river for about sixty miles to near the junction of the Gatineau and Pickanock and the village of Gracefield. The train, which left Ottawa about 9.30 a.m., made very fair time

and the run was made in a little more than two hours. About half a mile south of Gracefield the train stopped, a walk of another half mile through woods and meadows brought the excursionists to a pine grove, where lunch was dispatched with much relish. In the afternoon all formed one party and walked to the Gatineau river, then down that river to where the Pickanock empties into it, and up the Pickanock for a half mile or more ; when under the shadow of the trees by the river's bank a short rest was taken, and addresses given by Mr. W. B. Sinclair, Vice-Principal, Normal School ; Dr. A. Lehmann ; Mr. Whitley, of London, Eng., and Mr. W. T. Macoun. After ascending a neighboring hill, where a magnificent view was obtained of the surrounding country, Gracefield was reached, and leaving there shortly before six p.m., the train arrived in Ottawa at 8.35. Everyone seemed pleased with the day's outing.

While the district visited abounds in beautiful scenery, it did not at that season offer a good field for the botanist or ornithologist. Very few birds were seen and no plants of especial interest noted. The wooded land was stony and the growth not very luxuriant. An interesting object on the hillsides was the moose-wood (*Dirca palustris*), large clumps of this shrub being very prominent there.

W. T. M.

EXCURSION.—As very many of the members of the Club are this month out of town and satisfactory arrangements cannot be made with the railways or steamboats for a small party, the Excursion Committee has decided to postpone for the present the "Outing" announced in the last issue.

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THE PELICAN.

By PROFESSOR EDWARD E. PRINCE,
Dominion Commissioner of Fisheries, Ottawa.

Of all ungainly birds the pelican *(Pelecanus erythrorhynchos, Gmelin)* seems to be the most ungainly and awkward. Its huge beak with swollen gular pouch is so disproportionate when compared with the small size of the head, while the head and beak together appear to completely overbalance the short squat body. When seen alive in zoological gardens its actions are far from graceful. It waddles about its wire netting enclosure, clumsily moving the head from side to side, and dipping frequently into the miniature pond, hoarsely screaming, and heavily flapping its long wings, the very emblem of uncouth awkwardness. It is, indeed, difficult to realise that this solitary bird of the desert has any graceful features at all.

Such an impression is far from the truth. No doubt the pelican resorts to remote waters, and shuns the company of man. Out on the secluded lakes of the vast prairie country or along certain stretches of unfrequented rivers of the north, it makes its home. I had recently the opportunity (early in September), which few visitors to the border of the Barren Lands can forego, of shooting the Grand Rapids of the Big Saskatchewan, and saw on that occasion the pelican in its natural habitat. The Grand Rapids, it is hardly necessary to say, occur just before the noble Saskatchewan debouches into Lake Winnipeg towards the north end of that lake. As our spacious York boat, manned by four swampy Cree Indians, danced down the swift current, bouncing over boiling whirlpools, and plunging past swirling eddies, we

noticed on a distant shallow strip of bush-grown shingle an assemblage of white pelicans. They were crowded in a long line like a company of soldiers arrayed in spotless white tunics. It was early morning (6 a.m.), and as the bright sun shone through the clear northern air, the line of large white birds stood out in bold relief amidstream. They were bobbing their heads up and down, and shifting uneasily as though they were going through the old method of regimental "sizing"—tallest at the end, shortest in the middle of the line. With characteristic timidity they rose in flight when our boat was two or three hundred yards away. I counted them as they rose and found that there were 76 birds, and there must in all have been at least a hundred pelicans along the rapids which extend some four miles. They looked like huge swans or gulls, the head being gracefully thrown back, bringing the point of the long beak very little in front of the breast. The shortness of the tail was obscured by the stout yellow webbed feet which were backwardly directed in flight and gave the bird a greater apparent length, as the feet extended beyond the blunt tail which, it may be added, consists of 20 or 25 short feathers. Each tail-feather terminates in a white pointed plate or horny tip. The expanse of the wings was the most remarkable feature. It imparts a majestic appearance to the bird. Seen from below, the outer half of each wing is observed to be of a dull black colour ; the inner part, next to the body of the bird, is cream white ; so that the wings have the appearance, when expanded, of a huge letter "U" of white, with the outer broad fringe of black. One famous U.S. naturalist speaks of the pelican as "clumsy on the wing;" but no one could so speak who saw these birds as I saw them in their native haunts.

They flew for some distance in a confused manner, without arranging themselves like ducks or geese in regular flying order. Some separated from the rest and moved round gracefully in circles with motionless outstretched wings, after the manner of

huge sea-gulls. Nothing could exceed the soaring sweep and grace of these great wheeling birds. Others settled upon the surface of the water and, with head upstream, gradually drifted down with the swift current.

When swimming the wings are not closed tight upon the body, as in the case of the duck: but are raised up and form a plumed arch above the body. The head is thrown back somewhat and the neck curved so that the beak is directed diagonally downward. The bright yellow gular pouch could be readily seen through a field glass. The Indians cut off this pouch when they secure a pelican, and sewing two together they make a quaint but useful pocket for needles, &c. The beak, I observed, was moved continually from one side to the other, more especially to the left side, that is, towards the bank of the river, alongside which the birds were drifting. Whether they were driving the fish shorewards or not I could not make out: but they were evidently not feeding. The tip of the beak was merely dipped into the surface of the water as they gracefully floated down below the rapids to the mouth of the river. On reaching the river mouth, several miles below, they are said to fly up to their starting point and once more drift down again, repeating this procedure time after time. They are said to be expert at catching fish, chiefly the fine whitefish which ascend from Lake Winnipeg to the Grand Rapids for spawning purposes in September and October. Each fish, as soon as it is caught in the capacious beak, slides into the pouch and then slips down the throat at a single gulp.

The Indians in the locality charge the pelicans with having driven the whitefish out of the river: but if the fish have diminished in number it is not necessary to seek further for the cause than the action of the Indians themselves who, for years, have scooped the rapids with dip-nets, and have captured the parent fish in numbers when just about to spawn. There is no better

method of ensuring the depletion of fish than that, and the Grand Rapids certainly did not swarm with whitefish in September and October as they once did. The fish keep close to the bank of the river on account of the swiftness and force of the current, and slowly creep up, as it were, into the very midst of the boiling tossing rapids, which it is claimed are the finest rapids in the world. The salmon in the Fraser and other Pacific rivers hug the shore in the same way, when ascending the swift water of the canyons, the dark backs of the fish appearing above the surface of the turbid water, indicating the crowds of salmon at the very edge of the river. The capture of such fish is easy, and I had the opportunity of seeing some of the whitefish scooped up by the Indians just above the Grand Rapids Hudson's Bay Post.

The pelicans appear to be well aware of this habit of the migrating fish, for they float as a rule near the bank on either side, and capture the unsuspecting whitefish just when exerting all their strength and attention in battling with the descending stream.

The nesting grounds of these pelicans appear to be the dry gravelly beaches of Cedar Lake, over twenty miles above Grand Rapids. Their large streaked eggs, in shape like the eggs of the goose, may be gathered there in numbers. The pelican makes little or no nest, and has the reputation of being a very incompetent and neglectful parent. A common belief prevails that the black cormorants, of which a few are usually seen wherever the pelicans are found, sit and watch the eggs of the latter when the pelican is away fishing, and in return the cormorant receives a share of the captured fish. The pelican's eggs, it is said, are so exposed to the sun's rays that incubation continues when the parent bird is absent fishing. If the cormorants mutually consort with the pelicans, and share in the spoils of fish, as a return for guarding the temporarily forsaken eggs, they

afford a most remarkable case of commensalism or exalted parasitism, even more remarkable than that of the association of the Burrowing Owl *(Speotyto cunicularia, Mol.)* and the so-called Prairie Dogs.

The male pelican, during the breeding period, shows certain features prominently, such as the thick bunch or crest of white plumes passing down from the back of the head. A dry feathery bunch of plumes decorates the breast similar to the "powder-down" tract in the Heron *(Ardea)*. These breast-feathers are often said to be phosphorescent, and when the pelican is fishing at night they are declared to lure the fish. The beak, at the period of nesting, exhibits an erect flat plate of yellow horny substance, some little distance from the tip of the upper mandible. Behind this large plate, about one and a half or two inches high, and two or two and a half inches long, there are several smaller erect plates, forming a saw-like ridge along the top of the beak. The adjacent surface, moreover, shows large flat scales, and at the tip of the upper mandible there is a sharp tooth-like hook almost as large as the nail of the little finger and actually pointed.

The male and female birds are alike in coloration, and this and some of the other features just mentioned support Stejneger's view that these birds, the Steganopodes generally indeed, are closely related to the Herodiones (the Herons and Storks).

ON THE COMPOSTION OF CANADIAN VIRGIN SOILS.*

By FRANK T. SHUTT, M.A., F.I.C., F.C.S.,
Chemist, Dominion Experimental Farms.

The soil investigations carried on in the Laboratories of the Dominion Experimental Farms, at Ottawa, have included the chemical and physical examination of certain typical virgin (uncropped and unmanured) soils. The samples, over 100, were carefully collected in the various provinces of the Dominion and may be regarded as types or representatives of areas of fair uniformity and considerable magnitude.

The majority of these samples are surface soils, but in a large number of instances the results upon their respective subsoils have also been obtained. The paper is accompanied by six tables of analytical data.

The exact value of an ordinary soil analysis in ascertaining the fertility or productiveness of a soil, is considered, and while it is admitted that hot hydrochloric acid sp. g. 1·115 dissolves larger amounts of mineral plant food than are of immediate availability to crops, it is pointed out that a knowledge of the "maximum" amounts shows decisively deficiencies, if any exist, and thus indicates lines for rational and economic treatment of the soil with fertilizers. Further, it is pointed out that soils possessing large "maximum" amounts will in all probability prove more fertile than those showing smaller percentages, the climatic influences in both cases being equally favourable.

The diagnosis of a soil as regards productiveness cannot be made from a chemical analysis alone—even if such includes a determination of the so-called "available" plant food. The physical condition of the soil, drainage, rainfall, mean tempera-

*Abstract of a paper read before the Chemical Section of the British Association for the Advancement of Science, Toronto, August, 1897.

ture, sunshine, &c., are factors that must receive careful consideration.

Pot or plot experiments with the various fertilizers are at present the only means of gaining reliable or accurate knowledge of a soil's needs, but the incentive given by Dr. Dyer in 1894 in publishing his results by the one per cent citric acid solution has resulted in many agricultural chemists on this continent directing their attention to this important subject, and the probabilities are that ere long we shall be agreed upon laboratory methods for determining available plant food in soils.

The standards of fertility as suggested by Dr Hilgard, of the California Experiment Station, are stated and deductions made from Canadian data are given. The latter show that good agricultural soils possess usually between ·25% and ·5% of potash—less than ·15% indicating the value of potassic fertilizers; phosphoric acid is usually between ·15% and ·22% but the adequacy of this element depends largely on the amount of lime associated with it. In lime, less than 1% in clay soils indicates that their productiveness will be increased by an application of a calcareous fertilizer. Peaty soils have always responded well to a dressing of lime. Richness in nitrogen invariably indicates, in Canada, loams of excellent productiveness. Omitting prairie soils, the large number of our good soils contain between ·125% and ·225 of nitrogen; many, however, reach ·5% and some exceed 1·0%.

BRITISH COLUMBIA.

As far as our investigations in this province have carried us, the soils fall into three well marked groups: (*a*) Deltaic, as at the mouth of the Fraser and Pitt Rivers, very rich in plant food; (*b*) Valley soils, of alluvial origin, of more than average fertility; and (*c*) Bench and plateau soils at varying altitudes—frequently light and sandy, ranging from very poor to soils of medium fertility.

Table I presents data from 29 samples, collected in Vancouver Island and the districts of New Westminster, Yale and Cariboo. The amounts of plant food, and the chief physical characters of these soils receive consideration and deductions are made therefrom as to their relative fertility. The soils formed by the accumulation of detritus at the mouths of the Fraser, Pitt and other rivers are shown to be particularly rich in plant food.

NORTH-WEST TERRITORIES AND MANITOBA.

The prairie soils of these regions present considerable uniformity in character. They are justly noted for their productiveness, for analysis has shown them to contain, as a rule, large percentages of the essential constituents of plant food. Especially are they rich in humus and nitrogen. The prevailing prairie soil is a black or greyish-black loam in which nitrification proceeds rapidly when the soil is tilled.

Attention is drawn to the fact that alkali soils are almost invariably found to contain an abundant supply of plant food. The application of gypsum, drainage and irrigation are the means suggested for converting them into fertile soils. Such methods, unfortunately, are not always feasible.

Table II gives analytical data of eight typical surface soils from these provinces ; those of a sam. le from the prairie soil of the Red River Valley being discussed in detail. The results demonstrate clearly that it may be classed among the richest of known soils.

ONTARIO.

Data are presented in Table III obtained from soils collected in the district of Muskoka only. These soils are characterized by a preponderance of sand, being such as would be classed as light loams. Clay loams, however, are occasionally met with. The chief deficiencies are in humus and nitrogen—frequently resulting from destructive forest fires—and in lime. Speaking of them as a class, the Muskoka soils are scarcely

heavy enough for wheat. Good yields of oats, potatoes and root and fodder crops, generally, are under good systems of culture readily obtained in favourable seasons.

QUEBEC.

The analytical results of clays and loams obtained from widely different areas in this province are contained in Table IV. Much variation in composition is to be observed, as might be expected, but, although some show inadequate quantities of certain elements for best results, all the surface samples come well within the limits of fertility we have discussed, and many of the soils are seen to compare most favourably with those of recognized productiveness.

THE MARITIME PROVINCES.

The analyses of several typical soils in the Maritime Provinces are given in Table V. Prominent among these is one from the Sackville Marsh, N.B., at the head of the Bay of Fundy. The tides of this bay are phenomenally high, carrying with them vast amounts of detritus. Large deposits of this so-called marsh mud consequently form, and this material is highly prized by many farmers as an amendment, frequently being applied at the rate of 100 to 200 loads per acre. Reclaimed marsh lands are found to be exceedingly fertile.

Particulars are presented of a typical soil from Prince Edward Island. It is seen to be inferior in several particulars to many of our Western soils and it would seem, therefore, that this province, justly known as a fertile one, owes its reputation rather to good soil texture and favourable climatic conditions than to large percentages of soil-food constituents.

Table VI shows the averages of the results from the soils examined, taken province by province. The data, however, are only to be interpreted as representing the composition of soils of large areas in the respective provinces.

General conclusions are drawn which indicate that in all the provinces large tracts of untilled land exist that would rank with the fertile soils of other countries and, further, it is shown that many Canadian soils are possessed of most abundant stores of plant food—stores so vast as to allow of their most favourable comparison with the richest soils of which we have any knowledge.

THE POISON OF POISON IVY (*Rhus radicans*).

In the Year Book of the United States Department of Agriculture for 1896, recently issued, there is a very interesting chapter entitled: "Some Common Poisonous Plants," written by Mr. V. K. Chesnut, of the Division of Botany, U. S. Department of Agriculture. Among the plants described and illustrated, the Poison Ivy, "as the principal poisonous plant of America," receives attention. After an account of its habitat and botanical characters, in which the writer points out how it may be distinguished from non-poisonous plants that bear certain resemblances to it in the form of their leaves, &c., there follows a discussion regarding the nature of the poisonous principle—a question over which there has been much dispute. As this is a matter of no little interest and practical importance, we shall quote at some length this part of the author's article:

"Poison ivy has long been regarded by the ignorant with a degree of awe akin to superstition. No one was able to tell how it produced its effects, and why it attacked some people and not others. Mysterious principles were relied upon to explain the phenomena, and up to the present time the common belief has been that the poisonous constituent was really an exhalation from the plant. In the latter part of the last century it was so regarded by the expert; then, as our knowledge of

plant chemistry advanced step by step, it was attributed more concretely to a specific gas, a volatile alkaloid, and a volatile acid like formic acid. More recently still, bacteria have been accused of causing the affection. Experiments have seemed to verify these ideas in turn, but the falsity of all has at last been proved by the discovery of a more tangible compound. In January, 1895, Dr. Franz Pfaff, of Harvard University, announced that the poison is in reality a non-volatile oil. Numerous experiments have been performed with the purified oil, and it has been shown to produce exactly the same effect as the plant itself. Dr. Pfaff has called this substance 'toxicodendrol.' It is found in all parts of the plant, even in the wood after long drying. Like all oils, it is insoluble in water, and therefore cannot be washed from the skin with water alone. Alcohol dissolves it readily. Alkalies saponify it, and thus render it inert, but this result is more easily obtained by an alcoholic solution of the sugar of lead (lead acetate)."

The two chief points of interest to our readers are: the establishment of the fact that the poison is non-volatile and, therefore, that actual contact of the leaves with the skin is necessary to cause the poisoning; and, secondly, that a remedy has been found that is at once simple and efficacious. The writer, as the result of many trials, in which he experimented on himself and others, says that "applications of an alcoholic solution of the sugar of lead always give immediate and permanent relief." This is certainly to be regarded as a valuable discovery. Respecting the application of the remedy, the writer concludes as follows:—

"In practice it is not desirable to use strong alcohol, which is apt to be too irritating to a sensitive surface, but a weaker grade of from 50 to 75 per cent, should be preferred, and to this the powdered sugar of lead is to be added until no more will dissolve. The milky fluid should then be well rubbed into the

affected skin, and the operation repeated several times during the course of a few days. The itching is at once relieved and the further progress of the malady is checked. The remedy has been tried in a large number of cases and has always proved successful, but it must be remembered that it is itself a poison when taken into the mouth." F.T.S.

FURTHER NATURALIST'S NOTES ON THE PACIFIC COAST.—II.

By ANDREW HALKETT, Esq.

While sailing through the Straits of Juan de Fuca the Olympian coast-range of mountains in the State of Washington is seen to special advantage. The coast-line is mountainous and timbered on both the British Columbian and United States sides; and the Olympians located well inland, being capped and covered with snow, form a most beautiful spectacle.

The day spent in this place closed with a calm and quiet sunset. The mountains assumed a deep black blue—a vessel was to be seen here and there in the distance—and the light at Cape Flattery (U.S.) shone with the softness of a planet. As the day declined the moon arose behind the mountains.

The student of marine life would find enough to engage his attention at Ucluelet Arm, Barclay Sound, situated on the west shore of Vancouver Island. The Sound is studded with islands, with rugged, wooded mountains in the background, and in some cases capped with snow. On one of these islands the surf was seen dashing up the rocks with great violence.

Three Shags were seen sitting on the extreme point of an adjacent island, and these with other sea-birds, such as Pigeon Guillemots, added variety to the scene.

The Shag or Cormorant (*Phalacrocorax pelagicus*, Pall.) belongs to the Steganopodes or Totipalmate* order of birds, which is distinguished by having the hallux or hind claw drawn to the front, so that the foot is three-webbed, a peculiarity which is not shared by any other order. Another peculiarity is the possession of a naked gular pouch, which in the case of the Pelicans (*Pelicanus*) is enormously enlarged, but is quite rudimentary and non-functional in the Cormorants. It is rather curious that the Steganopodes, in common with a few other orders comparatively low in the avian scale, are altricial, that is the young, like the young of the Insessorials or singers and perchers, are immaturely hatched, and therefore require to be fed and tended by the parent birds.

The Pigeon Guillemot (*Cepphus columba*, Pall.) has a pure white space on each wing, called the "mirror," which contrasts finely with the sooty black colour of the body, hence seamen call it the "white-winged diver."

When the tide recedes at Ucluelet Arm the pools are full of Star-fishes (*Asterias*), Sea-urchins (*Echinus*), Anemones (*Actinia*), Mussels (*Mytilus*), various Gastropods, Hermit-crabs (*Pagurus*), and Barnacles ; and how delightful it is to watch the harmonious mingling of colours, forms, and movements. in these limpid salt-water pools of a soft emerald green.

Several genera of Star-fishes are represented, but the most common is a species of the typical genus *Asterias*, the individuals of which are nearly as varied in their colour as the flowers on a vine of morning-glories, Some are yellow, others purple, and others again brown, and in seeking a solution to this problem of difference of colour in the same species, I advance the following as a simple explanation.

It is well known that under domestication animals are more varied in their coloration than they are in a wild state, as is

* "Having all four toes connected by webbing."—*Jordan.*

often witnessed in a litter of kittens or rabbits. The same litter of kittens may contain white, black, piebald, and tortoise-shell individuals. But in a wild condition cats and rabbits are of a sombre or uniform colour, and one individual of either species is virtually just like any other individual. The reason of this is that the dull inconspicuous colour corresponds more or less with the creature's surroundings, so that the wild-cat is disguised from the birds upon which it preys, and therefore is the better equipped to approach them stealthily ; and the rabbit on the other hand is the better concealed from the attacks of the wily fox or other foe. Now when cats or rabbits are domesticated, any individuals manifesting unwonten conspicuous colours instead of the usual uniform greys have no creatures on the alert or foes to observe them, hence there is no call for the survival of the fittest, and in course of time we have cats and rabbits, and in the same way cows and horses, black, white, brown, or spotted. If domestic cats and rabbits were suddenly to revert to a wild state, and yet could retain their conspicuous colours, the former would catch very few birds, and the latter would escape very few foxes, and soon they would cease to exist. Now Star-fishes do not require to be hidden from enemies, because they have few enemies, and they do not require to be disguised from their prey, because just as a cow gets plenty to eat in a field of clover, so the rapacious Star-fish gets all it can desire in the luscious bivalves which are permanently moored by a byssus in thousands to its habitat. Therefore a uniform or sombre colour is not requisite, and their conspicuous yellow, purple, or brown tints may be thus accounted for.

The Urchins, observed in this locality, have moveable spines of a beautiful purple. Unlike the Star-fishes they never come out of the water, but under its surface can make their way into crevices of the rocks. The shell of a Sea-urchin, which is remarkably symmetrical in shape, is not composed, as might appear, of one piece, but of hundreds of plates sutured

together, and at regular intervals there are rows of punctures, being the passages for as many ambulacral feet. The digestive system is very complete, the mouth being furnished with five teeth. They are also possessed of five rudimentary eyes.

It would be difficult without visiting the tropics to find a more pleasing object to the eye than the Sea-anemone, which abounds on this shore. The ground colour is a soft green, merging as it approaches the ends of the tentacles into the most delicate shade of pink. Biologically the Sea-anemones hold a place very distinct from the Star-fishes and Urchins, although both groups were included by Cuvier in his sub-kingdom Radiata.

The Mussels and Barnacles cover the rocks by thousands and the Hermit-crabs having robbed many a gastropod of its shell, move about actively over the stones in the pools, or in the the moist places caused by a dense growth of algæ.

One of the most charming sights which I can recall in my natural history studies is that afforded by a deep salt-water pool among the inshore rocks in this part of the Pacific. The long and narrow bladed grass partially covers the surface, and curtains the sides, which are strewed with great Star-fishes, Chitons, and Anemones with tints of delicate pink and green, which blend perfectly with the soft colour of the water.

The islands off Barclay Sound are worthy of mention. A few are jagged rocks, crowned with conifers, and covered with mussels and barnacles. Here again the anemones and starfishes find a suitable habitat, and are hidden and revealed each alternate moment as the white waves dash against the sides. Other islands are merely bare rocks without any vestige of a tree, and afford a home to the White-headed Gull (*Larus heermani*, Cass.) which in the breeding serson has a bill of a bright vermilion red, and a red ring around the eye.

A specimen of the Picked Dog-fish (*Squalus acanthias*, L.) was caught near here in 30 fathoms of water. This species is a

very small shark, seldom exceeding a length of three feet. It occurs in both Atlantic and Pacific. The teeth have their points "so much turned aside that the inner margin of the tooth forms the cutting edge."—*Gunther.* Each dorsal fin is armed with a spine. The Dog-fish is valued for the oil which it yields.

A species of plant, of the natural order Ericaceæ, called *Gaultheria shallon* grows commonly throughout the woods at Ucluelet, and the berries are dried and used as food by the Siwash Indians, The Shallon grows several feet high in shaded woods. It is an ally of the Winter-green, the Heaths, the Arbutus, &c.

Leaving the shores of Vancouver Island the most conspicuous creatures to be seen whilst the vessel plies its way over the broad bosom of the Pacific Ocean are two species of birds. One of these is the Gony or Black-footed Albatross (*Diomedea nigripes*, Aud.) which "is noted for its protracted powers of flight, following vessels for hundreds of miles and subsisting on the refuse thrown overboard."* The other bird is the graceful Gray Fork-tailed Petrel (*Oceanodroma furcata*, Gmel), called by seamen the "Seal-bird."

Early one morning after a voyage of some twelve days land was fully in view, and the contrast between the vast expanse of ocean and the imposing volcanic mountain which now, as it were, suddenly loomed up before one, was so great as to render description difficult. Mount Shishaldin, situated on Unimak Island near the entrance to Unimak Pass, is over 8900 feet high. Adjoining it is another mountain, not a volcano nor as high, and both are covered with snow. As the volcano was approached, a thin film of smoke was observed to be issuing from it, but during the time it was in sight it did not appear to be continuously smoking.

On the west side of Unimak Pass are the picturesque islands of Tigalda, Akun, Akutan, &c.

Whilst the vessel was making its way through the pass I had the good fortune to see tens of thousands of Shear-waters (*Puffinus*) winging their way, near the surface of the water, in the opposite direction. These birds belong to the order Longipennes, which also comprises the Gulls, Terns and Petrels. Their onward, yet easy flight, their jet-black colour, and their countless numbers, produced a pleasing effect.

OTTAWA, March, 1897.

* "Nests and Eggs of North American Birds," by Oliver Davie.

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FILARIA OCULI—PARASITE IN THE EYE OF A HORSE.

BY DR. A. G. HOPKINS.

(Ontario Agricultural College, Guelph, Ont.)

I have been requested by Dr. Fletcher to write a short account of a parasite occasionally seen in the eye of the horse, and which I had the good fortune to examine. Quite recently, a man brought to my office a mare suffering from an affliction of one eye. The owner stated that he had noticed a bluish-white scum coming over the eye some three weeks previous, and had applied the usual home remedies. After examining the affected eye (I had to anaesthetise the patient to examine her thoroughly), I was surprised to find a thread-like parasite floating around in the eye, and white in colour. Whenever any object approached the pupil, the parasite increased its movements to a great rate of speed. I informed the owner that an operation was necessary, and on his consent being obtained laid the animal in a recumbent position and cocained the eye. In a few minutes the patient was ready to operate on. The operation was as follows : an incision was made with a small scalpel at the upper and outer corner of the affected eye, the scalpel being introduced on the flat at an angle so as to make a valve-like incision, in order to prevent the escape of the aqueous humour after the operation. After withdrawing the scalpel, a fine pair of forceps was used to dilate the wound, which done, the parasite and some of the aqueous humour were at once ejected. The *Filaria* was dead, almost as soon as it was outside poisoned by the cocaine. It was about two and one-quarter inches long and resembled a white thread.

Filaria oculi, the name applied to it, is rare in temperate climates, but is said to be common in India. The life-history of the parasite is not known, as far as I have been able to ascertain. If the operation is attempted in the early stages a cure may be effected, but in the other stages, the sight is usually destroyed.

MONDAY AFTERNOON LECTURES.

A series of four elementary lectures on Birds, Plants, Animals, Rocks and Minerals with Fossils, was delivered early in the season in the Y. M. C. A. Hall, corner of Queen and O'Connor streets, Ottawa, under the auspices of the Ottawa Field-Naturalists' Club. These lectures were undertaken with the special object in view of reaching those interested in natural science studies, and pointing out to them the best methods of huuting, collecting and preserving specimens in the various branches of natural science studies carried on by the Club.

The attendance was most gratifying, and the results accruing from them have already been productive of practical work. The lecturers who took part in this course of Monday Afternoon Lectures were :—

Prof. John Macoun, M.A., F.L.S.
Dr. James Fletcher, F.R.S.C.
Prof. E. E. Prince, B.A., F.L.S.
Dr. H. M. Ami, F.G.S.

The Club desires to take this opportunity of tendering to the authorities of the Y. M. C. A. their sincese thanks for the generous use of the hall on the four occasions referred to.

The following is an abstract of the lectures by Dr. Fletcher and Dr. Ami.

OUR SPRING BIRDS.

On May 10th, the first of the series of elementary lectures on natural history given to the school children of the city was delivered by Dr. James Fletcher in the comfortable rooms of the

Young Men's Christian Association. There was a large audience consisting of students, teachers and many of the general public. Much interest was added to the lecture through the kindness of Prof. John Macoun, who lent beautifully prepared skins of the birds mentioned by Dr. Fletcher. A simple classification of the birds found in Canada was given and delightful anecdotes of the habits of many species which had been observed during a study of twenty-three years by the lecturer. A special appeal for protection was made on behalf of the Pine Grosbeak, Wax-wings and other birds which visit us in winter time. The songs of our birds, the regularity of their migrations and the continuous delight to be found in their study were treated of in an enthusiastic manner which was highly appreciated by those present.

ROCKS AND FOSSILS.

On Monday, 31st May, Dr. H. M. Ami, one of the Leaders appointed last April by the Club, in charge of the geological section, delivered an interesting lecture on "Geology, with special reference to the Ottawa District." In the course of his remarks, Dr. Ami described, first, the leading kinds of rocks to be met with in studying the various geological formations about Ottawa. This done, he gave a careful description of the different formations, pointing out their mineral, stratigraphical and palæontological relations as seen in the field. The best and most typical exposures were then described and the localities, where the best collections of fossil organic remains might be obtained were pointed out.

Many of the students of our educational institutions present took notes on the lecture and asked numerous questions, to which the lecturer replied. The lecture was illustrated by means of diagrams on paper and on the blackboard, and also by numerous fossil organic remains illustrating the geological features of the formations met with in the Ottawa Valley.

ORNITHOLOGY.

NOTES ON OTTAWA BIRDS.

In publishing "Notes on Ottawa Birds," we hope to interest the young in the study of our birds and to assist the older members of the Field-Naturalists' Club, who have not made a special study of birds, to identify the various species when they are seen and heard. The distinguishing characteristics, the song, the nesting, and the habits of our birds will be prominent in these notes, which, with other interesting facts regarding them, will, we trust, make profitable reading.

W. T. MACOUN.
Associate Editor Ornithology.

THE THRUSHES.—To one familiar with the magnificent songs, the "argent utterances," of our native thrushes, any plain description of them must seem entirely inadequate, and the pen of a poet should be employed, and has been, many times. in telling of these most poetic of all our Canadian forest voices, The different members of the thrush family speak one language it is true, but it is not difficult to distinguish their songs one from another. While that of the veery, which, by-the-way, is not unlike "veer-y veer-y, veer-y," may be compared to three or four rippling waves in a rapid falling gradually downwards, that of the olive-back is a cascade falling upwards, if one may speak of such a thing, and the hermit's song also rises from the first note; but the hermit begins with one clear note, followed as a rule by a brief pause, which emphasizes it; at any rate without the impetuous frothy upward rush of the beginning of the oliveback's song, and the hermit's is a clearer utterance all through more nearly reducible to musical notation. The song of the wood thrush is not likely to be confused with the other three; it is more self-asserting and less meditative, and the notes ring with a bell-like quality which the others hardly possess; then, when one is near by, a faint cluck can always be heard im-

mediately before each outburst, and usually a wheezy whispering sort of thrill immediately after it, neither of which is noticeable in other members of the thrush family.—F A. SAUNDERS.

HERMIT THRUSH, *Turdus aonalaschkaepallasu*.—This bird is about the size of the Wilson's thrush, that is, about seven inches in total length, olive above shading to a rufous tail, which serves to separate it from all other thrushes ; and below white, olive shaded on sides and tinged with buff on breast, with breast and throat marked with large dusky olive spots. It is a summer resident here, common in the hills to the north but scarcer near the city, arriving about the 3rd week of April. It usually prefers dry ground, and an elevation, at least to sing from, though in the migrations it may be found in swamps with the veery. The nest is on or very near the ground and is composed of leaves, rootlets and grass ; the eggs four or five, and greenish blue in colour, without spots and hardly to be distinguished from the eggs of the Wilson's and wood thrushes except by actual experience. Its food is largely composed of noxious insects, as is that of the other thrushes, and the influence of the whole family may on this account be considered beneficial, if one excepts perhaps the robin's taste for fruit. The hermit has a peculiar call besides a song very rarely heard, which sounds as though it were a chord of two notes, a low rising whistle by which it may sometimes be recognized in the deep woods when it is not in the mood for much music, more often however one hears nothing, as the thrushes are in their habits a noiseless family, but sees a quiet large eyed bird, perched with on a twig near by, or more likely catches a glimpse of an olive-back and rufous tail disappearing among the trees.—F. A. SAUNDERS.

OLIVE-BACK THRUSH—*Turdus ustulatus swainsonii*—This member of the thrush family is rather a difficult bird to determine in the woods. It may be described as of the size of the hermit or Wilson's thrush, of a uniform greenish olive colour,

having a distinct yellowish ring close about the eye. It can be separated from the hermit by the colour of the tail, and from the Wilson by the tint of the back and by the eye ring. It is rather a rare bird in summer, breeding near here as far as known only in the Laurentian country to the north (it has been heard near Meach's Lake) but it may be quite common in the migrating flocks, but its quiet habits and rather indistinct characteristics tend to make it inconspicuous. It arrives in Ottawa about the third week of April. Its nest will be found in a tree or bush, six or eight feet from the ground, composed of rootlets leaves and moss and containing four to five eggs of a greenish blue colour, freckled with brown in which latter feature the eggs are distinct from those of the other thrushes on our list.—F. A. SAUNDERS,

WILSON'S THRUSH, *Turdus fuscescens*—The tawny thrush or veery, as he is variously named, is nearly of the size of a bluebird, of a uniform tawny colour above, including the tail, and white below, olive shaded on sides, with a strong fulvous tint on the breast; and sides of neck spotted with *small* dusky spots. This is perhaps our commonest thrush, arriving in our woods and swamps about the third week of April, and breeding in nearly all favourable localities about Ottawa. Its nest is on or near the ground and is composed of grass, leaves and rootlets, rather loosely put together, without the mud or clay that the wood-thrush and the robin use. The eggs are four or five in number and of a greenish blue colour, unspotted. The veery is readily distinguished from the hermit by the colour of the tail and by the small size of the spots on the breast, and from the wood-thrush by its smaller size, by the fulvous tint on the breast, and again by the spots. It is the thrush which one usually finds in summer in moist woods, and such swamps as the one between St. Louis Dam and the Rideau resound in the June evenings with its splendid song. It has a very characteristic

vocabulary besides its song, and one may often hear a veery whistling in a very human way, much as a man expresses surprise —only that the veery must indicate very much surprise indeed to rise to the pitch of excitement into which he sometimes whistles himself. He also has a low deep cluck by which the initiated may sometimes discover him in the silent wood.—F. A. SAUNDERS.

WOOD THRUSH,—*Turdus mustetinus*.—This is the largest of the thrushes proper being of the size of a robin ; above it is bright tawny shading to olive on the tail, and beneath white with little or no buff shading, strongly marked on breast with large dusky spots which stand out very distinctly against the white back ground, and serve along with the size, to distinguish it easily from the other thrushes. It comes rather rarely to Ottawa, and while one or two families may often be found in summer breeding in the wood on or near the southern face of King's Mountain, and doubtless in other places, it would take a very close observer to discover many of them during the migrations, and indeed, the time of their arrival and departure cannot be at all definitely given. Their nest is in a tree, seldom more than twenty feet from the ground, and is composed of twigs, rootlets, grass, leaves and moss, with a liberal supply of clay as a foundation. The eggs are four to five in number and of a deep greenish blue colour. The wood thrush may be readily recognized either by eye or ear. Besides its song it has a distinguishing cluck and sometimes, when disturbed, a curious alarm call, consisting simply of one note uttered separately and interspersed with much twittering. This is the common New England thrush, sometimes known there as the hermit and it is to be hoped that it is really becoming commoner here, as some birds seem to be, as its song, now rarely heard, would be a welcome addition to all our bird choruses.—F. A. SAUNDERS.

BLUEBIRD,—*Sialia sialis*.—A summer resident ; among the earliest of the spring arrivals appearing towards the latter part of

March or beginning of April. Nearly seven inches in length, sky-blue above, breast, reddish brown. It is a welcome bit of colour, in the dull tone of the early spring landscape. Lowell brings a familiar view of him to our minds when he says: "The bluebird shifting his light load of song from post to post along the cheerless fence." Of its song, Burroughs says: "The bluebird's note is more pleasing than most bird songs; if it could be reproduced in colour, it would be the blue of the purest sky," Its few low sweet notes are heard with pleasure by those favoured, as it is now rather scarce owing, it is reported, to great numbers being killed by severe and protracted frosts experienced in the southern states, notably Georgia, in the winter of 1895-96.

It favours a partially cleared locality and builds a loose nest well down in a hollow post, stump, or apple tree to hold the four to six pale blue eggs. It used to occupy boxes put up for its use till the house sparrow came. A few years ago a pair took possession of a robin's nest, containing two eggs, that was built on a beam under a verandah close to a railway. The robins fought hard for their home but had to give in.—GERTRUDE HARMER.

COMMON ROBIN, *Merula migratoria*.—The name "robin," given to this bird, which is really a thrush, is certainly a misnomer, and like many other popular errors, may be traced to the early settlers' habit of naming animals or birds after apparently similar forms in the land whence they came. Although much larger, there is in this case some resemblance to the robin redbreast of the Old World, the congener of which in America is the bluebird (*Sialia*). Our robin is a migrant, although stragglers are reported remaining all winter. I have never, however, got an authentic *reliable* record of such fact, and am under the impression the shrike, one of our winter birds, is mistaken for the robin, The latter is not as common as it was some years ago, owing partly to persecution by the sparrow, and partly to indiscrim-

inate slaughter and nest robbing. It is fond of orchards and it nests in trees of considerable size, mostly in a fork, the nest being bulky, rough outside, though compact, and not unfrequently lined with clay within. Its eggs, generally five in number, are greenish blue. It arrives late in March or early in April, according to the season, and leaves late in October, taking to wooded pastures and thickets prior to its final start. This bird is so well known that it needs no description.

Although its depredations on fruit trees, especially the cherry, are heavy, its splendid song and its usefulness in the destruction of noxious insects, makes amends for its fondness for fruit. At the break up of winter its thrilling notes, especially in the early morning are hailed as the overture to the great bird concert of the other feathered songsters to follow. The males are the first to arrive and in a few days the females join them.

It would be interesting to ascertain if any of these birds really remain during winter, whether such are not wounded birds, or incapacitated in some way for a long flight.—H. B. SMALL.

BIRD NOTES FOR SEPTEMBER.

Tame Pigeons Eating Chickweed.—The Common Chickweed (*Stellaria media*, Smith), is by no means a weed of frequent occurrence in Manitoba, but in some damp localities it is sometimes abundant and very troublesome. In September last, whilst staying at Manitoba House with my brother-in-law, Mr David Armit, who has charge of the Hudson Bay Post on Lake Manitoba, I had an opportunity of witnessing what I had before heard of the avidity with which tame pigeons in that locality feed upon the seed pods of Chickweed. The pods only were nipped off, and these were apparently swallowed whole. The birds seemed to spend a great deal of time on the patches of this weed which had grown most luxuriantly and was

giving much trouble in the garden. I also noticed that the plant is spreading rapidly and from its bright-green colour is becoming conspicuous along the fore-shore of the lake. The level of the garden is only slightly higher than that of the lake, and the soil is consequently very moist.

Although Manitoba House is so much farther North than Winnipeg, some plants, such as tomatoes, can be grown there with more certainty of a paying crop than at Winnipeg.

In addition to the Chickweed. I noticed that some other weeds were spreading and becoming abundant along the shores of Lake Manitoba and to some distance back into the adjacent woods. The most noticeable of these intruders were the so-called "Canada Thistle" and the Russian Pigweed (*Axyris amarantoides, L.*) I have been watching the spread of this latter plant for some years with much interest, as I fear it is going to prove a serious pest upon Manitoban farms. It is a tall, coarse-growing, very leafy annual and is most aggresive in choking out all other plants among which it grows. It matures large quantities of seeds and has spread rapidly through the province during the last ten years. The dead stems of this plant are particularly hard and rigid, making them difficult to clear, and also giving trouble around buildings by catching snow and causing drifts.

W. A. BURMAN, *Winnipeg.*

THE ROYAL SOCIETY, LONDON, ENGLAND.

At the June meeting of the Royal Society, London, Eng., one of our members, Robert Bell, M.D., LL.D., B.A.Sc., F.R.S.C., was duly elected a Fellow of that distinguished body. Dr. Bell's certificate as a candidate for F.R.S. states that he is one of the the Assistant Directors of the Geological Survey of Canada. Has been actively engaged in the field-work of the Survey for forty years. Was concurrently Professor of chemistry and geology of Queen's University, Kingston, Ont., for five sessions,

from 1863-68 ; Naturalist and Medical Officer on the Goverment Expeditions to Hudson Bay, 1884 and 1885 ; Royal Commissioner on the Mineral Resources of Ontario, in 1888. He is distinguished for his services in Canadian geology, having worked over large sections of the Dominion east of the Rocky Mountains ; has made extensive researches among the Laurentian and Huronian rocks, and also in reference to glacial phenomena ; has added materially to our knowledge of the zoology and botany (more especially of the forestry) of Canada. His writings include upwards of twenty official reports, some accompanied by maps, of geological surveys between 1857 and 1896, giving the results of explorations on both sides of Hudson Bay and Straits, along the principal waters between the Upper Great Lakes and James's Bay, and of those between the Winnipeg Basin and Hudson Bay ; the first survey of Lake Nipigon, geological surveys of the Canadian shores of Lakes Ontario, Erie, Huron and Superior, and in the North-west Territories and the Athabasca region, the Thunder Bay and Sudbury mining districts, the Gaspé peninsula, and in other parts of the extensive regions of Canada. These reports cover about one thousand pages royal octavo. Among many additional publications may be mentioned : "The Causes of the Fertility of the Land in the Canadian North-West Territories," "The Petroleum Field of Ontario," "The Huronian System in Canada," "Glacial Phenomena in Canada," "The Geology of Ontario with Special Reference to Economic Minerals," "The Laurentian and Huronian Systems north of Lake Huron," "The Origin of Gneiss," "The Forests of Canada," "Forest Fires in Northern Canada," "The Labrador Peninsula," "Recent Explorations South of Hudson Bay," "The Geographical Distribution of Forest Trees in Canada."

Dr. R. Bell's supplementary certificate (1897) states that he has been connected with the Geological Survey of Canady for forty years, and up to February 1897, has published 135 scientific papers, reports, &c,, besides abstracts of 42 others read by the author. The titles of most of these are published in the Transactions of the Royal Society of Canada for 1894.

His certificate was signed by sixteen Fellows from personal knowledge, among them being Sir Archibald Geikie, Prof. Crum-Brown, Sir William Turner, Prof. Bonney, Lord Kelvin, Sir William Dawson and Sir Frederick Abel.

FIELD EXCURSION TO CHELSEA, QUE.

PLACES VISITED—GEOLOGICAL, BOTANICAL AND OTHER NOTES OF INTEREST—ADDRESSES BY THE LEADERS, DR. FLETCHER AND DR. AMI, ALSO BY MESSRS. SINCLAIR, CLERK, BLUE, HALKETT AND ATWOOD.

Amid the bright crimson and yellow tints of a clear autumn day, the third General Excursion of the season of 1896-97, under the auspices of the Ottawa Field-Naturalists' Club was held on the 2nd October, when the district surrounding New and Old Chelsea was visited. There were one hundred and eight persons present, including a large contingent from the students of the Provincial Normal School. The excursionists left Ottawa *via* Ottawa and Gatineau Valley Railway at 1.45 p.m., reaching Chelsea Station at 2.20 p.m. Returning, the party left Chelsea at 8.04 p.m., arriving in Ottawa shortly after 8.30. Among those present were: Dr. James Fletcher, Mr. S. B. Sinclair, Dr. T. J. W. Burgess (Montreal), Mr. W. H. Harrington, Mr. Halkett, Dr. Ami, Mr. Atwood, Mr. Beddoe, Mr. Pollock (Aylmer). The weather was simply perfect and the "outing" thoroughly enjoyed by all. Botanical, geological and other parties having been formed on arrival at the station, each went in its special favourite direction. Rendez-vous was given at the station for 6 p.m., and by that time most of the excursionists had returned and compared notes on the finds made during the afternoon.

In the absence of Prof. Prince, our President, the Vice-President of the Club, called the Naturalists to order and asked the various "leaders" in the different branches of the Club's work to give some notes on the specimens collected. Mr. S. B. Sinclair, B.A., was first called upon. In a very neat and happy speech, he expressed the pleasure which such an outing afforded not only in the realm of science, but also in its suggestiveness on the ideal side. Mr. Sinclair then went on to show the relations which must exist between the scientific side of our nature and

the ideal—the religious side, the side of art and literature. A love for Nature seemed to embody all these different sides and brought us in touch with the truest and best. He was followed by Mr. Blue, student from the Provincial Normal School, who spoke on some of the botanical finds made during the day. The Asters were conspicuous and other members of the family of the *Compositæ*. On behalf of the students, Mr. Blue expressed the pleasure they had experienced during the day. Mr. Clark then added a few remarks and emphasized the remarks made by Mr. Blue. His remarks were received with deserved applause.

Dr. Ami then addressed the gathering on the subject of geology. At Chelsea, both extremes in the geological scale meet. The newest or Pleistocene formations were seen to great advantage, consisting of marine sands, gravels, clays, covering or overlying unconformably over the oldest or Archæan rocks of the district. These two sets of rock-formations are the most discussed at the present day and afford a vast amount of interesting material for special study, with good prospects of making interesting discoveries and elucidating some of the intricate problems still existing in these the opposite ends of the geological scale. At "The Ravine," near Old Chelsea, the geological section had repaired, and there examined the crystalline limestones, ophi-calcites, besides micaceous and other gneisses, serpentine rocks, &c., of the district. Glacial striæ, an interesting glacial phenomenon was observed in the bed of the stream as indicating clearly the bygone period of glaciation. A glacier once descended the slope in the general direction of the present course of "The Ravine." This might be called the Chelsea Glacier.

Other glaciers existed, whose glacial striæ and other markings are clear near King's Mountain, between the main mountain massif and the spur above Dr. Bourinot's residence, above King's Mere (Humboldt Glacier). These striæ were observed at a previous excursion of the Club.

Along the Gatineau Valley, in the beds of most of the streams which discharge their waters into the Gatineau River,

especially from the west side in each of these valleys which form part of the hydrographic basin of the Gatineau River there was a glacier. Along the banks of LaPêche River at Wakefield, where the Club held excursions on more than one occasion, similar striæ occur on the hard Archæan floor ; they indicate clearly the existence of a local glacier which followed the course of the Pêche River, as the direction of the glacial striæ indicate. These local glaciers were probably all united at one time with the larger and more important one, along the Gatineau Valley, which itself can be called the Gatineau Glacier. Its markings are seen all along the sides of the valley, as far as Ottawa city, near New Edinburgh and Rockliffe, especially at the latter place. Huge boulders were transported and lodged firmly and deeply into the Chazy measures of the then existing shore cliff of the Ontario side, or transported over the bluff into the country south and east of this great Gatineau glacier. It was at this time, during the Glacial Epoch, that the glaciers proceeding from the Chelsea Mountains, wended their way from a high altitude, to the cliffs north of Ottawa city, entering the areas now covered by the embayments along the shores of the Ottawa River at the Supreme Court Building, along the line of the Canal locks below, along the Governor General's Bay, where there are distinct dislocations or faults in the strata of the Palæozoic rocks there present, thus affording an easier passage, and offering less resistance to the action of the glacier coming from the north-west. The evidences of glaciation from the slopes of the Chelsea Hills to Ottawa City and over the surface of the Trenton and Utica formations of Hull and Ottawa are everywhere visible. Not only are there the usual striæ, but crescentic cross fractures are also present, chatter marks and various other markings and grooves, all well-known phenonema of ice-action.

Besides these markings observed at Chelsea, which suggest such a multitude of interesting notes on the glaciology of the

district, there were noted and obtained by the members of the Geological Section, several interesting rocks of Archæan age.

Principal Pollock, of Aylmer, an ardent student of geology, is. about to devote much of his time to the study of petrographical questions in this district, and we hope to have contributions from his pen in the OTTAWA NATURALIST.

Dr. Fletcher was then called upon and spoke at length on the plants and insects of interest which were collected, observed or captured during the day. He also spoke on the birds which were seen. An interesting addition to our local flora was made in *Deschampsia flexuosa*—a species new to the *Flora Ottawaensis.* In his usual happy, entertaining and practical style, Dr. Fletcher interested the large assemblage present, so also did Mr. Andrew Halkett, who spoke on general zoological topics, and Mr. A. E. Atwood, on "Astronomy." The excursion was pronounced by all who were present as an eminently successful and enjoyable one.—H.M.A.

BOOK NOTICE—BOTANY.

"THE PLANT WORLD," Vol I., No. 1, October, 1897, "a monthly journal of popular botany"—published by Willard N. Clute & Co., Binghamton, N.Y., and edited by Dr. F. H. Knowlton, of the U. S. National Museum, Washington, D.C., together with a staff of eminent gentlmen and lady botanists—has just appeared, and affords its readers accurate yet popular notes of great interest. The editorial staff are all enthusiastic and active botanists. The style and dress of this magazine is excellent and the contents of the first number make it most attractive. The magazine is enriched with good illustrations.—H.M.A.

NEW MEMBERS.

C. A. Douglas, Esq., Ottawa, Ont. ; Rev. J. A. Macfarlane, M.A., New Edinburgh, Ont. ; LeRoy J. Boughner, Esq., Sim-

coe, Ont. ; S. B. Johnson, Esq., Ottawa, Ont. ; Bryant Walker, Esq., Detroit, Mich., U.S.A. ; Mrs. Ella Walton, Ottawa, Ont. ; John Marshall, Esq., Ottawa, Ont.

NEW EXCHANGE.

"Journal of School Geography," care of Dr. Richard E. Dodge, Morningside Heights, New York City, N.Y.

THE FOREST TREES.*

Spread o'er the vast and lovely earth
There lives a band,
With firm feet planted in the soil,
The product of their ceaseless toil,
Their mother nature gives them birth
All o'er the land.

And noiseless, working as they grow
So tall and grand,
They silent watch the flowing tide
Of man's unrest, his sin and pride,
While rich blood through their hearts will flow
At God's command.

They clothe the plains, they crown the hills
From strand to strand,
In whispers low they breathe of life,
In wailing sobs they tell of strife,
By rivers broad and tiny rills
Look how they stand !

They regal rule where tropic heat
Glows on the sand,
Their singing leaves to soul a calm,
Their tinted greens to eyes a balm,
Mid winter's snow they crack and beat,
A hardy band.

With relics of a bygone race
Who once did stand,
Where generations toil and rest ;
In flinty rocks all firmly pressed
The shadowy footprint we trace
Of Mighty Hand.

ELLA WALTON.

Ottawa, May 22nd, 1897.

*Lines written on the occasion of the May excursion of the Ottawa Field-Naturalists' Club to Chelsea.

THE OTTAWA NATURALIST.

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THE CRYPTOGAMIC FLORA OF OTTAWA.

BY PROF. JOHN MACOUN, M.A., F.L.S., F.R.S.C.

INTRODUCTORY NOTE.

For a number of years the writer has been collecting and studying the Cryptogamic flora of Ottawa and the surrounding country, during his holidays and in spare hours. At the present time his notes and observations have accumulated to such an extent that he considers it better to publish an incomplete list rather than wait until his excursions could take in a wider area and include a larger number of species.

Dr. James Fletcher, in "*Flora Ottawaensis*," includes an area of about 30 miles around Ottawa, and the writer purposes to cover about the same radius, but owing to want of time and other causes, only the district close to the city has been properly examined. It is the writer's intention to continue this work and from time to time publish the additions made by himself or others. The aim of the writer has been to place in the herbarium of the National Museum a complete set of all the species enumerated, but where possible a characteristic specimen of each species has been laid aside so that should the day ever come when the local flora of our city and its vicinity be gathered into one herbarium the Cryptogams will be forthcoming. I may then say that every species which appears in the following lists is held in duplicate and can be seen and examined at any time by those interested in the study of botany.

My notes extend over many years, as my first collections were made in the autumn of 1883, and have continued up to the present time. Owing to my absence from the city every summer, my collecting is chiefly done in September and October, and hence many fungi that are quite common around the city do not appear in the lists. Musci, Hepaticæ, and Lichens are more fully represented, but there are many species yet to be detected when my excursions become more widely extended.

The chief excuse for publishing these lists at the present time is that our club may be shown what a field for research lies at its very doors and how easily any one desirous of doing something in the botanical field can find work ready to his hand. In the following lists the dates following a locality mean the date when the specimen in our herbarium was collected.

MUSCI.

I. SPHAGNUM. PEAT MOSS.

1. **S. fimbriatum,** Wilson.

Our peat bogs contain many species of Sphagnum, but none have been carefully examined except the Mer Bleue near Eastman's Springs, 12 miles from the city. This species has been gathered in the swamp on the Glebe property, Bank St.; in the Mer Bleue, and near Casselman on the C.A.Ry.

2. **S. Girgenshonii,** Russ.

This species is chiefly found amongst black ash, growing in rigid hummocks. Collected in the swamp at the north-east corner of Beechwood Cemetery.

Var. **hygrophilum,** Warnst.

This form has been found on the Glebe property and in the swamp on the north side of Beechwood Cemetery.

3. **S. fuscum,** (Schpr.) var. **fuscescens,** Warnst.

This is a common species in all peat bogs, and is particularly abundant in the Mer Bleue; at Casselman; and in the swamp on the Glebe property. This is the dull rusty-coloured form.

Var. **pallescens**, Warnst.

Very common in the Mer Bleue and certainly in all large bogs in in the district.

4. **S. tenellum** (Schpr.) var. **rubellum,** (Wils.)

This form is very abundant is the Mer Bleue, and is easily distinguished from the preceding by its bright red colour.

5. **S. acutifolium,** (Ehrh.)

This is a very common species in all peat bogs, and takes many forms and colours, passing from white to purple and bright red. The common form is abundant in the swamp on the Glebe property, in Dow's Swamp at Casselman, and in the Mer Bleue.

Var. **versicolor,** Warnst.

This form is white and purple, and is very beautiful. It is abundant in the Mer Bleue, and in the swamp on the Glebe property.

Var. **pallescens,** Warnst.

Growing generally in water, and always quite white. Common in the Mer Bleue.

6. **S. recurvum,** (Beauv.) var. **pulchrum,** Lindb.

This species prefers the borders of peat bogs, water-holes in them, and black ash swamps, and takes many forms. Its forms are recognized by their recurved leaves. Wet woods along the borders of the Mer Bleue.

Var. **mucronatum,** Russ.

Wet woods along the Mer Bleue.

Var. **amblyphyllum,** Russ.

In water in holes in the Mer Bleue,

Var. **parvifolium** (Sendt.)

In the Mer Bleue and in the swamp north of Beechwood Cemetery.

7. **S. cuspidatum,** (Ehrh.) var. **submersum,** Schpr.

Much like the preceding, but leaves not recurved. In the swamp on the Glebe property, Bank St.

8. **S. squarrosum,** Pers, var. **speciosum,** Russ.

This is a very beautiful species, generally found in hollows in damp woods. Its leaves are always very much recurved. In damp woods north of Beechwood Cemetery; at Casselman; and in woods by the Mer Bleue.

9. **S. Wulfianum,** Girg.

Abundant in spots in the Mer Bleue. A beautiful species.

Var. **macroclada,** Warnst.

In wet spots in the woods north of Beechwood Cemetery.

Var. **viride,** Warnst.

Swamp north of Beechwood Cemetery; and in the swamp on the Glebe property, Bank St.

10. **S. cymbifolium,** Ehrh.

This, the next two species and *S. acutifolium* form the bulk of peat moss found in the bogs of Europe and America and produce the

litter now so extensively used iu the large cities of Europe and America. Abundant in Dow's Swamp, on the Glebe property and in the Mer Bleue.

11. **S. papillosum,** Lindb.

Abundant in the open parts of the Mer Bleue.

12. **S. medium,** Limpr. Var. **purpurascens,** Russ.

This species has been taken for a red or purplish variety of No. 10, but it is considered quite distinct. Abundant in the Mer Bleue.

II. EPHEMERUM. Hampe.

13. **E. minutissimum,** Lindb.

Abundant on the indundated ground on both sides of the discharge from Leamy's Lake, near Hull, Que. Sept. 16th, 1889. Fruiting.

III. ARCHIDIUM, Brid.

14. **A. ohioense,** Sulliv.

On inundated soil along the outlet of Leamy's Lake, Hull, Que. Fruiting in September.

IV. GYMNOSTOMUM, Hedw.

15. **G. curvirostum,** Hedw.

Under wet ledges along the Ottawa at Rockliffe, near the old mill, Nov. 9th, 1896 ; also on wet rocks, Kingsmere, near Chelsea, Que. Fruiting in summer.

16. **G. rupestre,** Schw.

On wet limestone ledges at the east side of Rockcliffe, near the old mill, May 7th, 1896.

V. WEISSIA, Hedw.

17. **W. viridula,** Brid.

On earth in woods east of Leamy's Lake, Que. ; collected on earth along the cliff, Rockcliffe Park, April 22nd, 1896. Fruiting in September.

VI. CYNODONTIUM, Schimp.

18. **C. Wahlenbergii** (Brid.)

On dead and decaying logs in woods near Leamy's Lake, Hull, Que. ; at Meeche's Lake, north of Chelsea, Que., Sept. 23rd, 1893.

VII. DICRANELLA, Schimp.

19. **D. varia,** Schimp.

On springy or wet clay banks. Fruiting in September. Sides of

ditches along the railway on the Experimental Farm ; also along the Parry Sound Railway west of Hintonburg ; on the sides of the discharge of Leamy's Lake, near Hull, Que. ; in a C. A. Ry. cutting at Moose Creek. Sept. 6th, 1889.

20. **D. heteromalla,** Schimp.

Common in sandy woods or on the roots of turned-up trees and by roadside banks. Fruiting in summer. Woods at Ironsides and Chelsea, Que. ; also at Casselman and Carleton Place ; in woods at West End Park, Ottawa ; in McKay's Woods. Sept. 12th, 1889.

VIII. DICRANUM, Hedw.

21. **D. montanum,** Hedw,

On decaying logs, and stumps and bases of standing trees in woods. Does not fruit at Ottawa. On the bases of trees at Leamy's Lake, Hull, Que. ; on stumps on "Pine Hill," Rockcliffe Park, April 14th, 1896.

22. **D. fulvum,** Hook.

On boulders in woods. Not rare in McKay's woods, but seldom fruiting ; on boulders "Pine Hill," Rockcliffe Park ; on rocks, Aylmer Road west of Hull, Que. October 10th, 1891.

23. **D. viride,** Schimp.

On the bases of growing trees ; always barren. Quite common in McKay's Bush and Beechwood Cemetery ; in woods at Buckingham, Que., May 14th, 1896.

24. **D. flagellare,** Hedw.

On decaying logs in damp or shady woods. Fruiting in spring. Meeche's Lake and Chelsea, Que. ; on "Pine Hill," Rockcliffe Park. April 28th, 1896.

25. **D. scoparium,** Hedw.

Very common on earth in all woods around Ottawa. Rockcliffe Park, April 22nd, 1897.

26. **D. scopariiforme,** Kindb.

Intermediate between *D. scoparium*, Hedw. and *D. fuscescens*, Turn. Dioecious. Leaves greenish-yellow, flexuous, lanceolate, subulate with a short and flat subula ; margin nearly flat or slightly incurved, densely and sharply serrate to one-third ; cell-walls rarely interrupted by pores ; upper cells oblong-oval, lower not much narrower, inner basal light brown ; costa thick, percurrent, with two serrate ridges at the back in the upper part. Capsule curved, not striate ; pedicel red, and short.

On earth and logs in damper woods than the preceding species. Damp and wet logs in the swamp north of Beechwood Cemetery ; on rocks Meeche's Lake, near Chelsea, Que. Sept. 23rd, 1893.

27. **D. fuscescens,** Turn.

On old logs in Dow's Swamp ; at Chelsea and Kingsmere, Que. Fruiting on old logs near Leamy's Lake, Hull, Que. Sept. 6th, 1889.

28. **D. Bonjeani,** DeNot.

On earth in Dow's Swamp ; in wet woods along the borders of the Mer Bleue. Aug. 26th, 1889. Barren.

29. **D. undulatum,** Turn.

Common in cool damp woods on earth. Stewart's Bush, Dow's Swamp, Mer Bleue, and McKay's Woods ; on the cliffs, Rockcliffe Park, April 22nd, 1896. Fruiting in summer.

30. **D. spurium,** Hedw.

On Laurentian rocks on Gilmour's Island, Chelsea, Que. May 22nd, 1892. Barren.

IX. FISSIDENS, Hedw.

31. **F. bryoides,** Hedw.

On earth in woods between St. Patrick's Bridge and Beechwood Cemetery, east of the road ; on earth in woods Leamy's Lake, Hull, Que. Oct. 16th, 1889. Fruiting.

32. **F. minutulus,** Sulliv.

On stones in the channel of the small brook entering McKay's Lake near Beechwood Cemetery, Oct. 12th, 1884. Fruiting.

33. **F. pusillus,** Wils.

Abundant on damp, flat, limestone rocks in McKay's Woods, south-west of the lake. Oct. 12th, 1884. Fruiting.

34. **F. osmundoides,** Hedw.

On earth on turned-up trees in Dow's Swamp ; on roots of trees in woods at Leamy's Lake, Hull, Que. ; on roots of trees in old woods at Carleton Place. May 31st, 1884.

35. **F. decipiens,** DeNot.

Very abundant on turned-up roots and old stumps in Dow's Swamp ; on earth in woods at Leamy's Lake, Hull, Que. ; also in McKay's Bush near the lake ; collected on damp rocks, Rockcliffe Park, April 22nd, 1896.

X. LEUCOBRYUM, Hampe.

36. **L. vulgare**, Hampe.

On earth in damp woods north of Beechwood Cemetery : also in woods on " Long Point," Mer Bleue ; on the banks of the Lievre River at Buckingham, Que, May 14th, 1896. Seldom fruiting.

XI. CERATODON, Brid,

37. **C. purpureus,** Brid.

Very common everywhere in pasture fields, by roadsides, on old fences and roofs of houses. Our commonest moss, and found in all parts of the habitable earth. Fruiting in early spring. With mature fruit, May 12th, 1896.

XII. SELIGERIA, Bruch and Schimp.

38. **S. campylopoda,** Kindb.

Agrees with *Seligeria recurvata* in the shape of the capsule and the arcuate pediel, but differs considerably in the leaves being broader, very much shorter, sublinear, obtuse, rarely short-acuminate and subacute. and the costa not excurrent, the perichetial leaves ovate-oblong, thin-costate, the peristome darker red. The male flower is fixed on the side of the female.

Under damp overhanging limestone rocks near the upper part of the Beaver Meadow, on the east side, west of Hull. Que. April 26th, 1891. Fruit nearly full grown.

39. **S. recurvata,** Bruch. and Schimp.

On large boulders by the roadside leading from the end of the Electric Railway eastward towards the old mill, Rockcliffe Park. May 7th, 1896. Fruit ripe.

XIII. DIDYMODON, Hedw.

D. rubellus, Bruch. and Schimp.

On damp limestone ledges near McKay's Lake ; also on ledges at Leamy's Lake, Hull ; Chelsea and Meeche's Lake, Que. ; on damp limestone rocks Rockcliffe Park. April 22nd, 1896. Fruiting.

XIV. LEPTOTRICHUM, Hampe.

41. **L. tortile,** C. Muell.

Roadside near the Mer Bleue ; at Eastman's Springs, Sept. 29th, 1892 ; on an old road in woods at the end of the Electric Road, Rockcliffe Park.

42. **L. glaucescens**, Hampe,

On calcareous earth in crevices of rocks along lakes and rivers. Along the outlet of Leamy's Lake, south side ; at Kirk's Ferry and Meeche's Lake ; on the cliffs facing the Ottawa, Rockcliffe Park. April 22nd, 1896.

XV. BARBULA, Hedw.

43. **B. brevirostris**, Bruch. and Schimp. (?)

On large boulders, growing with *Seligeria recurvata* along the road leading east from the end of the Electric Road at Rockcliffe Park, May 7th, 1896. Fruiting.

44. **B. tortuosa**, Web. and Mohr.

On rocks near McKay's Lake and around the cliffs, Rockcliffe Park ; on "Pine Hill," Rockcliffe Park, April 16th, 1896 ; on rocks Meeche's Lake near Chelsea, Que., Sept. 23rd, 1893.

45. **B. unguiculata**, Hedw.

Very common, some years, on old roads and streets in and around Ottawa. Mackenzie Ave, Oct. 12th 1896 ; on limestone rocks by the Ottawa, Rockcliffe Park.

46. **B convoluta**, Hedw,

Quite common in pastures, growing with *Ceratodon purpureus*, known by its *yellow* pedicels. By roadsides and in pastures at the Experimental Farm and north-west to Hintonburg ; also by the C.P.Ry. at Carleton Place ; on earth in pastures at Rockcliffe Park, May 12th, 1896. Fruiting early in spring.

47. **B. ruralis**, Hedw.

Generally found on limestone shingle or gravelly ridges. Rockcliffe Park near Governor's Bay ; at Britannia and along the railway at Carleton Place. Barren.

XVI. GRIMMIA.

48. **G. apocarpa**, Hedw.

On boulders everywhere around Ottawa ; especially in McKay's Woods ; at Meeche's Lake and Chelsea, Que. ; at Carleton Place, and Stittsville ; on "Pine Hill," Rockcliffe Park, April 14th, 1896. Fruiting abundantly late in autumn.

XVII. HEDWIGIA, Ehrh.

49. **H. ciliata**, Ehrh.

Quite common on boulders, McKay's Woods, and other places

around Ottawa ; on boulders " Pine Hill," Rockcliffe Park, April 16th, 1896. Fruiting.

Var. **viridis,** Schimp.

On boulders in shady woods quite common at Ottawa ; Oct. 12th, 1884.

Var. **subnuda,** Kindb.

Leaves nearly hairless, the greater number broadly ovate, borders reflexed ; cells larger, subquadrate.

On boulders in McKay's Woods near the lake, April 28th, 1896. Fruiting.

XVIII. ULOTA, Mohr.

50. **U. Ludwigii,** Brid.

On trees along the creek in Beaver Meadow north of the toll-gate on the Aylmer Road ; very rare on " Pine Hill," Rockcliffe Park. May 7th, 1896.

51. **U. crispa,** Brid.

On cedar trees in Dow's Swamp ; and on spruce trees along the Beaver Meadow Creek west of Hull, Que. ; on spruce trees in Rockcliffe Park near Governor's Bay, April 22nd, 1896.

52. **U. camptopoda,** Kindb.

Stem not creeping. Leaves, when dry crisped, when moist patent, or squarrose, often curved, faintly papillose, from a short dilated ventricose base, suddenly narrowed into the acute or subulate acumen, borders recurved at the base, and also often above on one side ; outer basal cells, disposed in 2-5 rows, quadrate-rectangular thick-walled ; inner narrow, orange, upper rotundate ; costa elevate, stout percurrent. Capsule small, long-necked, when dry faintly plicate, narrow, subcylindric and not constricted below the mouth, obovate when moist ; teeth bigerminate, pale, when dry recurved ; cilia none ; lid long-apiculate ; pedicel long, but not much emergent, flexible, more or less curved or geniculate, in young as well as in the dry state ; calyptra densely hairy, covering the capsule.

Habit of *U. crispula.* Agrees with *U. maritima* in the curved pedicel ; differs from *U. Ludwigii* in the narrower capsule. Growing together with *U. Ludwigii* on trees along the Beaver Meadow Creek west of Hull, Que. ; also on the pales on the south-west corner of the Cemetery west of Hull on the Aylmer Road, Que. ; April 26th, 1891.

53. **U. connectens,** Kindb.

Monœcious. Tufts soft, pulvinate, green above ; blackish below. Stems erect. Leaves, from an ovate concave base, linear-lanceolate,

when dry very much crisped, when moist subarcuate, short attenuate to the acute apex ; borders revolute above the base, for the greater part, at least on one side, distinctly papillose, also at the back ; cells at basal wings sub-quadrate hyaline with incrassate transverse walls, those next the costa narrower, rectangular, in straight rows, the lowest orange ; costa pale, sub-percurrent. Male flower at the side of the female. Inner perigonial leaves broad, short-ovate, obtusate or suddenly short-acuminate ; cells round only in the acumen, the others narrow, the lower basal wider and yellow ; antheridia about 9, with several paraphyses. Perichetial leaves with sublinear basal cells. Capsule dark-brown short subovoid, not contracted at the mouth, costate ; pedicel short, scarcely emergent. Calyptra densely hairy.

This species is a true *Ulota*, although the revolute leaf-borders, the distinctly papillose cells and short pedicellate capsule are more like an *Orthotrichum*,

On cedar trees (*Thuya occidentalis*) in Dow's Swamp, September 16th, 1886.

Both the preceding species are believed to be forms of *U. crispa* by Mrs. E. G. Britton, who has made a special study of the genus.

XIX. ORTHOTRICHUM, Hedw.

54. **O. anomalum,** Hedw.

On rocks and ledges along the Ottawa at Governor's Bay, Rockcliffe Park ; also on ledges near McKay's Lake, in fruit April 22nd, 1896. Fruiting.

55. **O. speciosum,** Nees.

Common on balsam fir, cedar and spruce trees in the woods east of Beaver Meadow west of Hull, Que. ; also on spruce trees in Rockcliffe Park ; collected on trees and fence rails near Hintonburg, April 13th, 1896. Fruiting.

56. **O. sordidum,** Sulliv. and Lesq.

Common on beech trees in woods near Ironsides, Que. ; collected on trees in Rockcliffe Park and Beechwood Cemetery, April 22nd, 1896. Fruiting.

57. **O Ohioense,** Sulliv. and Lesq.

On trunks in woods near Leamy's Lake, Hull, Que. ; old fence rails at Carleton Place ; collected on trees in woods near Governor's Bay, Rockcliffe Park, April 22nd, 1896. Fruiting.

58. **O. Canadense,** Bruch and Schimp.

This species appears in Part VI under *O. Schimperi* but was discovered by Mrs. E. G. Britton when monographing the genus some

years since. It is apparently very rare as its occurrence in America was doubted when Lesq. and James' work on the mosses appeared in 1884.

On rocks at the corner of Rockcliffe Park close to Governor's Bay. October 12th, 1884.

59. **O. cupulatum,** Hoffm.

On limestone rocks along the cliffs facing the Ottawa near Governor's Bay, Rockcliffe Park. April 16th, 1891.

60. **O. strangulatum,** Beauv.

On trunks and fences around Ottawa ; woods at Ironsides, Chelsea and near Leamy's Lake, Que. ; also in McKay's Woods and in Beechwood Cemetery ; collected on trees in Rockcliffe Park, April 22nd, 1896.

61. **O. psilothecium,** C. M. and Kindb.

Plants small, 1 cm. long or less, green. Leaves short oblong-lanceolate, obtusate or short-acuminate, sub-obtuse, revolute at the borders to the greater part, faintly papillose ; costa percurrent, Capsule small, immersed, oblong, not striate before sporosis, very short-necked; vaginula naked ; calyptra slightly hairy at the blackish apex, finally glabrous and light-brown, narrow, covering the whole capsule ; lid rostellate. Male flowers on distinct branches.

This species has the habit of *O. fallax*, Schimp. (*O. Schimperi*, Hamm.) We have not been able to examine the peristome and the stomata of the capsule, because only one capsule (in our specimen) is nearly ripe, the others are quite unripe.

On old fences in Rockcliffe Park ; on cedar rails along the Richmond Road, near Hintonburg ; collected on old fences at Carleton Place, Aug. 26th, 1889.

62. **O. obtusifolium,** Schrad.

On old cedar rails and trunks of balsam poplar ; on rails in McKay's Bush ; on poplar trees along the Gatineau River, near Leamy's Lake, Hull, Que. ; collected on poplar trees near Hintonburg, April 18th 1896.

XX. ENCALYPTA, Schreb.

63. **E. vulgaris,** Hedw.

On limestone ledges on the south side of the outlet of Leamy's Lake, near the Hull Cemetery, Que., Oct. 11th, 1890.

64. **E. Macounii,** Austin.

In crevices of limestone rocks around the whole cliff facing the Ottawa in Rockcliffe Park, April 22nd, 1896 ; crevices of rocks along the Gatineau at Kirk's Ferry, Que. Fruiting.

65. **E. streptocarpa,** Hedw.

On limestone rocks at the outlet of Leamy's Lake, near Hull Cemetery, Que., Sept. 6th, 1889 ; on the cliffs at Governor's Bay, Rockcliffe Park. Barren.

XXI. TETRAPHIS, Hedw.

66. **T. pellucida,** Hedw.

On the bases of stumps and dead logs (chiefly pine and cedar), in all swamps and wet woods around Ottawa. On old stumps in Dow's Swamp, and on Cowley's Farm, near Hintonburg ; collected April 18th, 1896. Fruiting.

XXII. PHYSCOMITRIUM, Brid.

67. **P. immersum,** Sulliv.

On inundated alluvial soil (in small tufts) along the outlet of Leamy's Lake, near Hull, Que. Sept. 16th, 1889. Fruiting.

68. **P. platyphyllum,** Kindb.

Lower leaves sublingulate, yellow-margined, serrate all round, with a percurrent costa ; the upper very broad, ovate acuminate ; indistinctly margined, serrate above the middle, costa percurrent or short excurrent ; cells wide sub-hexagonal, the basal sub-rectangular, all hyaline. Calyptra mitriform. Capsule pyriforme ; lid mammillate ; pedicel (unripe) yellow, about 1 cm. long, or shorter.

Since this description was published Mrs. E. G. Britton has examined the specimen and pronounces it *P. turbinatum*, Muell. Better specimens are wanted to settle the question, but houses and lawns and asphalt cover where it was found by Dr. Fletcher many years ago.

On earth at the southern end of Metcalfe Street, Ottawa.

XXIII. FUNARIA, Schreb.

69. **F. hygrometrica,** Sibth.

Very common on old walls and especially on burnt soil in damp woods and on old turned-up roots in swamps. Common around Ottawa and at Carleton Place.

XXIV. BARTRAMIA, Hedw.

70. **B. Œderiana,** Swartz.

On rocks east of the Beaver Meadow, west of Hull ; on damp rocks, Chelsea and Kingsmere, Que. ; on limestone rocks near McKay's Lake ; collected on the cliffs by the Ottawa, Rockcliffe Park, April 22nd, 1896. Fruiting.

LIFE-HISTORIES OF FISHES.

The late Frank Buckland, two days before his death in December 1880, wrote : "We want to know the times and places of the spawning of sea fish. Where do the soles lay their eggs? When and how do the plaice, turbot, brill, halibut, &c., spawn?" Buckland, it is true, was not an exact scientific investigator : but he was an untiring enthusiast who turned to account every opportunity for obtaining knowledge about fishes. His queries show how little was known about the life-history of fishes, especially sea fishes, less that twenty years ago. But a great change has happily been accomplished and the issue of a handsome volume condensing existing knowledge upon this important subject by Dr. McIntosh, Professor of Natural History in St. Andrews University, Scotland, and Mr. A. T. Masterman, Assistant Professor in the same University, marks an epoch in Ichthyology. Printed at the Cambridge University Press, England, this book, entitled "British Marine Food-Fishes," is the most notable work published up to this time on the eggs and young of fishes. It is a handsome volume of 516 pages, with twenty beautiful plates, and a coloured frontispiece, and worthily summarises the results of researches during the last twenty years by scientific workers on both sides of the Atlantic.

Wide as the subject of fish-development is, the ground covered by the authors is wider still, and apart from the objection that some of the marine species described have only indirectly any economic importance, scientific readers generally will be very grateful for this, and for the comprehensive account given in Chapter III on pelagic fauna, *i.e.*, the succession of life, vertebrate and invertebrate, in the sea during the twelve months of the year. The important and interesting nature of the subject gives the book an unusual valu,e but its numerous beautiful illustrations and lucid descriptions, it is a work that no zoologist

can afford to be without. It is interesting to note that of over 250 figures of eggs and young of fishes, about 70 are from drawings by the President of the Ottawa Field-Naturalists' Club. The beautiful plate of the stickleback, which forms the frontispiece, is also from his pencil, and the references to Professor Prince's researches upon fish-life abound throughout the work, which, as the authors say in their preface, owes much to the "researches of McIntosh and Prince," published in 1890 by the Royal Society of Edinburgh

A worthy summary of the results obtained by diligent workers, in Europe and on this continent, has been eagerly looked for, and by all competent to judge, this publication adequately fills the vacant place. It is true that two small books by Mr, J. T. Cunningham, of the Plymouth Laboratory, have appeared, one upon "The Sole" and the other on "British Marketable Fishes," but their scope was limited, and they had little scientific importance. The present work, as Professor Ray Lankester pointed out in his review in "Nature," August 12th, 1897, "appears to be less directly addressed to the general public than that of Mr. Cunningham"; but in no sense is it, as Prof. Lankester erroneously assumes, a supplement to Mr. Cunningham's publications. It stands on a different level, and is addressed to a different class of readers, and while the minor books, no doubt, serve well enough for fishermen, the present work meets the needs of students and investigators by the range and amplitude of its treatment. If any complaint can be made it is that so much of the work done at the St. Andrews Marine Laboratory, Scotland, has been laid under contribution; but this was inevitable, for that small zoological station has accomplished in this field results wholly disproportionate to its cost and equipment. The meagre scientific results yielded by costly stations at Plymouth, Granton, Rothesay and other points on the British coast, are to be explained by the bad locations selected and the paucity of fish-life there.

The authors' reference to McIntosh and Prince's researches as attempting for Teleostean fishes what the accomplished Francis Balfour did for the sharks has been objected to by Prof. Lankester on the ground that the mere sketching and description of coloured larval fishes is not embryology at any rate is not morphological. It is, however, precisely because the study and sketching of these translucent young fishes, in which the form and growth of almost every organ can be studied, that it is morphological in the truest sense, and had the critic himself ever studied from the egg onward the development of a fish, he would not have committed so gross an error in criticism.

There are few living workers to whom biological science owes more than to Professor McIntosh, and it is not too much to say that his elaborate ichthyological investigations have overturned all preconceived notions respecting the life and characteristic features of young fishes. It had been long imagined that when hatched out from the egg, a young fish resembled its parents, and that if the fry of various species could be obtained they could be easily recognized. The caterpillar and pupa of a butterfly were wholly unlike the perfect insect, and the young of the most familiar fishes passed through stages of life in which they did not resemble the adult fish with which we were all familiar. The salmon, herring, cod, halibut and other well-known kinds of fishes may be said to pass through at least four stages, viz., the larval, late larval, post larval and final condition ; in the last they resemble their parents, but are of very small size. Few fishes when hatched bear any likeness to the full-grown condition, and these are generally viviparous. Most fishes deposit eggs, and from such eggs there emerge in due time minute creatures, generally very transparent with large head and long tail and incommoded by a ponderous ball of yolk attached to their under side. In a later stage the yolk is gone and the breast fins and long fin on the back and tail are fully grown. Later, the breast

fins, and in some species the hind pair of fins, become enormously developed and project like wide-spread fans from the side of the body. These, no doubt, are effective for protection rather than locomotion. The study of young fishes has, in various ways, an important bearing on the commercial development of the fisheries in rivers, lakes and sea.

To naturalists, working in the privacy of their homes, the study of young fishes is at once possible and desirable. Few other living objects are more fascinating and beautiful, and the commonest fishes in our waters afford the best material.

The highest biological results can only be obtained by an exhaustive study of sections under the microscope, and following the lines of Frank Balfour's Elasmobranch papers the St. Andrews biologists have thoroughly studied the minute structure and development of larval fishes, and their popular summary derives additional value from that fact.

As in all Professor McIntosh's publications, full justice is done to all that other workers have accomplished. Most of these workers, as Mr. Holt and others, having had the advantage of being trained at St. Andrews in this department of research.

The literature of the subject is so vast that the book would have been burdened unnecessarily had any attempt been made to include a bibliography. Such a bibliography is, however, accessible enough to the specialist, and the synoptical table and practical directions regarding procuring fish eggs for study, added at the end of the volume, are of far more value to the student.—B.

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NOTES ON THE BIRDS OF THE MAGDALEN ISLANDS, P.Q.*

By Rev. C. J. YOUNG, B.A., Lansdowne, Ont.

My first impressions of the Magdalen Islands were far other than I had expected ; instead of barren rocks and a treeless waste, I found the majority of them to consist of red sandstone cliffs and dome-shaped hills ; the latter green to the very top. Grass grows in abundance, and a good deal of hay is raised. The timber is not large, the woods consisting entirely of spruce and fir, with a few birch trees, but no hard wood. In low places there is a growth of alder and willow ; and this completes the larger vegetation. On June the 15th the alders were only partially leafed out ; potatoes were just planted ; and oats an inch or two above the ground ; but after the 25th, vegetation became quite rapid, and the Islands assnmed a brilliant verdure. Now for the birds,—on the 15th, near the Parsonage, I saw the black snow-bird, the blue-jay, crows, robins, and a few others. On the following morning, rising early, I was driven to the north shore of Grindstone Island, and there spent the day on the beach and among the stunted firs that abound near the shore. Among these, for the first time I met with the fox-coloured sparrow. He is a fair songster, and certainly a noteworthy bird with his fulvous plumage and skulking ways. I saw five adults and one young bird just able to fly to-day (June 16th). Though I searched for the nest a long time, I was not successful in finding it ; their nests are hard to find. Another common bird was the black poll-warbler. They are everywhere and frequent the same localities as the fox-sparrow. I noticed a female with a

* Being a narrative of a visit, during the past season, to the Magdalen Islands, situated in the Gulf of Saint Lawrence, between 47° and 48° North Latitude, and between 61° and 62° West Longitude.—EDITOR.

rootlet in her beak, and after watching her for some time, located the nest in a small spruce about eighteen inches from the ground, but not by any means finished. During my stay on the Islands I found four of these nests, all built in spruce trees, the location varying from one to four feet from the ground. After reaching the beach I soon became aware of the presence of a small plover, and observing it through a good pair of field-glasses, which I usually carry on such expeditions, I identified it as the piping-plover. These birds were not uncommon ; I saw about ten pairs, and there must have been many more ; and during my stay found four nests. The first was found on the 16th by watching the birds. It was arranged much after the manner of the British ringed-plover, and contained four eggs, laid on the bare sand, but surrounded with a few pieces of broken shells, placed around the eggs, on a bank of sand and pebbles. These had been laid about a week, so it is evident the time to look for fresh eggs is from the 2nd to the 9th day of June, according to the season. Savannah sparrows were numerous here, but besides robins, a kingfisher, a warbler I could not identify, and the comman tern, there were few other birds.

On the following day, June 17th, I observed three or four pine-grosbeaks amongst the spruce trees ; they were apparently young birds of the year, and were quite tame. I also saw in the same locality five white-winged cross-bills in green plumage, and heard the hermit thrush, and saw a whet-owl, but found no nests to-day.

June 18th I walked to the summit of one of the highest hills on Grindstone Island—about 500 feet above sea-level,—where I obtained a fine view of the Magdalen group, of Grosse Isle and Bryon Island about 30 miles north, the view extending S.-E. as far as the Cape Breton coast. On the way I observed a warbler, probably golden-winged, the black snow-bird, and several others. Walking thence to the sea shore, while

passing through the woods of spruce and fir, I heard the hermit-thrush, and noticed two pair of golden-winged woodpeckers, whose nest-holes were in the dead birch trees, which were sparingly scattered amang the spruce. Near the sea shore I came across a pair of rusty blackbirds, which were quite tame and evidently breeding; they apparently had young, but I could not find the nest. In an alder thicket not far from the shore, was a yellow warbler's nest, just completed, but without eggs, the bird being on the nest. I saw several of these birds on the Island, but they were not so plentiful as either the red-start or black-poll warbler By the sea shore were several piping-plovers, and I found a nest well lined with broken pieces of shell, which contained four eggs, incubation advanced. In a swampy place not far off, a Savannah sparrow fluttered from my feet, and I saw the nest containing three young birds, well hidden from view. Close by, on the pond of brackish water, were several ducks, red-breasted mergansers, and a pair of black ducks with seven young, hatched about a week. Turning homeward, I met with several white-winged cross-bills, and a young pine-grosbeak, feeding on the buds of the spruce, which allowed me to approach within four or five feet.

June 19th.—To-day I walked through the spruce woods, and in a tree some eight feet high, frightened a black-poll-warbler from its nest, which contained five eggs, incubated a few days. The nest was built in a bough two feet from the ground, was quite bulky and substantial for the size of the bird, composed of a few spruce twigs, moss and grass, lined with rootlets and hair, and resembled the nest of the myrtle-warbler. On the way to the beach I saw a large nest on a fir-tree, which proved to be a fox-sparrow's, with two eggs in it. This nest was four feet from the ground, and was composed of much the same materials as the black-poll warbler's : spruce twigs, grass, moss, and lined with hair and fibres ; a very firm and compact structure. Near

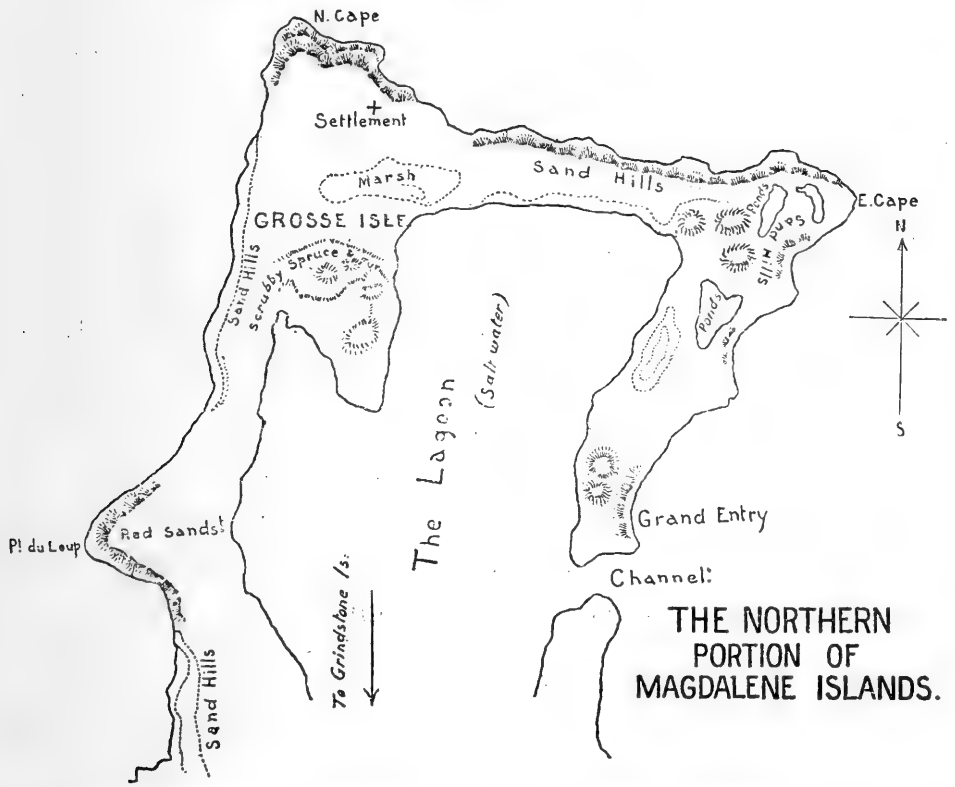
the cliff I found a second nest of this bird, built at the top of a stunted spruce, which contained four young birds just able to fly. Later, I came across four white-winged cross-bills, two of them in red plumage, which flew down to a pool of water to drink ; the other two seemed to be young birds in the green plumage ; also a warbler with a black chin and a black streak through the eye ; and a golden-crowned thrush. The warbler, I have no doubt, was the golden-winged.

June 20th.—This afternoon we drove along the beach for upwards of twenty miles to Grosse Isle. Besides a sparrow and some piping-plovers and spotted sand-pipers, I saw scarcely any birds, but heard the fox-sparrow repeatedly everywhere.

June 21st.—This was a very wet, blustering day, and it was impossible to get about, In a fisherman's house I saw eggs of the black guillemot, horned-grebe, scaup-duck, red-breasted merganser, kingfisher, least sandpiper, piping-plover, spotted sandpiper and swamp-sparrow, but spent most of the day in the house at Grosse Isle.

June 22nd.—The weather having cleared up, started to drive along the shore to the east point of Grosse Isle. The scenery is most interesting and unique. Sand hills line the coast about half to a mile across. Within and bounded by these is what is called the "lagoon," extending some thirty miles south to Grindstone Island, the shores consisting of sand and marshy flats and enclosed by sand hills, with the exception of a narrow channel at Grand Entry and House Harbour. This is a splendid place for ducks and waders. In the fall of the year they are reported to gather in thousands, along with the geese and plover, to feed in the salt marshes. In the month of June I saw a good many ducks, such as the scaup, and red-breasted merganser, with some others I did not identify. A few years ago "yellow-legs" are said to have been common ; I did not see one here, but was fortunate in finding a nest of the

"American stilt," with four somewhat incubated eggs. The bird rose from a grassy spot on the inside of the sand-hills, near the lagoon. Only the female showed herself; she was very uneasy,



and by her constant chirrup, and by flying over the place, soon convinced me she had a nest. After watching behind a sand-hill for some time I located the position of it, and going quickly to the spot where she disappeared, was rewarded for my patience by seeing her flutter along the grass as though wounded. I soon found the nest, placed among short grass in a dry part of the salt marsh; it was lined with a little withered grass. Only a few of of these birds now appear to breed among the Magdalens, in all probability a few years ago they were common. Proceeding eastward we drove among the sandhills, which are interspersed with boggy pools and fresh water ponds, where quantities of the large American cranberry grow. There is also here

a thick growth of stunted spruce, some of the trees twisted into fantastic shapes by the prevailing winds. Around the pools and swamps the mosquitoes were so bad that it was impossible to lie down and watch the birds. However on one of these ponds I noticed three pairs of horned grebe, and found a nest with two fresh eggs floating in two or three feet of water. Unless the bird is clearly identified the eggs can hardly be distinguished from the pied-billed grebe. The latter is the common grebe in the St. Lawrence above Brockville, Ont., but in the Magdalens I only saw these few pairs of horned grebes, and one specimen of the red-necked. In this locality, i.e., at the east point of Grosse Isle, the sora rail is quite common. We found a nest among some "cat-tails" with young just hatching to-day and containing six eggs as well. It was built in two feet of water in a very dense growth. The other eggs met with were mergansers and common terns. With the exception of the black-poll warbler, the fox and Savannah sparrows, I saw no small birds. Wilson's snipe, however is common and breeding I saw five to-day.

The following day, June 23rd, we started early for Bryon Island. some miles north of Grosse Isle, in a whale-boat, and the wind being partly favourable, reached that island in three hours. Though small, it is a very pleasant, and for the Gulf, quite a fertile spot. In size about four miles long, varying from half a mile to a mile wide. A great part of it is covered by a dense growth of spruce and fir, some of the trees of a larger size than I saw on the other islands, but the majority gnarled and twisted to a wonderful degree. The soil is good ; the cliffs consisting of a soft red sandstone, rising in places some 300 feet or more above the sea. Where the land is cleared grass grows luxuriantly and oats and potatoes are raised. The lobster fishing is very profitable. In the afternoon of to-day I started to walk round the island and investigate the fauna and flora along with

a man who was said to be an adept in rock-climbing. We found several nests of the pigeon or black guillemot, each with two eggs in, laid on the bare soil in a hole or crevice of the soft rock. Near the west end a few puffins breed, and we took one egg. On the south shore a stretch of sandhills and wet sandy beaches extends about a mile ; while a little distance inland great quantities of American cranberries grow, which though of last year's ripening were still fit for use. Among the small pools of fresh water I expected to meet with the yellow-legs, but saw nothing except some sparrows, and a few piping-plovers at the sea shore. We noticed a pair of ospreys, which doubtless had a nest in some of the larger spruce trees.

June 24th.—This morning walked with the proprietor of the island and my other friends to the lobster factory, thence to the east point, where a heavy sea was running, the spray flying over the tops of the cliffs. I saw the spotted sandpiper, another sandpiper, numbers of American scoters and a few mergansers. Fox-sparrows were scarce, there were a few pairs of black-poll warblers. We took a number of black guillemots eggs, nothing else. I learned that Leach's petrel still bred near the east point, so in the afternoon went with one of the boys who lived on the island to the locality where they were said to breed. After a short search we located a nest-hole among the roots of a scrubby spruce bush some thirty yards from the edge of the cliffs. The hole was eighteen inches deep, and found by the strong odour proceeding from the bird and pervading the whole bush. At the end of it was the nest consisting of matted grass, chips, fibres, &c. The first two I found, each contained one fresh egg ; in the third one the bird had been killed. I caught the old bird on both the nests that contained the eggs, and after carefully examining let them go. They appear to be nocturnal in their habits, and are at first dazed by the light. When taken in the hand they eject a few drops of a strong-smelling oil, whose odour lasts for a long

time. In the evening I took a nest of the Savannah sparrow behind the house, with five fresh eggs, and saw a second one close by. A few razor-bills and common guillemots are said to breed in the cliffs, but I did not see any, The only other birds of interest were a pair of loons, and a pair of young ravens.

June 26th.—I started to walk along the beach towards the east point, and on the way met with the semi-palmated plover. It is easily distinguished from the piping-plover by its darker plumage and broad black ring. Its note also is entirely different. I watched the bird for a long time hoping to locate its nest, but failed to do so, though confident it was breeding, Later I found a spotted sandpiper's nest with four eggs, and met with two pairs of rusty blackbirds. These appeared to have young, but I searched for the nest among the stunted spruces in vain. Towards evening the cry of the Wilson's snipe was very noticeable, and there must have been several pairs breeding near the lagoon, among the fresh water ponds. The only other birds seen to-day were the fox-sparrow, the black-poll warbler, and the piping-plover, besides one hawk, which could not be identified.

On the following day we drove back to Grindstone Island along the beach, the rest of our party having returned from Bryon Island. With the exception of a raven perched on a telegraph pole, a semi-palmated plover on a salt marsh by the the lagoon, and a marsh hawk, I saw no more birds of any particular interest. The marsh-hawk and the hawk seen yesterday, were the only birds of prey with the exception of the ospreys and owl, which I noticed on the Magdalens.

June 28th.—I visited the black-poll warbler's nest to-day, which I found on the 15th. It contained four eggs slightly incubated. In the afternoon I found a robin's nest with three fresh eggs The next day was very chilly, and with the exception of starting a pair of Wilson's snipe in the small swamp near

the Parsonage, I saw nothing of interest. The evening was cold and quite frosty.

June 30th.—This morning I walked through the woods of spruce and fir to the sea shore and met with a number of birds, but very few eggs. The Hudsonian tit is not uncommon, and in a stump about two feet high, I found a nest with seven young birds that could just fly. The nest was a very scanty affair almost on a level with the ground, and was approached from the top of the stump, not from any hole in the side. Later, I found four eggs of the Savannah sparrow, incubation advanced; the nest was in a tuft of grass in a very swampy place near the shore. On the way home I saw a number of common terns and herring gulls ; by a large pond of brackish water a greater yellow-legs (the only one I saw on the Islands), and several ducks with young ones ; among the scrubby spruce trees a blue-headed vireo, a pine-grosbeak, and two white-winged cross-bills.

July 1st was a very wet stormy day ; the following day was not much better until the afternoon, but I started along the beach towards Amherst Island and met with several pairs of piping-plover, and two small companies of least sandpipers, one consisting of five, the other of seven. They were very tame and were feeding above high-water mark on the beach between the sea and a large pond of brackish water. I took them to be male birds by their bright dark plumage, and conjectured that the females were possibly breeding in the salt marsh near the pond, as in the case of the nest previously found I saw no sign of the male bird.

July 3rd.—This morning I caught some trout in the small brook that flows by the Parsonage, and watched several white-winged cross-bills. I also saw two common cross-bills ; pine-grosbeaks, young ones, I think, one of which bathed itself very freely in the brook ; and a ruby-crowned wren. Besides these birds I saw a pair of blue-jays, a white-throated sparrow (the

only one I saw on the Islands), and amongst the spruce trees found several unoccupied nests, one of which I took to be a nest of the pine grosbeak, containing pieces of light coloured, egg-shell. Robins were numerous, and I saw a nest with three eggs in, and a nest of the fox-sparrow in the dense growth, placed on the top of a stump about three feet above the ground, with two young ones covered with black down, and hatched about a day.

July 4th was a fine bright day, the excessive heat which prevailed at this time in Ontario and parts of Quebec had not yet reached the Magdalen Islands. I watched some sand-swallows near the harbour.

The following day I spent in the spruce woods, and met with several interesting birds, amongst them a fox-sparrow that had a nest with three young ones in a thick fir-tree three feet from the ground. I met with a pair of blue-jays that were very noisy, and two golden-crested wrens. Also another Hudsonian tit's nest with four young ones, whose nest was located in a dead stump, built under precisely the same conditions as the first one found. The eggs must have been fresh early in June.

July 5th brought my visit to the Magdalen Islands to a close, and I took the steamer for Pictou, N.S., having spent three weeks very pleasantly on the Islands. Warm weather reached the Islands to-day.

Certain birds were found to be quite numerous, but some of the varieties I expected to find, were not meet with. It is a very difficult matter to find the nests amongst the dense growth of spruce and fir. If a person fond of ornithology spent two or three years on the Islands, he could probably make a good collection ; in a few weeks not very much can be done.

Of the 61 species met with, I was only able to locate nests of 23 of them ; while in all probability 43 out of the 61 regularly breed, as well as a few other warblers and one sparrow, which I did not identify. The grosbeaks breed early. On the morning

of July 5th I saw several young ones around the Parsonage. They were very tame, alighting on the wood pile and feeding on the seeds of dandelions, which they appeared to be very fond of, as were, too, the black snow-birds ; they probably lay in April. The crossbills are very irregular, but undoubtedly breed, as I saw them almost every day. On the 3rd of July a small flock of pine siskins was feeding on the buds of the spruce. These also appear to breed on the Islands, and their eggs, no doubt, could be procured by careful watching. The most interesting part to visit for the birds is Grosse Isle ; the Bird Rocks are well known as the abode of various species of sea fowl.

The following list of birds observed by me may be interesting to some readers ; I have also added a list of those that I found breeding, as regards nomenclature, following that adopted by the A. O. U :—

1. Holboell's Grebe.	June 18th, one.	
2. Horned Grebe.	June 22nd, three pairs.	Nest ; 2 eggs ; fresh.
3. Loon.	June 23rd, two ; 25th, one.	
4. Puffin.	June 23rd, two. June 24th.	Three nests ; 3 eggs.
5. Black Guillemot.	June 23rd, 24th, etc.	Several nests 2 eggs.
6. Common Guillemot.	June 25th.	Breeding.
7 Razor-bill.	June 25th.	Breeding.
8. Kittiwake.	June 25th, several.	Breeding.
9. A. Herring Gull.	June and July, numerous.	
10. Common Tern.	June and July, abundant.	Breeding.
11. Arctic Tern.	June 15th, several.	Breeding.
12. Cormorant.	June 13th, several.	
13. Red-breasted Merganser.	June 22nd, numerous.	Nest ; 6 eggs.
14. Black Duck.	June 18th, several.	Young hatched.
15. Scaup Duck (No. 147).	June 30th, several.	Breeding.
16. American Scoter.	June 24th, abundant.	
17. American Bittern.	July 2nd, a pair.	Breeding.
18. Lora.	June 23rd, several.	Nest ; 6 eggs.
19. Least Sandpiper.	June 22nd, July 2nd, several.	Nest ; 4 eggs.
20. Greater Yellow-legs.	July 3rd, one.	
21. Spotted Sandpiper.	June 20th, etc., numerous.	Nest ; 4 eggs.
22. Wilson's Snipe.	June 22nd, etc., numerous.	Breeding.

23. Semi-palmated Plover.	June 26th and 27th, two.	Breeding.
24. Piping Plover.	June 16th, etc., numerous.	Four nests.
25. Marsh Hawk.	June 27th, one.	
26. Osprey.	June 23rd, two.	Breeding.
27. Screech Owl.	June 17th, one.	
28. Kingfisher.	June 16th, etc., several.	Breeding.
29. Golden-winged Woodpecker.	June 18th, several.	Three nests.
30. Yellow-bellied Flycatcher.	June 13th and 15th, two.	
31 Blue-jay.	June 15th, etc., several.	Breeding.
32. Raven.	June 23rd and 27th, several.	Breeds.
33. Crow.	June 15th, etc., numerous.	Breeds.
34. Rusty Blackbird.	June 18th and 26th, 3 pairs.	Breeds.
35. Pine Grosbeak.	June 17th, etc., numerous.	Breeds.
36. A. Cross-bill.	July 1st and 3rd, three.	
37. White winged Cross-bill.	June 17th, etc., numerous.	Breeds ?
38. Pine Siskin.	July 3rd and 5th, numerous.	Breeds ?
39. Savannah Sparrow.	June 16th, etc., very "	Five nests.
40. White-throated Sparrow.	July 3rd, one.	
41. Junco.	June 15th, etc., a few.	Breeding.
42. Song Sparrow.	June 21st, etc., a few.	Breeding.
43. Lincoln's Sparrow.	June 18th, etc., several.	Breeding.
44. Swamp Sparrow.	June 21st, a few.	One nest.
45. Fox Sparrow.	June 16th, etc., numerous.	Four nests.
46. Cliff Swallow.	July 1st, a few.	
47. Sand Swallow.	June 27th, etc., numerous.	Breeding.
48. Blue-headed Vireo.	June 30th, one.	
49. Golden-winged Warbler. (No.642)	June 17th and 30th, two.	
50. Yellow Warbler.	June 18th, etc., several.	One nest.
51. Black-poll Warbler.	June 16th, etc., numerous.	Four nests.
52. Golden-crowned Thrush.	June 19th and 30th, a few.	
53. Redstart.	June 15th, etc., numerous.	Breeding.
54. Winter Wren.	June 30th, one.	
55. Hudsonian Tit.	June 15th, etc., numerous.	Two nests.
56. Golden-crowned Wren.	July 5th, two.	Breeding.
57. Ruby-crested Wren.	July 3rd, one.	
58. Hermit Thrush.	June 17th,23rd etc.,numerous.	Breeds.
59. Robin.	June 15th, etc., abundant.	Three nests.
60. Leach's Petrel.	June 24th and 25th, several.	Three nests.
61. Gannet.	June 25th, etc., numerous.	Breeding.

Besides the above birds, I saw one hawk, and several sparrows and warblers which I did not identify.

In this list most of the birds are included which were met with by Mr. William Brewster during his trip to the Gulf of St. Lawrence in 1881, (vide proceedings of the Boston Society of Natural History 1882-83. Page 364.) All these birds were clearly identified by myself and the nests where noted and examined. Of species noted by him as seen in the Magdalens, I did not meet with the black and yellow warbler ; the night-hawk and the red-throated diver. On the other hand I am able to add to his list of birds mentioned in those islands, 15 species, viz., the Holboell's grebe, the horned grebe, the scaup duck, the A. bittern, the lora, Wilson's snipe, the piping plover, the screech owl, the rusty blackbird, the pine grosbeak, the A. crossbill, the golden-w-warbler, the winter wren, the Hudsonian tit and the golden crowned wren.

The Island of Anticosti is doubtless a better locality for observing the birds that frequent the islands aud shores of the Gulf of St. Lawrence than the Magdalen Is., as the population on the latter is now considerable, and in a short summer tour it is sometimes difficult to get about from island to island.

I may add that the 'flora' of the Magdalen Is., is for the most part scanty and uninteresting. I made but a small list of plants, meeting with nothing of particular rarity, though some of them of course are of very local distribution, such as the trailing juniper, *Mertensia maritima*, *Hudsonia tomentosa*, *Lathyrus maritimus*, *Arenaria poploides*, *Hierochloa borealis*, (the holy grass) and a few others, mostly beach plants. On Grosse Isle I found the orchis *Habenaria viridis*, growing quite abundantly, and the 'dill' is a common and noticeable plant on Grindstone Is., growing in damp meadows.—

A trip to these islands is a very pleasant and healthful summer outing, but in the months of April and May when the cross-bills and grosbeaks should be breeding the weather is cold and foggy and at times said to be very wet.

In connection with the white winged cross-bills I may mention that during the past winter (1897) they, as well as the A. cross-bill,were very common in Ontario,and I saw three of them, one in the red and two in green plumage among the Thousand Isles, St. Lawrence River, as late as the 8th of April. These were very tame and were feeding on the ground on hemlock seeds. I also saw the pine siskin on the 1st April in a black spruce swamp. These birds breed readily in confinement, and this year some eggs were laid by them at Rockwood House, Kingston.

I trust the above notes may be of interest, and that at a future time I may have an opportunity of throwing further light on the summer 'habitat' of some of our well-known birds.

Lansdowne, Ont., September 13th, 1897.

OBITUARY—EDMUND VON MOJSISOVICS.

Edmund Mosjsisovics, of Mojsvar, died at the end of August last, at Feldbach, in Styria, after a prolonged illness caused by brain disease. As an eminent scholar, geologist and palæontologist, Mosjsisovics was well known the whole scientific world over. He was born at Vienna on October 18th, 1839. In 1867 he entered the Imperial College of Geology, and in 1870 became chief geologist and mining expert. In 1891 he was elected an effective member of the Vienna Academy of Sciences, and in 1892 was appointed Vice-Director of the Imperial College.

For his excellent work and labours in the field of palæontological science he was best known. In addition to numerous contributions on various subjects dealing with fossil organic remains, Mosjsisovics published his great work entitled "*Die Cephalopoden der Hallstater Kalke*," which appeared in two volumes, accompanied by an atlas. In morphological and geological exploratory research he did a great deal of work in the mountains of Bosnia and Hercegovina. In 1896 Mosjsisovics was at his own request transferred to Gratz where he held the post of Professor of Zoology until his regretted demise.—H.M.A.

RECENT GEOLOGICAL PUBLICATIONS.

MATTHEW, W. D.—*A revision of the Puerco Fauna.* Bulletin of the Amer. Mus. of Nat. Hist., Vol. IX., Art. XXII., pp. 259-323, New York, Nov 15th, 1897.

A very comprehensive paper in which the author re-arranges the species already described, and reduces their number.

BLUE, ARCHIBALD.—*Sixth Report of the Bureau of Mines.* Printed by order of the Legislative Assembly of Ontario, Toronto, 1897 (Distributed November). Contains a great deal of valuable information regarding the work carried on by the Ontario Government to aid the mining industry of the Province. Section I. deals with the production of nickel, copper, gold, corundum, graphite and iron. Section II. consists of the *Third Report on the West Ontario Gold Regions*, by Prof. A. P. Coleman, of the University of Toronto, Ont. Other reports in this volume, as follows :—

Section III,—*The Story of Silver Inlet*, pp. 125-158. Section IV.—*Anthraxolite or Anthracitic Carbon*, by Dr. A. P. Coleman. Section V.—*Geology of the Nipissing-Algoma line.* Section VI.—Moss Litter. Section VII.—Mining Schools of Ontario. Section VIII.—Mineral collections for Mining Schools. Section IX. Some notes on the Milling of Gold Ores. There is added the "Seventh Report of the Inspector of Mines," by A. Slaght.

Two geological maps of part of Ontario, prepared by the Geological Survey of Canada, Ottawa, and placed at the disposal of the Ontario Bureau of Hines, accompany the Report.

INTRODUCTION TO NATURAL HISTORY.

On the evenings of February 8th, February 22nd and March 8th (Tuesdays), the President (Prof. Prince), will deliver a course of lectures, illustrated by lantern slides and specimens, the subjects being respectively :

I. A Fish.
II. A Bird.
III. A four-footed Animal.

Each evening there will be a demonstration by the dissection of fresh specimens. The lectures will be adapted to the needs of those commencing natural history studies, and admission will be by special ticket, limited to members of the Naturalists' Field Club and the Y.M.C.A.

OTTAWA FIELD-NATURALISTS' CLUB.

PROGRAMME OF SOIRÉES, 1897-98.*

1897.

Dec. 21. Meeting for Exhibition of Specimens and Conversation.

"The San José Scale, and some other Injurious Insects." (Illustrated.) By James Fletcher, LL.D., F.R.S.C., F.L.S.

Note on a specimen of the Sea-lion in the National Museum, Ottawa, By Mr. James Melville Macoun.

1898.

Jan. 4. Meeting for Exhibition of Specimens and Conversation.

"On Faults and folds in the Ottawa District." By R. W. Ells, LL.D., F.R.S.C., &c.

Preliminary note on Mastodon remains found in Western Ontario. By H. M. Ami, M.A., F.G.S.

Report of the Geological Branch. By the Leaders.

Jan. 18. Meeting for Exhibition of Specimens and Conversation.

Paper on "The recent advance in our knowledge of Bacteria." By Mr. F. T. Shutt, M.A., F.C.S.

"Note on a Fish-eating Plant." By Mr. Andrew Halkett.

"The natural and artificial cross-fertilizing and hybridizing of plants, with notes on some important results." By Mr. W. T. Macoun.

Jan. 25. CONVERSAZIONE AND MICROSCOPICAL SOIRÉE, at 8 p.m.

Address by the President on "The House Sparrow and other despised creatures."

A number of interesting preparations will be shown by means of Dr. Ami's projection microscope.

Microscopical objects connected with various branches of Natural History will be exhibited by several members of the Club under their respective microscopes.

Feb. 1. Meeting for Exhibition of Specimens and Conversation.

Report of the Entomological Branch. By the Leaders.

"Notes on the life-histories of Blister and Oil-beetles." By Mr. W. H. Harrington, F.R.S.C.

Exhibition of 600 species of Japanese insects collected by Mr. W. H. Harrington.

Exhibition of rare exotic and native butterflies; by Dr. Fletcher.

Feb. 15. Meeting for Exhibition of Specimens and Conversation.

Paper on "Local Distribution of certain Fresh-water Shells." Illustrated by specimens. By Mr. F. R. Latchford, B.A.

"Notes on the Eskimo," By Dr. R. Bell, F.R.S., F.R.S.C.

Report of the Conchological Branch. By the Leaders.

Mar. 1. Meeting for Exhibition of Specimens and Conversation.

Report of the Ornithological and Zoological Branches.

Paper "On the Burrowing Habits of *Cambarus*—the Cray-fish." By Dr. Ami.

N.B.—At each meeting, various objects belonging to different departments of science will be exhibited, and at any meeting short papers may be read by members of the Club upon any Natural History subject.

*Held Tuesday evenings, 8 p.m., in the Lecture Hall of the Y.M.C.A., Corner of Queen and O'Connor Streets, Ottawa.

THE OTTAWA NATURALIST.

VOL. XI. OTTAWA, DECEMBER, 1897. NO. 9.

THE CRYPTOGAMIC FLORA OF OTTAWA.

BY PROF. JOHN MACOUN, M.A., F.L.S., F.R.S.C.

Continued from October No.

71. **B. pomiformis**, Hedw.

Crevices of damp and dripping rocks near Gilmour's Mill, Chelsea, Que.; collected on damp limestone ledges on the cliffs facing Gatineau Point, Rockcliffe Park, April 22nd, 1896. Fruiting.

XXV. PHILONOTIS, Brid.

72. **P. fontana**, Brid.

By springs at Kingsmere, and Kirk's Ferry, Que.

XXVI. LEPTOBRYUM, Schimp.

73. **L. pyriforme**, Schimp.

Rather common on burnt soil in swamps and along ditches. Casselman and Carleton Place; border of Dow's Swamp, Oct. 12th, 1884.

XXVII. WEBERA, Hedw.

74. **W. nutans**, Hedw.

On rotten logs and stumps in swamps and wet woods; common. Dow's Swamp, Kingsmere and Casselman; common in McKay's Bush; collected on old logs in Beechwood Cemetery, May 12th, 1896. Fruiting. Mer Bleue June 15th, 1892.

75. **W. albicans**, Schimp.

On wet limestone rocks under the cliffs at the end of the Electric Road, Rockcliffe Park. Nov. 9th, 1896.

XXVIII. BRYUM, Dill.

76. **B. pendulum**, Schimp.

On wet earth at Ottawa; woods north of Beechwood Cemetery, October 20th, 1884.

77. **B. bimum,** Schreb.

Common in wet woods and swamps. Borders of the Mer Bleue, June 15th, 1892.

78. **B intermedium,** Brid.

Crevices of damp rocks and old walls. In the old quarry in Rockcliffe Park and along the cliffs by the Ottawa. May 12th, 1896.

79 **B argenteum,** Linn.

Very common on roadsides and on desiccated soil in old pastures and waste places. On earth along St. Louis Dam, October 24th, 1884.

80. **B. cæspiticium,** Linn.

On earth in pasture fields and open thickets ; open places in Rockcliffe Park, May 7th, 1896 ; in old pastures near Hintonburg, Oct. 4th, 1884.

81. **B. capillare,** Linn. Var. **heteroneuron,** C. M. & Kindb.

On roots of trees in McKay's Bush near the lake, May 24th, 1888.

82. **B. Duvalii,** Voit.

In ditches and on wet rocks. In a springy place at the end of the Electric Railway, Rockcliffe Park.

83. **B. pseudo-triquetrum,** Schwæger.

In wet woods and swamps. Swamp north of Beechwood Cemetery ; also in Dow's Swamp.

84. **B. Ontariense** Kindb.

Intermediate between *B. roseum* and *B. Beyrichii* (Hsch.), C. Mueller. Comal leaves very numerous ; lingulate, abruptly and short acuminate, revolute to ⅔ or ¾, yellow-margined above with great confluent teeth ; costa stout, excurrent. Capsule pale, with a distinct, curved collum half as long, teeth papillose and hyaline above ; archegonia numerous ; lid convex short-apiculate, not oblique.

Hitherto confounded with *B. roseum*, and quite common throughout Ontario ; generally in a barren state. On old logs and sometimes on limestone rocks in maple woods around Ottawa. Beechwood Cemetery, Rockcliffe Park, Carleton Place and Eastman's Springs ; on logs in Dow's Swamp, October 10th, 1889.

85. **B. Laweri,** Ren. and Cardt.

On rocks opposite the island in the Gatineau River, Gilmour's Park, Chelsea, Que., Sept. 9th, 1889.

XXIX. MNIUM, Linn.

86. **M. cuspidatum,** Hedw.

Quite common on earth at the roots of trees in dry woods. On earth in woods Patterson's Creek, Stewart's Bush, Carleton Place, and Beechwood Cemetery ; on earth in Rockcliffe Park, April 28th, 1896.

87. **M. rostratum,** Schwægr.

On a large boulder on "Pine Hill," Rockcliffe Park, April 16th, 1896. Barren.

88. **M. Drummondi,** Br. and Sch.

In damp or swampy woods, near High Rock, Lièvre River, above Buckingham, Que., May 19th, 1884.

89. **M. affine,** Bland.

On earth in swamps and along brooks. On roots of trees along the brook west of West End Park, October 10th, 1884.

90. **M. rugicum,** Laur.

Rather common, growing in the wettest part of Dow's Swamp. Sept. 16th, 1889.

91. **M. orthorrhynchum,** Br. and Sch.

On damp limestone rocks near McKay's Lake, Aug. 26th and Oct. 12th, 1889.

92 **M. pseudo-lycopodiodes,** C. Muell.

On the bases of trees in cedar and black ash swamps. In Dow's Swamp and at Casselman ; in the swamp north of Beechwood Cemetery, May 7th, 1896. Fruiting ; on rocks in a brook, Meeche's Lake, near Chelsea, Que., Sept. 23rd, 1893.

93. **M. inclinatum,** Lindb.

On old stumps in Dow's Swamp ; on damp limestone rocks along McKay's Lake, April 22nd, 1896 ; old fruit. Old stumps in Dow's Swamp, Sept. 16th, 1889.

94. **M. spinulosum,** Br. and Sch.

On earth at the bases of trees, chiefly hemlocks. Wet woods north of Beechwood Cemetery ; woods near Carleton Place ; on the bank of the Lièvre River at Buckingham, Que., May 14th, 1896. Fruiting.

95. **M. stellare,** Hedw.

On old stumps in cedar swamps. In Dow's Swamp, May 2nd, 1896. Old fruit.

96. **M. punctatum,** Hedw.

On earth in cedar swamps and along small brooks in woods. In Dow's Swamp ; also by a brook near Meeche's Lake, north of Chelsea, Que., Sept. 23rd, 1893.

XXX. AULACOMNIUM, Schwægr.

97. **A. palustre,** Schw.

Very common in swamps. Mer Bleue and at Casselman.

XXXI. TIMMIA, Hedw.

98. **T. megapolitina,** Hedw.

On roots of trees by brooks in wet woods and on wet rocks. On roots of trees in Dow's Swamp, May 2nd, 1896, by a brook west of West End Park ; and on wet rocks south end of McKay's Lake, Oct. 16th, 1884.

XXXII. ATRICHUM, Beauv.

99. **A. undulatum,** Beauv.

On damp sandy earth in cool woods and wet sandy pastures. Common in McKay's Woods, Beechwood Cemetery, Mer Bleue and Casselman ; woods rear of Cowley's Farm, Hintonburg, April 18th, 1896. Fruit old.

XXXIII. POGONATUM, Beauv.

100. **P. brevicaule,** Beauv.

Along a ditch cut along the road leading through West Casselman. May 12th, 1891.

101. **P. alpinum,** Rœhl.

On damp sandy slopes and amongst rocks east side of Rideau River, near Hog's Back, May 7th, 1897.

XXXIV. POLYTRICHUM, Linn.

102. **P. gracile,** Menz.

Not uncommon in the Mer Bleue, near Eastman's Springs, June 15th, 1891.

103. **P. Ohioense,** Ren. and Card.

On earth in woods near Casselman, east of the Nation River. May 16th, 1891.

104. **P. juniperinum**, Willd.

In old pastures and on old pine stumps in fields and by roadsides; quite common. At the base of stumps north of Beechwood Cemetery, May 12th 1896.

105. **P. commune**, Linn. Var. **Canadense**, Kindb.

Differs principally in the low stem, about 6-8 cm. high, the pedicel not much longer, the blackish capsule much shorter than in the type which probably is very rare in Canada and only once examined by Kindberg.

In wet places at Britannia, Oct. 11th, 1892; also in hollows in the pine woods by the lake, east of Aylmer, Que., Sept. 11th, 1892; wet pastures at Casselman, June 12th, 1892.

XXXV. BUXBAUMIA, Hall.

106. **B. aphylla**, Linn.

On rocks at Chelsea, eight miles from Ottawa, Que. (Dr. Fletcher.)

XXXVI. FONTINALIS, Dill.

107. **F. antipyretica**, Linn.

On stones in the brook running through the Beaver Meadow west of Hull.

XXXVIII. DICHELYMA, Myrin.

108. **D. pallescens**, Bruch and Schimp.

On the bases of trees and twigs in water-holes near St. Patrick's Bridge; also very abundantly in the woods subject to spring floods around Leamy's Lake, Hull, Que., Nov. 9th, 1896. Fruiting.

XXXIX. NECKERA, Hedw.

109. **N, pennata**, Hedw.

Quite common on trunks in swamps or wet woods around Ottawa. On trunks north of Beechwood Cemetery, also in Dow's Swamp; on trunks "Pine Hill," Rockcliffe Park, April 16th, 1896.

110. **N. oligocarpa**, Bruch and Schimp.

On ledges of limestone rocks opposite Gatineau Point, Rockcliffe Park, May 7th, 1896.

XL. LEUCODON, Schwægr.

111. **L. sciuroides**, Schwægr.

Common on trunks in all old woods. Dow's Swamp, Carleton Place, Eastman's Springs and Casselman; in McKay's Woods, May 7th, 1896. Barren.

XLI. HOMALIA, Brid.

112. **H. Macounii,** C. M. and Kindb.

H. trichomanoides, Lesq. and James Mosses of N. America, 245. Very nearly allied to *Homalia trichomanoides* ; differs in the leaves being longer, rather lingulate, the lowest basal cells yellow, the perichetial leaves more suddenly narrowed to the very short acumen, the segments of the peristome cleft between the articulations.

On the bases of trees on the south end of Cowley's Farm, west of Hintonburg ; on limestone rocks east end of McKay's Lake ; on the cliffs facing Gatineau Point, Rockcliffe Park, May 7th, 1896.

XLII. MYURELLA, Bruch and Schimp.

113. **M. julacea,** Bruch and Schimp.

On old stumps in cedar swamps. In the swamp north of the Experimental Farm ; also in Dow's Swamp.

114. **M. Careyana,** Sulliv.

On ledges of limestone rocks, east of the creek in the Beaver Meadow west of Hull, Que. ; crevices of wet limestone rocks at the north end of Rockcliffe Park near the old mill, May 7th, 1896 ; on rocks at Meeche's Lake, Sept. 23rd, 1893.

XLIII. LESKEA, Hedw.

115. **L. polycarpa,** Ehrh.

Very abundant on the bases of trees in the inundated flats between Leamy's Lake and the mouth of the Gatineau River. Nov. 9th, 1896.

116. **L. nervosa**, Myrin.

On trunks in McKay's woods ; on boulders at the east end of Rockcliffe Park, near the old saw mill, May 7th, 1896 ; also at Carleton Place.

XLIV. ANOMODON, Hook. and Tayl.

117. **A. rostratus,** Schimp.

Very common on the roots of trees in swamps and on the faces of perpendicular, damp rocks. Seldom fruiting. On rocks in Rockcliffe Park, April 22nd, 1896.

118. **A. attenuatus,** Heuben.

Quite common on the bases of trees in black ash swamps and wet woods. Fruiting abundantly in the autumn. On trees in Rockcliffe Park, April 16th, 1896.

119. **A. obtusifolius,** Br. and Sch.

Abundant on the bases of trees in black ash swamps and wet woods around Ottawa. Fruiting in the autumn. On trunks south end of Cowley's Farm, near Hintonburg, April 18th, 1896.

120. **A. apiculatus**, Bruch and Schimp.

On decaying logs and flat limestone rocks in McKay's Woods, opposite the entrance to Beechwood Cemetery ; on limestone rocks, Rockcliffe Park, April 22nd, 1896.

121. **A. viticulosus**, Hook. and Tayl.

Very common on limestone rocks near McKay's Lake and along the Ottawa west of Hull, and on damp ledges in woods along the Beaver Meadow west of Hull, Que. ; on damp rocks facing the river, Rockcliffe Park, April 22nd, 1896.

122. **A. heteroideus**, Kindb.

Plants densely tufted, green, finally fuscescent or blackish. Stem creeping, subpinnate, much branching and furnished with numerous small, flagelliform branchlets, densely beset with very small, oblong, obtuse and nerveless leaves ; paraphyllia broad. Stem-leaves subdistant, decurrent, appressed when dry, open-erect when moist, from a broadly ovate base suddenly narrowed to a long, subulate or sublinear acumen, entire, faintly papillose ; margins revolute at the base ; branch-leaves more attenuate ; cells round-oval, the marginal of the base quadrate ; costa vanishing below the acumen. Dioecious. Fruiting specimens not found. This species resembles *Leskea nervosa* in habit.

On flat limestone rocks and the roots of trees in McKay's Woods, opposite the entrance to Beechwood Cemetery ; on limestone rocks at Meeche's Lake, near Chelsea, Que., Sept. 23rd, 1893.

XLV. PLATYGYRIUM, Bruch and Schimp.

123. **P. repens**, Bruch and Schimp.

On old logs in woods at Eastman's Springs, Casselman and Carleton Place ; on old logs in woods north of Beechwood, May 7th, 1896.

Var. **orthoclados,** Kindb.

Branches elongate and not curved. All basal leave-cells orange. Segments linear, not completely free at base, smooth or denticulate at one side, not shorter than the teeth.

On old logs at the south end of Skead's Farm, west of Hintonburg, May 15th, 1885.

XLVI. PYLAISIA, Bruch and Schimp.

124. **P. polyantha,** Bruch and Schimp.

On rotten logs at Carleton Place ; on trees in McKay's Woods, Oct. 12th, 1884.

125. **P. Selwynii,** Kindb. Ott. Nat. II., 156.

Differs from *P. intricata* in the denser, darker green tufts, the leaves broader, short-acuminate, reflexed to the acumen at one border or at both, the short alar and marginal cells more numerous, the capsule short-oval, the segments adhering to two-thirds of the teeth.

Very abundant on old cedar fences along the Richmond Road, three miles west of Ottawa ; also on fences west of Hintonburg, April 18th, 1896. Mr. A. J. Grout reduces this species to *P. intricata*, and believes it to be merely a more compact form.

126. **P. intricata,** Bruch and Schimp.

Common on logs and trunks, in woods and on old cedar rails around Ottawa ; on fence rails and trunks and branches in Rockcliffe Park, April 28th, 1896.

127. **P. velutina,** Bruch and Schimp.

On old logs in Dow's Swamp, Sept. 25th, 1889.

XLVII. ENTODON, C. Mueller.

128. **E. acicularis,** C. M. and Kindb.

Tufts compact, brown-yellow or variegate with green. Stems much divided, very radiculose ; branches very short and turgid, not attenuate Leaves imbricate, with difficulty loosed from the stem, scarcely open when moist, finally golden-yellow, from the ovate-oblong base suddenly narrowed to a fine aciculiform or subulate point, denticulate nearly all around ; cells not chlorophyllose, linear-lanceolate or fusiform, the alar not well defined ; costa generally wanting. Barren.

On limestone rocks in woods near McKay's Lake, May 2nd, 1885 ; also by an old lime-kiln at Britannia, Oct. 11th, 1890,

In a late revision of the genus Mr. A. J. Grout has reduced this species also to a form of the next.

129. **E. cladorrhizans,** (Hedw.)

On old logs in Rockcliffe Park and McKay's Woods, April 16th. 1896 ; on stones and logs at Britannia ; and very abundant on old logs in woods at Carleton Place. Fruiting abundantly in autumn.

XLVIII. CLIMACIUM, Web. and Mohr.

130. **C. Americanum,** Brid.

On the ground in swamps about wet woods around Ottawa. Seldom fruiting, but frequent in woods along the Beaver Meadow, Hull

Que. ; on earth in the swamp north of Beechwood Cemetery, May, 1885.

131. **C. dendroides,** Web. and Mohr.

In a swamps on the east side of the Beaver Meadow west of Hull, near the north end, Oct. 24th, 1891. Fruiting abundantly.

XLIX. PTEROGONIUM, Swartz.

132. **P. brachypterum,** Mitten.

On a small maple trunk in a piece of woods along the west side of McKay's Lake. Fruiting. April 28th, 1896. This determination is doubtful.

L. THUIDIUM, Schimp.

133. **T. minutulum,** Bruch and Schimp.

On old logs in McKay's Woods ; also in woods at Ironsides ; on stumps and rocks, Rockcliffe Park, April 22nd, 1896.

134. **T. scitum,** Aust.

On beech trunks in McKay's Woods ; on beech trees on the south end of Cowley's Farm, west of Hintonburg, April 18th, 1896.

135. **T. gracile,** Bruch and Schimp.

On old logs in woods at King's Mountain, near Chelsea, Que. ; abundant on rotten logs at Leamy's Lake, near Hull, Que., Nov. 9th, 1896. Fruiting.

136. **T. recognitum,** (Hedw.) Lindb.

On old logs around the Mer Bleue ; in Dow's Swamp and in a swamp at Stittsville ; on rotten wood, "Pine Hill," Rockcliffe Park, April 16th, 1896.

137. **T. delicatulum,** Mitt.

On earth in the Mer Bleue and in the swamp north of Beechwood Cemetery ; on earth in Dow's Swamp, May 2nd, 1896.

138. **T. abietinum,** Bruch. and Schimp.

Quite common on exposed limestone rocks at Carleton Place ; also abundant around the cliffs of Rockcliffe Park. April 22nd, 1896. Always barren.

139. **T. Blandovii,** Bruch and Schimp.

In damp woods at Britannia ; in the Mer Bleue ; also on earth in Dow's Swamp.

LI. CAMPTOTHECIUM, Schimp.

140. **C. nitens,** Schimp.

Abundant in the Mer Bleue ; also in Dow's Swamp, June 4th, 1884.

LII. BRACHYTHECIUM, Schimp.

141. **B. laetum,** Brid.

A common species on stones in woods around Ottawa ; on boulders in woods at the south end of Cowley's Farm, west of Hintonburg, April 18th, 1896. Fruiting.

142. **B. digastrum,** C. M. and Kindb.

Tufts largely cohering, olive-green, not shining. Stem rigid, subpinnate or irregularly branching, radiculose below ; branches sub julaceus, obtusate. Stem-leaves when dry loosely appressed or subimbricate, crowded, patent or subsecund when moist, decurrent, not auricled, plicate, biventrose, ovate and short-acuminate with the acumen flexuous or when dry serpentino-corrugate, borders more or less recurved but not reflxed, subentire or faintly denticulate above ; lower basal cells wide and sub-rhombic, the alar rather quadrate-rectangular and not very distinct, the upper conflate, small, very chlorophyllose, the inner median sublinear, the others oblong-lanceolate ; costa thick and subflexuous, long and vanishing near the acumen. Branch leaves ovate-oblong, more distinctly revolute at the borders, denticulate at the acumen and narrower areolate. Female flowers small, inner perichetial leaves filiform-acuminate with the acumen arcuate, long-costate and denticulate. Capsule asymmetric sub-cylindric, curved ; lid long-conic ; pedicel smooth 1-2 cm. long. Peristomial teeth conic-connivent when moist, dark red-brown below, very much longer than in the middle open segments ; cilia nodulose not apendiculate, annulus none. Monœcious.. Habit of *Leucodon julaceus*.

On rocks in McKay's Woods near south end of the lake, Oct. 12th, 1889. Fruiting.

143. **B. acuminatum,** (Beauv.)

On earth in McKay's Woods between the old entrance to Beechwood Cemetery and the lake ; also on logs at Carleton Place.

144. **B. salebrosum,** Bruch and Schimp.

On stones in damp woods north of Beechwood Cemetery, Oct. 16th, 1884 ; on stones at the rear of Cowley's Farm, west of Hintonburg, April 18th, 1896.

145. **B. acutum,** (Mitt.) Sulliv.

On earth in wet woods north of Beechwood Cemetery ; also in damp woods along the Beaver Meadow west of Hull, Que., Oct. 12th, 1891.

146. **B. platycladum,** C. M. and Kindb.

Tufts densely cohering, bright green, shining. Stem irregularly branching ; branches short, obtuse, complanate. Leaves loosely imbricate or patent, nearly flat, long-decurrent, distinctly auriculate, faintly striate, broad, ovate, suddenly and generally short-acuminate ; borders not recurved, faintly sinuolate or sub-entire below the middle, more distinctly denticulate above ; cells pale, the upper narrow, the lower near the base dilated, the alar large and well defined ; costa short, reaching little above the middle. Capsule sub-oval, faintly curved ; teeth dark-yellow, entire at the borders ; cilia not appendiculate ; lid unknown ; pediel rough, about 2 cm. long, or shorter. Perichetial leaves long, fiiliform-acuminate, the point arcuate. Dicœcious.

Differs from *B. rutabulum* principally in the long-decurrent auricled leaves and the dicœcious inflorescense ; from *B. rivulare* in the peristome, etc.

On stones in the bed and along the sides of a brook, north of the Parry Sound Railway, west of West End Park, May 21st. 1885.

Mr. F. A. Grout, of Columbia College, New York, who has just completed a monograph of *Brachythecium*, refers the above species to *B. rutabulum* (L.) var, *flavescens*, Brid.

147. **B. Donnellii,** Aust.

On limestone rocks in McKay's Woods, near the Lake, Sept. 25th, 1889.

148. **B. velutinum,** Bruch and Schimp.

On earth in Gilmour's Park, Chelsea, Que., Sept. 9th, 1889 ; on the bases of trees in Dow's Swamp, May 2nd, 1896.

149. **B. intricatum**, Hedw. (New to America.)

On rocks by a brook near Meeche's Lake, north of Chelsea, Que. Sept. 23rd, 1893.

150. **B. Starkii,** Bruch and Schimp.

On stones in the brook north of the Parry Sound Railway and west of West End Park ; on the bases of trees along the Beaver Meadow west of Hull, Que., Oct. 16th. 1884.

151. **B. œdipodium,** (Mitt.)

On old log's in woods Gilmour's Park, Chelsea, Que. Sept. 9th, 1889 ; on rocks in woods west of Hull, Que., Oct. 20th, 1891 ; on earth in Beechwood Cemetery, Oct. 12th, 1889.

152. **B. curtum**, Lindb.

On stones in damp places McKay's Woods, Oct. 12th, 188

153. **B. reflexum,** Bruch and Schimp.

On boulders along a brook near Meeche's Lake, north of Chelsea, Que., Sept. 23rd, 1893.

154. **B. rivulare,** Bruch and Schimp.

On stones and roots in springs north of Beechwood Cemetery, Oct. 12th, 1889.

155. **B. populeum,** Bruch and Schimp.

On rock's in Gilmour's Park, Chelsea, Que. Sept. 9th, 1889; on rocks in McKay's Woods, Oct. 12th, 1889; and on boulders "Pine Hill" Rockliffe Park, April 16th, 1896; on rocks at Meeche's Lake, north of Chelsea, Que. Sept. 23rd, 1893.

156. **B. plumosum,** Bruch and Schimp.

On boulders in McKay's Woods, May 28th, 1884; on rocks in woods, Meeche's Lake, north of Chelsea, Que. Sept. 23rd, 1893.

LIII. EURHYNCHIUM, Schimp.

157. **E. strigosum,** (Hoffm.) Bruch and Schimp.

On earth and stones in woods; common. In McKay's Woods; on earth in Dow's Swamp, May 2nd, 1896; on old logs in Beechwood Cemetery, Oct. 12th, 1889; on earth in woods at Meeche's Lake, Sept. 23rd, 1863.

158. **E. Novae-Angliæ,** (Lesq. and James.)

On old logs in woods at Meeche's Lake, Que. Sept. 23rd, 1893.

159. **E. Sullivantii,** (Spruce.) Lesq. and James.

On limestone rocks along the east side of the creek in the Beaver Meadow west of Hull, Que. May 16th, 1885.

160. **E. hians,** (Hedw.) Lesq. and James.

On earth in woods near McKay's Lake, Oct. 12th, 1889. This specimen is still doubtful.

LIV. RAPHIDOSTEGIUM, Lesq. and James.

161. **R. recurvans,** (Schwægr.) Lesq. and James.

Very common on the bases of leaning trees in woods. Beechwood Cemetery and McKay's Woods, April 28th, 1896; old woods at Carleton Place.

LV. RHYNCHOSTEGIUM, Schimp.

162. **R. deplanatum,** Schimp.

On flat limestone rocks in McKay's Woods, May 2nd, 1885; also on flat rocks and earth Carleton Place Sept. 26th, 1889; on earth in Beechwood Cemetery, Oct. 12th, 1884.

RECENT CONCLUSIONS IN QUEBEC GEOLOGY.

R. W. ELLS, LL. D., F. R. S. C., Geological Survey, Ottawa.

(Read before Section C., British Association Meeting, Toronto, Canada, 1897.)

The paper gives a brief outline of the progress of geological exploration in this portion of the Dominion, with a statement of the most recent conclusions arrived at as the result of the detailed study of the rocks in the field. It is largely a summary of the conclusions stated in the published report of the Geological Survey of Canada,* on this district.

The principal problems west of the St. Lawrence were the relations of the great Anorthosite masses, lying to the north of Montreal, to the Laurentian Fundamental Gneiss and the Grenville Series ; and secondly, the relations of the Grenville Series itself to the underlying Gneiss on the one hand and to the Hastings Series of Ontario on the other.

These may now be regarded as fairly well settled, at least to the satisfaction of those who have most recently worked in this field. In regard to the age of the Anorthosites the old contention that these were an altered series of the sedimentary rocks, resting unconformably on the gneiss and limestone of the Grenville series, has been abandoned. It has been found that the Anorthosites and Gabbros which are associated with these, are igneous in character, and that they are newer, in point of time, than the Grenville rocks ; that they have invaded these at many points and altered them along the lines of contact.

The change of view in regard to their origin dates back to about 1879-80, and their igneous intrusive character was first pointed out by Vennor nearly twenty years ago. This view was expounded by Dr. Selwyn in the report for the years mentioned, but the whole question has more recently been investigated, principally by Dr. F. D. Adams, whose observations in the field and in the laboratory have finally conclusively settled the problem and shewn that the anorthosite areas are masses of igneous rocks newer than the Grenville limestone and associated gneisses.

The second grand problem as to the relations of the Grenville limestone and associated rusty and hornblende gneisses to the Fundamental Gneiss of the Laurentian proper, has also been conclusively settled. It is now held by all the recent observers in this field that the rocks of this division are a newer

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* Annual Report, Vol. VII, N. Series, 1894, Part J.

series, resting upon the Fundamental Gneiss. In this no trace of sedimentation is now apparent; while in the Grenville series the originally clastic character is clearly recognized in several of its members. The rocks of the Grenville series have been worked out along their westward development and have been found in this direction to include the series named by Vennor, the Hastings, which is apparently the same as the Grenville, under different conditions as regards alteration and local development; the limestones of the Hastings series being frequently less altered, and associated with micaceous and other schists, along with beds of slate and true conglomerates.

East of the St. Lawrence.

The great problems as to the structure of the Quebec Series or Group which have been prominent for nearly fifty years have also been settled, at least to the satisfaction of those most familiar with all the aspects of the question. The crystalline series of the Sutton Mountain, at one time regarded as the newest member of the Group has been separated and placed in the pre-Cambrian division, and are presumably of Huronian age, since it has been found that these rocks underlie the lowest fossiliferous Cambrian sediments. Above these crystalline rocks there is a very considerable thickness of strata which represent the Cambrian and which have been locally assigned to the lower Sillery formation, for the sake of description; and these rocks contain, at many points, organic remains such as trilobites, graptolites, etc., which have a marked Cambrian aspect. The fossiliferous beds of the upper Sillery and Levis have been carefully searched and studied, stratigraphically, and it has been conclusively shewn that the Levis is the upper member and overlies the upper Sillery; and, that in fact the Sillery is the downward prolongation of the Levis without manifest break, except that the fossil contents become less abundant in the upper Sillery, as in the case of the passage of the Calciferous of the Ottawa Basin downward into the Potsdam sandstone, where there is also no marked line of separation, except in the change of character in the composition of the strata. There is however a marked break between the slates and sandstones of the upper Sillery and the limestones and slates of the lower Sillery; since in connection with heavy faults between the two series there are thick beds of limestone conglomerate at the base of the upper Sillery, abounding in pebbles of limestone which contain numerous specimens of *Olenellus Thompsoni*, and

other lower Cambrian fossils. In point of time the Levis beds may be regarded as the equivalents of the Calciferous of the Ottawa Basin, while the lower portion or upper Sillery may be taken as the equivalent of the Potsdam sandstone.

The rocks of Quebec City and the Citadel Hill are somewhat higher in the scale than those of the Levis shore opposite. They were at first regarded as of Levis age and lower in position than the Sillery. Subsequently they were held to represent the Hudson River and Utica divisions, but a careful study of the fossil contents, as well as of the stratigraphical relations as shewn in other portions of the field, where the similar rocks appear, shews this peculiar development of strata to belong largely to the lower division of the Trenton and not far from what is designated the Black River division. The equivalence of the areas in the vicinity of Quebec to those seen in the Phillipsburg section has also been very clearly established, and the rocks of the latter are found to range upward from the base of the Calciferous to the top of the Chazy formation. Thence eastward the ascending sequence can be traced upward into the black slates and limestones of Farnham which are apparently the equivalents of those of Quebec city, but which were at one time described as a part of the Potsdam formation.

The great areas of upper Silurian, once depicted on the map of the province of Quebec, have in large part been removed. These were supposed to occupy the greater portion of the province, east of the Sutton mountain range; and their Silurian horizon was maintained from the presence of a number of areas of these fossiliferous rocks found at various places in this district. The detailed study of this field shewed conclusively that these Silurian areas were detached outliers, sometimes of very limited extent, in places infolded with the underlying Cambro-Silurian sediments. The age of the latter was established by the finding of characteristic fossils, such as graptolites and trilobites at a number of points. It can therefore be safely asserted that by far the greater part of the area east of the Sutton Mountain anticlinal is occupied by strata of Cambro Silurian and Cambrian age and that the upper Silurian and Devonian portions are very limited in extent.

The question of the age of the mountain masses of diabase and syenite so conspicuously displayed in the area east of the St. Lawrence, has also been a somewhat difficult one to decide. In places the associated rocks have been so altered as to present the

aspect of Pre-Cambrian schists and for a time these mountains were supposed to be as old as the lowest Cambrian. Their intimate association with Silurian and Devonian sediments at a number of points, together with the fact that numerous spurs were given off from the main masses of igneous rocks which penetrated these newer sediments in the form of dykes, the fossiliferous Silurian and Devonian in contact being frequently converted into schists and otherwise altered, shews conclusively that the age of most of these mountain masses must be more recent than the sediments which they penetrate so that they are at least post-Silurian.

There are however large areas of igneous rocks in association with the pre-Cambrian strata of the Sutton Mountain axis which are of Pre-Cambrian age, since they are overlaid by the slates of the lowest Cambrian. These have also been altered and are now often seen in the form of chloritic and other schists.

The age of the Granite masses which are conspicuous features in the eastern portion of Quebec, is probably not very different from that of the diabase hills just referred to. These cut rocks of all ages from the pre-Cambrian to the Silurian. The strata in their vicinity are all greatly altered, the slates being changed into chiastolite and staurolite schists, while the Cambro-Silurian limestones have been rendered schistose and are filled with small scales of mica. often with a large development of quartz veins.

The serpentine areas in which the asbestus of the Eastern Townships is frequently found apparently belong to the diabase and olivine group. They are often found in association with the Cambrian slates but they also occur in connection with the Cambro-Silurian and Silurian strata. They are apparently altered portions of the diabase and olivine masses.

The same remarks apply to most of the igneous rocks of the Gaspé peninsula. These is here a central zone of pre-Cambrian rocks, overlaid on the north by Cambrian slates and limestones, and on the south by Silurian and Devonian strata of the great Siluro-Devonian basin. Through these newer rocks great mountain masses of diabase and kindred rocks protrude; similar to those found in the areas east of the St. Lawrence, and these are evidently newer than the fossiliferous sediments which they penetrate, since, at several points, pieces of the fossiliferous limestones are caught and held in the igneous mass.

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FORMATIONS, FAULTS AND FOLDS OF THE OTTAWA DISTRICT.*

By R. W. ELLS, LL.D., F.R.S.C., F.G.S.A.,
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With the exception of the remarks on the geology of the Ottawa area, contained in the "Geology of Canada," 1863, but little attention has been paid, in any of the official publications of the Geological Survey to the study of the rock formations in the vicinity of this city. This has been in large part due to the fact that the work of the different members of the field staff has lain, for the most part, in districts more remote. The local geology and palæontology have however been described in some detail by several members of this Club, more especially by Dr. Ami, Mr. T. W. E. Sowter, Mr. Walter R. Billings, and others, who have contributed papers from time to time in the Transactions, so that we have a very fair general knowledge of the formations about our city. There is however a large field for collectors at our very doors, and the object of this paper is more particularly to direct attention to the distribution of the several geological formations in our more immediate vicinity, as well as to indicate some points of structure, in connection with certain faults and folds, which occur in close proximity to Ottawa, as well as in the city itself. These have not hitherto been prominently referred to, but they have served to complicate very considerably the geological relations of the several formations of the Palæozoic series.

*Read before the Ottawa Field-Naturalists' Club, Tuesday, Jan. 4th, 1898.

The geological structure of this area is confined almost entirely to the Cambro-Silurian formations. To the north of Hull, the old rocks of the Archæan approach within a short distance of that city, while to the west of Ottawa, in the eastern portion of the township of March and in that part of Nepean adjoining on the east, similar granites, gneisses and limestones are well displayed in a somewhat prominent ridge which extends eastward from Arnprior. Resting upon these are the nearly horizontal strata of the Potsdam sandstone and the Calciferous limestone in their regular order, and in places these graduate upward regularly into the Chazy and the succeeding formations, to the top of the Cambro-Silurian series, which is capped by the soft red shales of the Medina, in the adjacent township of Russell.

Much of the rock structure of Ottawa city is concealed at the present time, and only occasional outcrops are visible at widely separated intervals. Much information concerning these hidden portions has been obtained, principally by Dr. Ami, from an examination of the excavations made for drainage and for buildings, and in this way we have been enabled to obtain a fairly comprehensive idea of the geological structure of the whole city.

The oldest of the Palæozoic formations, near Ottawa, are the Potsdam sandstone and the Calciferous limestone, there being no break between these two series of strata. These can be well observed in the vicinity of Templeton station on the Canadian Pacific railway, where the Potsdam sandstone rests directly upon the Archæan gneiss and limestone and forms an escarpment about thirty feet in height. These sandstones shade upward into the Calciferous strata, which are well exposed in the village of Templeton and along the road to the crossing of the Wabassee Creek. These are the only Palæozoic formations seen in this part of the section. To the west of the city, in the

western part of March, and in that part of Nepean adjoining, the same succession of the Potsdam and Calciferous can be observed ; but here there is an upward passage into the Chazy and thence into the overlying formations. The greenish-grey shales of the Chazy can be seen all about the village of Britannia, from which place they extend eastward along the shore of the Ottawa to the vicinity of the old burned mill at Skead's. Along the Rideau River, at Black Rapids and thence south to Smith's Falls, the Calciferous limestone is the prevailing rock, and this occupies a great portion of the townships of Osgoode and Nepean.

The Chazy does not appear in the city itself, west of the park at Rockliffe ; but to the west of Hintonburg, going along the south shore of the river, the limestones of the formation come into view from beneath the Black River, about half a mile west of the Little Chaudiere rapids, in rear of Mechanicsville. The Chazy shales first appear at the cove above the old Skead mill, and thence they extend westward, as already noted, to Britannia and for some distance beyond to the contact with the underlying Calciferous. They are well exposed on the road to Bell's Corners, near the crossing of the Ottawa and Parry Sound railway, where they also rest upon the Calciferous in regular order. Characteristic Chazy shales with bands of limestone are also seen at the Hog's Back on the Rideau, but the outcrop, although conspicuous at this place, is limited, and a fault to the south, along the shore, brings in the Black River and Trenton, and cuts out the upper or limestone portion of the Chazy proper. About a mile above the Hog's Back, Chazy strata again appear on the east bank of the Rideau, but a short distance further south these are in contact with the Calciferous by a fault which is conspicuous along the road up the east side of the canal, where the strata are tilted at a high angle

The portion of the Ottawa from a point a couple of miles above Britannia to about one mile east of Berry's Wharf, shows

outcrops of the Calciferous limestone, and these at the latter place pass upward into the basal beds of the Chazy, which here consist of coarse greenish grits and fine conglomerates. The Chazy strata thence extend along the south shore of the Ottawa to the mouth of the Mississippi at Fitzroy Harbor, where they again rest upon the Calciferous limestone. The Chazy limestones are well seen in a part of this section, coming in on the hill to the south of Berry's Wharf, and also along the shore several miles west of this place, whence they extend to the western line of Torbolton. On the north side of the river the shales are exposed at the village of Quyon, resting upon the Calciferous which forms a narrow fringe along that part of the river. Nearer the city the shales are visible at Aylmer and along the north shore as far west as the cove near Breckenridge station on the Pontiac and Pacific railway; a small selvage of the Calciferous limestone occupying the shore below high-water mark, in the upper part of this distance. East of Aylmer the shales extend to a point about two miles east of Conroy's Mills at Du Chene. They are also well seen along the line of the Electric railway till they are overlapped by the Chazy limestones west of Tetreauville. They do not appear along the north side of the Ottawa below this point with the exception of a very small outcrop along the road in Tetreauville near the fault between the Trenton and the Black River.

East of the city the Chazy comes prominently into view a short distance west of the Gatineau Ferry landing at Rockliffe. The contact between the Chazy shales and the Trenton limestones is indicated by a fault of considerable extent which is about ten chains west of the ferry landing, the nodular limestones of the Trenton there coming to the surface. Limestones, apparently all of Trenton age thence occupy the shore to the western side of the point below the upper ferry wharf, where they are in contact, also by a fault, with the Trenton limestones of New

Edinburgh and the Chazy and Black River limestones are apparently absent. East of Rockliffe, the Chazy shales extend to Beechwood, and thence continue along the south side of the Ottawa for some miles, appearing occasionally as far east as Point Fortune. At the South Nation River they are overlain, one mile south of the Ottawa, by the limestones of Black River age. The contact of these formations can also be well seen at Besserer's, Rockland, Cumberland and at several other places in this direction. A very small outcrop of the Chazy is also seen on the north-east angle of Fairy Lake, which is at the head of the Beaver meadow and about one mile north of Hull. This exposure is limited and the rocks which are shaly, are cut off by a well defined line of fault, separating them from the Black River formation. No other true Chazy rocks were observed to the east of the city of Ottawa.

The Black River and Trenton formations which come next in order, are well developed in the vicinity of Ottawa, but are very considerably affected by faults in this district. The outcrops of the former are not very numerous or extensive as compared with some of the others, but the formation is found at a number of points and is always characterized by its peculiar fossils, especially as regards corals. To the west of Ottawa, the Black River is seen at the Hog's Back and at the Experimental farm, near the Director's house. The limestones extend north to the Ottawa River at the foot of the Little Chaudiere rapid, whence they cross the river and appear in the village of Tetreauville. At all these places the Black River is separated by a fault from the limestones of the Trenton. The outcrop of the formation at Fairy Lake has already been referred to. The area at this place is small and there are two faults, one of which affects the Black River and the Chazy, while the other separates the Black River from the Trenton. A line drawn from the Hog's Back to the head of Fairy Lake, with a course of north twenty degrees

west, will cut all the points at which the line of fault between the Black River and Trenton are seen, though there are several minor breaks clearly visible at a number of places intermediate between the two extremities of this line. This fault is particularly well exposed at Tetreauville, along the railway and on the shore ; at Mechanicsville, at the west side of the deep cove, and on several of the roads in this village ; along the line of the Ottawa and Parry Sound railway, and at the Hog's Back. South of the Richmond road, near Skead's Mill, Black River limestones are also exposed to the line of the railway and these beds appear to pass beneath the escarpment of Trenton which occupies the area between that road and City View post office.

To the east of the city the beds of the Black River are seen at the entrance of Beechwood cemetery, overlaid by the Trenton on the south and east of this. In the direction of Green's Creek, this formation keeps to the north of the Montreal road in the vicinity of Robillard's quarries which are in the overlying Trenton. From this place it can easily be followed in escarpments and broad ledges to the crossing of the South Nation River, being well observed at Rockland and Clarence Creek about three miles south of the Ottawa. In this direction also almost continuous exposures are seen along the road between ranges II and III, Gloucester, for several miles, or nearly to the eastern line of Carleton county. The characteristic corals of the formation can be obtained in abundance at all these places. They are also well seen to the south of the village of Cumberland and form broad, nearly flat lying, ledges for a long distance.

West of the fault in Mechanicsville the limestones of the Black River are also well exposed along the line of the Canadian Pacific railway as far west as Skead's Mill corner, where the formation passes down into the Chazy.

The Trenton formation is probably the most widely distributed in the city of Ottawa and vicinity. It is also well de-

veloped in the neighboring city of Hull, all the quarries at this place being in the Trenton limestone while the characteristic cliffs about Ottawa are very conspicuous geological features.

In the eastern portion of the city, though rarely appearing at the surface, it is known to underlie the greater part of lower town, situated to the south of the canal and extending south almost to the head of the Deep Cut, and east as far as Chapel street, whence the limit of the formation crosses the Rideau about the east end of the railway bridge in the western part of New Edinborough. In Centre town the limestones occupy the hill on which the Parliament buildings are placed as far south as Wellington street where they are met by the overlap of the Utica shales, whence, from the corner of Bank street, the outline of the formation takes the form of a curve, the western line of which is a short distance west of Lyon, on Lisgar street. The line of the formation then curves eastward and reaches Bank street again near the Canada Atlantic tracks, whence, crossing the Bank street road, it follows a flat curve and returns to the west of the road again, a short distance to the north of the Rideau near Billing's Bridge. It then keeps close to the line of the canal as far as the enlargement or pond at Dow's Swamp, when the outline strikes south along the course of the Ottawa and Prescott railway, and the contact with the Utica is seen about half a mile west of what was formerly known as Chaudiere Junction. The limestones are also well exposed in quarries and outcrops to the south of Hog's Back and along the road up the south side of the river for several hundred yards, where they are underlain by the Black River formation To the east of this outline the country is mostly occupied by the dark bituminous shales of the Utica, which gradually pass upward into the overlying Lorraine formation, with its grey shales and sandy beds. A broad plateau of the Trenton is also seen about City View post office and to the north, resting upon the Black River

which occupies much of the country thence to the Ottawa

In the western portion of the city proper, the Trenton is well developed at many points. It constitutes the bold escarpment at the west of Maria and Lisgar streets, and can be seen in the cuttings along the line of the Ottawa and Parry Sound railway in the direction of Hintonburg. Good outcrops are exposed along the east side of the canal expansion on the road to the Experimental Farm as also to the west of that depression on the portion of the farm east of the fault which separates the Trenton from the Black River. Along the line of the Parry Sound railway a number of cuttings are seen in which the relations of the Trenton to the Black River can be well studied, and several instances of faulting are apparent. Some of these disturbances are in the beds of the Trenton entirely, while others affect the two formations. The strata at the contact dip at a high angle, or from fifty to seventy degrees, with a course of twenty to thirty north of west, magnetic. This is the same direction as noted in Tetreauville on the north side of the Ottawa, as also at Fairy Lake, where the contact of the two formations is similar, several faults being visible at both these places.

To the north of Hull on the road to Chelsea, the Trenton beds appear to overlap the other formations and the underlying strata are not exposed in this section, though this may be due to the great deposits of clay which cover so large an area west of the Gatineau. East of this river, where the continuation of this formation might naturally be looked for, the surface is also clay-covered for miles, but the outcrops which occasionally appear at no great distance back from the Ottawa are of gneiss, while at the mouth of the Wabassee Creek, three miles east of Gatineau Point, the Calciferous and Potsdam come to the shore of the river from the vicinity of Templeton station. There is apparently a line of fault in the direction of the lower Gatineau which separates the rocks of these two formations from the

prevailing Trenton beds which appear near the west side of that stream.

South and east of Ottawa the Trenton strata are again seen on the Montreal road at Robillard's quarries. They first appear on this road a short distance east of the road from the shore, between lots 24 and 25, where they are in contact with the Utica shales which extend south from Janeville. The contact is also well seen on the road which comes to the Montreal road along the east side of the Catholic cemetery, about two hundred yards north of the latter. These Trenton rocks thence extend eastward in the direction of Navan, overlying the Black River formation which is well exposed in large flat lying ledges along the second road north of the Ottawa in Gloucester, and already referred to. The contact of the Trenton with the Utica in this direction is about thirty chains north of the corner at Navan.

The Utica shales come in their proper place upon the Trenton in New Edinborough and thence westward they occupy the southern portion of the city past Billing's Bridge, sweeping south, however, near the east end of Dow's swamp but with a basin shaped area extending northward in the depression partly occupied by the pond in the direction of Cedar street. A limited area also occurs to the west of the canal, east of the pond which is apparently faulted in with the Trenton of this area. From the Pond the southern trend of the basin carries the west line of the Utica several hundred yards south of the Hog's Back, and brings it in contact with the Black River about half a mile west of the junction of the railway from New Edinborough with that from the Canadian Pacific station leading to Prescott. The southern edge of the Utica, to the south east of this place, meets the Calciferous by a line of fault which crosses the Rideau about two miles south of the Hog's Back, and this fault can be easily recognized on the Gloucester road about lot 18, range V, of Gloucester. From this place it can be seen at ntervals to the east for some miles.

The Utica is this direction appears to constitute a continuous basin for more than fifty miles which apparently extends to within a short distance of Vankleek Hill,occupying the valley of the South Nation for some distance and being underlain by the Trenton limestones which thence continue northward in the direction of the Ottawa. The width of the Utica shales in some portion of this area is not far from twelve miles and they are in turn overlain by the Lorraine shales and sandy beds, which in turn pass upward into the soft red shales of the Medina, so conspicuous in the townships of Osgoode and Russell and in the south-west part of Cumberland. Several minor undulations affect the strata of the several formations in this part of the district, but none of these have apparently resulted in greatly disturbing the beds, with the exception of the great fault between the Calciferous and the Utica. There are other faults visible in the northern portion of the Palæozoic basin, notably to the south of L'Original, where there is a break between the Chazy and the Black River or Trenton but this cannot be of great magnitude since both these formations are comparatively thin.

The foregoing will pretty well represent the distribution of the principal rock formations in the immediate vicinity of Ottawa, and in the extension of the basin to the east and west for some miles. It may be remarked that they are all readily recognized by their characteristic fossils, and large collections have been made from time to time, from many localities, both by the officers of the Geological Survey as also by several observers who are interested in the study of the geology of the district.

No attempt will be made in this paper to describe the glacial and post-glacial deposits of the area. These have already been discussed at some length by different members of the club, and large lists of the marine fauna, so abundant in the clays and gravels, have been published in the Club's Transactions.

The principal folds which affect the strata near Ottawa can be readily recognized. They occur both to the east and west of the city. Near Rochester street, on the line of the Canada Atlantic railway, one of these is seen to the north of the track, which disturbs the regular dip of the limestone to some extent, but affects only the strata of the Trenton, as these limestones continue west as far as the road south from Hintonburg. On the line of the Ottawa and Parry Sound railway, however, a short distance west of this road, there are several breaks in the strata, the dips increasing suddenly from five to sixty degrees. The first of these affects merely the Trenton limestones, but a second disturbance, a few yards further west, is more pronounced and brings the Trenton abruptly against the Black River limestones. The vertical extent of this fault cannot however be very great. It is however, of interest, from the fact that it can be traced for some miles both to the north and south. Thus if prolonged on a course of south twenty degrees east, magnetic, it will reach the faulted area at the Hog's Back, where however, several other breaks are seen, while on the other hand if traced northward, it can be recognized in the several streets of Hintonburg, and Mechanicsville, from which it can be followed across the Ottawa, through Tetreauville and out to Fairy Lake, the line connecting all these points being quite straight. At all these points the Trenton is brought into contact with the Black River. At Tetreauville, several other minor faults can be easily seen in the area between the Aylmer road and the river, some of which affect the Trenton beds ouly, as is the case with the disturbance along the post road into Hull at the pitch of the hill near Tétreauville. This disturbance can also be seen on the line of the Electric railway near the junction of the tracks to south of this village.

The portion of the Ottawa River between the foot of the Little Chaudiere rapids and the railway bridge shows a considerable breadth of disturbed strata. The broken character of the Trenton beds in this direction can be readily recognized among

the numerous islets which here occupy the channel, and this line of disturbance continues through the western portion of Hull. Along the Creek in the Beaver meadow, north of this place, a number of outcrops of Trenton limestone appear which are tilted at a moderately high angle, and this line of disturbance continues to the head of the Fairy Lake, where several faults are evident Thus, on the east side of the lake, strata of the Chazy shales, the Black River limestones and the Trenton can all be seen, while on the west side, descending the escarpment, not far from the south-west angle of the lake, tilted beds of Trenton are again exposed. These rest upon the Black River beds which can be followed thence to Tétreauville.

Along the river in front of the city, several small faults can be observed. One of these is to the west of the bluff on which the Parliament Buildings are placed, but this affects the beds of the Trenton only. At the end of Nepean point also, there is a small local area of disturbance in the usually horizontal strata of this place, but the displacement is apparently only slight. The faulted character of the beds between New Edinburgh and Rockliffe where the disturbances affect the Chazy and the Trenton has already been referred to.

In the area to the south of Clarkstown, near the entrance to Beechwood cemetery, a well defined fault can be seen near the angle of the road opposite the greenhouse. This fault brings the Utica shales against the Chazy, and is probably one of the most extensive in the Ottawa basin, as the Trenton and Black River formations have both disappeared.

One of the most interesting places at which one may readily study the Palæozoic formations of this district and also within easy reach of the city, is at the village of Rockland, about thirty miles down the river. At this place the whole series from the Laurentian to the Trenton can be well seen within the space of a couple of miles. The Archæan shews in a small outcrop in the vicinity of the steam mills near the wharf, and is there covered over by the basal or arkose beds of the Potsdam sandstone.

These pass upward in a few feet into the quartzose strata of that formation which form a well outlined escarpment nearly forty feet in hight, and these in turn are succeeded upward by the calcareous portion of the Calciferous which forms another escarpament. The Calciferous limestones occupy the greater part of the village of Rockland and can be well seen along the main road through this place. This formation is covered by the Chazy shales in the flat area to the south, in the direction of the Stewart quarries. The Chazy limestones are not so well seen at this point, but the base of the steep escarpment, about one mile south of the Ottawa, is occupied by the limestones of the Black River while the Trenton beds occupy the upper portion of the same escarpment. In this way we can very readily study the peculiar features of the several formations and with very little unnecessary travelling. A paper on the geology of a part of this district was read several years ago by Dr. Ami and the relations of the Black River and Trenton were pointed out.

In the present paper it has been possible to state, in the briefest manner only, the principal points of interest in the district under consideration. It will however serve, possibly, to call the attention of those interested in the geology and palaeontology of the area to a number of places in our immediate neighborhood, and in this way may be of some practical benefit. There are many localities in the vicinity of Ottawa and Aylmer which will yield a rich harvest to the diligent collector, if the work is systematically done, as the study of the fauna in the strata of this vicinity, has been by no means exhausted.

BRITISH ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

The 67th annual meeting of the British Association for the Advancement of Science has been held in Canada, and as on the occasion of the Association's visit to Montreal, in 1884, has proved a great success. The attendance of members from Great Britain and America was very gratifying. One interesting feature of the gathering was the joint action or co-operation of the American Association for the Advancement of Science, which sent not less than 800 of its members and officers from the Detroit meeting to Toronto. The President of the Association was the distinguished physician Lord Lister, the President-elect, Sir John Evans, K.C.B., For. Sec. Geol. Soc. London.

There were many distinguished men of Science present at this Toronto meeting, and it would be impossible in a brief sketch like this to give a detailed list of all. Lord Kelvin, better known to many as Sir Wm. Thompson or Professor Thompson of Glasgow University, was a conspicuous figure throughout these meetings, and his jovial face coupled with his lucid remarks at all times attracted those who were fortunate enough to listen to him. Prof. Rücker, Prof. Roberts-Austen, Prof. C. LeNeve Foster, Prof. I. C. Miall, Prof. Michael Foster, Prof. Herdman, Prof. Sir Wm. Turner, Prof. R. Meldola, Prof. A. D. Waller, Mr. J. Scott Keltie; the Rt. Hon. James Bryce, M.P. Prof. J. Milne, Dr. H. R. Mill, Mr. A. C. Seward, M.A., Prof. W. T. Blanford, Prof. Lamplough, Prof. H. A. Miers, and a score of other specialists of Europe contributed much by their energies and guidance in the affairs of the British Association meetings to make them both exceedingly useful and practical, exhibiting at all times a most business like character.

Not less than 800 papers on various topics of live scientific interest were presented and read at this meeting. The discussions which followed many of these were of a most interesting nature, and the cosmopolitan character of scientific researches was demonstrated beyond expression: the views of workers in one field of science in Europe were freely

discussed by those engaged carrying on similar researches in North America, or *vice versa*, and the interchange of ideas always brought light with it.

Of foreign or European members and delegates there were :—Prof. Albrecht Penck, Prince Kropotkin, Dr. Dorhn, Mons. C. Richet, Sir George Robertson, Mr. F. C. Selous, Prof. Brauner, Prof. Meslans, Prof. Lloyd Morgan, Prof. Richards, whose interesting papers captivated the attention of all who had the pleasure of listening to them in their respective sections.

The United States of America contributed not a little to the success of these meetings and the papers read were of a high type. Among those who took an active part in the work of the various sections from the United States were :—Prof. W. J. McGee, Prof. G. K. Gilbert, Prof. Simon Newcombe, Dr. A. F. Chamberlin, Dr. W. M. Davis, Dr. R. E. Dodge, Mr. F. B. Taylor, Prof. Mendenhall, Prof. E. W. Claypole, Prof. H. L. Fairchild, Prof. Homer T. Fuller, Prof. F. W. Putnam, Dr. Wm. Osler, Prof. Bailey Willis.

Of Canadians, who read papers in various sections of the British Association, we note the following from our note-book :—Dr. G. M. Dawson, Mr. J. F. Whiteaves, Prof. A. B. Macallum, Dr. A. P. Coleman, Prof. R. Ramsay Wright, Dr. R. W. Ells, Prof. E. E. Prince, Prof. James Mavor, Dr. Wm. Saunders, Prof. D. P. Penhallow, Dr. F. D. Adams, Prof. B. J. Harrington, Prof. H. T. Bovey, Prof. L. W. Bailey, Messrs. J. B. Tyrrell, A. E. Barlow, James White, W. F. Ferrier ; Professor J. Fowler, and Drs. W. W. Andrews, G. T. Kennedy, and J. W. Spencer.

Among the Canadians who occupied prominent positions in the various sections we note :—Dr. G. M. Dawson, President of Section C. Geology ; Prof. A. Johnson, J. C. Glashan, Prof. J. G. MacGregor, in Section A ; Drs. Ellis and Ruttan, Prof. Pike and Prof. Harrington, in Section B, Chemistry ; Prof. Coleman, Secretary of Section C ; Prof. R. Ramsay Wright and Prof. Prince, in Section D, Zoology ; Prof. Burwash, Capt. Deville, Mr. J. B. Tyrrell, in Section E, Geography ; Prof. J. Mavor and Prof. Adam Shortt, in Section F ; Prof. Bovey, Prof. Galbraith, Profs. Callendar and Dupuis in Section G ; Prof. Macallum,

in Section I, Physiology; Prof. Penhallow and Dr. Jeffrey, in Section K, Botany.

Too much praise cannot be given to the very energetic and painstaking General Secretary of the British Association, Prof. Griffith; also to Prof. John Hopkinson, of the General Conference Committee, and to the gentlemen of the Local Committee: Mr. B. E. Walker, Dr. Macallum, Prof. R. R. Wright and Mr. J. S. Willison. It would take too much space to give an exhaustive account of the papers read even by the members of our Club who were present at those meetings, much as we should be disposed to publish abstracts of their papers. These abstracts will appear in the Annual Volume of the Association. A paper of general interest presented before the General Conference Committee of the Association and dealing with "Museums in Canada," was ordered to be printed in extenso and we hope to give a synopsis of the same at a future date.

An outcome of the British Association meeting in Toronto was the appointment of a Committee to investigate and report upon the suitability of a site as a Canadian Biological Station. Cache Lake has been visited and its suitability practically established. The Committee to investigate this matter consisted of Professors E. E. Prince, (Ottawa); Ellis, Toronto; Miall, England; Wright, Toronto; and Dr. G. M. Dawson, Ottawa.

A sum of money has also been placed at the disposal of a Committee, consisting of Sir Wm. Dawson, Prof. A. P. Coleman, Prof. D. P. Penhallow, Mr. G. W. Lamplough, and the writer, to investigate the Pleistocene flora and fauna of Canada.

Various other committees were struck as usual, and grants of money made for specific scientific purposes. H. M. A.

ANNUAL MEETING.

The Annual Meeting of the Ottawa Field-Naturalists' Club for the Election of Officers, reception of reports, and the transaction of other business, will be held on Tuesday, March 15th, at 8 p.m., in the Y. M. C. A. Hall.

THE OTTAWA NATURALIST.

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THE CRYPTOGAMIC FLORA OF OTTAWA.

BY PROF. JOHN MACOUN, M.A., F.L.S., F.R.S.C.

Continued from December No.

163. **R. pseudo-serrulatum**, Kindb.

Leaves ovate or ovate-oblong, minutely denticulate, striate and chlorophyllose, not or indistinctly decurrent; cells lanceolate, the lower shorter and more dilated; costa thin, vanishing above the middle. Stem leaves, short-acuminate or filiform-pointed; branch-leaves with short subulate sometimes twisted point. Capsule arcuate; lid apiculate; pedicel rough very long. Stem subpinnate or irregularly divided. Tufts dark green, faintly glossy, radiculose at the base. Monœcious. Habit of *R. serrulatum*.

On earth and small stones in McKay's Woods near the lake, Oct. 12th, 1889,

164. **R. serrulatum**, (Hedw.)

On earth in McKay's Woods, Sept. 6th, 1889.

165. **R. rusciforme**, (Weis.) Schimp.

Abundent on stones in the brook that discharges Kingsmere four miles west of Chelsea, Que., Sept. 9th. 1889.

Var. **inundatum**, Kindb.

On rocks in the brook which discharges Kingsmere four miles west of Chelsea, Que., Sept. 9th, 1889; on rocks in a brook discharging into Meeche's Lake, north of Chelsea, Que., Sept. 23rd. 1893.

LVI. THAMNIUM, Schimp.

166. **T. Alleghaniense** (C. Muell.) Bruch and Schimp.

In crevices of thick bedded limestone rocks near McKay's Lake under ledges along the cliffs Rockliffe Park, April 22nd, 1896.

LVII. PLAGIOTHECIUM, Schimp.

167. **P. Passaicense**, Aust.

On cedar stumps and trees in Dow's Swamp, Sept. 6th, 1889.

168. **P. turfaceum**, Lindb.

Common on stumps in Dow's Swamp,Oct. 20th, 1885 ; on stumps at Carleton Place, May 30th, 1884 : and on stumps "Pine Hill," Rockliffe Park, April 16th, 1896 ; on stumps west of Hull, Que., Oct. 24th, 1884.

169. **P. denticulatum**, (L.) Bruch and Schimp.

On the bases of trees at Britannia, Sept. 11th, 1890.; in the swamp north of Beechwood Cemetery, Oct. 12th, 1889 ; on stumps in the Swamp along Bank street, on the Glebe property, April 27th, 1896; on earth Eastman's Springs, Aug. 26th, 1890 ; on base of trees Carleton Place, Oct. 30th, 1884.

170. **P. sylraticum**, Bruch and Schimp.

On earth in damp woods borders of Dow's Swamp, Oct. 16th, 1884.; also in wet woods at Britannia, Sept. 14th, 1891.

171. **P. Sullivantiæ**, Schimp.

On earth on limestone ledges along the cliff north side of Rockliffe Park, May 7th, 1896 ; on earth at the roots of trees Meeche's Lake, north of Chelsea, Que., Sept. 23rd, 1893.

172. **P. membranosum**, Kindb.

Tufts dense, green and glossy. Leaves distichous, crowded and patent, flat. ovate-oblong, acute or short-acuminate, estriate, entire or denticulate above the middle, decurrent ; cells very long and narrow, the alar large hyaline and subquadrate ; costa none or obsolete. Capsule cylindric-obovate, horizontally curved ; teeth yellow ; pedicel smooth, 2 cm. long. Lid unknown. Probably dicœcious.

On dead wood in Dow's Swamp, Oct. 17th, 1884.

173. **P. brevipungens**, Kindb.

Tufts dense, dark green. Stems prostrate, irregularly pinnate ; branches attenuate. Leaves crowded, scarcely decurrent, ovate-oblong, acute or short-pointed, auricled, not plicate nor reflexed on the borders, entire or slightly denticulate at the apex ; upper cells long and narrow, the alar very distinct, quadrate, inflate and hyaline ; costa very short, thick and simple or none. Capsule curved ; lid short, conical ; pedicel smooth. Monœcious.

On stones in McKay's Woods opposite the entrance to Beechwood Cemetery, May 21st, 1885.

174. **P. attenuatirameum**, Kindb.

Tufts green, faintly shining, loose, with few rhizoids. Primary stem very short ; branches elongate, long-attenuate, finally flagelliform. Leaves sub-distichous, the lower broadly ovate, obtuse or obtusate,

entire, long-decurrent, concave, recurved at the borders from the base to the middle, at least at the one side ; cells chlorophyllose, somewhat dilated, the lowest very much wider and shorter, nearly uniform ; costa generally short and double, rarely simple and reaching to the middle ; the other leaves gradually smaller, narrower and more acute or acuminate. Barren.

On rocks in Gilmour's Park, Chelsea, Que., Sept. 6th, 1889.

LVIII. AMBLYSTEGIUM, Schimp.

175. **A. Sprucei,** Bruch. and Schimp.

On old cedar stumps in Dow's Swamp, Oct. 16th, 1884.

176. **A. subtile,** Bruch. and Schimp.

On the bases of large trunks in McKay's Woods, Oct. 10th, 1889 ; on the borders of Dow's Swamp, Oct. 16th, 1884 ; in Beechwood Cemetery, April 28th, 1896; also at Hog's Back, May, 1897.

177. **A. confervoides,** Bruch. and Schimp.

On flat limestone rocks in woods north of the Experimental Farm ; along the Ottawa, west of Hull ; and in McKay's Woods near the Lake, Sept. 9th, 1889 ; also on the cliffs and flat rocks, Rockcliffe Park, April 16th, 1896.

178. **A. Yuratzskæ,** Schimp.

On dead wood, stones and bases of trees, McKay's Woods, Oct. 12th, 1889 ; on earth at Dow's Swamp, Oct. 16th, 1884 ; on stones in Beechwood Cemetery, May 21st 1885.

179. **A. serpens,** Bruch. and Schimp.

On earth in woods and at the roots of trees ; common ; on roots of trees, Rockcliffe Park, May 7th, 1896; at the base of trees, Hog's Back, May, 1897.

180. **A. porphyhizum,** (Lindb.) Schimp.

On stones in McKay's Woods, Aug. 26th, 1889 ; also in woods at Carleton Place, Sept. 25th, 1889.

181. **A. varium,** (Hedw.) Lindb.

On stones in damp parts of McKay's Woods and Beechwood Cemetery, Oct. 12th, 1889 ; on stones at Leamy's Lake, Hull, Que., 1896.

182. **A. fluviatile,** Bruch. and Schimp.

On stones in the brook that discharges Kingsmere, four miles west of Chelsea, Que., Sept. 9th, 1889 ; on rocks in a brook at Meeche's Lake, north of Chelsea, Que., Sept. 23rd, 1893.

183. **A. curvipes,** Guemb.

In pools in Dow's Swamp, Oct. 16th, 1884.

184. **A. adnatum,** (Hedw.) Lesq. and James.

On flat stones in McKay's Woods, May 16th, 1885 ; and in woods west of Hull, Que. ; on " Pine Hill," Rockcliffe Park, April, 16th, 1896.

185. **A. compactum**, (C. Muell.) Bruch. and Schimp.

On decayed wood in a swamp at Carleton Place, May 30th, 1884.

186. **A. riparium**, Bruch. and Schimp.

On sticks and roots in pools in woods near St. Patrick's Bridge; also in the swamp north of Beechwood Cemetery, Oct. 12th, 1884.

LIX. HYPNUM, Linn.

187. **H. hispidulum,** Brid.

On the bases of trees around Ottawa ; on earth at Carleton Place, 30 miles from Ottawa, Sept. 25th, 1889 ; bases of trees, Gilmour Park, Chelsea, Que., Sept. 9th, 1889.

188. **H chysophyllum,** Brid.

On earth and roots of trees at Ottawa, Aug 26th, 1889 ; common at Carleton Place, May 30th, 1884 ; on the cliff facing the Ottawa River, Rockcliffe Park, April 22nd, 1896.

189. H. **Sommerfeltii,** Myrin.

On earth at the bases of trees at Ottawa, Aug. 26th, 1889 ; on old logs near Leamy's Lake, Hull, Que., Nov. 9th, 1896.

190. **H. unicostatum,** C. M. and Kindb.

Differs from *Hypnum chysophyllum* in the dense tufts, the stem more irregularly branching, creeping, the leaves shorter-acuminate, the alar cells smaller, not yellow, the costa more distinct, the capsule smaller, the perichetial leaves gradually acuminate-subulate or filiform-pointed with acumen arcuate.

On earth in the Mer Bleue, close to the sulphur spring, near Eastman's Springs, Oct. 4th, 1890.

191. **H. Kneiffii,** (Bruch. and Schimp.)

Bogs and swamps. In swamps north of Beechwood Cemetery, Oct. 22th, 1889 ; also in Dow's Swamp ; in a bog at Britannia, six miles west of Ottawa, Sept. 14th, 1891; in a swamp near Hog's Back, 1897.

Var. **laxum**, Kindb.

In Dow's Swamp, Oct. 12th, 1884.

Var. **rectifolium**, Kindb.

On damp rocks in McKay's Woods, Aug. 26th, 1889.

Var. **platyphyllum**, Kindb.

Leaves very broad and short-acuminate.

On damp rocks in woods east of the end of the Electric Road, Rockcliffe Park, Aug. 26th, 1889.

192. **H. Sendtneri**, Schimp.

In water in Dow's Swamp; in a bog at Britannia, six miles west of Ottawa, Sept. 14th, 1891.

193. **H. fluitans**, Linn.

In a swamp along the Beaver Meadow west of Hull, Que., Oct. 16th, 1891; in boggy places north of Beechwood Cemetery and McKay's Lake, Sept. 25th, 1889.

194. **H. uncinatum**, C. M. and Kindb.

Quite common in wet woods north of Beechwood Cemetery, Oct. 12th, 1889; in Dow's Swamp and at the Hog's Back, May 22nd, 1897; also in the Mer Bleue, Oct. 4th, 1890.

195. **H. conflatum**, C. M. and Kindb.

Allied to *Hypnum Kneiffii*. Stem slender, subfiliform, distantly pinnate, not radiculose. Leaves small, concave, distant, denticulate all around; stem leaves decurrent, from a broad-ovate base suddenly narrowed into a very short, subulate-filiform, straight point; alar cells very large, hyaline or faintly yellowish, the other nearly uniform, oblong-lanceolate, conflate; costa pale-yellow, vanishing in the acumen; branch leaves narrower, oblong-lanceolate, more or less short-acuminate, curved or straight. Capsule very small, arcuate and contracted below the mouth. Dicœcious.

In a swamp near Britannia, six miles west of Ottawa, Sept. 14th, 1891.

196. **H. rugosum**, Linn.

On dry rocks along the exposed cliffs facing the Ottawa River, Rockcliffe Park, April 22nd, 1896.

197. **H. crista-castrensis**, Linn.

On logs and on earth in damp woods around Ottawa. Collected near McKay's Lake, April 28th, 1896; in Dow's Swamp and at Casselman.

198. **H. molluscum**, Hedw.

On old logs in Dow's Swamp, Sept. 9th, 1889; on logs near the Lake in McKay's Woods, April 28th, 1896.

199. **H. reptile**, Michx.

Abundant on trunks of trees in woods around Ottawa. On trunks "Pine Hill," Rockcliffe Park, April 14th, 1896 ; on old logs in Beechwood Cemetery and along the Aylmer Road, Oct. 12th, 1887.

200. **H. pallescens**, Schimp.

On limestone rocks on an old stone fence along the Aylmer Road, near Tetreauville, west of Hull, Que., Sept. 24th, 1891 ; on boulders along the road leading east from the end of the Electric Road, Rockcliffe Park, May 7th, 1896.

201. **H. Canadense**, Kindb.

On old logs and stones at Rockcliffe near the end of the Electric Road, Rockcliffe Park, May 7th, 1886 ; on stones in woods west of Hull, Que., Sept. 11th, 1891 ; on rocks in Rockcliffe Park, Sept. 25th, 1889.

202. **H. fertile**, Sendt.

On old logs at Casselman, June 11th, 1892.

203. **H. imponens**, Hedw.

Common on rotten logs around Ottawa, at Chelsea and Casselman.

204. **H. arcuatiforme**, Kindb.

Tufts dense, green, not glossy. Stem creeping, subpinnate. Leaves arcuate, ovate-lanceolate, generally short-acuminate or sub-obtusate, entire, decurrent, not striate ; alar cells large, well-defined, orange, the other pale and narrow ; costa none or short and double. Capsule subcylindric, curved, not striate nor furrowed, constricted below the wide mouth ; teeth when dry incurved, pale-yellow, hyaline-margined ; cilia long, appendiculate ; pedicel about 3 cm. long. Probably dioecious. Resembles in habit *Hypnum cupressiforme*. Lid and male flowers not found.

The allied *Hypnum Lindbergii*, Mitt. (*H. arcuatum*, Lindb.) differs at once in the not creeping, irregularly divided stem, the shorter pedicel, the larger capsule, &c.

On earth near the gate of Beechwood Cemetery, Sept. 29th, 1889

205. **H. Renauldii**, Kindb.

Agrees with *Hypnum curvifolium* in the stem being more or less pinnate, the inner basal leaf-cells finally yellow ; with *Hypnum Lindbergii* in the leaves being decurrent, alar cells very much dilated, the capsule not plicate in a dry state ; differs from both in the entire leaves. *Hypnum pratense* differs in the leaves not being striate nor decurrent, and alar cells not evolute.

On earth near the small lake at the head of the Beaver Meadow, west of Hull. Que., May 14th, 1891.

206. **H. curvifolium**, Hedw.

On old logs in damp or swampy woods around Ottawa.

207. **H. Lindbergii**, Mitt.

On earth on rocks along Leamy's Lake, Hull, Que., Nov. 9th, 1896.

208. **H. Haldanianum**, Grev.

Abundant on rotten logs around Ottawa. In woods at Leamy's Lake, Chelsea, Ironsides and Meeche's Lake, Que.; in woods at the south end of Cowley's Farm, west of Hintonburgh, April 18th, 1896; on logs in Beechwood Cemetery, Oct. 12th, 1889; rotten logs at Casselman, Aug. 20th. 1884.

209. **H. pseudo-drepanium**, C. M. and Kindb.

Tufts loose, green, faintly glossy. Secondary stems very long, flaccid, subpinnate, sparingly radiculose, faintly compressed; paraphyllia none; branchlets very short, curved at the apex. Leaves plicate, entire, from a short broad-ovate base narrowed into a short-incurved, acute acumen, crowded, loosely appressed when dry, not decurrent, not distinctly chlorophyllose; basal cells hyaline, dilated (the inner sometimes yellowish (thick-walled, the alar large sub-rectangular, well-defined, the other longer and narrower; auricles excavate; costa indistinct or short and double. Dicœcious. Female plants not found.

On old logs in Dow's Swamp, Sept, 16th, 1889.

210. **H. stramineum**, Dicks.

In the Mer Bleue, near Eastman's Springs.

211. **H. cordifolium**, Hedw.

In wet woods and swamps; in holes in Dow's Swamp; in pools in the swamp north of Beechwood Cemetery, May 12th, 1897; swamp west of Hull, Oct. 16th, 1884.

212. **H. Richardsoni**, (Mitt.) Lesq. and James.

In water along the south end of McKay's Lake, near Beechwood Cemetery, Sept. 26th, 1893.

213. **H. giganteum**, Schimp.

In the spring creek in Dow's Swamp; also in the Beaver Meadow creek, west of Hull, Que., Oct. 3rd, 1893.

214. **H. Schreberi**, Willd.

Abundant on earth in old woods around Ottawa. In shady woods, Rockcliffe Park, April 22nd, 1896.

LX. HYLOCOMIUM, Schimp.

215. **H. splendens**, (Hedw.) Schimp.

Very abundant in damp woods everywhere around Ottawa. In shady woods along the cliff facing the Ottawa River, Rockcliffe Park, April 22nd, 1896 ; Casselman, Aug. 20th, 1884.

216. **H. brevirostre**, Schimp.

On damp rocks near High Falls, Lievre River, near Buckingham, Que., May 19th, 1884.

217. **H. triquetrum**, (Linn.) Schimp.

Very common in old cool or damp woods. In shady woods along the cliff facing Ottawa River, Rockcliffe Park, April 22nd, 1896 ; Casselman, Aug. 20th, 1884.

218. **H. pyreniacum**, (Spruce) Lind.

On rocks by a brook, Meeche's Lake, north of Chelsea, Que., Sept. 23rd, 1893 (*Addendum.*)

219. **Didymodon trachneuron**, Kindb. (Just published)

Leaves short-attenuate, subacute, brittle ; costa pale, papillose at back, sometimes excurrent. Tufts low, green. Capsules unknown.

On large boulders in a brook near North Wakefield, Que., Sept. 13th, 1893. (J. M. Macoun)

220. **Grimmia arctophila**, Kindb.

Leaves ovate oblong, involute above, suberect when moist, appressed when dry, the uppermost not larger, basal cells generally short, the upper short-opaque ; hair point not long; capsule sub-oblong, brownish ; lid apiculate ; annulus indistinct ; pedicel straight. Tufts generally cohering, blackish when dry, about 3 cm. high.

On rocks, Paugan Falls, on the Gatineau River, Que , Aug. 24th, 1894.

HEPATICÆ (LIVERWORTS).

I. FRULLANIA, Raddi.

221. **F. Eboracensis**, (Gottsch.) Lehm.

Very common, especially on beech trees in all the old woods around Ottawa. On bark of various trees, especially beech at Cassel-

man, Eastman's Springs. Carleton Place, Chelsea and near Hull ; on beech trunks, Pine Hill, Rockcliffe Park, April 16th, 1896 ; Beechwood Cemetery' on beech trees, Oct. 14th, 1884 ; on trees at Leamy's Lake, Hull, Que., Sept. 6th, 1889.

II. LEJEUNEA, Libert.

222. **L. calcarea**, Libert.

On the bases of cedar (*Thuya occidentalis*) trees in Dow's Swamp, Sept. 21st, 1889 ; on cedar bark in woods, Rockcliffe Park, April 22nd, 1896. Very rare.

III. RADULA, Dumortier.

223. **R. complanata,** Dumort.

Very common on rocks and the roots and bases of trees in woods around Ottawa. On rocks and trees in rear of Cowley's Farm, west of Hintonburg, at Chelsea, Kingsmere, Meeche's Lake, and near Hull, Que. on trees at Britannia and Carleton Place ; very common in Beechwood Cemetery and McKay's Woods, April 14th, 1896 ; on rocks along the Ottawa River, Rockcliffe Park, Oct. 16th, 1889.

IV. PORELLA, Dill.

224. **P. platyphylla**, (L.) Lindb.

Very common on the bases of trees by brooks and on ledges of damp limestone rocks around Ottawa. On trees by the brook in rear of Cowley's Farm, west of Hintonburg, April 18th, 1896 ; also on trees at Leamy's Lake, Hull, and on rocks near Tetreuville, west of Hull, Que., Oct. 12th, 1887 ; on trees in the swamp, Beechwood Cemetery, Aug. 24th, 1884.

V. PTILIDIUM, Nees.

225. **P. ciliare,** Nees.

Very common on old logs and rocks. On old logs, Beechwood Cemetery, McKay's Woods, and Rockcliffe Park, April 14th, 1896 ; in woods at Carleton Place, Eastman's Springs and Casselman ; Chelsea and Kingsmere, also Leamy's Lake, Hull, Que., Oct. 12th, 1884.

VI. TRICHOCOLEA, Dumortier.

226. **T. tomentella**, (Ehrh.) Dumort.

In moss in a swamp at Meeche's Lake, north of Chelsea, Que., Sept. 23rd, 1893 ; in moss in Dow's Swamp, May 2nd, 1896.

VII. BAZZANIA, S. F. Gray.

227. **B. trilobata**, S. F. Gray.

On old logs and stumps in swamps and wet woods around Ottawa.

In Dow's Swamp, Oct. 12th, 1884 ; and on old logs, McKay's Woods, April 28th, 1895.

VIII. LEPIDOZIA, Dumortier.

228. **L. reptans**, Dumort.

On old logs and stumps in cedar and other swamps. In the swamp near the head of the Beaver Meadow, west of Hull, Que., April 18th, 1896 ; in Dow's Swamy, May 2nd, 1896 ; on old logs, Cassselman, Aug. 20th, 1884.

IX. BLEPHAROSTOMA, Dumortier.

229. **B. trichophyllum**, Dumort.

On very rotten logs and stumps in swamps and wet woods ; also earth and stones. On rotten wood in Dow's Swamp, May 2nd, 1896 ; on olc logs in Beechwood Cemetery, May 8th, 1895 ; in a swamp at Casselman, June 18th, 1894.

X. CEPHALOZIA, Dumortier.

230. **C. Virginiana**, Spruce.

On old logs in damp woods. On rotten wood in Beechwood Cemetery, May 9th, 1885.

231. **C. multiflora**, Spruce.

Very common on rotten wood in damp woods and swamps. On rotten wood in Dow's Swamp, May 2nd, 1896 ; also in the swamp on the Glebe property, Bank St., Ottawa, April 27th, 1896 ; on stones and old logs near Experimental Farm, April 16th, 1892 ; on old logs, Beechwood Cemetery, May 9th, 1885 ; on dead wood, Moose Creek, Sept. 5th, 1891 ; also at Eastman's Springs, Sept. 29th, 1892.

232. **C. divaricata**, Dumort.

On dead logs in a swamp north of the Experimental Farm, April 16th, 1892.

233. **C. pleniceps**, (Aust.)

On rotten wood and on stones around Ottawa. Rotten wood in the swamp opposite the entrance to Beechwood Cemetery, Oct. 12th, 1884 ; on stones in the brook by McKay's Lake, Aug. 26th, 1884.

234. **C. bicuspidata**, Dumort.

On rotten wood in Dow's Swamp, May 2nd, 1896 ; rotten wood in the swamp opposite the entrance to to Beechwood Cemetery, May 9th, 1885.

235. **C. curvifolia**, (Dicks.) Dumort.

On old logs in the swamp west of the old entrance to Beechwood Cemetery, May 8th, 1885.

XI. ODONTOSCHISMA, Dumortier.

236. **O. denudata**, (Mart.) Lindb.

On a pine log in Beechwood Cemetery, May 9th, 1895.

XII. KANTIA, S. F. Gray.

237. **K. Trichomanis**, (L.) S. F. Gray.

On dead wood in swamps and wet woods around Ottawa. Damp woods, Carleton Place, 30 mmiles west of Ottawa, May 20th, 1884 ; on dead wood in a swamp north of the Experimental Farm, April 16th, 1892.

XIII. SCAPANIA, Dumortier.

238. **S. glaucocephala**, (Tayl.) Aust.

On elm and other logs at Ottawa. Along the Beaver Meadow, Hull, Que , Sept. 23rd, 1883 ; on old logs, Dow's Swamp, Oct. 20th, 1884.

239. **S. curta**, (Mart.)

On logs in Rockcliffe Park, Sept. 24th, 1897 ; in Dow's Swamp on old logs, Oct. 5th, 1884.

240. **S. nemorosa**, (Linn.) Dumort.

On rotten logs by a brook at Meeche's Lake, north of Chelsea, Que., Sept. 23rd, 1893 ; on earth on a wet bank by the Rideau River at the Hog's Back, May 14th, 1897.

XIV. GEOCALYX, Nees.

241. **G. graveolens**, (Schrad) Nees.

On dead wood and old stumps in the swamp on the Glebe property, Bank St., Ottawa, April 27th, 1896 ; on earth in a swamp north of the Experimental Farm, April 16th, 1892 ; on rotten logs in Dow's Swamp, Oct. 16th, 1885 ; on dead logs near Leamy's Lake, Hull, Que , April 23rd, 1892.

XV. LOPHOCOLEA, Dumortier.

242. **L. bidentata**, (Linn.) Dumort.

On rotten logs at Eastman's Springs, 12 miles from Ottawa, Sept. 27th, 1892.

243. **L. minor**, Nees.

On limestone rocks and calcareous earth, Rockcliffe Park, April 22nd, 1896; on rocks at Carleton Place, May 30th, 1884; on dead wood in Dow's Swamp, Sept. 4th, 1889; on rocks north of Experimental Farm, April 16th, 1892.

244. **L. Macounii,** Aust.

On rotten wood, in woods west of the Beaver Meadow, Hull, Que., Sept. 23rd, 1883.

245. **L. heterophylla,** (Schrad.)

Quite common on rotten wood in swamps and wet woods at Ottawa. On rotten wood at Hintonburg, April 18th, 1896; on elm logs, Moose Creek, Sept. 6th, 1891; on rocks north of Experimental Farm, April 16th, 1892; on old logs, Beechwood Cemetery, April 23rd, 1892; by Leamy's Lake, Hull, Que., Sept. 29th, 1889.

XVI. PLAGIOCHILA, Dumortier.

246. **P. porelloides**, (Torrey.) Lindb.

Common on earth and old logs along brooks at Ottawa. On old logs in the swamp near the entrance to Beechwood Cemetery, April 28th, 1896; on logs in Dow's Swamp, 16th Oct., 1889; on damp rocks, Meeche's Lake, Hull, Que., Sept- 24tb, 1893.

247. **P. asplenioides**, (Linn.) Dumort.

On earth in wet woods at Ottawa, April 24th, 1885; on the margin of the brook west of Victoria Park, May 9th, 1884; on wet rocks in a brook at Meeche's Lake. Que.. Sept. 23rd, 1893.

248. **P. interruptus**, (Nees.) Dumort.

On earth in Dow's Swamp, Sept. 24th, 1889.

XVII. HARPANTHUS, Nees.

249. **H. scutatus**, (Web. and Mohr.) Nees.

On rotten logs in McKay's Woods, April 28th, 1896; also in woods at Leamy's Lake, Hull, Que., 16th Oct., 1892.

XVIII. JUNGERMANNIA, Micheli.

250. **J. Schraderi**, Mart.

On dead logs in damp woods and swamps around Ottawa. On old logs in the swamp in rear of Cowley's Farm, west of Hintonburg, April 18th, 1896; Dow's Swamp, 1885; at Carleton Place, 1884; on old logs, Experimental Farm. April 16th, 1891.

BIRD NOTES FOR DECEMBER.

The following notes were sent in by Mr. W. T. Macoun, Associate Editor in Ornithology :

FOX SPARROW.—On the 4th of December I observed a fox sparrow on the Aylmer Road. This is a very late date for this sparrow.

BRUNNICH'S GUILLEMOT—On Sunday the 12th of December this bird passed up the Ottawa river in large numbers, in fact there were considerably over one thousand. The birds, in flocks of from 20 to 100, were passing Rockliffe from 10 a.m. until 3 p.m. Several were shot. On Monday the 13th inst., one was caught alive in a field between Metcalfe and Osgoode stations, which lived for two days. On examination, the stomach was found empty. All of the birds obtained were in very poor condition.—GEO. R. WHITE.

PINE GROSBEAK—A small flock of Pine Grosbeaks was seen by Mrs. Ridley, of Vittoria street, eating mountain ash berries, on the 21st December. This is the earliest date recorded for this winter.—W. T. MACOUN.

THE WESTERN AMERICAN GOSHAWK, *Accipiter atricapillus* var. *striatulus* is hardly entitled to sub-specific rank and should only be regarded as a geographical race, as complete *intergrading* occurs, and the adults, unless typical, are inseparable. West of the Cascades the dark form (*striatulus*) is resident, the typical form only occurring in winter; here, at Vernon, B.C., in the Okanagan district, I believe both forms breed, and I have taken very dark plumaged young (in the beginning of August) in the Gold Range district, forty miles to the east. There are, I think, no differences in the markings of the two forms, at all events in the adult; the whole difference lies in the darker plumage of the western form. Typical young of each form look very different, but are not nearly so constant as the young of *Fales columbarius* and *F. columbarius suckleyi*, as to markings. As a rule the adult of the western form has a scarlet, and the eastern, an orange or yellow iris, but this is not to be relied on. However, the two forms are more entitled to separation than the four sub-

species of Ruffed Grouse, or the Great Horned Owls ; typical specimens of all the sub-species of these birds can be taken here, in one district, except perhaps, *B. Virginianus arcticus*.—ALLAN C. BROOKS, Vernon, B.C.

THE AMERICAN GOSHAWK, *Accipiter atricapillus*—This beautiful hawk is rare at Ottawa although occasionally seen. When seen flying it looks to be almost white. Mr. W. E. Brooks, now of Mount Forest, Ont., but who has done good ornithological work in India and British Columbia, writes under date Dec. 10th, 1897 : "I got a fine female *Accipiter atricapillus* last week which measured 24 inches, and a Snowy Owl, *Nyctea nyctea*, about a week before. Goshawks were much more common at Chilliwack, B.C., than they are here. They used to take our poultry, and sometimes pounced upon mallards I had shot, before I could pick them up ; but the Goshawk could not carry off a mallard and was easily secured as well as the duck."—J. FLETCHER.

AN ALBINO SPARROW.—An almost white variety of *Passer domesticus*, Linn., frequented one of the public squares of Montreal during the year 1897. It was a dirty white, having the feathers which characterise the ordinary male bird, of a dun color. I watched, at the close of the nesting season for additions to the flock with the same markings, but none had the slightest peculiarity. It was tamer than its less conspicuous companions. Its haunt is a busy thoroughfare for pedestrians, and it is remarkable that it did not fall a victim to some cnriosity-hunter's shot. I have not seen it for some time, and fear such has been its fate.

A WINTER BOARDER.—A solitary sea-gull spent all last winter in the fields around Point aux Trembles, Montreal Island. I was never near enough to determine the species. The motor-men of the Montreal Belt Line tried in vain to shoot it. It was too wary for them and lived to join its comrades in the spring.—CHARLES STEVENSON, Montreal.

List of Birds, with dates when last seen in Autumn of 1897, by Geo. R. White.

Tree Swallow. 10th July.
Great Crested Flycatcher. 4th August.
Bank Swallow. 4th August.
Purple Martin. 6th August.
Barn Swallow. 8th August.
Redstart. 20th August.
Black-billed Cuckoo. 23rd August.
Chimney Swift. 24th August.
Summer Warbler. 26th August.
Black and White Warbler. 28th August.
Kingbird. 29th August.
Rose-breasted Grosbeak. 29th August.
Cliff-swallow. 6th September.
Whip-poor-will. 6th September.
Night Hawk. 7th September.
Solitary Vireo. 9th September.
House Wren. 11th September.
Pigeon Falcon. 16th September.
Ruby Humming-bird. 16th September.
Spotted Sandpiper. 17th September.
Red-headed Woodpecker. 18th September.
Sparrow Hawk. 18th September.
Vesper Sparrow. 19th September.
Phoebe. 19th September.
Goldfinch. 19th September, in breeding plumage.
Holboell's Grebe. 20th September.
Black-throated Green Warbler. 22nd September.
Northern Pharalope. 22nd September.
Savannah Sparrow. 23rd September.
Chipping Sparrow. 25th September.
Fish Hawk. 28th September.
Golden Plover. 30th September.
White-headed Sparrow. 7th October.
Cat-bird. 7th Oetober.
Hermit Thrush. 7th October.
Fox Sparrow. 8th October.
Golden-winged Woodpecker. 8th October.
Yellow-bellied Woodpecker. 9th October.
Ruby-crowned Kinglet. 9th October.
Surf Duck. 9th October.
Hudsonian Godwit. 9th October.
Velvet Duck. 9th October.
Pintail Duck. 9th October.
Blue-wing Teal. 9th October.
Mallard. 11th October.
Ruffle-headed Duck. 12th October.
Song Sparrow. 13th October.
Bluebird. 13th October.
Kingfisher. 13th October.
White-throated Sparrow. 16th October.
Junco. 24th October.
Myrtle Warbler. 24th October.
Greater Yellow-legs. 25th October.
Bronzed Grackle. 25th October.
Pied-billed Grebe. 25th October.
Solitary Sandpiper. 25th October.
Tree Sparrow. 26th October.
Pectoral Sandpiper. 26th October.
Black-bellied Plover. 26th October.
Marsh Hawk. 27th October.
Virginian Rail. 28th October.
Goosander. 28th October.
American Bittern. 28th October.
Wood Duck 29th October.
American Pipit. 29th October.
Green-wing teal. 30th October
Hooded Merganser. 30th October.
Black Duck. 30th October.
Rusty Grackle. 30th October.
Redwing Blackbird. 30th October.
Blue Heron. 30th October.
Herring Gull. 30th October.
Robin. 4th November.

DEATH OF A DISTINGUISHED AMERICAN AMATEUR GEOLOGIST AND PALÆONTOLOGIST.—S. A. MILLER.

On December 18th, 1897, HON. DR. SAMUEL A. MILLER, of Cincinnati, Ohio, died of cancer of the liver, after a three weeks' illness, at the age of 60 years. Although a prominent member of the Cincinnati bar, with a large and lucrative practice, as well as a politician and public speaker in the front rank of his party, yet he found time to so devote himself to scientific research that his published works on palæontology are more voluminous and contain more original descriptions and figures of new forms than are to be found in those of many an eminent professional palæontologist. We learn from the Cincinnati *Enquirer* that "every morning he arose with the dawn and worked on his geological books until 9 or 10 o'clock; he attended to his law practice during the rest of the day, and early evening found him at work at his books again."

Dr. Miller's first great work was "American Palæozoic Fossils," published in 1861, undertaken with a view to smooth the way of the student of palæontology by furnishing a complete index of original descriptions of North American palæozoic fossils. This unique work was in use by all palæozoic palæontologists, by whom it was considered indispensible, until replaced by his later and more comprehensive work "North American Geology and Palæontology," published in 1889. The latter work, together with its appendixes, published in 1892 and 1897 respectively, contain descriptions of all the published American palæozoic genera and an index of all the species, filling 793 octavo pages and illustrated by 1,457 generic illustrations consisting of about 3,000 separate figures. Such a work in itself should be considered a proud record for the life work of one amateur—but we find the work of this man appearing in the geological reports of five States of the American Union, viz., Illinois, Missouri, Indiana, Ohio and Wisconsin, for which he figured and described about 800 species of fossils, the greater part crinoids, besides figuring and describing about 300 species of fossils, a part in the Cincinnati Journal of Science (1874-75) and the remainder in its successor, the Journal of the Cincinnati Society of Natural History. In 1881 he published a review of the bibliography, etc., of North American Mesozoic and Calnozoic Palæontology, covering 338 pages.

He was one of the leading founders of the Cincinnati Society of Natural History; a graduate in Arts, Law and Philosophy of Ohio University and the deserving recipient of academic and othes honors from many sources. His great integrity, benevolence, love of justice in public and private affairs and his eminence as a public speaker and jurist, are alluded to at great length by the Cincinnati daily papers.

W. R. B.

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NOTES ON THE PLEISTOCENE GEOLOGY OF A FEW PLACES IN THE OTTAWA VALLEY.

By W. J. WILSON, Ph. B.,
Of the Geological Survey of Canada.

The Ottawa River rises near the height of land in Latitude 48° N. and Longitude 76° W., whence it flows westwardly for a distance of 250 miles to Lake Temiscaming. From this lake its course is south-east till it reaches the St. Lawrence River. Its whole length is about 650 miles, but from its source to the St. Lawrence River in a direct line is less than 200 miles. Its branches on the north or Quebec side are the Dumoine, Black, Coulonge, Gatineau, Lièvre, and Rouge, all of which flow nearly south. From the west or Ontario side it receives the waters of the Montreal, Mattawa, Petewawa, Bonnechere, Madawaska, Mississippi, Rideau, and South Nation, all of which flow eastward. The whole area drained by the Ottawa is approximately fifty-six thousand square miles.

It is the purpose of this paper to record the result of observations made at a few points extending from the city of Ottawa to Pembroke, a distance of eighty miles, during the summers of 1895-96, more especially the district included in the townships of Ross, Westmeath, Stafford, Wilberforce, Bromley, S. Algona, Sebastopol and Grattan, in Renfrew county.

Everywhere in this district there is abundant evidence of ice action, both in the polished and striated rocks and in the general distribution of boulder-clay and boulders. The question of the direction of the ice movement is comparatively simple. Near the Ottawa River the striæ follow closely the course of the

valley as seen north of Allumette Island in two places, at Vinton, Portage du Fort, and near Bristol, on the Quebec side, where the course is from S. 10° E. to S. 30° E * On the south side the same courses were seen north of Pembroke, at several places in Ross and Bromley townships ; at Shamrock, south of Renfrew, and at Galetta. In Ottawa city, "Barrack Hill,"† the course is S. 45° E., and Dr. Ami reports striæ on Park Avenue and Nicholas Street almost due east and west.‡ Near Hintonburg on the Ottawa, Arnprior and Parry Sound Railway, the course is S. 87° E. While the south-east course is constant in the valley close to the river, at a distance of ten to twenty miles back the ice moved west of south. On the south side of the river a large number of observations show the direction to be from S. 2° W. to S. 35° W., the most common being from S. 15° W. to S. 25° W. It is probable that the south-west course is the older of the two, and that the south-east course was produced when the ice had become so thin that it was deflected by the minor irregularities of the surface, and so followed the course of the river. At an earlier stage the ice had evidently been thick enough to over-ride irregularities of surface of considerable size, the course being south-west, as above stated, where the present drainage is to the east. The south-east and the south-west courses were not observed on the same surface in the area under consideration, but in the vicinity of Lake Temiscaming these two courses are frequently seen crossing each other, and Mr. Barlow states that the oldest course is about S. 20° W., while the more recent courses follow the river valleys.

Speaking generally of the glaciation of the district particularly referred to, it may be said that good exposures of rock are common where the results of ice movement can be studied.

* The bearings are referred to the true meridian.
† Geology of Canada, p. 892.
‡ Ottawa Naturalist, 1887, p. 69.

Splendid examples of stossing are numerous, and even where the rock is so weathered that no striæ are visible, the rounded and smooth appearance of the north side of exposures, and the abrupt and sharp edges on the south, so characteristic of glacier action, may be seen and often enable us to determine with considerable accuracy the direction in which the ice moved. Boulder-clay, boulders, Leda-clay, sand and gravel are also abundant, while the less common phenomena of surface geology, viz.: kames, äsar or eskers and moraines are occasionally seen.

BOULDER-CLAY.

Till, or boulder-clay has been described as a "firm, tough tenaceous clay which gives evidence of having been subjected to great pressure. Often the accumulation becomes coarser and sandier. Again it may be described as a coarse agglomeration of subangular and angular stones set in a scanty matrix of coarse earthy grit and sand. Sometimes the stones in the till are so numerous that hardly any matrix of clay is visible." It will be seen that the term boulder-clay embraces deposits whose appearance differs widely, but however it may vary in appearance and composition it can ususlly be recognized by the peculiar shape and striation of the stones contained in it. Typical boulder-clay may be seen in many places near Ottawa, as in the cutting on the Ottawa, Arnprior and Parry Sound Railway near Hintonburg already referred to, at Hog's Back, and in very many places in the area under consideration. In connection with the boulder-clay a word about the distribution of boulders will be in place. This district is no exception to the general rule that most of the boulders in the boulder-clay and those scattered over a country are from rocks near at hand, and only a few of the harder kinds are carried to a great distance. In this district the boulders commonly seen are limestone, usually flat and angular, and gneiss, granite, etc., more rounded and worn. Dr. Ells has already referred to the great blocks of Black

River limestone which occur along the Opeongo Road on a ridge south of Clear Lake, at a height of nearly fourteen hundred feet above sea-level.* Some of these blocks are five to eight feet through and very angular. As far as known the Black River formation nowhere occurs in the vicinity of Clear Lake at a greater height than eight hundred feet, so that if the relative levels of the country have not changed since the glacial period, these boulders have been carried upward a distance of five to six hundred feet. Travelled boulders in similar positions have been frequently noted. Sir J. W. Dawson records large Laurentian boulders on Montreal Mountain which, he says, must have been carried probably a hundred miles from the Laurentian region to the north-east.† Dana states that Mount Katahdin in Maine has many boulders on its northern face derived from the Devonian rock of the low country to the north, three thousand feet below it in level.‡ In Nova Scotia sandstone boulders are common on the Cobequid Mountains at a considerable height above the present level of the Carboniferous beds, from which they were derived. The position of these boulders at such heights forms a most interesting subject for study, and many theories have been advanced in regard to it. Among the theories put forward the following may be mentioned. Some writers claim that these erratics were placed in their present position by floating ice. They claim that the land was submerged to a depth sufficient to allow icebergs or ice jams to pass over or become stranded on the higher ground, where they deposited whatever material was embedded in them, or carried on their surface. Another explanation is that the land was covered by a glacier to a depth equal to or more than the greatest height at which these boulders are found, and that this mass moved over the country, carrying boulders, etc., along with

* The Ottawa Naturalist, December, 1896, p. 171.
† Canadian Ice Age, p. 201.
‡ Manual, p. 690.

it and deposited them wherever it chanced to be when the ice ceased to move forward. In connection with this it is urged that blocks of stone, entering the bottom of the glacier under certain conditions, gradually rise to the surface and in this way often reach a height far above their original position. It may be remarked that more or less serious objections have been raised against all these explanations.

LEDA CLAY.

The next formation in ascending order is the Leda clay, which is common in all the lower levels of the Ottawa Valley, where it forms broad stretches of level country. It is a bluish-gray clay, somewhat unctuous, and when dry becomes very hard and cracks into square or oblong shaped blocks. In Ross and Bromley townships there are large areas covered with this clay. In one place in Ross is a plain five miles across which extends lengthwise for a much greater distance, The approximate height of these plains is from four hundred to four hundred and fifty feet. Though the roads traversed passed over many miles of this formation the only fossil found was a fragment of a shell which was too small to be identified.

For a description of this deposit below the City of Ottawa, I quote the following. "Along the south bank of the Ottawa River from the city of Ottawa to Hawkesbury, and again from Point Fortune to its junction with the St. Lawrence the lower clay is seen in banks of from twenty to forty feet in height. . . . The greatest breadth of the level clay surface which has been observed here is in the township of L'Orignal, where it extends about fifteen miles back from the river. . . . On the north side of the Ottawa, from Hull to Isle Jesus, the clay often covers a considerable breadth between the river and the Laurentian Hills and extends among these for several miles up the larger tributaries."* Mr. A. E. Barlow states that this clay is abundant at

* Geology of Canada, p. 916.

Lake Temiscaming, the level of which at high water is five hundred and ninety-six feet above the sea. Perhaps the most remarkable thing about this clay is the scarcity of marine shells even where it is known to be far below the level reached by the sea during the Champlain subsidence. Marine fossils are recorded at Montreal at a height of five hundred and sixty feet, at Smith's Falls four hundred and twenty feet, near Galetta four hundred and seventy-five and Chelsea four hundred and twenty-five, so that the land in this valley during the time the Leda clay was laid down must have been six hundred feet lower than at present. We can therefore, I think, fairly assume that the stratified clays which are not more than five hundred or six hundred feet above sea level are marine. The marked resemblance of the clays on the higher levels to those on the lower, where fossils are found, is strong corroborative evidence of a similar origin. Even at the lower levels fossils are by no means common in this clay. In the city of Ottawa where excavations are frequently made and large quantities of clay are throwu out, I have seen fossils in two places only. At Mohr's Corners, about a mile from the village of Galetta, there is a sand terrace abounding in marine shells. Underlying the sand there is a bed of this clay, well stratified, twenty to thirty feet deep, and although there was a section ten feet deep on the roadside for a quarter of a mile, a careful examination revealed no fossils. Sir J. W. Dawson says : "Where the Leda clay is thick and well developed it admits of sub-division into a lower Leda clay, unfossiliferous or with only shells of *Leda glacialis* and *Macoma Grænlandica*, and an upper Leda clay, usually more sandy and holding a rich boreal fauna identical with that of the northern part of the Gulf of St. Lawrence at present."* Mr. F. B. Taylor in a recent article says "Near the city of Ottawa the upper limit

* Canadian Ice Age, p. 60.

of the Champlain submergence was not less than four hundred and seventy-five feet above the sea and was probably higher. Beaches undoubtedly belonging to this submergence have been found near Renfrew, and also at about four hundred and fifty feet at Pembroke, and also at about five hundred and thirty feet at Mackey's Station on the Ottawa River. Between Hudson Bay and Lake Superior shells of the same age have been found up to four hundred and fifty feet above the sea, and within one hundred and fifty miles of the lake. The upper limit of the submergence was probably still higher. It seems almost certain that during the Champlain submergence the sea extended far up the Ottawa valley, probably reaching the head of Lake Temiscaming." He says, however, that within the area no continuous tracing of the marine beaches has been made.

SAXICAVA SAND.

The Saxicava sand is also well represented in the Ottawa valley. It is a shallow water or shore deposit, and where a section is complete rests on the Leda clay. It is yellow or brownish and varies from fine sand to coarse gravel. Sometimes there is a distinct line between this formation and the Leda clay, while in other places the one runs into the other. It is at the junction of the two that the fossils are most plentiful Exposures of this sand are abundant everywhere in this valley, and in many places nothing else is seen for a long distance. Many such areas were noted in Renfrew county, but no fossils were seen. In a cutting a short distance north of Chelsea Station on the Gatineau Valley Railway there is a narrow seam of coarse yellow sand which in places is full of shells of *Saxicava rugosa* and *Macoma fragilis*. Near this seam, if not in it, a small perfect shell of *Leda arctica* was found, and in a higher bank of Leda clay a fragment of a *Balanus*, probably *Hameri*. These deposits attain a height of four hundred and twenty-five feet at this point. About half a mile west of Carp station this sand forms

a terrace known as Johnston's Grove, in which *Saxicava rugosa* and *Macoma fragilis* are abundant at a height of about three hundred and fifty feet. These shells are also found in a cutting at Carp Station, as stated by Dr. Ells. At Mohr's Corners, already referred to, there is a sand terrace which rises to a height of four hundred and seventy-five feet and contains the above shells in great abundance. In a cutting through a gravel bed on the Electric Railway west of Hintonburg, *Leda arctica*, *Saxicava rugosa* and a fragment of a *Balanus* were found. This is so different from the other localities that it deserves special mention. It is composed of a beach-like gravel, distinctly stratified and well water-worn The pebbles are generally one to two inches in diameter, with a small number of larger ones, the interstices being filled with sand. *Leda arctica* is the most abundant here, while at the other places named, only one specimen was found. The shells are small but well preserved, and in some cases the two valves are joined. The few specimens of *Saxicava rugosa* which were found were also well preserved. This cutting is on the edge of a terrace which extends back to the Ottawa, Arnprior and Parry Sound Railway and is about two hundred and thirty feet above sea level.

TERRACES.

Terraces and old shore lines or beaches have been described as occurring in many places along the Ottawa Valley. A good example of a cut terrace may be seen on the Montreal road near Green's Creek, at a height of about two hundred feet, but this may be of fluviatile origin. At Chelsea there is a terrace at a height of three hundred and fifty feet, and one round the base of King's Mountain seven hundred and five feet high, North of the west end of Muskrat Lake on the road leading to Beachburg, a fairly well defined shore-line occurs at a height of from four hundred to four hundred and fifty feet. In many places where the level tracts of Leda clay occur there are sloping

ridges rising on each side fifty to one hundred feet, and just where one would expect to find a cut terrace, but none were seen that could safely be put down as such. On the north-west side of Lake Doré there is a well defined gravel terrace at a height of four hundred and fifty feet above sea level and forty feet above the level of the lake.

A few sand and gravel ridges occur in this district, though none of any great length were seen. Two small ridges occur in Westmeath township. They are composed largely of sand and gravel, and are ten to fifteen feet high. They lie about S. 30° E. Another low ridge was seen near Caldwell Station on the Ottawa, Arnprior and Parry Sound Railway, though the material in this one is more of the character of boulder clay. On the road between Concessions XXI and XXII, Lot 12, Wilberforce township, just east of the stream from Green Lake there are four ridges running parallel to each other, course S. 23° E. The first is only a few rods from the stream which cuts through it south of the road. In this part it is very regular in shape and rises about twenty feet above the surrounding ground. Where the road cuts through it, it is about two hundred and twenty-five feet wide, flanked on each side by a low ridge four or five feet high The sides are steep and meet in a sharp ridge at the top, Between the first and second ridges there is a peat bog two hundred feet wide. The second ridge is about the same size as the first, then another narrow bog, and the third crosses the road. It is similar to the other two only not quite as high. A short distance from this is a fourth ridge, but it is low and rounded at the top. A good section is shown in each where the road crosses. They are composed of well rounded water-worn pebbles, sand and gravel and a few angular fragments of rock, but the second one mentioned differs considerably from the others. A section in descending order is—rounded pebbles, sand and gravel, five feet ; fine sand well stratified

twelve feet, covered near the base with boulder clay. Striæ on the same road a short distance to the east run S. 2° W. These ridges do not extend for any great distance as far as could be seen from the road, but on the next Concession road to the north-west, I saw short ridges composed partly of boulder-clay and partly of water-worn material, which were in the same line with those just described but not continuous. Gravel ridges and mounds occur near Beachburg and eastward and enclose small lakes. Mounds partaking of the character of drumlins occur on the road between Concessions VIII and IX, Wilberforce township.

MORAINES.

The Geology of Canada mentions ridges of glacial drift or boulders running north and south and resembling moraines as occuring at the Hudson Bay Company's post eighteen miles from the head of Lake Temiscaming, at Long Sault just below the Lake, at the mouth of the Maganissippi, about twenty miles above the Mattawa, at Roche Capitaine, near Green's Creek, and at L'Orignal where six ridges occur in less than a mile. Along the south side of Mink Lake in Wilberforce township there is an irregular mass which extends continuously more than a mile and rises in places to thirty feet in height. It has an average breadth of three hundred and fifty feet. It does not rise to a sharp ridge like those at Green Lake just referred to, but is flat on the top and in some parts there are two or more ridges parallel, or diverging at an angle of from 10° to 20°. At the west end it is broken up into hillocks or mounds and at the east end it is lower and bends toward the north following the shore of the lake, but it does not continue across the marsh at the north east end of the lake. A low ridge which may be a continuation of it was seen to the east. Many large angular blocks of limestone are scattered over the surface, and sections both transverse and lateral showed that it was composed of clay and

angular or sub-angular stones such as are seen in ordinary till. Water-worn or stratified material was seen in it. Its approximate height is five hundred feet above sea level, course nearly east and west. Striæ on road along side of ridge. Course S 7° E.

In Hull there are several moraine-like ridges. One crosses Bridge street about half a mile from the Ottawa River, and is a mass of large limestone blocks mixed with a small quantity of sand and gravel. It reaches a height of ten to twenty feet and is three hundred feet wide. It lies in an east and west direction. It extends east of Bridge street a short distance and west to the next street where there is a break, but about two hundred feet to the north another ridge of similar character begins and continues westward to Brewery Creek. Two short ridges strike off from this at right angles to the south but extend only for a short distance. A section is exposed along the south side of the long ridges and clearly shows their composition. They are made up of large, flat, angular blocks of limestone (some are ten feet long and nearly as wide), arranged in layers overlapping each other and generally dipping south at different angles. This feature is very noticeable in walking over the ridges and is also seen in the lateral sections. On the surface no fine material was observed, but down in the mass there is a small quantity of water-worn gravel and stones, an occasional rounded boulder from the Laurentian rocks occurs. As far as observed these are well rounded and smooth but not striated.

The underlying limestone is polished and bears distinct striæ, course S. 60° E. Not more than one hundred and fifty feet from the western and longest part of the ridge an almost parallel ridge lies to the north. This is composed almost entirely of well rounded Laurentian boulders, gneiss, granite, etc., with an occasional flat limestone block. There are no openings in it, so that it is impossible to say what it is like below the surface, but judging from what can be seen there is more clay mixed with the boulders than in the first mentioned, It is crescent shaped

the concave side, facing the north, and is highest midway tapering and spreading out towards both ends. Further observation has shown that these ridges with slight breaks extend eastward through the city of Hull toward Lake Flora. Northward as far as the Gatineau River there are many low ridges of rounded boulders of much the same material as in the most northerly ridge referred to above.

The diversity both in the character and condition of the material composing the first ridges described, taken in connection with their proximity, makes it somewhat difficult to account for their origin, Those lying to the north and extending to the Gatineau River are probably moraines, and were left in their present position by ice moving down the Gatineau Valley.

The angular condition of the blocks in the most southerly ridge shows that they have not been transported any very great distance. The following section is from this ridge near Chaudiere street and is in descending order,

1. Large angular blocks of limestone mixed with sand and gravel, and an occasional rounded boulder of granite, etc ..... 8 feet
2. Fine sand and gravel ..... 2 "
3. Fine tough bluish stratified clay (Leda clay) ..... 1¼ "
4. Boulder clay ..... 3 "
5. Limestone rock in place, glaciated, striæ, course S. 60° E.

If No. 1 of this section is of morainic origin, then after the ice which glaciated the underlying rock had receded, leaving the boulder-clay, the land remained submerged long enough to admit of the deposition of the clay and sand. (Nos 3 and 2 of the above section) after which the ice again advanced, and without displacing the underlying material deposited the limestone blocks composing the ridge. Another explanation is that it was formed by ice jams in the Ottawa River when it flowed through the channel where Brewery Creek now runs.

THE GEOLOGICAL SOCIETY OF AMERICA.

Tenth Winter Meeting, Montreal, Canada, 1897.

The Geological Society of America, which counts nearly forty Fellows from Canada, met in Montreal, Canada, Dec. 28th, 29th and 30th, 1897, for the reading of papers and the transaction of regular annual business. It was the Tenth Winter Meeting. This is the third time that the Society has met in Canada, the two former meetings having been held in Toronto in 1890, and in Ottawa in 1892.

There were some thirty visitors from south of the international boundary, prominent among whom were: The President, Dr. E. Orton, Ohio; Prof. B. K. Emerson, Amherst, Mass.; Prof. J. J. Stevenson, New York City, President-elect for 1898; Dr. I. C. White, Virginia; Prof. David White, U. S. National Museum, Washington, D.C.; Prof. W. M. Davis, Cambridge, Mass.; Prof. Whitman Cross, U. S. Geol. Survey, Washington, D.C.; Profs. Quereau, W. N. Rice, J. F. Kemp, H. D. Campbell, H. P. Cushing, J. P. Iddings, W. B. Scott, of Princeton, N.J.

Of the Canadian geologists present, there were: Dr. G. M. Dawson, Director of the Geological Survey of Canada; Prof. A. P. Coleman, Toronto University; Dr Robert Bell, Dr. R. W. Ells, Prof. F. D. Adams, Mr. Chalmers, Mr. J. B. Tyrrell, Mr. R. G. McConnell, Mr. A. E. Barlow, Mr. R. W. Brock, Mr. A. A. Cole, Mr. N. N. Evans, Mr. W. F. Ferrier and the writer.

An address of welcome to the members of the Geological Society was read by George Hague, Esq., on behalf of the Governors of McGill University. Prof. E. Orton, President of the Society replied, acknowledging in gracious terms the kindness of the University in throwing its buildings and treasures open to the visiting geologists. The reports of the Council and Auditors were then submitted, and the new Fellows elected. The Editor was, according to the vote taken by ballot, elected an officer of the Society.

Prof. W. B. Scott then gave a very comprehensive and instructive biographical sketch of the late lamented Fellows in the person of Prof. E. D. Cope. Cope's work in the Oligocene or White River beds, in the Eocene as known in the Unita and Bridger or Wind River and

Green River equivalents, the Wasatch and Puerco faunas, in the Blanco and Good-night beds of Pliocene age as well as in the Loup Fork and John Day series of Miocene age, was described in its broader bearings and results, together with further work in the Pleistocene deposits of Pt. Kennedy, &c. Cope's correlations of American strata with European equivalents, from a palæontologist's point of view, have proved to be "exactly right."

Prof. J. F. Kemp then read the obituary notice of the late Prof. J. F. James of the U S. Geological Survey, prepared by Mr. T. W. Stanton, of Washington. It showed the amount and nature of the work done by this enthusiastic geologist, who died at such an early age.

There were some very interesting papers read, among which we note the following titles and abstracts of special interest to Canadians and the members of this Club :—

ELLS, DR. R. W.—"*Notes on the Sands and Clays of the Ottawa Basin.*"

In this paper Dr. Ells showed the views held in 1863, when the chapter on "The Superficial Geology of Eastern Canada and the Lower Ottawa," was written in the "Geology of Canada" (Logan). He went on to describe the relative heights of principal points in the Ottawa Valley, Grand Lake, 900 ft.; Lake Temiscaming, 585 ft.; Headwaters of the Rideau River, 417. The general distribution of the marine clays and sands throughout the Ottawa valley was also given and the occurrence of fossiliferous calcareous nodules at Lachute, Rouge River, Besserer's, Green's Creek, and west as far as Bryson. Fish remains and shells occur in the marine beds. The Chalk River sand plains were also noticed and their genesis indicated.

BELL, DR. ROBERT.—"*Fossil-like forms in the Sault Ste. Marie Sandstone.*"

The markings noticed were said by Dr. Bell to be "probably casts of dessication cracks."

BELL, DR. ROBERT.—"*Mastodon and Mammoth Remains found near Hudson Bay.*"

Notes (1) the discovery of Mastodon remains near the junction of

the Mattagomi and Missinaibi Rivers, in the southern part of the basin of Hudson Bay ; (2) the finding of a small Mammoth's tooth on Long Island off the east main coast of Hudson Bay.

AMI, H. M.—"*The Mastodon in Western Ontario.*"

In the course of this paper, the writer gave a brief sketch of the interesting discovery of remains of portions of three skeletons of the mastodon in the counties of Norfolk and Essex, Ont.

TAYLOR, FRANK B.—"*Notes on the Moraines of the Georgian Bay Lobe of the Ice-sheet.*"

When the ice-sheet had retreated in the basin of Lake Huron so far as to leave the summit of Blue Mountain south of Georgian Bay uncovered, there still remained a well defined glacial lobe projecting towards the south-east nearly to Toronto and eastward beyond Lake Simcoe. This lobe was divided in two parts by the Penetang peninsula, the larger one extending south-east from Nottawasaga Bay and the smaller one extending east-south-east from Matchedash Bay. Recently the moraines of the eastern limb of the Nottawasaga lobe were partially explored and a well defined series of five moraines was found filling the interval from the head of Georgian Bay to the "Oak ridges" north of Toronto. During the latter stages of this lobe there was a glacial lake covering Lake Simcoe and a considerable area to the east, and probably held up on that side by a lobe projecting from the north-east up the Valley of the Trent river. Its beach is 90 to 100 feet above the Algonquin beach a few miles north-east of Barrie. Well marked glacial striae were found on the summit of the promontory of Blue Mountain over 1100 feet above Georgian Bay, running S. 60° E. Some of the moraines running along the east side of Lake Huron were also traced northward to the vicinity of Durham and Flesherton.

DAWSON, SIR J. WM.—"*Note on Lepidophloios Cliftonensis.*"

In connection with this paper, Sir William writes the following synopsis which appears in the printed programme of the Montreal meeting : "In the bulletin of this Society for May, 1891, appeared a paper by the author on Fossils from the Carboniferous of Newfoundland, including new species of *Lepidodendron* (*L. Murrayanum*). In connection with this species I noticed what seemed a closely allied form from New Brunswick, which I had named *L. Cliftonense.* Later studies of this species have shown me that it should rather be placed in the allied genus *Lepidophloios.* I have so placed it in a more recent paper on that genus in the present year.* It should, therefore, be named *Lepidophloios Cliftonensis*, but is one of the species of that genus nearest to *Lepidodendron* and especially to my *L. Murrayanum* and to *L. Wortheni* of Lesquereux, as I have already stated in the paper to which this note is an addendum and erratum."

*Trans. Royal Society of Canada.—Paper read before meeting at Halifax, N.S., June, 1897.

CUSHING, HENRY P.—"*Syenite-porphyry Dikes in the Adirondack Region.*"

Recent work in Clinton county N.Y., has shown the existence of dikes belonging to the syenite-trachyte family of eruptive rocks, which are of different age from the bostonites described by Kemp and Marsters from the near vicinity. They are older than the Potsdam sandstone as they have furnished pebbles to its basal conglomerate. On the other hand the older rocks of the region were metamorphosed before their extrusion. Together with the associated diabases they show great resemblance to the Keweenawan eruptives of the Lake Superior region. They possess considerable petrographical interest.

ADAMS, DR. F. D.—"*Nodular Granite from Pine Lake, Ontario.*

The paper describes a granite from a recently surveyed portion of the Province of Ontario, which in places contains an abundance of nodules scattered through it. These nodules differ in a marked manner from those occurring in any of the hitherto described nodular granites, among other things in being more acid in composition than the rock itself. They are frequently found to be arranged in long lines which, when followed up, coalesce into sheets having all the characters which are commonly presented by secondary quartzose veins. The phenomenon evidently results from a process of differentiation in the original magma and has an intimate bearing on the question of "contemporaneous veins."

ADAMS, F. D. and NICHOLSON, J. T.—"*Experiments on the flow of rocks now being made at McGill University.*"

This valuable paper on experimental geology was very well received and threw not inconsiderable light upon the behaviour of rock material under great pressures. Numerous experiments made upon the compressibility of marble and the form assumed by a cylinder of marble after being submitted to great pressure were carefully described and illustrated. The bearing of the results obtained even at these early stages of the investigation on the nature of the action of rock masses on a large scale in nature—on earth movements in general—were also pointed out.

COLEMAN, A. P.—"*Clastic Huronian Rocks of Western Ontario, and the relation of Huronian to Laurentian.*"

The Presidential Address by Prof. Orton was on the subject: "*Geological probabilities as to Petroleum.*"

NOTES.—The Sessions were held in the Lecture Room of the Peter Redpath Museum of McGill University.

On the evening of Wednesday, Dec. 29th, a private reception was tendered to the Fellows of the Society by Mrs. Porter and Mrs. Adams, in the new Macdonald Mining Laboratories of McGill University.

The thanks of the Society were tendered to the Governors of McGill University, and to Profs. Adams and Porter for their kindness and attention during the meetings.

Dr. Adams, Dr. Ells and the writer having been requested by Secretary Fairchild to give notes on the geology of Montreal, Dr. Adams led in an interesting talk, which was followed with much interest by all present.—H.M.A.

INDEX.