THE CANADIAN

RECORD OF SCIENCE

INCLUDING THE PROCEEDINGS OF

THE NATURAL HISTORY SOCIETY OF MONTREAL,

AND REPLACING

THE CANADIAN NATURALIST.

VOL, VIII. (~~1900~~-1902.)
1899

MONTREAL:

PUBLISHED BY THE NATURAL HISTORY SOCIETY.

1902.

EDITING AND EXCHANGE COMMITTEE.

CONTENTS OF VOLUME VIII.

PAGE.

Zoological Problems for the Natural History Society of Montreal. By E. W. MacBride, M.A., B.Sc. 2

The Gramineæ, Cyperaceæ and Juncaceæ of Montreal Island. By Harold B Cushing, B.A., and Robert Campbell, M.A., D.D. 11

Dimorphism and Polymorphism in Butterflies. By Henry H. Lyman, M.A. 24

Royal Society of Canada, Meeting at Ottawa 36

Proceedings of the Natural History Society..43, 114, 246, ...258, 388, 477, 532

Field Day to Montfort 58

Notices of Books and Papers:

Atkinson's Elementary Botany. By John Craig... 62

An Illustrated Flora of the Northern United States and Canada, westward to the 102nd Meridian. By Robert Campbell, M.A., D.D. 134

Report on the Geology of the Nipissing and Temiscaming Districts. By H. M. Ami, M.A., D.Sc., F.G.S. 198

Bailey's Elementary Text-Book on Botany. By John Craig 333

Essai D'une Monographie Des Depot Marin et Continentaux du Quaternaire Moseen. By G. J. M. 411

A New Physical Geography. By John Craig 411

Sponges from the Coasts of North-Eastern Canada. By O. E. L. 412

Dr. Wesley Mills' Nature and Development of Animal Intelligence. By R. C. 493

Prof. Robinson's Problems and Possibilities of Systematic Botany. By R. C 496

Sargent's Notes on Quebec Cratægus and New or Little Known Trees. By R. C. 497
Lambe's Revision of the Genera and Species of Canadian Palæozoic Corals. By R. C 499
Dr. D. C. MacCallum's Academic Addresses. By R. C 500
Studies of the Geology of the vicinity of Montreal which might be undertaken by Members of the Natural History Society. By F. D. Adams, Ph.D. 65
Phenological Observations in Canada. By A. H. Mackay, LL.D., F.R.S.C. 71
Botany in the Island of Montreal. By Robert Campbell, M.A., D.D. 84
The Lake on the Mountain near Picton, Ont. By A. T. Drummond, LL.D. 90
The Parent Rock of the Diamond in South Africa. By T. G. Bonney, D.Sc., LL.D , V.P.R.S 95
Sir John William Dawson. By Professor Frank Adams, Ph.D. 137
Letter of Late Sir William Dawson. 148
The Subdivisions of the Carboniferous System in Eastern Canada. By H. M. Ami, M.A., D.Sc., F.G.S. 149
The Flora of the Rocky Mountains. By Robert Campbell, M.A., D.D. 163
North American Golden Rods. By Robert Campbell, M.A., D.D. 192
Notes and Comments. By H. M. Ami, M.A., D.Sc., F.G.S. 195
The Rate of Propagation of the Venous Pulse. By Dr. W. S. Morrow 205
A Forest Fire at St. John about 2,000 years ago. By G. . Matthew, LL.D., F.R.S.C. 213
The Rock Formation of the Bermudas. By J. S. Buchan, Q.C., B.C.L. 219
Notes on the Glaciation of Mount Orford, P.Q. By J. A. Dresser 223
On the Height of Mount Orford. By N. N. Evans, M.A.Sc., and O. E. Leroy, B.A. 225

Oldhamia. By G. F. MATTHEW, LL.D., F.R.S.C. 228
Progress of Geological Work in Canada during 1899. By H. M. AMI, M.A., D.Sc. 232
Duck Hawk on Mount Royal. By ALFRED GRIFFIN 265
List of Members of Natural History Society of Montreal.. 267
Some Palæobotanical Aspects of the Upper Palæozoic in Nova Scotia. By PROFESSOR DAVID WHITE, U.S. National Museum, Washington, D.C.. 271
Additional Notes on the Flora of Cap-a-L'Aigle. By ROBERT CAMPBELL, M.A., D.D. 281
On a New or hitherto Unrecognized Geological Formation in the Devonian System of Canada. By H. M. AMI, D.Sc. 296
An Hour's Botanizing on the Side of Mount Royal. By JOHN DEARNESS ....
The Canadian Marine Biological Station. By F. SLATER JACKSON, M.D. 308
A Hornblende Lamprophyre Dyke at Richmond, P.Q. By JOHN A. DRESSER. 315
Was Mount Royal an Active Volcano? By J. S. BUCHAN, K.C., B.C.L. 321
Addenda and Corrigendum to Progress of Geological Work in Canada during 1899. By H. M. AMI, D.Sc...... 329
Palæontological Note. By H. M. AMI, D.Sc. 331
The Devonian of the Acadian Provinces. By R. W. ELLS, LL.D., F.R.S.C. 335
Letter on D. White's Article in last issue. By G. F. MATTHEW, LL.D., F.R.S.C. 344
Life History of the Camberwell Beauty Butterfly. By A. E. NORRIS 345
The Flora of Montreal Island, Continued. By ROBERT CAMPBELL, M.A., D.D. 349
List of the Published Writings of Elkanah Billings, F.R.S., Palæontologist to the Geological Survey of Canada, 1856-1876. By B. E. WALKER, F.G.S..... 366
George Mercer Dawson. By BERNARD J. HARRINGTON, M.A., Ph.D., LL.D.,—with Portrait.............. 413

An Experimental Investigation into the Flow of Marble. By Frank D. Adams, M.Sc., Ph.D., and John T. Nicholson, D.Sc. 426
Ostracoda of the Basal Cambrian Rocks in Cape Breton. By G. F. Matthew, LL.D., F.R.S.C. 437
Notes on the Albany Meeting of the Geological Society of America, held December, 1900. By H. M. Ami, D.Sc. 471
Inaugural Address of the President of the Natural History Society, E. W. MacBride, M.A., D.Sc. 479
Bibliography of Dr. George Mercer Dawson. By H. M. Ami, M.A., D.Sc. 503
Some Notes on Mount Royal. By J. S. Buchan, K.C., B.C.L. 517
Some Recent Folds in the Lorraine Shales. By Dr. Alfred W. G. Wilson, McGill University 525

Published quarterly; Price $3.00 the Volume of eight numbers.

VOLUME VIII. NUMBER 1.

THE CANADIAN RECORD OF SCIENCE

INCLUDING THE PROCEEDINGS OF
THE NATURAL HISTORY SOCIETY OF MONTREAL,
AND REPLACING

THE CANADIAN NATURALIST.

CONTENTS.

	PAGE
Editorial Note	1
Zoological Problems for the Natural History Society of Montreal. By E.W. MacBride, M.A., B.Sc.	2
The Gramineæ, Cyperaceæ and Juncaceæ of Montreal Island. By Harold B. Cushing, B.A., and Robert Campbell, M.A., D.D.	11
Dimorphism and Polymorphism in Butterflies. By Henry H. Lyman, M.A.	24
Royal Society of Canada. Meeting at Ottawa	36
Proceedings of the Natural History Society. Session 1897-1898	43
Field Day to Montfort	58
Book Notices:	
Elementary Botany. By George F. Atkinson, Professor of Botany, Cornell University	62

MONTREAL:
PUBLISHED BY THE NATURAL HISTORY SOCIETY.

LONDON, ENGLAND:
Collins, 157 Great Portland St.

BOSTON, MASS.:
A. A. Waterman & Co., 36 Bromfield St.

1899.

NATURAL HISTORY SOCIETY OF MONTREAL.

[*Incorporated* 1832.]

OFFICERS—SESSION 1899-1900.

Patron :

His Excellency the Governor-General of Canada.

Hon. President :

Sir J. William Dawson, LL.D., F.R.S., F.R.S.C.

President :

T. Wesley Mills, M.A., M.D.

Vice-Presidents :

Lord Strathcona and Mount Royal.

Rev. Robt. Campbell, M.A., D.D.
Frank D. Adams, Ph.D., F.R.S.C.
B. J. Harrington, Ph.D., F.R.S.C.
C. T. Williams.
J. H. Joseph.
Hon. Justice Würtele.
Walter Drake.
H. H. Lyman, M.A.

Hon. Recording Secretary :

Chas. S. J. Phillips.

Hon. Corresponding Secretary :

J. S. Buchan, B.C.L.

Honorary Treasurer :

F. W. Richards.

Curator :

Alfred Griffin.

Members of Council :

Albert Holden, *Chairman.*

J. A. U. Beaudry, C.E.
E. T. Chambers.
Joseph Fortier.
Rev. G. Colborne Heine, B.A.
Edgar Judge.
Prof. E. W. McBride, M.A., B.Sc.
H. McLaren.
Geo. Sumner.

Editing and Exchange Committee :

Rev. Robt. Campbell, M.A., D.D., *Chairman.*

Frank D. Adams, Ph.D., F.R.S.C.
J. S. Buchan, B.C.L.
Prof. J. T. Donald.
A. T. Drummond, LL.D., Kingston, Ont.
H. H. Lyman, M.A.
Prof. E. W. McBride, M.A., B.Sc.
G. F. Matthew, St. John, N.B.
T. Wesley Mills, M.A., M.D.
J. F. Whiteaves, Ottawa, Ont.

Library Committee :

E. T. Chambers, *Chairman.*

J. A. U. Beaudry, C.E.
Walter Drake.
Joseph Fortier,
Alfred Griffin.
G. M. Tod.
C. T. Williams.
A. F. Winn.

Museum Committee :

A. F. Winn, *Chairman.*

Rev. Robt. Campbell, M.A., D.D.
G. A. Dunlop.
O. E. LeRoy, B.A.
H. H. Lyman, M.A.
Prof. E. W. McBride, M.A., B.Sc.
J. B. Picken.

Field Work Committee :

C. T. Williams, *Chairman.*

Frank D. Adams, Ph.D., F.R.S.C.
J. S. Buchan, B.C.L.
Rev. Robt. Campbell, M.A., D.D.
Albert Holden.
H. H. Lyman, M.A.
Prof. E. W. McBride, M.A., B.Sc.
J. B. Picken.
F. W. Richards.

Lecture Committee :

Chas. S. J. Phillips, *Chairman.*

Rev. Robt. Campbell, M.A., D.D.
Prof. John Cox, M.A.
Walter Drake.
N. N. Evans, M.A.Sc.
B. J. Harrington, Ph.D., F.R.S.C.
Rev. G. Colborne Heine, B.A.
Edgar Judge.
T. Wesley Mills, M.A., M.D.
Hon. Justice Würtele.

House Committee :

Albert Holden, *Chairman.*

H. McLaren.
C. T. Williams.

Membership Committee :

Walter Drake, *Chairman.*

J. A. U. Beaudry, C.E.
Rev. Robt. Campbell, M.A., D.D.
Albert Holden.
Edgar Judge.
H. McLaren.
Chas. S. J. Phillips.
Geo. Sumner.
C. T. Williams.

Superintendent :

Alfred Griffin.

THE

CANADIAN RECORD

OF SCIENCE.

VOL. VIII. JANUARY, 1899. No. 1.

Editorial Note.

An apology is due to the members of the Natural History Society of Montreal, and to the readers of "The Canadian Record of Science" generally, for the delay of several months which has occurred in issuing the magazine. The responsible editor, appointed at the annual meeting of the Society in 1898, was occupied throughout the summer months in actively prosecuting the practice of his profession, and had no time to devote to the interests of the Natural History Society as bound up in the publication of the "Record of Science." After returning to his academical work in the city, he was taken seriously ill, and was for a long time laid aside from duty, and, when he did recover, he had so much leeway to make up in his professional work proper that work on the Society's journal had to be still further postponed. But the Committee now in charge of the publication will endeavor to overtake lost ground, and hope to present the "Record" regularly each quarter.

It will be conducted for the present on the old lines, laid down when the new series was begun in 1884, and "will contain, in addition to the Society's proceedings, original papers on scientific subjects of interest to Canadians and reprints of scientific papers published elsewhere which deal with Canadian materials."

All communications and correspondence concerning the "Record" should be addressed,

THE EDITOR CANADIAN RECORD,
32 University Street,
Montreal.

ZOOLOGICAL PROBLEMS FOR THE NATURAL HISTORY SOCIETY OF MONTREAL.

By E. W. MACBRIDE.

The subject matter of the study of natural history is of wide, one might almost say, illimitable extent, embracing, as it does, all animated nature in all its infinite variety. Compared to it, the studies of physics and chemistry appear of limited scope. In so vast a field, it is but natural that first one aspect and then another aspect should have rivetted the attention of students. In the early part of the century, the main object of the naturalist was to catalogue the different varieties of living things which he saw around him, distinguishing them from one another by external and easily recognized marks. Later, the celebrated anatomists, Cuvier, Owen and many others, laid the foundation of what has been called transcendental zoology, that is, they recognized that there were deep-seated agreements in the general plan of structure running through whole groups of animals, and that to properly classify them, animals must be thoroughly examined, internal structure as well as external features being taken into account.

The meaning of these deep-seated unities underlying differences puzzled the earlier anatomists very much.

They were wont to speak of animals having a common plan of structure, and to explain that by plan they meant an idea in the mind of the Creator. With the advent of Darwin, all this was changed, and it was recognized that the fundamental agreement in structure of many different animals implied community of descent. This enlightening and fascinating idea gave a tremendous spur to anatomical investigation, and for a time the dissecting room and the laboratory almost monopolized the attention of natural history students, especially when, at the same time, the new mode of interpreting the development or life history of animals, as a recapitulation of the ancestral history of the race, came into the foreground.

Of late years, however, there has been somewhat of a revulsion of feeling in this respect. It has been remembered that an animal is not a mere piece of intricately constructed matter, but a working machine, and in order to properly understand it, it must be studied living amidst its natural surroundings. We ought to beware of repeating the mistake of the older anatomists and over-emphasizing one side of the truth. We cannot, it is true, fully explain the structure of an animal with reference to its present habits and surroundings. If we could, all evidence for the descent of different animals from a common ancestor would disappear. No, an animal is to be compared to a piece of wax which has been passed through many different moulds, each of which has left its impress, and the newer impress has never entirely obliterated the traces of the older. Each form-impressing mould will then represent a set of circumstances and of habits possessed by the ancestors of the animal at one period of its existence, and the present habits and environment represent, so to speak, the last mould into which the piece of wax has been pressed.

In studying the surroundings and habits, then, we are not merely trying to explain some part of an animal's structure; we are really observing the mode in which evolution, that is modification of structure, has taken place.

Now it is surprising how few accurate observations we have on the relation of animals to their environment. The older naturalists were content, as I have said, to classify, interspersing here and there some remarks as to habits, which were generally erroneous. Yet there are few subjects of study more important to zoology. Some of the most fundamental questions in the science depend for their solution on such studies. Chief among these is the amount of weight to be assigned to the principle which was regarded by Darwin as the driving power of evolution, viz., natural selection.

I need hardly remind you that by natural selection is meant the theory, that the struggle for existence, which inevitably follows from the tendency of every species of animal to produce far more young than can possibly survive, will select survivors with some advantageous peculiarity, which peculiarity will, in this way, become a character of the species.

Now, when stated in these broad, general terms, few would deny the truth of the theory, and certainly when we examine the larger differences which separate families and orders from each other, we can often show their relation to differences in surroundings and habits, but the question at issue is whether the minute differences which separate species from species can be so explained. High authorities have taken opposite sides on this question, and it can only be settled by systematic open air study. If the marks of species are not so to be interpreted, then we want to know what is their explanation, and, above all, what keeps allied species from intermingling.

The first duty of a Natural History Society is to prepare an accurate list of the species of animals from the surrounding country. I am well aware that our Society has done this in several groups of the animal kingdom, but there are others in which it is yet to be done. The Vertebrata are, of course, all fairly well known. The Entomological Society, which, in my humble judgment, ought to be a section of this Society, has, no doubt, prepared a list of the insects, but I doubt very much whether any list of the Crustacea and Arachnida, to say nothing of the various groups of worms, has been made.

Once such a list has been made, innumerable interesting problems suggest themselves, of which I can select two or three as examples. We have, for instance, at least, four species of frogs in the neighboring country. The great bull-frog, or Canadian nightingale, Rana Catesbiana, attains a considerable size, and has a dull, yellowish, brown skin, sprinkled with minute black dots. Not attaining quite this size is the green frog, Rana clamata, the skin of which is of a uniform dull green, and which has an immensely developed tympanum or ear-drum. The common grass frog, Rana halecena, is much smaller, and has skin varying in color from bright green to golden brown and is diversified by oblong black patches. Finally, we have the wood frog, said to be identical with the common English species, Rana temporaria. This variety has a uniformly brown skin above and yellow beneath. I have not yet come across examples of this species.

Now the question arises, do these species differ from one another in their mode of life or not, and are their specific marks related to their surroundings?

With regard to the grass frog, Rana halecena, I may mention an observation which I myself made. I noticed at Ste. Rose a specimen on the grassy bank of the river. When not moving it was absolutely impossible to see it, the black patches on the green ground harmonized so completely with the color of the blades of grass and the shadows they threw. Now, it is stated that the bull-frog rarely leaves the water, and one might surmise that the muddy color of the skin resembled that of the muddy ground on which it usually was to be found. Further, if it is true that Rana temporaria, the English grass frog, is only found in woods, its deeper color might very possibly harmonize with the deeper shades in the forest. I do not put this suggestion forward even as a theory. I merely mention it as a working hypothesis to point to a direction promising good results if properly looked into.

It must be clearly borne in mind that a pretty extensive knowledge of the habits of an animal is required before one can hope to find the use of an external feature. On the English coast a small crab of a dark green color is very abundant. It is known as the Partin or shore crab (Carcinus Moenas), and one of its marked features is a series of five sharp notches on either side of the front part of the carapace. When one sees the animal in the course of a shore-collecting expedition, there is nothing in its habits that could suggest any reason for the existence of these notches. But if we keep some specimens in a tank with a gravelly bottom, we shall find that they form burrows, and, when not on the look out for prey, remain hidden in them. Under these circumstances, the limb, which ends in the great claw, is held closely pressed against the front edge of the carapace. The five notches referred to above constitute a grating, through the meshes of which the water streams to the gills, whilst the meshes are fine enough to prevent particles of the gravel in which the animal is buried slipping down. We must know where an animal passes all its time before we give up the idea that a feature is of some use to it.

Now, in the St. Lawrence, we have two well-marked species of Crayfish—Cambarus virilis and Cambarus Bartonii. The first has large eyes, and the predominant color is dark greenish-brown, although red specimens are also met with. It has a prominent rostrum with spines at the sides. The first abdominal legs in the male end in whip-like lash. This species is most abundant along the north shore as far as Lachine. Cambarus Bartonii, on the other hand, is always of a light red color; it has markedly smaller eyes, a broad, blunt rostrum without spines at the edge, and the first abdominal leg of the male ends in a hook. Cambarus Bartonii is much rarer than the other species, so far as my experience goes. I have found single specimens everywhere, but it appears to be abundant in the late fall on the back river (Ottawa.) It would be a most interesting problem to try to determine the distribution of these two species, and, if possible, their habits. Faxon, who has made a study of the North American Astacidae, places the two species in two different sections of the genus Cambarus, but he has no observations on their habits.

Another most interesting question which inevitably arises when we find two species of one genus living side by side is what prevents them from intermingling. The only proper definition of a species is a group of individuals closely resembling one another and breeding with one another so as to produce fertile offspring. Now when the naturalist separates two varieties as distinct species, he is seldom able to bring proof that they will not interbreed with one another. Hence the vast majority of determinations of species are mere surmises, surmises based on the belief that the only thing which will cause a group of animals to remain similar to one another is constant interbreeding. This is all very well in cases where the species are as distinct as our species of Cambarus, but in very many cases the differences separating allied species are so slight that there is the strongest reasons for doubting whether, in the true and physiological sense, they are distinct.

It would be comparatively easy to cross Cambarus virilis and C. Bartonii in the spring, and the animals experimented on could be kept either in a small pond or in little aquaria.

Some very interesting experiments are at present being carried out on butterflies in Cambridge. Some European species of butterflies are well known to be represented by two varieties—a mountain variety found in the upper meadows of the Alps, and a valley variety. The mountain variety is a dusky form. Now it occurred to Mr. Bateson, a distinguished naturalist in Cambridge, that if one started below in the valley and worked one's way upward, one of two things must happen; either one would find a slow gradation of one variety into the other, or one would arrive at a point where the two varieties are found flying together. Mr. Bateson found, as a matter of fact, that it was the latter alternative which was really the case. He collected a quantity of each variety and crossed them. The result is very interesting; the two varieties are perfectly fertile amongst themselves, but the offspring are not intermediate in character between the two parents; they either "take after" the father or the mother. Now, I feel sure that there are many cases known to the entomologists of Montreal where similar experiments could be made, and only in such ways shall we gradually arrive at an idea how one species may have given rise to two. In passing, it may not be inopportune to remark that there is a great deal of misconception in the way in which many people represent the *modus operandi* of evolution to their minds. They speak as if they believed that evolutionists thought that one species living in one place, of its own internal motion, broke up into two or three species, and hosts of imaginary difficulties have been raised, such as the supposed swamping of varieties by intercrossing, and so on. It must be confessed that these difficulties seem to have taken root in the mind of even so renowned an evolutionist as Alfred Russel Wallace. Now such a view seems to me to be entirely irrational. If we could have been spectators of the history of a species through the lapse of ages, we should have seen that so long as it inhabited the same area, it remained one, just as the English nation has remained one, although its general character has slowly changed, just as species have become modified in the lapse of time. What has led to the breaking up of a species into several has been the migration of parts into new areas and the isolation of these groups of individuals from the main stock; in a word, the sending out of colonies. The new conditions under which the colonists live make them, to a certain extent, different from the parent stock. Bateson's experiments show that there can be differentiation even where the territories of the mother country and the colony adjoin, and that, when this differentiation has reached a certain pitch, it is preserved from the fact that the characters of the two varieties will not mix in breeding.

The science of conchology is a branch of natural history eminently characteristic of the older period. It was an easy and agreeable task to collect shells; their colors were pretty, and the external characters were well marked. The passion for making new species out of all sorts of chance variations raged unchecked, and the number of species has reached portentous dimensions. Now, the question is, how far have these species determinations any real validity? and this question is only to be settled by systematic study on the spot. Owing to the difficulty of rearing fresh water molluscs, it is hardly possible to apply the test of interbreeding, but it might be at least ascertained how far the so-called species are really distinct and whether they do not grade into each other. Another most important and interesting point is to ascertain how far differences in the structure of the animals are correlated with the external differences in the shell. In the course of my expeditions to collect material for the classes in McGill, I have made some interesting observations on our two common species of mussel, Unio Complanatus and Unio Ventricosus, both found living together in the St. Lawrence at Verdun. Unio Complanatus has a long, narrow, comparatively flat shell. Unio Ventricosus, a shorter, broader and deeply arched shell. Now the first has a structure similar in all respects to that of Anodonta, which is the typical species described in zoological text books. The inner lobe of the inner gill is attached to the foot only in front and the outer gill is used as a nursery for the young. In Unio Ventricosus, on the other hand, the inner lobe of the inner gill is attached to the foot for the whole of its length and only the hinder part of the outer gill is used for a nursery. Here are two well marked anatomical facts correlated with a difference in the shells of two species of the same genus, and there are numerous other minor differences which I have not mentioned. It is exceedingly important to pursue this line of investigation further.

To sum up, the day is past when a natural history society could be held to justify its existence by the mere collecting and naming of species. Its function certainly is to collect, but that only as a means to an end, namely, to determine the conditions of the problems which it has to attack. From this point of view, whilst there is everything to be said in favor of making collections of total species, there is equally much to be said against spending time in making collections of species from all parts of the world, and especially against mixing species from different localities. Once the local fauna is fairly well known, the object of the naturalist is to study each species in relation to its environment, and leaving to the anatomist the task of elucidating the past history and wider relationships of an animal from its internal structure to determine what effect its present surroundings have had on it; in a word, to study evolution in action.

THE GRAMINEÆ, CYPERACEÆ AND JUNCACEÆ OF MONTREAL ISLAND.

By HAROLD B. CUSHING, B.A., and ROBERT CAMPBELL, M.A., D.D.

The following list, prepared jointly by Mr. Harold B. Cushing, B.A., and Rev. Robert Campbell, M.A., D.D., of Montreal, was communicated to the Natural History Society of Montreal on the evening of January, the 31st, 1898, by Dr. Campbell. It is the first time that a serious effort has been made to collect the local species of these three important families. The collections being continued over a period of four years, the list may be regarded as tolerably complete. The number of grasses—species and varieties—is 85, of which only 18 have been previously reported. The Cyperaceæ number 89—species and varieties—and of these only 10 have been previously reported. The Juncaceæ number 14, and none of these have been hitherto reported. In all there are 179 species and 9 varieties given in this paper, of which only 28 have been previously credited to the Island of Montreal. It may surprise some of those under whose eye this catalogue may fall, that in an island only twenty-eight miles long and nine miles wide, so many species of grasses, carices and reeds should be found. In fact, we have in the Counties of Hochelaga and Jacques Cartier an epitome of the flora of all the Eastern Provinces. The reason, doubtless, is that the insular situation of these counties, and especially their geological character—being the combined Provinces of Ontario and Quebec in miniature —peculiarly fit them, owing to the occurrence of mountains, rivers, marshes, swamps and woods close together, for affording a suitable *habitat* to the plants in question.

The nomenclature followed is that given in Britton & Brown's Flora of the United States and Canada. They have embodied in the main the determinations of the

Torrey Club, now regarded as the most eminent authority on the Flora of Eastern America. The *Gramineæ* of their publication were elaborated by Geo. V. Nash; the *Juncaceæ*, by F. V. Coville, while Prof. Bailey's conclusions were generally adopted in regard to the *Carices.* Wherever there has been a departure from the nomenclature of Gray's "Manual," 6th edition, the latter is placed within brackets.

GRAMINEÆ JUSS.

SYNTHERISMA WATT.

1. SYNTHERISMA SANGUINALIS (L.) Nash. (*Panicum sanguinale.*)—Yards and roadsides. Rare.

PANICUM L.

1. PANICUM CRUS-GALLI L.—Very common in yards and waste places. July and August.

2. PANICUM PORTERIANUM Nash. (*P. latifolium.*)—Mount Royal Park and Cemetery. June.

3. PANICUM CLANDESTINUM L.—Bagg's Woods. July, 1896.

4. PANICUM XANTHOPHYSUM A. Gray.—Mount Royal Park. June.

5. PANICUM SCRIBNERIANUM Nash.—Mount Royal Park. July.

6. PANICUM DICHOTOMUM L.—Mount Royal Cemetery. Reported by Dr. Holmes as *P. nitidum.*

7. PANICUM DEPAUPERATUM Muhl.—Top of Mount Royal. 1894.

8. PANICUM MILIACEUM L.—Cote St. Paul. July 17, 1897.

9. PANICUM CAPILLARE L.—Common in yards, roadsides, lanes. August.

IXOPHORUS SCHLECHT (*Setaria.*)

1. IXOPHORUS VERTICILLATUS (L.) Nash. (*Setaria ver-*

ticillatus.)—Common. Reported by Holmes and Fletcher.

2. IXOPHORUS VIRIDIS (L.) Nash. (*Setaria viridis.*) Common. Reported by Holmes.

3. IXOPHORUS GLAUCUS (L.) Nash. (*Setaria glauca.*)—Common everywhere. July and August.

4. IXOPHORUS ITALICUS (L.) Nash. (*Setaria Italica.*) Cote St. Antoine. 1896.

ZIZANIA L.

1. ZIZANIA AQUATICA L.—Mouth of St. Pierre River. August, 1895.

HOMALOCENCHRUS MIEG (*Leersia.*)

1. HOMACLOCENCHRUS ORYZOIDES (L.) Poll. (*Leersia oryzoides.*)—St. Pierre River. August. Reported by Holmes.

PHALARIS L.

1. PHALARIS ARUNDINACEA L.—Mouth of St. Pierre River. June and July.

2. PHALARIS ARUNDINACEA PICTA L.—Cote St. Paul. August.

3. PHALARIS CANARIENSIS L.—Cote St. Antoine and city lanes. August.

SAVASTANA SCHRANK.

1. SAVASTANA ODORATA (L) Scribn.—Savanne. June, 1897.

STIPA L.

1. STIPA MACOUNII Scribn. (*S. Richardsonii.*) Mount Royal Park, near riding course. August.

ORYZOPSIS MICHX.

1. ORYZOPSIS JUNCEA (Michx) B. S. P.—Mount Royal Park. June, 1896.

2. ORYZOPSIS ASPERIFOLIA Michx.—Cemetery woods and north mountain. May.

3. Oryzopsis melanocarpa Muhl.—Woods north of riding course. August.

Milium L.

1. Milium effusum L.—Hill west of Mount Royal Cemetery gate. August.

Muhlenbergia schreb.

1. Muhlenbergia Mexicana (L.) Trin.—Common on Mount Royal. August.

2. Muhlenbergia racemosa (Michx) B.S.P.—Savanne, St. Michel. August, 1897.

3. Muhlenbergia sylvatica Torr. — Pointe-aux-Trembles and Mount Royal Park. August.

4. Muhlenbergia tenuiflora (Willd) B. S. P.—Bagg's woods. August. Reported by Holmes as *agrostis tenuiflora.*

Brachyelytrum Beauv.

1. Brachyelytrum erectum (Schreb) Beauv.—Hochelaga woods. June. Reported by Holmes as *B. aristatum.*

Phleum L.

1. Phleum pratense L.—Common. June and July.

Alopecurus L.

1. Alopecurus geniculatus L.—Swamps on Mount Royal and Annex. July. Reported by Holmes.

Cinna L.

1. Cinna latifolia (Trev.) Griseb. (*C. pendula.*)—Swamp on Mount Royal. July and August.

Agrostis L.

1. Agrostis alba L.—Common. June and July.

2. Agrostis alba vulgaris Thurber.—Common. June and July

3. Agrostis perannens (Watt) Tuckerm.—Swamp on Mount Royal. August.

4. Agrostis hyemalis (Watt), B S. P. (*A. scabra.*)—South mountain. August.

Calamagrostis Adams.

1. Calamagrostis Canadensis (Michx) Beauv. (*Arundo. Canadensis.*)—Mount Royal. August.

2. Calamagrostis Langsdorfii (Link) Trin. (*Arundo Langsdorfii.*)—Woods west of riding course. August.

3. Calamagrostis neglecta (Ehrh.) Gaertn. (*Arundo neglecta.*)—Hochelaga woods. August.

Holcus L.

1. Holcus lanatus L.—Montreal Junction. August. Reported by Holmes as *Hierochloa borealis.*

Deschampsia Beauv.

1. Deschampsia flexuosa (L.) Trin.—In Cemeteries and on Mount Royal. June and July.

Arrhenatherum Beauv.

1. Arrhenatherum elatius (L.) Beauv.— Between Pointe-aux-Trembles and Sault au Recollet. June, 1894.

Danthonia DC.

1. Danthonia spicata (L.) Beauv.—Abundant top of Mount Royal and Cemeteries. June.

Spartina Schreb.

1. Spartina cynosuroides (L.) Willd.—Pointe-aux-Trembles. August. Reported by Holmes.

Eatonia Raf.

1. Eatonia Pennsylvanica (DC.) A. Gray.—Montreal Junction. August.

Dactylis L.

1. Dactylis glomerata L.—Common.

Cynosurus L.

1. Cynosurus cristatus L.—Rare. August. Reported by Holmes.

Poa L.

1. Poa annua L.—Common on roadsides, lawns. June and July.

2. Poa compressa L.—Common. June and July.

3. Poa pratensis L.—Common. July and August. Reported by Holmes.

4. Poa trivialis L.—Hochelaga bank and Bagg's woods. August.

5. Poa nemoralis L.—Mount Royal Park and Lachine. August.

6. Poa flava L. (*P. serotina.*)—Common in many places. Reported by Holmes as *P. serotina.*

7. Poa debilis Torr.—Bagg's woods. August.

8. Poa alsodes A. Gray.—Swamp north of riding course. August.

Graphephorum Desv.

1. Graphephorum melicoideum (Michx) Beauv.—Hochelaga woods. August, 1897.

Panicularia Fabr. (*Glyceria.*)

1. Panicularia Canadensis (Michx) Kuntze. (*Glyceria Canadensis.*)—Common. Reported by Holmes as *Poa Canadensis.*

2. Panicularia elongata (Torr.) Kuntze. (*Glyceria elongata.*)—Common in woods. June and July.

3. Panicularia nervata (Willd) Kuntze. (*Glyceria nervata.*)—Common. Reported by Holmes as *Poa nervata.*

4. Panicularia Americana (Torr.) MacM. (*Glyceria

grandis.)—In wet places. Common. Reported by Holmes as *Poa aquatica*.

5. PANICULARIA PALLIDA (Torr.) Kuntze. (*Glyceria pallida.*)—South mountain. August.

6. PANICULARIA FLUITANS (L.) Kuntze. (*Glyceria fluitans.*)—Marsh, Logan's Park. August.

FESTUCA L.

1. FESTUCA OCTOFLORA Watt. — South mountain. August.

2. FESTUCA OVINA L.—Common.

3. FESTUCA OVINA DURIUSCULA (L.) Hack.— Cemetery path. July.

4. FESTUCA SCABRELLA Torr.--South mountain. August.

5. FESTUCA ELATIOR L.—Bagg's woods. August.

BROMUS L.

1. BROMUS CILIATUS L.—Mount Royal Park, near upper reservoir. August.

2. BROMUS ASPER Murr.—Mount Royal Park, near riding course. August.

3. BROMUS STERILIS L.—Cote des Neiges road. August, 1897.

4. BROMUS KALMII A. Gray.—Mount Royal Park, near upper reservoir. August.

5. BROMUS SECALINUS L.—Cemetery and Mount Royal. August, 1897.

LOLIUM L.

1. LOLIUM PERENNE L. — Mount Royal Cemetery. August. Reported by Holmes.

AGROPYRON J. GAERTN.

1. AGROPYRON REPENS (L.) Beauv.—Too common.

2. AGROPYRON VIOLACEUM (Hornem) Vasey. — South mountain. August.

3. Agropyron caninum (L.) R. & S. — Mount Royal Park. August.

Hordeum L.

1. Hordeum jubatum L.—Westmount, Pointe-aux-Trembles. July. Reported by Holmes.

Elymus L.

1. Elymus striatus Willd.— Mount Royal Park. August.

2. Elymus Virginicus L.—Mount Royal Park, near upper reservoir. August.

3. Elymus Canadensis L.— Sault au Recollet. September, 1897.

4. Elymus Glaucus Buckl.—South mountain. August.

5. Elymus arenarius L.— Shore of St. Lawrence, Point St. Charles. July, 1896.

Hystrix Moench. (*Asprella.*)

1. Hystrix Hystrix (L.) Millsp. (*Asprella Hystrix.*) Common. Reported by Holmes as *Elymus hystrix.*

CYPERACEÆ J. St. HIL.

I. Cyperus Tourn.

1. Cyperus diandrus Torr.—Point St. Charles. August, 1897.

2. Cyperus Esculentus L.— Cote St. Paul. August, 1897.

3. Cyperus Strigosus L.—Lachine. September, 1897.

Dulichium L.C. Richard.

1. Dulichium arundinaceum (L.) Britton.— River St. Pierre. August, 1896.

ELEOCHARIS R. BR.

1. ELEOCHARIS OVATA (Roth.) R. & S.—Hochelaga, Cote St. Paul and Annex.

2. ELEOCHARIS PALUSTRIS (L.) R. & S.—Common everywhere.

3. ELEOCHARIS ACICULARIS (L.) R. & S.—Common in swamps.

4. ELEOCHARIS TENUIS (Willd) Schultes.—Hochelaga woods, Point St. Charles. June, 1896.

5. ELEOCHARIS ACUMINATA (Muhl.) Nees.—Mount Royal Park. August, 1897.

STENOPHYLLUS RAF.

1. STENOPHYLLUS CAPILLARIS (L.) Britton. (*Fimbristylis capillaris.*)—Point St. Charles. August, 1897.

SCIRPUS L.

1. SCIRPUS AMERICANUS Pers.—Point St. Charles. July, 1896. (Dr. Holmes.)

2. SCIRPUS LACUSTRIS L.—Hochelaga bank and St. Pierre River. June, 1895.

3. SCIRPUS FLUVIATILIS (Torr.) A. Gray.—Hochelaga woods. July, 1897.

4. SCIRPUS ATROVIRENS Muhl.—Common everywhere.

5. SCIRPUS MICROCARPUS Presl.—Swamp above riding course. August, 1896.

6. SCIRPUS CYPERINUS (L.) Kunth.—Swamp above riding course. September, 1897.

7. SCIRPUS CYPERINUS ERIOPHORUM (Michx) Britton.—Swamp, Pointe-aux-Trembles. September, 1896.

ERIOPHORUM L.

1. ERIOPHORUM VAGINATUM L.—Hochelaga woods. August, 1897.

2. ERIOPHORUM POLYSTACHYON L.—Pointe-aux-Trembles. August, 1896.

Carex L.

1. Carex intumescens Rudge.— Mount Royal, Mile End, St. Michel. May.

2. Carex lupulina Muhl.—Montreal Annex, Cote St. Paul, Hochelaga bank.

3. Carex utriculata Boott.— Marsh in Hochelaga woods and Bagg's woods. August, 1896.

4. Carex monile Tuckerm.— Marsh at Pointe-aux-Trembles, August, 1897.

5. Carex Tuckermani Dewey.— Mountain swamp. June. 1894.

6. Carex retrorsa Schwein.—Mountain swamps and Annex.

7. Carex lurida parvula (Paine) Bailey. (*C. tentaculata*, var. *parvula.*)—Lachine. July, 1896.

8. Carex hystricina Muhl.—Mount Royal, Hochelaga woods. June, 1894.

9. Carex Pseudo-Cyperus L.—Mount Royal and Mile End. June, 1894.

10. Carex comosa Boott. (*C. Pseudo-Cyperus*, var. *Americana.*)—Pointe-aux-Trembles. September, 1897.

11. Carex aristata R. Br. (*C. trichocarpa*, var. *aristata.*)—Savanne, St. Michel. July, 1896.

12. Carex riparia Curtis.— Shore of St. Lawrence, Verdun. August, 1897.

13. Carex lanuginosa Michx. (*Filiformis*, var. *latifolia.*)—Mount Royal, Annex, Hochelaga.

14. Carex stricta Lam.— Aqueduct, Cote St. Paul, Lachine. June, 1895.

15. Carex stricta angustata (Boott) Bailey.—Hochelaga woods. August, 1896.

16. Carex stricta xerocarpa (S. H. Wright) Britton. —Bagg's woods. September, 1897.

17. Carex Haydeni Dewey. (*C. stricta*, var. *decora.*) —Hochelaga swamp. July, 1896.

18. CAREX AQUATILIS Wahl.—Swamp near Back River. August, 1897.

19. CAREX GOODENOVII J. Gay. (*C. vulgaris.*)—Lachine. July. Reported by Dr. Holmes as *C. vulgaris.*

20. CAREX PRASINA Wahl.— Hochelaga bank. June, 1897.

21. CAREX CRINITA Lam.— Mount Royal, St. Anne's, Hochelaga.

22. CAREX GYNANDRA Schwein.—Woods at St. Michel. July, 1897.

23. CAREX GRACILLIMA Schwein.—Common.

24. CAREX DAVISII Schwein.— Mount Royal. July. Reported by C. F. McCrea.

25. CAREX ARCTATA Boott.—Mount Royal, Hochelaga, Westmount, St. Anne's.

26. CAREX ARCTATA FAXONI Bailey.—Hochelaga woods. June, 1897.

27. CAREX TENUIS Rudge. (*C. debilis,* var. *Rudgei.*)—Bagg's woods. July, 1896.

28. CAREX GRANULARIS Muhl.—Common in many places.

29. CAREX FLAVA L.—Mile End and Montreal Annex. June, 1895.

30. CAREX PALLESCENS L.—Mount Royal. May and June, 1895.

31. CAREX HITCHCOCKIANA Dewey. — Near riding course, June, 1895.

32. CAREX LAXIFLORA Lam.— Mount Royal and Mile End. Reported by Dr. Holmes.

33. CAREX LAXIFLORA BLANDA (Dewey) Boott.—Mount Royal and Hochelaga. May, 1895.

34. CAREX ALBURSINA Sheldon. (*C. laxiflora,* var. *latifolia.*)—Mount Royal. May, 1895.

35. CAREX PLANTAGINEA Lam.—Sides of Mount Royal. May, 1895.

36. CAREX PLATYPHYLLA Carey. — North mountain. Reported by Holmes and McCrea.

37. Carex aurea Nutt.— Mount Royal and Cote St. Paul. May and June, 1895.

38. Carex pedunculata Muhl.— Mount Royal and Westmount, 1894. Reported by McCrea.

39. Carex pedicellata (Dewey) Britton. (*C. communis.*)—Mount Royal, Westmount, St. Anne's.

40. Carex pedicellata Wheeleri (Bailey) Britton. (*C. communis*, var. *Wheeleri.*)

41. Carex Pennsylvanica Lam.— Common in Mount Royal Park. May.

42. Carex Varia Muhl.— Common on Mount Royal. Reported by Dr. Holmes.

43. Carex Novæ Angliæ Schwein.—Hochelaga bank. June, 1897.

44. Carex umbellata Schk.—Mount Royal Park and Cemetery. May, 1895.

45. Carex pubescens Muhl.— Mount Royal. Rare. 1894.

46. Carex leptalea Wahl. (*C. polytrichoides.*)—Swamp on Mount Royal. May, 1894.

47. Carex chordorhiza L.— Bog, Hochelaga woods. August, 1896.

48. Carex stipata Muhl.—Cote St. Paul and Mount Royal. Fairly common. June.

49. Carex teretiuscula Gooden.— Lachine. July, 1897.

50. Carex vulpinoidea Michx.—Common. Reported by Holmes and McCrea.

51. Carex tenella Schk.—Swamps on Mount Royal.

52. Carex rosea Schk.—Common Mount Royal.

53. Carex sparganioides Muhl.—Near riding course. June, 1895.

54. Carex cephalophora Muhl.— Mount Royal, Mile End and Westmount.

55. Carex sterilis Willd. (*C. echinata*, var. *microstachys.*)—Common. Reported by Holmes as *C. scirpoides.*

56. CAREX CANESCENS L.—Swamps on Mount Royal. June, 1894.

57. CAREX FŒNEA Willd.— Mountain swamp. July, 1897.

58. CAREX TENUIFLORA Wahl.—Lachine swamp. July, 1897.

59. CAREX DEWEYANA Schwein.—Mount Royal. Fairly abundant. Reported by Holmes and McCrea.

60. CAREX BROMOIDES Schk.—Hochelaga bank swamp. June, 1896.

61. CAREX TRIBULOIDES Wahl.—Cote St. Paul, Lachine, Bagg's woods. July.

62. CAREX SCOPARIA Schk.—Mount Royal, Hochelaga. Lachine. August.

63. CAREX CRISTATELLA Britton. (*C. tribuloides,* var. *cristata.*) Cote St. Paul. August, 1896.

64. CAREX ADUSTA Boott.— Montreal Annex. July, 1897.

65. CAREX STRAMINEA Willd.— Hochelaga, Lachine. June, 1896.

66. CAREX TENERA Dewey. (*C. straminea,* var. *aperta.*) —Hochelaga bank. June, 1897.

67. CAREX FESTUCACEA Willd. (*C. straminea,* var. *brevior*).—Mount Royal. June, 1897.

(The following were omitted in their proper places in the list.)

68. CAREX HARTII Dewey.— Mount Royal, Montreal. July, 1897.

69. CAREX REDOWSKYANA C. A. Meyer.

JUNCACEÆ VENT.

I. JUNCUS L.

1. JUNCUS EFFUSUS L.—Mount Royal and Point St. Charles. July, 1895.

2. JUNCUS BALTICUS Willd. — Point St. Charles. August, 1897.

3. JUNCUS BUFONIUS L.—Not rare.

4. JUNCUS TENUIS Willd.—Common.

5. JUNCUS DICHOTOMUS Ell.—Lachine. August, 1897.

6. JUNCUS MARGINATUS Rostk.—Lachine. September, 1897.

7. JUNCUS STYGIUS L.—St. Michel, Savanne, 1897.

8. JUNCUS ARTICULATUS L—Rockfield. July, 1897.

9. JUNCUS RICHARDSONIANUS Schultes.—(*Alpinus,* var. *insignis.*)—Mount Royal. 1896.

10. JUNCUS NODOSUS L. (Var. *genuinus.*)—Mount Royal, 1894.

11. JUNCUS CANADENSIS J. Gay.—Pointe-aux-Trembles.

12. JUNCUS CANADENSIS BREVICAUDATUS Engelm. (Var. *coarctatus.*)—Hochelaga bank, 1897.

II. JUNCOIDES ADANS. (*Luzula, D C.*)

1. JUNCOIDES PILOSUM (L.) Kuntze. (*Luzula vernalis.*) —Mount Royal Cemetery. 1896.

2. JUNCOIDES CAMPESTRE (L.) Kuntze. (*Luzula campestris.*)—Mount Royal Cemetery, 1895.

DIMORPHISM AND POLYMORPHISM IN BUTTERFLIES.[1]

By HENRY H. LYMAN, M.A.

The subject which I have chosen for my address to-night is one of very great interest and is capable of excellent illustration among the butterflies of this continent, some of which furnish remarkable examples of diverse forms.

I shall confine my remarks strictly to the North American species, as these are the only ones which I have

[1] Read before the Natural History Society, 25th Feb., 1895.

studied, and the facts which I shall set forth are the common property of lepidopterists.

Under the title dimorphism, I have included sexual diversity, although this is frequently treated of separately under the term antigeny.

You are all aware that many animals exhibit striking differences between the sexes, and this is true of many butterflies, some of which differ much more between the sexes than do those of the same sex of different species, and some differ so greatly that you would suppose them to belong to different genera, while others differ so little that it takes an entomologist of some experience to separate them. Not only is there great range of degrees of difference, but also the variety of ways in which they differ seems almost endless.

And not only do the different genera vary greatly in this way, but even within the limits of a single genus you may have species in which the sexes are practically identical, species in which they differ slightly, others, differing more strongly, and so on till we reach a species where the sexes are so unlike that they might easily be taken for different species or even different genera. Such a group is the genus Argynnis, a genus very typical of the Palearctic and Nearctic fauna.

The smaller species, such as Myrina, Montinus, &c., which Dr. Scudder separates under the generic name Brenthis, are practically identical in the sexes, though there is a slight difference in the point of origin of one of the nervules of the hind wing.

In the majority of the species the males may be said to have the ground color fulvous, while in the females it inclines to luteous, but in a few there is a very striking diversity between the sexes.

Argynnis Cybele, which is quite common in this locality, is a very good example of the majority, though the contrast is, perhaps, greater than in the average, while

Argynnis Nokomis is a splendid species, in which the male is of a fiery fulvous, while the female is of a dark brown tone, and Argynnis Leto is a similar though less marked example in the same class. But the most striking case in this genus is that of Argynnis Diana, the most superb species of the genus. In this the male, while fairly preserving the usual colors of the genus, departs widely from the normal type of ornamentation, as instead of the ground color being fulvous, marked with bars and spots of black, it is for two-thirds of the distance from the base of a dark brown color, with a bright tawny border, but the female not only departs widely from the usual type of ornamentation, but also loses every trace of tawny or fulvous coloring, becoming a dark blue butterfly with a striking resemblance to the genus Limenitis.

This is an example of the fact that where there is marked dimorphism between the sexes it is almost invariably the female which departs from the usual type, but whether this is to be accounted for by the general desire of that sex for striking and varied costumes, I am unable to say.

The genus Colias, one of the most puzzling and, therefore, most interesting, of genera, furnishes some striking cases of sexual dimorphism.

This genus is composed of the so-called Sulphur Butterflies, the yellow or orange butterflies which are found everywhere, flitting about the clover fields especially, and which Dr. Scudder thinks were probably the first to be called butterflies, as the yellow Ranunculus is called the buttercup. The most striking case of sexual dimorphism in this genus is Colias Eurydice, which some authors separate from that genus under the generic name Meganostoma.

It is a most beautiful species in the male sex, but the female is of a uniform pale sulphur yellow, only resembling the male in the shape of the wings and in the discal spot of the primaries.

So great is the contrast that it was described as Rhodocera Lorquini by the celebrated Dr. Boisduval, who had previously named the male, and it was also described as Meganostoma Helena ♂ by Mr. Reakirt.

In Colias Pelidue, which occurs in Labrador, the male is of a sulphur yellow, while the female is of a rather dingy white, thickly sprinkled below on the secondaries with greenish brown, and similar examples occur elsewhere, especially among the alpine and sub-arctic species of the genus.

Among those species which do not appreciably vary in the sexes are some of the most strongly marked species, species, moreover, which are either cosmopolitan or have a very extended range over a great part of the earth's surface, and upon which the differing climatic conditions of their various habitats seem to have been powerless to effect any change. Of these the most marked are Vanessa Antiopa, called in England, where it is a great rarity, the Camberwell Beauty, Pyrameis Atalanta, or Red Admiral Butterfly, and the species to which Mr. Kirby in his catalogue gives the locality as "Mundus," Pyrameis Cardui, the so-called Painted Lady, an opprobrious name in my estimation.

On the other hand, the species which varies the most in the sexes is the beautiful species named Diadema Missipus, from Indian River, Florida, which differs so greatly that no one unacquainted with it would suppose that the two sexes were of the same genus, still less of the same species. This species forms a sort of link between the genus Limenitis, in which the colors are largely purple brown and white, and the genus Danais, which is tawny, with black and white markings. Indeed, the female of Missipus may be classed with the mimetic or mimicking forms, "but that," as Rudyard Kipling would say, "is another story."

Between these two conditions—of no variation and very great variation—there is every possible gradation. Pyrameis Huntera, very closely allied to the cosmopolitan Cardui, only differs perceptibly in the color of the transverse bar near the apex of primaries which is white in the male, but tawny in the female. In Danais Archippus the sexual mark is a slight black swelling close to the lowest median nervule of the hind wings, which is really a pouch enclosing the androconia or scales peculiar to the male sex. These androconia are thought by some to be scent organs for the purpose of rendering the male pleasing to the female, the male being thought to have the power of opening at will the pouches or folds in which they are contained. They are of very various forms and are placed in different parts of the wing in different species.

In the larger species of the genus Argynnis they occur along the branches of the median and along the submedian vein of the fore wings. They are covered up and protected by other scales, which gives the appearance of a thickening of the veins, and these species also have a row of hairs in the males above the subcostal vein of the hind wings.

In the Theclas or Hair Streaks, these scales are often crowded together in a peculiar patch near the front of the fore wing, and in some species of Satyrs, especially in the genus Chionobas, they cluster together in a peculiar dash on the front wings running towards the apex, and when the species, as is frequently the case, are ornamented with ocelli, these are generally larger and more conspicuous in the females. In other genera the sexes are distinguished by a considerable difference in the shape of the wings, a very striking example of this being found in the genus Apatura, as in Apatura Clyton, where the wings of the female are much fuller and more rounded than in the male, and similarly in Thecla Titus the fore wings of the male have a pointed tip and the hind wings have the inner angle sharply defined, while in the female both these parts are broadly rounded, but in most of the species of this genus no such striking distinction in shape occurs.

Another curious point is found in connection with the atrophy or partial atrophy of some of the legs. In the Hesperidæ or Skippers, the little brownies of the butterfly world, which are universally admitted to be the lowest family of butterflies, there are six fully developed legs, while in the Nymphalidæ, which is certainly a higher family, there are only four legs used in walking, the front pair having become aborted into furry lappets, folded down on the breast, whence the English name sometimes given to this group, Brush Footed Butterflies.

But the most curious point in this connection is that between the six-footed butterflies and four-footed butterflies stands an intermediate family, the Lycænidæ, which are among the gems of the butterfly world, in which the fore legs are perfectly formed in the females, but more or less atrophied in the males, so that if the doctrine which assigns the higher plane to the four-footed butterflies is sound, it must be admitted that the ladies of this intermediate family are upon a lower level of creation than their lords and masters, a most deplorable conclusion.

In this family there are often great differences between the sexes in color and ornamentation in addition to the structural difference just referred to.

In the Theclidi the differences are generally not great, though one beautiful species, Læta, differs so much that the sexes were described as different species by Mr. Wm. H. Edwards, one of the very foremost American lepidopterists.

In Chrysophanus the males are frequently brown with a purplish reflection, and the females of a fiery coppery hue; whence their name "Coppers," as in Chrysophanus Thoë, which occurs here, though rarely, but in some of the species, such as Hypophleas, which is abundant all through this eastern part of the continent, no such distinction exists.

In Lycæna, or the "Blues," the females are generally more heavily bordered with dark brown than the males, and sometimes are almost entirely brown, with a border of orange spots.

Among the skippers the differences are generally well marked in the Pamphilidi, in which the males are generally more tawny than the females, and frequently have a peculiar discal dash on the front wings where the androconia are placed, but are not well marked in the other tribe, the Hesperidi, though in some genera the male has a peculiar fold on the costal or front margin of the fore wings in which the androconia are concealed. But though I have not nearly exhausted the subject of sexual dimorphism, I must hasten on to treat of the more general subject of dimorphism and polymorphism other than sexual.

It is a very remarkable fact that certain species of butterflies exist in two or more distinct forms which in many cases have been described as distinct species.

This kind of dimorphism may be partial or complete, that is, it may exist in one sex or both. Further, it may occur in part of a butterfly's habitat, but not in all parts. Again, it may be seasonal or occur regardless of season, or it may be partly seasonal and partly not.

To take a few instances of partial dimorphism, one of the most striking is the case of our common yellow swallowtail, Papilio Turnus.

In the north both sexes are yellow, but south of a line which may be roughly described as starting at a point a little south of New York and curving northwesterly to a little north of the international boundary north of Montana, a black form of female, to which the name Glaucus was given, begins to take the place of the yellow form and rapidly replaces it to total exclusion as we go south to the Gulf States.

Another somewhat similar case, but in the reverse sex, is the black male of Lycæna Violacea, one of the polymorphic forms of Lycæna Pseudargiolus, which is found in this spring brood in Virginia and the South.

This case is especially remarkable in being the only example so far known of partial dimorphism in which the male instead of the female departs from the type.

I have already referred to the fact in treating of sexual dimorphism that in some species of the germs Colias, the male is yellow and the female white, but in quite a number of other species and among them our common Sulphur Butterfly, Philodice, there are two forms of female, one yellow like the male, and the other albino, though the albino specimens are rare, but no case of an albino male is known.

Partial dimorphism is not by any means common, and the only other instance in our butterfly fauna which is familiar to me is that of Pamphila Hobomok which has two forms of female, and was therefore nicknamed the Mormon by Dr. Scudder, one being largely tawny like the male, and the other very dark in colour, and formerly supposed to be distinct, was named Pocahontas.

Among the species in which complete dimorphism occurs may be mentioned several species of Graptas, popularly called Comma Butterflies from the silvery mark resembling a comma on the underside of the hind wings.

These are Grapta Interrogationis with its two forms, Fabricii and Umbrosa, Grapta Comma with its two seasonal forms, Harisii the autumnal and spring form, and Dryas the summer form.

Grapta Satyrus, a most interesting species, having its home or metropolis in the far west where it is dimorphic with a second form named Marsyas, but occurring extremely rarely in the east where the form Marsyas has never been found, and Grapta Silenus another western species with a dimorphic form, Oreas.

All these butterflies have at least two broods in the season, otherwise dimorphism could never develop, and in the allied species, such as Gracilis and Faunus, which are single brooded or monogoneutic, it does not occur.

These forms were all formerly thought to be distinct species and were so named, and it was only by careful observations and breeding from the egg that their interesting relationship was discovered.

Among this group, the most curious case is that of Grapta Interrogationis, as it not only differs in colour but also in the shape of the wings, and even in certain structural features.

In most of these cases the dimorphism is largely seasonal, one form being the autumnal form, which hibernates and appears again in the spring, and the other the summer form produced from the hibernators, but the separation is not complete, as a few of the summer brood are of the autumnal type.

But by far the most startling instance of dimorphism, on this continent at least, if not in the world, is that which has been recently worked out by Mr. David Bruce and Mr. W. H. Edwards, to the latter of whom we owe most of our knowledge not only of the dimorphism and polymorphism of our butterflies but also of their preparatory stages, and who stands at the head of North American Lepidopterists.

The case to which I refer, is the discovery that Papilio Oregonia, a form of yellow swallowtail, and Papilio Bairdii, a form of black swallowtail, are merely dimorphic forms of one species, in spite of belonging to two distinct subgroups of the genus Papilio.

So incredible did this seem that some of us found fault with Mr. Edwards for his first announcement, as we thought the evidence not perfectly conclusive, so Mr. Edwards, though a man of 72 years of age, went out to

Colorado last summer to work out on the spot the life history of these most interesting forms.

So far I have spoken only of dimorphism, but polymorphism also exists among our North American butterflies.

The most striking instance so far known among butterflies occurring commonly in Eastern Canada is the case of the beautiful little blue butterfly which may frequently be seen in its favourite haunts early in May. Dr. Scudder calls it the Spring Azure and its scientific name is Lycæna Pseudargiolus.

This species occurs in many forms, most of which have been regarded as distinct species. In the north there first appears the variety Lucia with an occasional Violacea and sometimes an intermediate form which Mr. Edwards named Marginata. Then in the summer there is the form Neglecta. To the South, say in Virginia, the forms Lucia and Marginata do not occur, Violacea being the regular earliest Spring form, but it has a dimorphic black male to which reference has already been made, and there is an additional and later Spring form, the largest in the series and the one first described under the name Pseudargiolus, while the later broods are few in numbers and of the form Neglecta.

In Arizona another variety occurs which Mr. Edwards calls Cinerea, and there is also the Pacific Coast form Piasus, with its variety, Echo, which occurs in California and Arizona.

A wonderful example of polymorphism is the case of Colias Eurytheme the bright orange butterfly of the West, though on two occasions single individuals have been taken in this Province.

Its typical form is of fiery orange with a heavy black border, but there are also albino females; then it runs through various degrees of less orange until we get the winter form Ariadne, small and with hardly any orange at all, and then there is the form which Mr. Edwards named

Hagenii after Dr. Hagen, supposing it to be distinct, but which was found by breeding to be merely a yellow polymorphic form of this species.

Another fine example of polymorphism is the case of Papilio Ajax with its forms Walshii, Telamonides and Marcellus. Of these forms the first two are Spring forms both coming from chrysalides of the previous year, Walshii appearing first and Telamonides shortly afterwards, and Marcellus being the summer form, but the relations of these forms to each other are very curious and could only be made clear by an extended notice, but Mr. Edwards sums up the results thus :—

Walshii produces Walshii, Telamonides and Marcellus, the same season; Telamonides produces Marcellus the same season and its own type in the following Spring; Marcellus produces successive broods of Marcellus the same season and occasionally Telamonides, and the last brood produces Walshii and Telamonides in the Spring.

In conclusion, we may consider the possible causes of dimorphism and polymorphism and the results which are likely to follow.

Some cases of dimorphism, especially the strongly marked cases of sexual dimorphism and the cases of partial dimorphism are extremely obscure, as it is impossible to assign a reason as yet why Turnus male should not be affected by the climatic changes in the southern range of its habitat except to become larger and finer, while the female is turned into a nigger.

But in some cases such as the cases of complete and seasonal dimorphism, it doubtless results from the greater or less heat at the time the different broods are maturing, while in the case of Lycæna Pseudargiolus it probably results in part from climatic conditions and in part from the difference, and abundance or scarcity of the food of the different broods. This species is of such a dainty appetite that it does not feed on the leaves of its food plants, but only upon the flowers, and as the flowering time of most plants is limited to a comparatively short period of the summer the successive broods have to seek different food plants. In West Virginia, according to Mr. Edwards, they feed in the Spring on the flowers of the Dogwood (Cornus). In June and July the larvæ feed on the flower buds of the Rattle-weed (Cimicifuga Racemosa), and later in the season on Actinomeris Squarrosa.

Mr. Edwards noticed that the caterpillars varied somewhat in colour according to the food plant and this might doubtless affect the shade of colour of the resulting butterfly.

In regard to the results of these variations it seems probable that we have here species actually forming before our eyes.

In the case of the Spring Azure, Mr. Edwards found that there was only the very slightest connection between the large typical Pseudargiolus and the form Violacea, and that if the few straggling specimens of the form Neglecta which emerge late in the summer, instead of hibernating in the chrysalis stage and producing Pseudargiolus in the following May, were suppressed, the separation would be complete and we should have two species instead of one.

In the case of Grapta Interrogationis, the separation has gone so far that were the males of each form to mate only with females of like form, the species would be permanently divided into two.

Species forming, however, is slow work and none of us can see but a very short way along the path, but to those who have the eyes to see, even the slight glimpse which we can get is most interesting, and we know at least that the great creative process is still going on according to the natural laws laid down by the great Architect of the Universe.

ROYAL SOCIETY OF CANADA.

MEETING AT OTTAWA.

It was an important step, in the interest of the Science and Literature of the Dominion, which was taken by the Marquis of Lorne, then Governor-General of Canada, when he inaugurated, in 1882, the Royal Society of Canada. It has since increasingly formed a rallying centre for those engaged in scientific and literary research in Canada. As all local societies in the country, including the Natural History Society of Montreal, report their proceedings to the Royal Society, and individual workers in original research are encouraged to send their papers to the Society, if we wish to keep track of the progress made in either the Science or Literature of Canada, we shall find the best record of it in the journal of that Society. We believe, therefore, we are doing the readers of the "Record of Science" real service in presenting the following abstracts of papers read before Sections III. and IV. of the Royal Society, at its recent meeting, kindly furnished by Sir John Bourinot, Honorary Secretary of the Society, as containing a summary of what was accomplished during 1898 in connection with the Physical, Chemical, Geological and Biological Sciences, those subjects in which, it may be assumed, the readers of the "Record of Science" are specially interested.

The proceedings of the Royal Society were opened by an address by the President, T. C. Keefer, Esq., C.M.G., C.E., on "Canadian Water Power and its Electrical Product in Relation to the Undeveloped Resources of the Dominion," a subject of exceptionable importance to Canada at the present time. The evening of May 25th was given up to Popular Science, when Professor Rutherford, of McGill, who has taken the place of Professor Callendar, delivered the admirable lecture, with which the patrons of the Natural History weie favored, in the Somerville Course, last spring, on "Wireless Telegraphy," with experiments.

Section III.—Mathematical, Physical and Chemical Sciences.

1.—"The Need for a Hydrographic Survey Department for Canada" (Present state of the question.) By Professor Alexander Johnson, LL.D.

2.—"The Synchronism of Terrestrial Magnetic Disturbances and Unusual Excitation in the Trails of Comets." By Arthur Harvey, President of the Astronomical and Physical Society of Toronto.

The author communicated his discovery that the sudden increase occasionally observed in the brightness of comets, sometimes accompanied by changes in the form of their tails,and by their apparent disintegration,are synchronisms with terrestrial magnetic disturbances. He considers this to furnish proof that the cause of these phenomena is electrical, has its origin in the sun, and is probably related to auroral displays.

3.—"Illustrations of Remarkable Secondary Tidal Undulations on January 1st, 1899." (From Recording Tide Gauges in the region of Nova Scotia.) (With 2 plates.) By W. Bell Dawson, M.A., Ma.E., Asst. M. Inst. C.E.

4.—"La Vie, l'Evolution le Materialisme." By C. Baillargé, M.A., C.E.

5.—"An Investigation of the Physiology of the Brain of the Bird." By Professor T. Wesley Mills, of McGill University.

This is a preliminary communication, based on experimental investigation of the brain of the Pigeon, now in progress, and is in part a continuation of work already reported to the Society, and in part a research in a new field of brain physiology, involving the application of a variety of methods of investigation.

6.—"An Examination of Some Points in the Psychology of the Bird, based in part on the above." By the same author.

SECTION IV.—GEOLOGICAL AND BIOLOGICAL SCIENCES.

1.—President's Address. "Canadian Geological Nomenclature." By R. W. Ells, LL.D.

The paper comprised a short sketch of the origin and introduction into Canadian geological literature of most of the terms now employed in the description of the several rock formations, found in the older or eastern provinces of Canada. A brief outline is also given of some of the changes of opinion which have been published from time to time, by the several workers in the geological field, regarding the interpretation of certain difficult problems which have arisen in this connection, and of the reasons which have led thereto, with a statement of some of the most recent conclusions reached from the systematic study of the rocks, both in the field and laboratory.

2.—"Recent Additions to the List of Injurious Insects of Canada." By James Fletcher, LL.D., F.L.S.

In 1883, Saunders's important work upon the "Insects Injurious to Fruit" was published. Since that time a great deal has been done in economic entomology, both as to working out the life histories of crop-pests and as to means of controlling many of these. The above paper treats of several injurious species which have attracted public attention by their ravages upon crops of all kinds for the last twenty years.

3.—"Catalogue of Canadian Proctotrypidæ." By W. Hague Harrington.

This contribution toward a more adequate knowledge of the Canadian insect faunas, consists of a list of all the species in the family Proctotrypidæ, which are known to occur therein, but, owing to the absence of systematic collecting in other localities, it is virtually limited to the species obtained at Ottawa. Of the two hundred species enumerated, fully nine-tenths are recorded from Ottawa or its immediate vicinity. The insects are parasitic in their habits, either in the eggs or upon the larvæ of other insects. They are all small, and the majority are so minute as to be difficult of identification without careful microscopical study. They, however, exhibit a considerable and interesting diversity of structure, and a large proportion of the genera are readily recognizable. Descriptions of several apparently new species are included in the paper, as well as some remarks on previous records, and on the habits of certain species.

4.—" The Geology of the More Important Cities of Eastern Canada." By Henry M. Ami, M.A., D.Sc. Communicated by R. W. Ells, LL.D.

The paper discusses the geological formations as seen around the cities of Ottawa, Montreal, Quebec, St. John, Toronto, Hamilton and London. In the last named place the information has been largely obtained by means of borings which have been made in the vicinity, since rock-formations do not appear at the surface in that locality.

5.—" Origin and History of Some New Varieties of Wheat Produced at the Dominion Experimental Farms." By Wm. Saunders, LL.D., F.R.S.C., F.L.S., Director of Experimental Farms.

In this paper the author traces the history of some of the most promising of the cross-bred varieties of wheat which have been produced during the past ten years at the Experimental Farms. The objects in view in undertaking this work are referred to and some of the more striking instances of success given.

Particulars as to how these varieties compare with the standard sorts in cultivation are also given, together with facts indicating their adaptability to the different climates of the Dominion.

6.—" The Scientific Work of Prof. Charles Fred. Hartt." By G. U. Hay, M.A., Ph.B.

The scientific career of Prof. Chas. Fred. Hartt, teacher and geologist, although extending over a period of less than a score of years, was one of brilliant achievement. The work of his riper years was confined to the States and Brazil, yet he was a Canadian by birth and education. Born at Fredericton, N.B., he was graduated from Acadia College in 1860, and pursued a course under Prof. Agassiz at Cambridge, Mass., extending over four years. He accompanied Agassiz in his expedition to Brazil; and after he was appointed to the chair of geology in Cornell University, he made several journeys thither accompanied by some of his students. The results were embodied in a comprehensive work entitled "The Geology and Physical Geography of Brazil," published in 1870. He was afterwards appointed Chief of the Geological Commission, to make a survey of the vast empire of Brazil. With a corps of talented assistants he pursued this work in the face of great difficulties until he fell a victim to yellow fever, in 1878, at Rio Janeiro.

Hartt found time amid the absorbing labors of the Commission to study the language and traditions of the early Indians of Brazil, and had prepared a grammar and dictionary of their language. His genius, coupled with an extraordinary aptitude for linguistic studies, would have made him one of the foremost ethnologists of the age; and there is little doubt that inclination and sympathy had long been leading him to this broader and more fascinating field of research.

7.—"Studies on Cambrian Faunas, No. 3. The Upper Cambrian Fauna of Mount Stephen, B.C. The Trilobites and Worms." By G. F. Matthew, D.Sc., LL.D.

This paper deals with the fauna of Mt. Stephen, British Columbia, Canada, which fauna is remarkable for the excellent preservation of the organic remains composing it. The author is able to correlate its genera more closely with European forms than has hitherto been done, and comes to the conclusion that the fauna is Upper Cambrian.

Some new genera and species are described, and others already described are more fully shown.

An attempt is made to rate the chronological standing of the fauna, by considering the relative length of the thorax and pygidium of the several genera contained in it. The presence of Ogygia gives it an Ordovician aspect, but many of the genera are related to those of the Upper Cambrian, and some to rare genera of the Upper Paradoxides beds of Sweden. Several plates of figures accompany the article.

8.—" Studies on Cambrian Faunas, No. 4. Fragments of the Cambrian Faunas of Newfoundland." By the same author.

In this article are reviewed several species already published by other authors, and some new species of the Cambrian terrane in Newfoundland are described.

The species referred to in this article range from the Protolenus to the Dictyonema fauna. A Raphistoma is found in the Upper Cambrian. A number of genera of the Protolenus fauna are found beneath the Paradoxides beds of this island, showing that that fauna is present. A genus of the Sardinian Cambrian, Metadoxides, not heretofore found in America, is recognized; and one species described in the Bulletin of the Natural History Society of New Brunswick is given with further details of structure.

Several plates of figures accompany this article.

9.—" The Etcheminian Fauna of Smith Sound, Newfoundland." By the same author.

This article gives the result of the author's visit to Newfoundland in the summer of 1898, for the purpose of comparing the Etcheminian system of that colony with that of New Brunswick in Canada.

The first part of the article is given to a description of the stratigraphical and lithological conditions of the sediments that contain this fauna. These were found similar in most respects to those of the New Brunswick sediments of this age. A surprising similarity can be observed in the deposits of this age for a long distance along the Atlantic border.

The fauna consists chiefly of species of the family Hyolithidæ, mostly of the genera Hyolithes and Orthotheca; the latter showing the greater variety of species, the former the larger forms. Next in importance come the conical gasteropods. The spiral gasteropods and the lamellibranchs are each represented by minute species. One species of Aptychopsis represents the Crustaceans, there being no trilobites in the fauna, so far as the collections show.

The zoological position of the Hyolithidæ is discussed in this paper and the conclusion reached that they should be classed with the Tubicolous Worms.

The new and the characteristic species of the fauna are figured.

10.—" Notes on Some Additions to the Molluscan Fauna of the Pacific Coast of Canada." By Geo. W. Taylor, of Nanaimo, B.C.

Notes on forty species of Marine Mollusca added to the list since the publication of the " Preliminary Catalogue," in 1895; also some corrections in the nomenclature employed in that catalogue, and additional information as to the distribution, &c., of many of the species. The paper was not ready for last year's transactions.

11.—" L'Antiquité de la Terre et de l'Homme." By C. Baillargé, M.A., C.E.

12.—" On the Origin of the Silvery Appearance in the Integument of Fishes." By Prof. E. E. Prince, Commissioner of Fisheries. Communicated by R. W. Ells, LL.D.

13.—" Some Chitinous Elements in the Larval Skeleton of Fishes which appear to be Primitive." By the same author. Communicated by R. W. Ells, LL.D.

Proceedings of the Natural History Society.

Session 1897–98.

Montreal, Oct. 25th, 1897.

The first monthly meeting of the Society for the Session of 1897–98 was held in the Library this evening at eight o'clock. Edgar Judge acted as Chairman. There were also present Dr. Fr. D. Adams, the President; Major Latour, J. B. Williams, Rev. Robt. Campbell, D.D., E. T. Chambers, Albt. Holden, A. F. Winn, Hon. J. K. Ward, J. Stevenson Brown, Geo. Sumner, Mrs. A. F. Gault, Miss Jessie Brown, and a number of other ladies.

Minutes of meeting of April 26th last were read and approved.

The Report of Council (October 18th) was read. On motion of Edgar Judge, seconded by Major Latour, it was received and adopted.

The Hon. Curator's report was also read, together with his very full report to the Council, which reported work done in the Museum from June till September of the present year. On motion the report was adopted.

E. T. Chambers, the Hon. Librarian, presented the report of the Library Committee, which, on motion of Edgar Judge, seconded by J. B. Williams, was received.

On motion, the following were elected as members of the Society:—

Mrs. H. H. Austin as Associate member.

Mrs. C. E. E. Ussher as an ordinary member.

The Hon. Curator, J. C. Williams, read a long list of donations to the Museum since May last. On motion of J. Stevenson Brown, seconded by E. T. Chambers, the acceptance and thanks of the Society were tendered to the various donors The list is on file with the reports.

The President, Frank D. Adams, Ph.D., F.R.S.C., then delivered his special communication on "Some Recent

Discoveries Concerning the Older Rocks of Canada," which was listened to with very great interest. On motion of Rev. Robt. Campbell, D.D., seconded by Edgar Judge, a very hearty vote of thanks was tendered to Dr. Adams for his very excellent lecture, and unanimously carried.

The Recording Secretary being absent, Mr. F. W. Richards acted as Secretary.

MONTREAL, Nov. 29th, 1897.

The second monthly meeting of the Society was held this evening at eight o'clock, the President, Dr. F. D. Adams, in the chair. There were also present J. Stevenson Brown, J. A. U. Beaudry, A. F. Winn, Prof. Cox, Albert Holden, F. W. Richards, E. T. Chambers, Miss Derick, Capt. W. Ross, H. McLaren, Dr. C. W. Wilson, Harold B. Cushing, B.A., and seventeen others, among whom were Mrs. Cox, Mrs. Dr. Blackader and Mrs. Cowans.

The minutes of previous meeting were read and confirmed.

The resignation of Mr. John S. Shearer as First Vice-President of this Society was read.

It was then resolved, on motion of J. Stevenson Brown, seconded by Albert Holden, "That in view of the statements made by those who have interviewed Mr. Shearer with the object to have him withdraw his resignation as 1st Vice-President of the Natural History Society, in which they had not been successful, the Society is now obliged, with much regret, to record the resignation of Mr. Shearer as 1st Vice-President."

The following resolution was then put to the meeting and unanimously carried :—

Moved by J. Stevenson Brown, seconded by Chas. S. J. Phillips,

"That in recording the resignation of Mr. John S.

Shearer as 1st Vice-President of the Natural History Society, the Society wishes to place on record its deep regret that he is unable to continue longer an active worker in the administration of its affairs, and at the same time takes this opportunity to express its high appreciation of the many valuable services rendered by Mr. Shearer and to testify of his untiring energy and zeal for the welfare of the Society, extending over a period of nearly 30 years.

And furthermore the Society feeling assured of Mr. Shearer's loyalty to its best interests, hopes and trusts that he will continue to advance its interests from time to time as occasion may arise.

"And further that it is the instructions of this Society that a copy of this resolution be sent to Mr. Shearer."

DONATIONS.—The following additions have been made since last meeting:—Eleven eggs of Canadian birds, presented by Master R. Allan Phillips; a Horned Lizard, Centipede, Tarantula and Tarantula Fly by purchase; a Jewish Phylactery, by Alfred Griffin; a piece of Mexican Pottery, donor, E. D. Wintle; two images of Pottery from the Astec City of Caletipec, donor, D. A. Ansell; two Meadow Browns (Chinonobras Jutta), one of the rarest butterflies in Canada, donor, A. F. Winn.

It was resolved that the thanks of the Society be tendered to the different donors.

Professor McBride, Professor of Zoology in McGill University, then gave his communication on "Studies in Development," which was listened to with intense interest and delight.

After questions and remarks by Prof. Cox and other members, the thanks of the meeting were, on resolution, tendered to Prof. McBride.

The meeting then adjourned.

MONTREAL, Jan. 31st, 1898.

The third monthly meeting of the Society was held in the Library this evening at the usual hour. Rev. Robert Campbell, one of the Vice-Presidents, occupied the chair. There were also present A. F. Winn, J. B. Williams, H. B. Cushing, Capt. W. Ross, James Gardner, Rev. G. Colborne Heine, Prof. J. T. Donald, Miss Radford, Miss Ethel Radford, and the Recording Secretary.

The minutes of the last meeting were read and confirmed.

DONATIONS.—The following were given as additions to the Museum and Library :—1 live Muskrat, by Dr. J. A. Springle; 1 White-footed Mouse, by A. Joyce; 1 Hippopotamus Tusk, by Dr. J. A. Springle in exchange; 1 Emu's Egg, by Mrs. J. A. Springle; 2 Swimming Crabs, by J. B. Williams; 4 Eggs, long-billed Marsh Wren, by C. N. Sonne; 1 Egg of Crested Flycatcher, by D. N. Stewart; "Comstock's Manual," by Entomological Society.

It was moved by J. B. Williams, seconded by James Gardner, that the thanks of the Society be tendered to the donors for the above contributions. Carried.

The suspension of the rules was moved by James Gardner, seconded by A. F. Winn, and the following gentlemen were then balloted for as an ordinary and Associate member respectively: Hugh Watson and C. N. Sonne.

Dr. Campbell having vacated the chair, Mr. James Gardiner, at his request, presided, while Dr. Campbell and H. B. Cushing, B.A., gave their very excellent communication on the "Reeds, Grasses and Sedges of the Island of Montreal," with specimens of over 170 varieties. The paper was listened to with great interest, and at the conclusion a hearty vote of thanks was tendered these gentlemen, being moved by J. B. Williams, seconded by A. F. Winn.

Notice of motion, by A. Holden, *re* change of night for Council meeting, was referred back to Council to act as they think best.

There being nothing further before the Council, the meeting adjourned.

MONTREAL, Feb. 28th, 1898.

The fourth monthly meeting of the Society was held this evening at the usual hour, Geo. Sumner, Vice-President, in the chair. There were also present E. T. Chambers, H. McLaren, A. Holden, J. B. Williams, C. T. Williams, Dr. Wilson and J. A. U. Beaudry and others.

In the absence of the Secretary, Mr. J. A. U. Beaudry consented to take the minutes.

The minutes of last meeting were read and confirmed.

The following addition was made to the Museum:—One Snowy Owl (adult male) from Manitoba, received in exchange from G. E. Atkinson.

The notice of motion of Mr. A. Holden, *re* changing of night for holding Council meetings was then discussed at some length, and, having been duly seconded by E. T. Chambers, was carried unanimously.

Mr. A. B. Macfarlane was proposed as an ordinary member by A. F. Winn, seconded by J. B. Williams; the rules of the Society being suspended, Mr. Macfarlane was duly elected.

Mr. J. B. Williams, F.Z.S., then gave a very interesting paper on "Canadian Reptiles," which was evidently very much enjoyed.

A vote of thanks having been proposed by E. T. Chambers, seconded by H. McLaren, and carried unanimously, the meeting then adjourned.

MONTREAL, March 28th, 1898.

The fifth monthly meeting of the Society was held this evening at 8.20.

The President, Dr. F. D. Adams, in the chair. There were also present; A. F. Winn, J. A. U. Beaudry, J. S. Brown, Geo. Sumner, C. T. Williams, Rev. R. Campbell, E. T. Chambers, F. W. Richards, and others.

In the absence of the Secretary, Mr. A. Holden acted as same.

The minutes of last meeting were read and confirmed.

The following addition to the Library was reported by the Librarian: Report of the Maryland Geological Survey.

The following additions to the Museum were reported by J. B. Williams: 1 Musk Rat (alive), Dr. J. A. Springle; 1 Meadow Mouse (alive), Henry Jackson; 140 North American Butterflies and moths, T. Dwight Brainerd; 30 Canadian Butterflies and Moths, A. F. Winn; 2 European Butterflies, J. B. Williams; 12 Canadian Birds, in exchange, J. Manghan, Jr., Toronto.

A vote of thanks was duly passed to the above donors.

Moved by Geo. Sumner, seconded by J. A. U. Beaudry, that the thanks of the Society be tendered to the Lecturers of the Saturday Afternoon Lectures to young people. Carried.

Moved by Geo. Sumner, seconded by A. F. Winn, that the rules be suspended and Mr. J. B. Picken be elected a member. Carried.

Mr. A. F. Winn read a very interesting paper, " A Trip to the Gomin Swamps;" also exhibited many butterflies captured in the vicinity.

Mr. C. T. Williams read his paper, " Through a Pocket Lens," which he illustrated with many beautiful and interesting objects with the lime light lantern.

J. Stevenson Brown, seconded by F. W. Richards, moved a very cordial vote of thanks to Mr. A. F. Winn and Mr. C. T. Williams for their very interesting papers. Carried.

MONTREAL, May 30th, 1898.

The annual meeting of the Society was held this evening in the large hall. The President: Prof. Frank D. Adams in the chair. There was also present J. H. Joseph, A. Holden, Wm. Ross, J. A. U. Beaudry, J. B. Williams, Rev. Dr. Campbell, J. Stevenson Brown, F. W. Richard, E. T. Chambers, H. McLaren, R. W. McLachlan, Hon. J. K. Ward, Walter Drake, Judge Wurtele and Chas. S. J. Phillips.

The minutes of the last annual meeting were read and confirmed. Donations to the Museum :—

The following donations have been received since last meeting :—1 young Alligator, sent by W. Whitaker; 1 young Garter Snake from Rigaud Mountain, donor, J. B. Williams; 2 Brown Snakes, 1 Red Bellied Snake, C. S. Lemesurier; 6 Brown Snakes, 3 Red Bellied Snakes, and 2 Grass Snakes, donated by T. Lomer; 2 samples of Magnetic Iron Sand from the Moisei River, donor J. R. Miller; 1 Menobranchus or Mud Puppy, given by Dr. J. A. Springle, also by the same gentleman the following, all from the South Pacific :—12 Crabs, 2 Prawns, 1 Shrimp, 1 Fishy Louse, 2 Centipedes, 3 Starfish, 2 Brittle Stars, 2 Sea-Urchins, 2 Sea-Cucumbers, 4 Sea-Slugs, 1 Sea-Horse, 3 Midibranchus.

The following Annual Reports were read and are now on fyle :—

Chairman of Council.

Treasurer, showing bal. in hand of $49.57.

House Committee, Curators.

Librarian. No report from Editing Committee.

PRESIDENT'S REMARKS.

The President then made his annual address in which he made an apology for the small amount of time given to the Society, owing to his labors in the College and other Societies that made their demands upon his time, but was glad to say that the Rev. Dr. Campbell did the work, and everything had gone forward satisfactorily.

The papers at the monthly meetings had been good, especially those of Prof. McBride, Dr. Campbell, and Dr. Cushing.

The Somerville Course of Lectures were exceptionally good and had been well attended, as were also the Saturday afternoon talks to the young people. The President made mention also of the very excellent lectures on the Wild Flowers of the Rocky Mountains, delivered to a large and delighted audience in the High School Hall during the winter. Reference was also made to the "Record of Science" and the amount of time taken in the editing of it, also that the last number closed a volume and that it should be kept up sharply and promptly.

It was then moved by Dr. Campbell and seconded by J. H. Joseph, that the above reports be received and adopted and be published in the "Record of Science." Carried.

The election of officers for the ensuing year was then proceeded with.

Sir J. Wm. Dawson was by acclamation elected Hon. President.

For President, Frank D. Adams, Ph.D., F.R.S.C. Moved by Judge Wurtele and seconded by J. Stevenson Brown, that the Recording Secretary be instructed to cast the ballot. Carried.

Prof. Adams elected.

The following Scrutineers were appointed by the Chair, F. W. Richards and Albert Holden.

On vote the following were elected as Vice-Presidents :—

Rev. Dr. Campbell, Lord Strathcona, Judge Wurtele, Dr. Wesley Mills, J. H. Joseph, Walter Drake, Hon. J. K. Ward, Dr. Harrington and Geo. Sumner.

On motion of Judge Wurtele, seconded by Walter Drake, it was instructed that the ballot be cast by the Scrutineers for C. S. J. Phillips as Recording Secretary. Elected.

On a similar motion Dr. W. E. Deeks was elected Corresponding Secretary.

It was moved by J. Stevenson Brown, and seconded by Judge Wurtele, that Mr. J. B. Williams be appointed Hon. Curator. Carried.

It was moved by Rev. Dr. Campbell and seconded by Judge Wurtele, that Mr. F. W. Richards be appointed Hon. Treasurer. Carried unanimously.

On motion the following were nominated and elected as Members of Council. Albert Holden, G. P., Girdwood, M. D., C. T. Williams, Prof. McBride, A. F. Winn, Rev. E. I. Rexford, J. A. U. Beaudry, Alex. Brodie, H. McLaren.

On motion of J. Stevenson Brown, seconded by J. B. Williams, Mr. E. T. Chambers was elected Librarian.

On motion the following were appointed, Editing and Exchange Committee.

Alex. Brodie, B.A. Sc., Chairman, G. F. Matthew, St. John, N. B., Rev. Robt. Campbell, M.A., D.D., J. F. Whiteaves, Ottawa, Ont., N. N. Evans, M.A. Sc., Prof. Goodwin, Carrie M. Derick, M.A., Frank D. Adams, Ph.D., F. R. S. C., O. E. Leroy, B.A.

There being no further business the meeting adjourned.

Report of the Chairman of Council for the Year Ending May 30th, 1898.

The Chairman of the Council begs to report that nine meetings of the Council, for the transaction of the Society's business, have been held during the year.

There have been seven meetings of the Society for the reading and discussion of papers.

The titles of the papers have been as follows:

Oct. 25. "Some recent discoveries concerning the older Rocks of Canada," by Frank D. Adams, Ph. D.

Nov. 29. "Studies in Development," by Prof. W. McBride.

Jan. 31. "Reeds, grasses and sedges of the Island of Montreal," by Rev. Robt. Campbell, D.D., and H. B. Cushing.

Feb. 28. "Canadian Reptiles," by J. B. Williams, F.Z.S.

Mar. 28. "A trip to the Gomin Swamp," by A. F. Winn, and "Through a Pocket Lens," by C. T. Williams.

April 21. "The Corundum Deposits of Shooting Creek, North Carolina," by A. McKenzie and Prof. J. T. Donald.

The Annual Field Day last year took place on June 5th, when the members and their friends visited the River Rouge, where they were hospitably entertained by the Hon. J. K. Ward.

The weather was all that could be desired, and the outing proved, altogether, a very enjoyable one.

The Somerville Lectures for the present year provided an interesting, and varied series of topics. They were given on the Thursday evenings from February 24th to April 7th. The attendance was very good; on several occasions the hall and adjoining rooms were quite crowded.

The Museum was, as usual, open to the public for an hour before the commencement of each lecture, and a considerable number visited it on these evenings.

The lectures were as follows:

"Butterflies," by Prof. Fletcher, F.R.S.C.

"Bees," by Percy Selwyn.

"Curious Protective Features in Animals." by Prof. Prince, B.A.

"The Marine Mammals of Canada," by Prof. Robert Bell, LL.D.

"The Modern Steamship," by Prof. A. J. Durley, B.Sc.

"Precious Metals," by Prof. Frank D. Adams, Ph.D.

"Coal and Iron," by Osmond E. LeRoy, B.A.

The Saturday Half-hour Lectures to Young People proved very attractive, and several times the attendance was so large that the doors had to be closed soon after the lecture began.

The lectures were as follows:

Feb. 12. "Dick's Dive in a Duck Pond," by C. T. Williams.

Feb. 19. "Life among the Esquimaux," by A. W. Buckland.

Feb. 26. "Frogs and Snakes," by J. A. Williams, F.Z.S.

Mar. 5. "Humanity to Animals," by Rowley James.

" 12. "Fossils," by E. T. Chambers.

" 19. "Volcanoes," by T. Denis.

" 26. "The Ferns of Montreal," by Rev. Robert Campbell, D.D.

The attendance at the Museum has increased considerably during the year. On the pay days the total admissions have been 429, nearly a hundred more than last year; on Saturdays, the free day, the attendance has varied from about 50 to 150, though it was much larger on the Saturday-Lecture afternoons. Since the beginning of this year the Museum has also been open free on Wednesday afternoons, and the number of visitors is increasing very much on that day. Altogether there must have been about 4,000 visitors to the Museum during the past year.

The "Canadian Record of Science" has been issued, as usual, though we have failed to obtain a renewal of the grant from the Quebec Government, which in former days used to defray the cost of publication.

An appeal has been issued to members and friends asking for financial aid. The sum of about $10,000 is required as an endowment fund to replace the loss of the Government grant.

It is impossible to provide for the publication of the "Record of Science," the care and maintenance of the Library and Museum, and the annual courses of public Lectures, without some such addition to our income.

In each of these departments the Society is doing useful and valuable work, and it would be a great pity for any of it to be curtailed or abolished for lack of means to properly carry it on.

Eight new members have been added this year, and we have lost four by death, viz.: H. Lyman, one of our oldest Life Members, Robert Mitchell, R. R. Grindley, and W. Kennedy.

The number of members, at present, is only about 170; this includes the life, ordinary, and associate members.

Respectfully submitted,

J. Stevenson Brown,
Chairman of Council.

Museum Report for 1897–98.

During the past year I have to report that our collection of Hummingbirds has been named and labelled, and this has completed the renaming of our entire bird collection.

The Birds' Eggs have been cleaned and re-arranged, and quite a number of additional specimens have been named and placed on exhibition, so that these cases of eggs form quite an attractive feature of the Museum.

Mr. Winn has re-arranged several drawers in the insect cabinet, and both he and Mr. Brainerd have made valuable additions to our collection of Canadian Lepidoptera.

The two cases of Lepidoptera on the Landing have also been cleaned and labelled. We hope to exhibit in the Museum this summer live specimens of the larva of some of our large Moths and Butterflies, so that visitors may see them in the various stages of their developement.

The collection of Crabs, Lobsters and other Crustacea has been re-arranged in the gallery cases and the different families grouped together and labelled, and the Corals, Sponges and other low forms of life have also been cleaned and re-arranged and placed all together in the gallery cases.

The Fish Collection has been re-arranged and a large part of the specimens have been cleaned, named and labelled, according to recent classifications.

The Esquimaux tools and relics have all been re-arranged, cleaned, and labelled.

The Roman Antiquities from Pompeii have been cleaned and re-arranged in a more conspicuous position than they had previously occupied.

The collection of Indian pipes, stone weapons, etc., has been cleaned and re-arranged, and the relics from Hochelaga, which have a special local interest, have been placed in a case by themselves.

The Botanical specimens which were scattered in various places have been grouped together in cases near to the Botanical Cabinet, and our collection of Montreal Ferns, which, by Dr. Campbell's generosity, has been made nearly a complete series, was arranged, and placed on view for several months in one of the Mineral cases.

If we had some proper cases for this purpose, different groups from the Botanical Cabinet might be placed, alternately, on exhibition; and such a series would do something towards informing and interesting visitors in the riches and peculiarities of our local flora.

Part of the Society's collection of Coins which has hitherto been stored away, has been cleaned, arranged, labelled and placed on exhibition in one of the Mineral cases in the gallery.

The Roman, Italian, English, and Canadian are the series thus exhibited.

We have, besides, a number of French American, East Indian, Turkish, Chinese, Grecian, Russian, German, Danish; Norwegian, and Belgian coins.

The whole, if exhibited, would form a very interesting collection, and would require some new cases for their proper display. Though they cannot be classed, either as Botany or Zoology they illustrate the natural history of man, and form, as it were, the fossils of human civilisation.

Complete lists of additions and donations to the Museum have been given at our Monthly Meetings, and need not, therefore, be repeated here in detail. We have received twenty-five additional specimens of Canadian Birds in exchange for some of our duplicate specimens, and shall be able to make further additions in this way in the near future.

I have just commenced cleaning and re-arranging the Shells, of which we have about 4,000 specimens. It is several years since anything has been done to them, and dust and disorder have to some extent marred their beauty.

If, however, they are put into good order, and have *English names* placed upon the different groups, the collection will be much improved in appearance, and they will become interesting and intelligible to the ordinary as well as to the scientific visitor.

For, at present, the name (Meleagrina radiata) conveys to very few the fact that they are looking at a Pearl Oyster; the name (Archatina perdix), does not vividly impress on the mind that this is the shell of one of the largest Land Snails in the world; and our specimens of the beautiful Pearly Nautilus are not labelled at all, so that visitors pass them without paying any homage to this queen of all the Sea-Shells, and are hardly aware that they are looking at the only surviving representatives of one of the most ancient and highly distinguished families of the Mollusca.

Respectfully submitted,

J. B. WILLIAMS,
Curator.

NATURAL HISTORY SOCIETY OF MONTREAL,

IN ACCOUNT WITH

F. W. RICHARDS, *Treasurer*,

RECEIPTS AND EXPENDITURE FROM JUNE 1ST, 1897, TO MAY 27TH, 1898.

Dr.

To Balance cash on hand, June 1st, 1897	$ 39	16
" Rents	778	50
" Members' Subscriptions	479	00
" Donations	565	00
" Loan, Merchants Bank	398	36
" Entrance fees to Museum	32	75
" Interest as per bank book		85
" Surplus Field Day, 1897		67
	$2302	09

Cr.

By Superintendent's Salary and Commission		$482	50
" "Record of Science"		436	78
" Museum	account	283	68
" Lecture	"	149	82
" Sundry Expense	"	143	69
" Fuel	"	139	63
" Lighting	"	133	53
" Repairs and Renovations	"	126	99
" Printing	"	71	94
" City Water Tax	"	33	95
" Merchants Bank account loan		250	00
" Cash on hand		49	57
		$2302	09

Audited and found correct,

C. T. WILLIAMS,
A. HOLDEN,
Auditors.

F. W. RICHARDS, *Treasurer.*

MONTREAL, May 27th, 1898.

REPORT OF THE LIBRARY COMMITTEE.

The Librarian has little to report for the work of the past year. The Library Committee has not been called together as there was no business they could do. No funds being available either for binding or for adding to the shelf-room ; the shelves being so crowded that work in the improvement of the library is at a standstill.

The usual exchanges have been received, entered and acknowledged. I have also to report the receipt of "Comstock's Manual of the Study of Insects," presented to the Society by the Montreal Branch of the Canadian Entomological Society. This is a very useful work and a valuable addition to the library as we have but few modern works on that branch of Science. Another valuable gift to the library is "Lydekker's Royal Natural History," in six volumes, generously purchased and presented to the library by a few of the members.

In consideration of the large number of valuable works still unarranged, it is hoped that the Society will soon be in a position to assign a sufficient sum to enable the Committee to complete the work of arrangement and cataloguing, which has been so long in hand.

E. T. CHAMBERS,
Hon. Librarian.

May 30th, 1898.

FIELD DAY TO MONTFORT.

The annual field day of the Natural History Society of Montreal is an event which is pleasurably anticipated by the members of the Society and their friends, and which seems to be growing more and more popular an excursion with the public generally as the years pass on. At least, so one would judge from the crowds that were present on Saturday morning at the Windsor street Station, all on pleasure intent, whether it consisted in fishing, exploring, or the collection of specimens. So large, indeed, was the number of the excursionists, that it was found necessary to add another car to the train, making six cars in all, which at 8.30 pulled out, each car being well filled with people.

The organizers of the excursion, in selecting Montfort as the place for the field day, no doubt had in mind the idea that a picturesque railway journey would be appreciated, nor were they wrong in so judging. Montfort is hidden far away amid the Laurentian Mountains, or perhaps it would be better to say "was," as the Montfort & Gatineau Colonization Railway, has brought it within a few hours' journey of this city. The village is some thirteen miles from the junction of the above-mentioned road with the C.P. R., and is situated on Lake St. Francois-Xavier, a small body of water pent in by lofty fir-clad hills.

Although the railway had begun to rise soon after St. Jerome had been left, it was on leaving Montfort Junction that the real climbing commenced. The railway is comparatively new. The grades are very steep, and it was at first a matter of doubt to the officials of the line whether such a heavy train could be taken up to Montfort at all. However, with the aid of two locomotives, one being of the old picturesque wood-burning type, the train proceeded, and for the whole of the distance to Montfort the car windows on each side presented a panorama of as magnificent scenery as anyone could wish to see. There were some of the party who, deeming it too tame to admire the surroundings from the windows, preferred to stand on the steps of the platforms, and really, in the pure, fresh mountain air, it seemed preferable to do so to staying in the cars. Up, up, went the train, ever upward, winding round tortuous curves, passing over high embankments, plunging into deep and narrow valleys, between lofty hills, running through dense woods where the tree branches almost touched the car-windows, till at length the train stopped opposite the Montfort Industrial School, about half a mile from the Montfort station, where the boys of the institution greeted the excursionists with loud cheers. The Rev. Father Bouchet, who is in charge of the school, came up and addressing Professor Wesley Mills, M.D., the president of the Natural History Society, welcomed him and the officers and members of the Society to Montfort. A number of the boys came forward and sang a pretty chanson, after which, Dr. Wesley Mills and the officers of the society having thanked the rev. father for his kind greeting, the train continued its way to Montfort, which was reached in a few minutes.

Having arrived, the members of the party immediately scattered, each on his own or her particular pleasure bent. There was no system of separate sections for natural history and other work upon this occasion, every one who chose being left to collect specimens independently. The results were, on the whole, very gratifying, several persons returning to the cars well loaded with specimens. For the first forty minutes after arrival the members of the party engaged themselves in attending to the wants of the inner man, some going to the hotel for that purpose, while others preferred to take their lunch baskets and refresh themselves while enjoying the shade of the woods that stretched down to the lakeside. There was an abundance to see and to admire and, indeed, it was as great a pleasure as any to rest one's self and drink in the beauties of the scene around and to reflect that what one saw was only one very small corner of the Province of Quebec. Owing to the length of time taken up with the railway journey going and returning, the stay was necessarily a brief one, but during what time there was, about five hours, all managed to enjoy themselves. Entomologists, botanists and geologists were hard at it, and there was a plentiful field for their operations. Others went on board the train and journeyed a few miles further, to the terminus of the line, for the purpose of viewing more of the beautiful scenery. Enthusiastic anglers were also at work on the lakeside but if truth must be told, with very little success, for, from some reason or other, the fish, and there were many in the lake, refused to bite. Had there been time, there is no doubt that some members of the party would have climbed the hills on either side of the lake, but neither was climbing nor, indeed, walking in the woods, found to be an easy matter, for nature has been left to herself in these districts, and the woods have not been spoilt by the hand of man.

Towards five o'clock a move was made for the cars, and a few minutes after that hour the return journey commenced.

The run was this time down hill to the junction with the Canadian Pacific Railway, and was of a quite exciting character.

By the kindness of Sir William Van Horne refreshments were served on board the train, which were much appreciated, and which helped to pass the time.

Montreal was reached at 8.20 p.m., every one agreeing that the field day had been both most enjoyable and successful. While en route it was announced that the following prizes had been won for collections :—

Botany (unnamed specimens), Sidney Lyman and Fred Brown, equal, first, and Miss E. G. Watson, second; entomology, H. N. Cowan, first, and E. Norris, second; geology, (unnamed specimens), H. Cone first. The judges in the sections were: Botany, the Misses Van Horne; entomology, Messrs. H. H. Lyman and A. F. Winn; geology, Mr. E. T. Chambers.

Book Notices.

Elementary Botany.—By George F. Atkinson, Ph.B., Professor of Botany, Cornell University. 444 pages; illustrated. Publishers, Holt & Co., New York.

The "elementary botany" of to-day is vastly different from the elementary botany of ten or fifteen years ago. This is largely due to the changed method of presenting to the student the rudiments of botany. The old method introduced the pupil to the technicalities of systematic botany by way of the arbitrary rulings of the manual. If he enjoyed puzzles of that kind, he specialized in botany and the natural sciences, and eventually obtained his reward by seeing relationships in a broad and comprehensive way, but if these analogies had been first observed, it is probable that the "analysis" of the flower would not have appeared so tiresome. This work, presented to the public generally, but to teachers particularly, marks an important step in the new direction. This newer method is, in the words of the author, "to study first some of the life processes of plants, especially those which illustrate the fundamental principles of nutrition, assimilation, growth and irritability. In studying each one of these topics plants are chosen so far as possible from several of the great groups. Numbers of the lower as well as of the higher plants are employed in order to show that the process is fundamentally the same in all plants. . . . In this way, the mind is centred on this process and the discovery to the pupil that it is fundamentally the same in such widely different plants arouses a keen interest not only in the plants themselves, but in the method which attends the discovery of this general principle."

This volume is divided into three parts, Part I. being devoted to the life processes of the plant, absorption, transpiration, respiration, nutrition and the like. Part II. discusses the morphology of the plant and the relationships of different families. Part III., perhaps the most interesting section of the book, is devoted to ecology or the study of plants in their mutual and environmental relationships. The author fitly points out that by a study of the life histories of plants, their habits of behavior under different conditions of environment, we shall broaden our concept of nature and cultivate our æsthetic, observational and reasoning faculties. How much more important this is to the student than to be possessed of a few stray and disconnected facts of natural history! Ecology means study in the field, and is the kind of valuable nature-study-work so heartily and ably encouraged and fostered by the Natural History Society of Montreal and the Field Naturalists' Club of Ottawa. Atkinson's Elementary Botany will be of great value to High School teachers and to teachers in

Collegiate Institutes. It inspires the student by presenting the attractive features first, and trains his mind in logical methods of induction, which, as the author observes, is of vast importance in its influence upon the character of the pupil.

The book is well printed, beautifully illustrated, and substantially bound.

JOHN CRAIG.

Y, 1898.

vel, 187 feet, C. H. McLEOD, *Superintendent.*

DAY	Sky Clouded In Tenths. Mean.	Max.	Min.	Per cent. possible Sunshine.	Rainfall in inches.	Snowfall in inches.	Rain and snow melted.	DAY.
SUNDAY......	....	..	..	95	....	....	......	1..........SUNDAY
	3.5	8	0	73	...	....	....	2
	10.0	10	10	..	0.02	....	0.02	3
	10.0	10	10	..	0.11	....	0.11	4
	6.5	10	0	29	....	....	....	5
	0.0	0	0	94	....	....	....	6
	0.0	0	0	97	....	....	....	7
SUNDAY.....	...	..	..	89	....	....	...	8..........SUNDAY
	0.0	0	0	91	....	....	....	9
	8.2	10	3	41	0.00	....	0.00	10
	9.2	10	5	..	0.30	....	0.30	11
	8.5	10	5	7	0.64	...	0.64	12
	4.8	10	0	53	....	....	....	13
	7.3	10	0	37	0.09	....	0.09	14
SUNDAY.....	....		..	76	...	...	....	15..........SUNDAY
	7.8	10	0	14	0.07	....	0.07	16
	7.7	10	0	22	0.03	....	0.03	17
	4.3	10	0	72	....	....	...	18
	6.8	10	0	3	0.01	....	0.01	19
	5.0	10	0	68	0.09	....	0.09	20
	2.5	5	0	90	....	....	....	21
SUNDAY.....	....	..	.	36	0.00	....	0 00	22..........SUNDAY
	8.8	10	4	7	0.25	....	0.25	23
	9.0	10	6	27	0.57	....	0 57	24
	10.0	10	10	.	0.09	....	0.09	25
	6.8	10	0	[illegible]	....	....	....	26
	5.5	10	[illegible]	[illegible]	....	....	....	27
	8.3	10		46	0 03	....	0.03	28
SUNDAY....	....	..	..	10	0.32	....	0.32	29..........SUNDAY
	7.8	10	4	31	....	....	....	30
	0.0	0	0	96	....	....	....	31
Means......	6.09	8.2	2.4	45.3	2.62	....	2.62	...............Sums.
24 Years m for and inclu this month .	6.15	.	.	¶50.28	2.96	....	2.98	24 Years means for and including this month.

Direction..
Miles .....
Duration in
Mean veloci

Greates 8th.

Greate the 8th.

sea-level and

of mercury.

being 100.

the 31st; the 6th, giving a s.

ldest day was was 30.266 on 90 on the 19th nches. Maxi-

mum relative humidity was 98 on the 24th and 25th. Minimum relative humidity was 30 on the 8th.

Rain fell on 16 days.

Lunar halos on 2nd and 5th. Solar halo on the 2nd. Lunar coronas on the 6th and 7th.

Fog on 5 days. Thunder on 14th, 19th and 22nd.

ABSTRACT FOR THE MONTH OF MAY, 1898.

Meteorological Observations, McGill College Observatory, Montreal, Canada. Height above sea level, 187 feet, C. H. McLEOD, *Superintendent.*

DAY	THERMOMETER. Mean.	Max.	Min.	Range.	BAROMETER. Mean.	§Max.	§Min.	Range.	†Mean pressure of vapor.	‡Mean relative humidity.	Dew Point.	WIND. General direction.	Mean velocity in miles per hour	SKY CLOUDED IN TENTHS. Mean.	Max.	Min.	Per cent. possible Sunshine.	Rainfall in inches.	Snowfall in inches.	Rain and snow melted.	DAY.
SUNDAY........1	.....	64.6	43.0	21.6	......	....		......	......	....	....	N.W.	12.13	....	..	..	95	....	....	......	1...........SUNDAY
2	51.28	63.7	41.6	22.1	30.0127	30.050	29.961	.089	.2717	71.7	42.2	N.	16.96	3 5	8	0	73	...	....	....	2
3	49.95	54.3	43.5	10.8	30.0428	30.068	29.994	.074	.2977	82 8	44.7	N.	7.96	10.0	10	10	..	0.02	....	0.02	3
4	46.55	52.7	43.0	9.7	30.0245	30 051	29.975	.076	.2848	89 8	43 7	N.E.	10.13	10.0	10	10	..	0.11	....	0.11	4
5	45.95	51.4	40.2	11.2	29.9382	29 985	29.879	.106	.2140	69.2	36.2	W.	12.67	6.5	10	0	29	....	....	....	5
6	47.28	58.8	34.5	24.3	29.8433	29.925	29.764	.161	.1820	56 7	32.0	N W.	12.00	0.0	0	0	94	....	....	....	6
7	54.32	64.6	47.2	17.4	29.7487	29.867	29.683	.179	.1815	41.8	31.7	N.	13.67	0.0	0	0	97	....	....	....	7
SUNDAY........8	.....	57.0	36.8	20.2	......	......	......	....	......	....	...	N.	20.04	...	..	..	89	....	....	...	8...........SUNDAY
9	51.33	61.9	38.8	23.1	29.9793	30.036	29 935	.101	.1883	49 5	32 5	N.	9.17	0.0	0	0	91	....	....	....	9
10	50.18	60.9	40.8	20.1	29.9383	29 994	29.882	.112	.2240	61.7	37.2	N.	11.83	8.2	10	3	41	0.00	....	0.00	10
11	49.35	52.6	44.1	8.5	29.8398	29.868	29 831	.037	.3252	91 8	47 0	S.E	12.25	9.2	10	5	..	0.30	....	0.30	11
12	51.85	56.8	48.5	8 3	29.8257	29.874	29 784	.090	.3503	90.3	49.0	S.	13.42	8.5	10	5	7	0 64	...	0.64	12
13	52.40	58.4	43.0	15 4	29.9580	29.986	29.891	.095	.2885	73.2	44.0	S.W.	13.88	4.8	10	0	53	....	....	....	13
14	53.53	60.9	48.2	12.7	29.9873	30.008	29 962	.046	.3265	83.5	47 2	W.	10.71	7.3	10	0	37	0.09	....	0.09	14
SUNDAY........15	.....	68.4	45.6	22.8	......	......	......	......	......	....	....	W.	9.00	...		..	76	....	...	....	15...........SUNDAY
16	56.00	63.4	50.6	12.8	29.9027	30.018	29.804	.214	.3452	77.2	48.8	S.W.	12.04	7.8	10	0	14	0.07	....	0.07	16
17	49.30	55.0	46.0	9.0	29 8720	29.967	29.838	.129	.2603	73.8	41.3	W.	15.25	7.7	10	0	22	0.03	....	0.03	17
18	55.55	65.9	43.3	22.6	29 9867	30 086	29 885	.201	.3208	72 8	46.5	S.	11.08	4.3	10	0	72	....	....	...	18
19	61.80	69.8	53.0	16.8	29 6813	29.801	29.590	.211	.4475	80 2	55.3	S.W.	16.04	6.8	10	0	3	0.01	....	0.01	19
20	61.68	67.8	56.3	11.5	29.9435	30.135	29.590	.545	.3867	71.2	51.8	N.	10.92	5.0	10	0	68	0.09	....	0.09	20
21	62.97	73.2	48.7	24.5	30.2102	30 266	30 173	.093	.3435	60.3	48.5	N.	2.38	2.5	5	0	90	....	....	....	21
SUNDAY........22	.....	73.4	58.6	14.8	......	......	.....	......	......	...	....	S.	9 13	....	..	.	36	0.00	....	0 00	22...........SUNDAY
23	58.20	64.6	55.0	9.6	29 9452	30 038	29.827	.211	.3938	81.3	52.3	S.	13.21	8.8	10	4	7	0.25	....	0.25	23
24	61.30	70.9	57.0	13.9	29.7893	29.814	29.750	.064	.4970	92 3	58.8	S.	1 17	9.0	10	6	27	0.57	....	0 57	24
25	60.77	65.2	57.3	7.9	29 8682	29.936	29.817	.119	.4707	88.3	57.2	S.E.	8.58	10.0	10	10	.	0.09	....	0.09	25
26	61.10	68.7	54.6	14.1	29 9403	29.985	29.911	.074	.4270	79.3	54.3	E	9.58	6.8	10	0	[illegible]	....	....	....	26
27	62.88	71.3	51.4	19 9	29.8242	29.903	29.747	.156	.4218	74.3	54.3	N E.	9 46	5.5	10	0	[illegible]	....	....	....	27
28	66.80	74.8	59.0	15.8	29.7305	29.770	29.698	.072	.4983	76.2	58.7	S. E.	7.75	8.3	10		46	0 03	....	0.03	28
SUNDAY...... 29	.....	68.6	60.8	7.8	......	....	......	......	......	....	....	S.	17.21	....	..	..	10	0.32	....	0.32	29...........SUNDAY
30	59.65	64.6	55.6	9.0	29.7418	29 837	29.656	.181	.3957	77.2	52.5	S.	14.54	7.8	10	4	31	....	....	....	30
31	67.98	79.5	52.5	27.0	29.9493	29.976	29.837	.139	.4020	59.8	52.7	S.	8.33	0.0	0	0	96	....	....	....	31
Means............	55.77	63.99	48.34	15.65	29.9048	29.9709	29.8334	.1375	.3363	73.97	46.94	S. 87½° W.	11.38	6.09	8.2	2.4	45.3	2.62	....	2.62	...............Sums.
24 Years means for and including this month	54.72	64.02	45.84	18.18	29.9314	......	......	.168	.2912	66.3	....	....	s 14.26	6.15	.	.	¶50.28	2.96	....	2.98	24 Years means for and including this month.

ANALYSIS OF WIND RECORD.

Direction........	N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.	CALM.
Miles	2318	303	234	691	1775	11.84	1239	725	
Duration in hrs..	184	34	27	66	148	98	102	57	28
Mean velocity....	12.60	8.91	8.67	10.47	11.99	12.08	12.14	12.72	

Greatest mileage in one hour was 29, on the 8th.

Greatest velocity in gusts 36 miles per hour on the 8th.

Resultant mileage, 1,655.
Resultant direction, S. 87½° W.
Total mileage, 8,469.
Average velocity 11.38 m. p. h.

* Barometer readings reduced to sea-level and temperature 32° Fahrenheit.

§ Observed.

† Pressure of vapour in inches of mercury.

‡ Humidity relative, saturation being 100.

¶ 17 years only. s 12 years only.

The greatest heat was 79°.5 on the 31st; the greatest cold was 34°.5 on the 6th, giving a range of temperature of 45.0 degrees.

Warmest day was the 31st. Coldest day was the 5th. Highest barometer reading was 30.266 on the 21st. Lowest barometer was 29.590 on the 19th and 20th, giving a range of 0·676 inches. Maximum relative humidity was 98 on the 24th and 25th. Minimum relative humidity was 30 on the 8th.

Rain fell on 16 days.

Lunar halos on 2nd and 5th. Solar halo on the 2nd. Lunar coronas on the 6th and 7th.

Fog on 5 days. Thunder on 14th, 19th and 22nd.

ꟷE, 1898.

ꟷel, 187 feet, C. H. McLEOD, *Superintendent.*

DAY	Sky Clouded in Tenths. Mean.	Max.	Min.	Per cent. possible Sunshine.	Rainfall in inches.	Snowfall in inches.	Rain and snow melted.	DAY.
	1 5	4	0	94	....	....	......	1
	5.5	8	0	43	...	....	....	2
	4.3	9	0	84	....	....	....	3
	4.5	10	0	58	....	....	....	4
SUNDAY........	...	..	..	58	0.14	....	0.14	5...........SUNDAY
	7.3	10	2	11	0.00	....	0.00	6
	6 8	10	0	63	....	....	....	7
	9.2	10	5	4	0.15	....	0.15	8
	4.7	10	0	78	0.08	....	0.08	9
	2.2	8	0	78	....	....	...	10
	10.0	10	10	2	0.23	....	0.23	11
SUNDAY........	...		..	00	0.72	...	0.72	12 ....SUNDAY
	8.3	10	4	47	0.01	....	0.01	13
	7.8	10	3	56	0.80	....	0.80	14
	1.8	10	0	91	....	..	....	15
	2.5	8	0	72	....	....	....	16
	2.2	8	0	82	...	....	....	17
	7.3	10	0	18	0.72	....	0 72	18
SUNDAY........	....	..	.	26	0.18	....	0.18	19...........SUNDAY
	4.5	10	0	69	0.00	....	0 00	20
	7.2	10	0	30	0.22	....	0 22	21
	4.7	10	0	64	0.17	....	0.17	22
	4.3	10	0	77	0.00	....	0.00	23
	9 2	10	5	12	0 02	....	0.02	24
	9.8	10	9	5	0.27	....	0.27	25
SUNDAY.......	...	..	..	53	1.00	....	1.00	26...........SUNDAY
	8.5	10	4	51	0.85	....	0.85	27
	8 0	10	0	4	....	....	....	28
	3.8	10	0	82	0.01	....	0.01	29
	3.7	10	0	63	....	....	....	30
Means....... ...	5.75	9.4	1.6	49.2	5.57	....	5.57	................Sums.
24 Years mean for and includin this month	5.61	.	..	¶53.28	3.60	....	3 60	24 Years means for and including this month.

Direction......	
Miles	
Duration in hrs	
Mean velocity..	

sea-level and
f mercury.
eing 100.
the 1st; the
)th, giving a
s.

Greatest mi dest day was
25th. was 30.336 on
Greatest ve l on the 25th,
the 25th. ximum rela-

tive humidity was 98 on the 28th. Minimum relative humidity was 42 on the 15th.

Rain fell on 19 days.

Fog on 3 days. Thunder storms on 9th, 12th, 14th 18th, 21st, 24th, 26th and 28th.

Earthquake on the 1st.

ABSTRACT FOR THE MONTH OF JUNE, 1898.

Meteorological Observations, McGill College Observatory, Montreal, Canada. Height above sea level, 187 feet, C. H. McLEOD, *Superintendent.*

DAY	THERMOMETER. Mean.	Max.	Min.	Range.	BAROMETER. Mean.	§Max.	§Min.	Range.	†Mean pressure of vapor.	‡Mean relative humidity.	Dew Point.	WIND. General direction.	Mean velocity in miles per hour	SKY CLOUDED IN TENTHS. Mean.	Max.	Min.	Per cent. possible Sunshine.	Rainfall in inches.	Snowfall in inches.	Rain and snow melted.	DAY.
1	70.07	82.3	58.0	24.3	29.9573	30.035	29.871	.164	.4713	65.5	57.3	N.	7.08	1 5	4	0	94	....	....	......	1
2	66.78	75.8	57.0	18.8	29.9482	30 015	29.911	.104	.4774	73 5	57.8	N.	7.92	5.5	8	0	43	...	....	....	2
3	63.17	72.1	55.9	16.2	30.1720	30 252	30 015	.237	.4388	76 3	55.3	N.	16.58	4.3	9	0	84	....	....	....	3
4	62.63	69.3	56.1	13.2	30.2763	30.336	30.225	.111	.4473	78 8	55.7	N.	13.87	4.5	10	0	58	....	....	....	4
SUNDAY.........5	.....	79.2	56.1	23.1	......	......	......	....	.....	....	...	N.W.	10.12	...	..	..	58	0.14	....	0.14	5...........SUNDAY
6	61.43	67.6	54.9	12.7	30.1612	30.193	30.130	.063	.3618	66 5	50.0	N.	10.29	7.3	10	2	11	0.00	....	0.00	6
7	65.40	74.0	54.7	19.3	30.1080	30.202	30.021	.181	.3932	62 0	52.0	S.	7.25	6 8	10	0	63	....	....	....	7
8	68.60	76.7	62 2	14.5	29.8173	30 021	29.709	.312	.6152	87.7	64.7	S.	13.16	9.2	10	5	4	0.15	....	0.15	8
9	67.52	76.6	57.0	19.6	29.8478	30.008	29 709	.299	.5362	78 2	60.5	S.	17.08	4.7	10	0	78	0.08	....	0.08	9
10	54.91	62.6	46.0	16 6	30.1542	30 215	30.000	.207	.2666	62 3	41.8	N.	9 58	2.2	8	0	78	....	....	...	10
11	55.68	59.7	50.4	9 3	29 9113	30 132	29 834	.298	.3882	86 5	51.5	N.E.	8.00	10.0	10	10	2	0.23	....	0.23	11
SUNDAY.........12	....	63.2	54.2	9.0	......	......	......	......	......	....	....	N.E.	8.50	...		..	00	0.72	...	0.72	12 ....SUNDAY
13	67.75	74.8	59.7	15.1	29 9000	29 969	29 819	.150	.5525	81.7	61.7	N.E.	5.67	8.3	10	4	47	0.01	....	0.01	13
14	70.32	80.5	61.1	19.4	29.7042	29.844	29.625	.219	.6202	83.7	65 0	S.	15.46	7.8	10	3	56	0.80	...	0.80	14
15	55.65	63.0	47.9	15.1	30 1980	30.271	29.844	.427	.2747	62.5	42.5	N W.	14.33	1.8	10	0	91	....	..	....	15
16	61.87	69.7	51.1	18.6	30 2150	30 302	30.132	.170	.3685	67.0	50 5	S.	13 22	2.5	8	0	72	...	....	....	16
17	66.62	74.6	54.0	20.6	30 0885	30.142	30 040	.102	.3877	59.3	51.7	S.	8.50	2.2	8	0	82	...	....	....	17
18	64.88	74.1	54.6	19.5	29.8228	30.041	29 687	.354	.4948	80.0	58.0	S.E.	13.83	7.3	10	0	18	0.72	....	0 72	18
SUNDAY.........19	.....	71.1	57.6	13.5	......	......	.....	......	......	...	....	S.W.	10.58	....	..	.	26	0.18	....	0.18	19...........SUNDAY
20	62 05	71.4	55.1	16.3	29 6285	29.656	29.601	.055	.4077	74 2	53.3	W.	16.25	4.5	10	0	69	0.00	....	0 00	20
21	58.67	66.5	52.7	13.8	29.7733	29.900	29.624	.276	.3868	78 3	51.7	W.	11.29	7.2	10	0	30	0.22	....	0 22	21
22	59.88	68.8	53.5	15.3	30 0415	30.108	29 900	.208	.3960	77.3	52.5	N.	10.08	4.7	10	0	64	0.17	....	0.17	22
23	66.33	74.8	52.8	22.0	30 0138	30.141	29.861	.280	.4283	66.8	54.5	S.W.	14.12	4.3	10	0	77	0.00	....	0.00	23
24	68.70	74.8	61.3	13.5	29 6575	29 861	29.404	.457	.5412	75.8	60.7	S W.	19.71	9 2	10	5	12	0 02	....	0.02	24
25	70.43	77.8	64.5	13.3	29.3288	29.404	29.271	.133	.6470	87 0	66.3	S.W.	16.71	9.8	10	9	5	0.27	....	0.27	25
SUNDAY....... 26	.... .	78.0	62.0	16 0	......	.....	......	......	......	....	....	S.	14.87	...	..	..	53	1.00	....	1.00	26...........SUNDAY
27	66.60	73.4	59.0	14 4	29 9872	30.013	29.921	.092	.5418	82 8	61.2	S.	7.33	8.5	10	4	51	0.85	....	0.85	27
28	66.43	74.2	63.5	10.7	29.8513	29.991	29.796	.195	.5972	91.5	63 7	S	11.04	8 0	10	0	4	....	....	....	28
29	69.88	78.2	63.1	15.1	29.9477	29 978	29.857	.121	.5567	76.7	61.8	N.	6 96	3.8	10	0	82	0.01	....	0.01	29
30	72.65	82.2	61.7	20.5	29.8983	29.989	29.770	.219	.6067	75.7	64.2	S. W.	14.12	3.7	10	0	63	....	....	....	30
Means............	64.80	72.90	56.59	16.31	29.9388	30.0392	29.8302	.2090	.4694	75.29	56 38	S. 65¼° W.	11.79	5.75	9.4	1.6	49.2	5.57	....	5.57	...............Sums.
24 Years means for and including this month	64.84	73.58	56.32	17.25	29.9061	......	......	.152	.4356	70.0	....	....	s 13.05	5.61	..	..	¶53.28	3.60	....	3 60	24 Years means for and including this month.

ANALYSIS OF WIND RECORD.

Direction.......	N.	N.E.	E.	S E.	S.	S.W.	W.	N.W.	CALM.
Miles	2785	218	184	219	2828	929	1292	31	
Duration in hrs..	274	28	21	19	227	48	97	4	2
Mean velocity....	10.16	7.79	8.76	11.53	12 46	19 35	13.22	7.75	

Greatest mileage in one hour was 32, on the 25th.

Greatest velocity in gusts 42 miles per hour on the 25th.

Resultant mileage, 1,630.
Resultant direction, S. 65¼° W.
Total mileage, 8,486.
Average velocity 11.79 m. p. h.

* Barometer readings reduced to sea-level and temperature 32° Fahrenheit.

§ Observed.

† Pressure of vapour in inches of mercury.

‡ Humidity relative, saturation being 100.

¶ 17 years only. *s* 12 years only.

The greatest heat was 82°.3 on the 1st; the greatest cold was 46°.0 on the 10th, giving a range of temperature of 36.3 degrees.

Warmest day was the 30th. Coldest day was the 10th. Highest barometer reading was 30.336 on the 4th. Lowest barometer was 29.271 on the 25th, giving a range of 1·065 inches. Maximum relative humidity was 98 on the 28th. Minimum relative humidity was 42 on the 15th.

Rain fell on 19 days.

Fog on 3 days. Thunder storms on 9th, 12th, 14th 18th, 21st, 24th, 26th and 28th.

Earthquake on the 1st.

LY, 1898.

vel, 187 feet, C. H. McLEOD, *Superintendent.*

DAY	Sky Clouded in Tenths. Mean.	Max.	Min.	Per cent. possible Sunshine.	Rainfall in inches.	Snowfall in inches.	Rain and snow melted.	DAY.
	3.3	7	0	80	....	....	......	1
	2.5	8	0	79	....	....	....	2
SUNDAY........	....	..	..	92	0.03	....	0.03	3..........SUNDAY
	8.3	10	2	50	....	....	....	4
	0.0	0	0	99	....	....	....	5
	0.3	2	0	93	....	....	....	6
	0.3	2	0	100	....	....		7
	4.2	10	1	57	0.12	....	0.12	8
	4.0	10	0	63	0.12	....	0.12	9
SUNDAY........	....	..	..	87	....	....	....	10..........SUNDAY
	3.5	10	0	95	....	....	....	11
	0.8	3	0	100	....	....	....	12
	3.5	10	0	71	....	....	....	13
	7.0	10	0	58	0.00	....	0.00	14
	3.3	10	0	95	0.01	....	0.01	15
	1.0	4	0	100	....	....	....	16
SUNDAY........	....	..	..	8	0.00	....	0.00	17..........SUNDAY
	8.0	10	3	37	0.09	....	0.09	18
	6.0	10	2	53	0.00	....	0.00	19
	3.8	10	0	92	0.59	....	0.59	20
	1.7	6	0	79	0.12	....	0.12	21
	0.7	2	0	100	....	....	....	22
	6.0	10	0	62	0.00	....	0.00	23
SUNDAY.......	...	..	..	85	....	....	....	24..........SUNDAY
	7.8	10	5	31	1.01	....	1.01	25
	2.3	10	0	87	....	....	....	26
	1.7	10	0	92	0.02	....	0.02	27
	1.2	2	0	90	....	....	....	28
	6.0	10	0	53	....	....	....	29
	8.2	10	4	19	....	....	....	30
SUNDAY........3	....	..	..	58	....	....	....	31..........SUNDAY
Means......	3.08	6.3	0.6	73.1	2.11	....	2.11	...............Sums.
24 Years means for and including this month	5.33	..	..	¶59.36	3.98	....	3.98	24 Years means for and including this month.

Direction......
Miles ....
Duration in hrs..
Mean velocity....

sea-level and

f mercury.
eing 100.

the 3rd; the
th, giving a
s.

Greatest mile dest day was
3rd. was 30.469 on

Greatest velo 1 on the 9th,
the 25th. ximum rela-

tive humidity was 96 on the 25th. Minimum relative humidity was 41 on the 6th.

Rain fell on 13 days.

Aurora was observed on 1 night.

Lunar coronas on 4 nights.

Fog on 2 days. Thunder storms on 3rd, 8th, 18th, 19th, 20th, 23rd and 25th.

ABSTRACT FOR THE MONTH OF JULY, 1898.

Meteorological Observations, McGill College Observatory, Montreal, Canada. Height above sea level, 187 feet, C. H. McLEOD, *Superintendent.*

DAY	THERMOMETER. Mean.	Max.	Min.	Range.	*BAROMETER. Mean.	§Max.	§Min.	Range.	†Mean pressure of vapor.	‡Mean relative humidity.	Dew Point.	WIND. General direction.	Mean velocity in miles per hour	SKY CLOUDED IN TENTHS. Mean.	Max.	Min.	Per cent. possible Sunshine.	Rainfall in inches.	Snowfall in inches.	Rain and snow melted.	DAY.
1	69.80	78.0	63.6	14.4	30.0392	30.162	29.876	.286	.4912	67.8	43.8	N.	14.54	3 3	7	0	80	...	....	......	1
2	73.00	81.8	59.5	22.3	30.0468	30.177	29.887	.290	.6000	73 0	63.8	S.E.	12.33	2.5	8	0	79	....	....	....	2
SUNDAY........3	.....	90.4	73.5	16.9	......	......	......	....	......	....	....	S.	21.87	....	..	..	92	0.03	....	0 03	3...........SUNDAY
4	69.63	77.1	58.5	18.6	29.8987	30 067	29 808	.259	.5397	72 8	60.2	N.W.	12.33	8.3	10	2	50	....	....	....	4
5	57.87	66.4	48.8	17.6	30.2210	30.267	30.067	.200	.3020	62 5	45.0	N W.	10.29	0.0	0	0	99	....	....	....	5
6	63.88	73.8	50.3	23.5	30.2017	30.281	30.118	.163	.3757	64 7	50.8	S.W.	8.08	0.3	2	0	93	....	....	....	6
7	73.75	83.6	61.0	22.6	30.0080	30.118	29.881	.237	.5052	60 5	59.2	S W.	16.71	0 3	2	0	100	....	....		7
8	71.48	80.7	67.0	13.7	29.7362	29 881	29.629	.252	.6175	80.8	64.7	S.W.	18.25	4.2	10	1	57	0.12	....	0.12	8
9	64.02	70.8	54.6	16.2	29.6802	29.822	29 601	.221	.4258	70 5	53.5	S. W.	14.00	4.0	10	0	63	0.12	....	0.12	9
SUNDAY........10	.....	62.6	48.8	13 8	......	......	......	......	......	....	....	W.	12 54	....	..	..	87	....	....	....	10...........SUNDAY
11	56.57	64.8	48.0	16.8	30.2350	30 360	30.091	.269	.2925	64.0	44 2	S.	11.00	3.5	10	0	95	....	....	....	11
12	63.58	71.4	50.5	20.9	30.4277	30 469	30.360	.109	.4072	69 2	53.3	S.	6.92	0.8	3	0	100	....	....	....	12
13	66.38	75.8	55.3	20.5	30.3043	30.403	30 214	.189	.5080	78 8	59.2	S.E.	6.44	3.5	10	0	71	....	....	....	13
14	71.30	80.8	57.7	23.1	30.0230	30.214	29.810	.404	.6327	82.2	65 3	S.	17.92	7.0	10	0	58	0.00	....	0.00	14
15	72.30	79.7	66.0	13.7	29.8503	29 896	29.800	.096	.4938	63 2	55.3	N.W.	17.75	3.3	10	0	95	0.01	....	0.01	15
16	70.93	79.6	63.6	16.0	29 9520	30 003	29.896	.107	.3985	52.8	52.7	N.W.	13.04	1.0	4	0	100	....	....	....	16
SUNDAY........17	.....	76.4	59.0	17.4	......	......	......	......	......	...	....	N.	7 25	....	..	..	8	0 00	....	0 00	17...........SUNDAY
18	73 05	84.3	64.1	20.2	29 9288	29.990	29 874	.116	.6022	74.8	64.0	S.W.	11.29	8 0	10	3	37	0.09	....	0.09	18
19	77.53	87.8	69.6	18.2	29.8435	29.874	29 786	.088	.7762	82 8	71 7	S.W.	11.67	6.0	10	2	53	0.00	....	0.00	19
20	79.63	89.3	71.0	18.3	29.8237	29.851	29.793	058	.7327	78 2	72.2	S.W.	11.83	3.8	10	0	92	0.59	....	0.59	20
21	73.30	82.2	65.3	16.9	30 0218	30.161	29.834	327	.5618	68.3	62 0	N.	13.42	1.7	6	0	79	0.12	....	0.12	21
22	67 97	77.7	56.9	20.8	30.2017	30.250	30 161	.089	.4140	61.0	53.5	N.	12.79	0.7	2	0	100	....	....	....	22
23	71.05	80.7	59.7	21.0	30 1307	30.188	30.079	.109	.6158	79.8	64.2	S.	7.42	6.0	10	0	62	0.00	....	0 00	23
SUNDAY....... 24	.....	83.5	66.8	16.7	......	......	......	......	......	....	....	N.W.	8.25	...	..	..	85	....	....	....	24...........SUNDAY
25	74.62	86.2	68.2	18.0	29 8897	29 975	29.828	.147	.7023	82 5	68.7	S.	15.17	7.8	10	5	31	1.01	....	1.01	25
26	69.78	77.8	62.1	15 7	29 9215	30.001	29.839	.162	.5283	73 2	60.5	N.	7.83	2.3	10	0	87	....	....	....	26
27	75.70	86.8	63.5	23.3	29.8477	29.921	29.783	.138	.6507	73 7	66.3	S.E.	5.71	1.7	10	0	92	0.02	....	0.02	27
28	79.20	88.8	68.6	20.2	29.7712	29.826	29.726	.100	.7425	75.0	70 2	S.	12.58	1 2	2	0	90	....	....	....	28
29	77.93	86.4	73.2	13.2	29.7487	29 774	29 720	.054	.7312	77.0	70.0	S	12 54	6.0	10	0	53	...	....	....	29
30	71.03	77.2	67.8	9.4	29.8643	29.923	29.773	.150	.5877	77.0	63.5	S.	12.83	8.2	10	4	19	....	....	....	30
SUNDAY........31	.... .	77 2	62.9	14.3	......	......	......	.....	......	....	....	N.	11.17	...	..	..	58	....	....	....	31...........SUNDAY
Means..............	70.58	79.34	61.46	17.88	29.9853	30.0713	29.8936	.1777	.5494	71.77	60 03	S. 39¾° W.	12.14	3.08	6.3	0.6	73.1	2.11	....	2.11	...............Sums.
24 Years means for and including this month	68.91	77.41	60.79	16.63	29.8986	......	......	.142	.5053	71.46	....	....	s 12.81	5.33	.	..	¶59.36	3 98	....	3 98	24 Years means for and including this month.

ANALYSIS OF WIND RECORD.

Direction......	N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.	CALM.
Miles	2066	89	116	356	3231	2015	567	590	
Duration in hrs..	172	19	20	40	236	153	47	44	13
Mean velocity....	12.01	4.68	5.80	8.90	13 69	13.17	12.06	13.41	

Greatest mileage in one hour was 31, on the 3rd.

Greatest velocity in gusts 48 miles per hour on the 25th.

Resultant mileage, 3,080.
Resultant direction, S. 39¾° W.
Total mileage, 9,030.
Average velocity 12.14 m. p. h.

* Barometer readings reduced to sea-level and temperature 32° Fahrenheit.

§ Observed.

† Pressure of vapour in inches of mercury.

‡ Humidity relative, saturation being 100.

¶ 17 years only. s 12 years only.

The greatest heat was 90.°4 on the 3rd; the greatest cold was 48.°0 on the 11th, giving a range of temperature of 42.4 degrees.

Warmest day was the 3rd. Coldest day was the 10th. Highest barometer reading was 30.469 on the 12th. Lowest barometer was 29.601 on the 9th, giving a range of 0·868 inches. Maximum relative humidity was 96 on the 25th. Minimum relative humidity was 41 on the 6th.

Rain fell on 13 days.

Aurora was observed on 1 night.

Lunar coronas on 4 nights.

Fog on 2 days. Thunder storms on 3rd, 8th, 18th, 19th, 20th, 23rd and 25th.

UST, 1898.

vel, 187 feet, C. H. McLEOD, *Superintendent.*

DAY	Sky Clouded In Tenths. Mean.	Max.	Min.	Per cent. possible Sunshine.	Rainfall in inches.	Snowfall in inches.	Rain and snow melted.	DAY.
	7.2	10	0	26	0.42	....	0.42	1
	6.3	10	2	72	0.00	....	0.00	2
	6.7	10	0	26	0.01	....	0.01	3
	9.0	10	3	14	0.03	....	0.03	4
	7.2	10	3	52	0.03	....	0.03	5
	2.7	10	0	96	....	....	......	6
SUNDAY......	....	..	..	56	....	....	....	7..........SUNDAY
	8.8	10	7	25	0.01	....	0.01	8
	4.3	7	0	81	0.00	....	0.00	9
	10.0	10	10	06	0.00	....	0.00	10
	2.5	10	0	80	0.00	....	0.00	11
	7.3	10	4	60	0.10	...	0.10	12
	6.3	10	0	47	0.11	....	0.11	13
SUNDAY. ...	....	..	..	89	....	....	....	14 ....SUNDAY
	6.7	..	0	67	0.00	....	0.00	15
	6.0	10	0	42	0.04	....	0.04	16
	5.5	10	0	43	0.53	....	0.53	17
	4.3	10	0	64	....	....	....	18
	6.7	10	0	00	....	....	....	19
	2.0	10	0	87	....	....	...	20
SUNDAY.. ..	....	..	..	43	0.02	....	0.02	21...........SUNDAY
	2.5	10	0	58	....	....	....	22
	7.8	10	0	0	0.04	....	0.04	23
	10.0	10	10	0	0.17	....	0.17	24
	9.7	10	8	5	0.21	....	0.21	25
	7.7	10	0	14	0.02	....	0.02	26
	2.0	6	0	93	....	....	....	27
SUNDAY ..	....	..	..	84	....	....	....	28...........SUNDAY
	6.3	10	0	4	0.81	....	0.81	29
	5.2	10	0	69	0.01	....	0.01	30
	8.0	10	3	29	0.00	....	0.00	31
Means......	6.21	9.7	1.9	46.2	2.56	....	2.56	...............Sums.
24 Years me[ans] for and includ[ing] this month ..	5.76		..	¶57.78	3.56	....	3.56	24 Years means for and including this month.

sea-level and

Direction..

Miles ....

Duration in

Mean velocity

f mercury.
being 100.

the 16th ; the
8th, giving a
s.

Greatest ldest day was
5th. was 30.262 on
Greatest 09 on the 25th,
the 5th and aximum rela-

tive humidity was 99 on the 24th. Minimum relative humidity was 43 on the 14th.

Rain fell on 22 days.

Fog on 8 days.

Thunder storms on 5th, 12th, 16th, 17th, and 29th.

ABSTRACT FOR THE MONTH OF AUGUST, 1898.

Meteorological Observations, McGill College Observatory, Montreal, Canada. Height above sea level, 187 feet, C. H. McLEOD, *Superintendent.*

DAY	THERMOMETER. Mean.	Max.	Min.	Range.	BAROMETER. Mean.	§Max.	§Min.	Range.	†Mean pressure of vapor.	‡Mean relative humidity.	Dew Point.	WIND. General direction.	Mean velocity in miles per hour	SKY CLOUDED IN TENTHS. Mean.	Max.	Min.	Per cent. possible Sunshine.	Rainfall in inches.	Snowfall in inches.	Rain and snow melted.	DAY.
1	67.37	74.3	59.4	14.9	29.9793	30.046	29.886	.160	.5825	85.8	62.8	N.	9.04	7 2	10	0	26	0.42	....	0 42	1
2	70.12	77.9	63.1	14.8	30.0042	30.032	29.959	.073	.5713	78.7	62.7	S.	6.92	6.3	10	2	72	0.00	....	0.00	2
3	72.52	81.8	62.4	19.4	29.9240	30 043	29 790	.253	.6263	77 5	65.0	S.E.	9.92	6.7	10	0	26	0.01	....	0.01	3
4	72.82	79.8	67.3	12.5	29.8015	29 837	29.774	.063	.6668	82 3	67.2	S.	14.12	9.0	10	3	14	0.03	....	0.03	4
5	67.97	79.4	61.1	18.3	29.8983	29.926	29.857	.069	.5048	75 2	59.5	S.W.	17.67	7.2	10	3	52	0.03	....	0.03	5
6	69.22	78.5	59.6	18.9	29.8907	29.942	29.858	.084	.4700	67.3	57.2	S W.	19.29	2.7	10	0	96	...	....	......	6
SUNDAY...... 7	.....	79.8	63.3	16.5	......	......	......	....	......	....	...	S.E.	13.08	....	..	..	56	....	....	....	7..........SUNDAY
8	73.68	80.9	68.0	12.9	29 7577	29.778	29.728	.050	.6987	84.5	68.5	S.	15.71	8.8	10	7	25	0.01	....	0.01	8
9	72.33	80.6	66.0	14.6	29.8492	29.925	29.763	.162	.5815	72.5	62.7	N.	12.21	4.3	7	0	81	0.00	....	0.00	9
10	66.50	74.4	59.2	15 2	29.9297	29.952	29 901	.051	.5022	78 0	59.2	N.	7.42	10.0	10	10	06	0.00	....	0 00	10
11	69.58	80.1	57.8	22.3	29.9675	30.003	29.938	.065	.5427	76.5	61.2	S.	9.00	2.5	10	0	80	0.00	....	0.00	11
12	70.22	79.2	62.8	16 4	29.9285	30.001	29 864	.137	.5895	80.5	63.7	S.	14.46	7.3	10	4	60	0.10	...	0.10	12
13	67.53	75.5	62.6	12.9	29.9928	30.137	29 895	.242	.5615	83.5	62.3	S.	15.87	6.3	10	0	47	0.11	....	0.11	13
SUNDAY. 14	.... .	77.5	59.5	18.0	......	......	......	......	......	....	....	S.	8.29	. ..	..	..	89	....	....	....	14 ....SUNDAY
15	70.05	79.8	57.4	22.4	30.0997	30.223	29.919	.304	.4977	68.7	58.7	S.	9.79	6.7	..	0	67	0.00	....	0.00	15
16	73.23	81.9	66.0	15.9	29.8498	29 900	29.804	.096	.6420	78.3	66.0	S.	17.96	6.0	10	0	42	0.04	....	0.04	16
17	68.62	78.0	62.3	15.7	29 8265	29.919	29.766	.153	.5692	82.2	62.5	S.	12.71	5 5	10	0	43	0.53	....	0.53	17
18	62 12	69.7	55.7	14.0	30 0015	30.050	29.964	.086	.4042	72 7	52 8	N.	8.29	4.3	10	0	64	....	....	....	18
19	59.90	64.9	55.2	9.7	30 0167	30 035	30.000	.035	.2925	76 5	52.3	N.	8.71	6.7	10	0	00	....	....	....	19
20	66.60	74.9	55.2	19.7	29.9748	30 069	29.881	188	.4632	71.7	56.8	S.	12.42	2.0	10	0	87	....	....	...	20
SUNDAY.. .. .21	....	77.0	62.5	14.5	......	......	......	......	......	...	....	S.	14.04	....	..	.	43	0.02	....	0.02	21....... ...SUNDAY
22	70.25	78.8	61.2	17.6	29.7852	29.834	29.742	.092	.5793	78.5	63.2	S.	7.46	2.5	10	0	58	....	....	....	22
23	64 25	68.0	61.4	6.6	29.7982	29 863	29.739	.124	.5275	87.5	60.5	N.	7.92	7.8	·0	0	0	0.04	....	0.04	23
24	63.68	66.8	60.6	6.2	29.8082	29.838	29.776	.062	.5490	93.0	61.5	N.	7.68	10 0	·0	10	0	0.17	....	0 17	24
25	64.77	71.6	60.6	11.0	29.6822	29.760	29.609	.151	.5563	90 2	61.8	N.	9.68	9.7	10	8	5	0.21	....	0.21	25
26	58.75	66.3	55 3	11.0	29.7635	29.848	29 656	.192	.4115	83 2	53.5	S.W.	18.79	7.7	10	0	14	0.02	....	0.02	26
27	60.20	67.0	51.2	15 8	30.0215	30.154	29 890	.264	.3368	65.2	48.2	S.W.	14.42	2.0	6	0	93	....	....	....	27
SUNDAY .. . 28	.....	69.8	49.0	20.8	......	.....	......	......	......	....	....	S.	7.54	....	..	..	84	....	....	....	28..........SUNDAY
29	63.97	73.2	57.3	15.9	29.8730	29.997	29.793	.204	.5395	89.2	60.7	S.	17.88	6 3	10	0	4	0 81	....	0.81	29
30	66.40	71.6	60.8	10.8	29.8982	29.959	29.837	.122	.4902	75.7	58.5	S.W.	12 13	5.2	10	0	69	0.01	....	0.01	30
31	68.95	75.2	63.7	11.5	29.9540	29.997	29 861	.136	.5487	77.7	61.7	S.W.	13.79	8.0	10	3	29	0.00	....	0.00	31
Means......	64 47	75.30	60.24	15.06	29 8991	29 9655	29.8315	1340	.5298	78.99	60 39	S. 24° W.	12.07	6.21	9.7	1.9	46.2	2.56	....	2.56	.........Sums.
24 Years means for and including this month	66.62	74.92	58.65	15.25	29.9373	......	.....	.134	.4821	73.38	....	....	s 12.46	5.76	.	..	¶57.78	3.56	....	3.56	24 Years means for and including this month.

ANALYSIS OF WIND RECORD.

Direction.. ...	N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.	CALM.
Miles	1911	18	131	148	4429	1561	472	308	
Duration in hrs..	212	2	21	11	331	96	50	16	5
Mean velocity....	9 01	9.00	6.24	13.45	13 38	16.26	9.44	19.25	

Greatest mileage in one hour was 27, on the 5th.

Greatest velocity in gusts 36 miles per hour on the 5th and 31st.

Resultant mileage, 3,825.
Resultant direction, S. 24° W.
Total mileage, 8,978.

* Barometer readings reduced to sea-level and temperature 32° Fahrenheit.

§ Observed.

† Pressure of vapour in inches of mercury.

‡ Humidity relative, saturation being 100.

¶ 17 years only. s 12 years only.

The greatest heat was 81.°9 on the 16th; the greatest cold was 49.°0 on the 28th, giving a range of temperature of 32.9 degrees.

Warmest day was the 8th. Coldest day was the 26th. Highest barometer reading was 30.262 on the 28th. Lowest barometer was 29.609 on the 25th, giving a range of 0·653 inches. Maximum relative humidity was 99 on the 24th. Minimum relative humidity was 43 on the 14th.

Rain fell on 22 days.

Fog on 8 days.

Thunder storms on 5th, 12th, 16th, 17th, and 29th.

ꞒMBER, 1898.

ʋel, 187 feet, C. H. McLEOD, *Superintendent.*

DAY	Sky Clouded in Tenths. Mean.	Max.	Min.	Per cent. possible Sunshine.	Rainfall in inches.	Snowfall in inches.	Rain and snow melted.	DAY.
	8.7	10	2	20	0.23	....	0.23	1
	5.3	10	0	29	0.66	....	0.66	2
	4.7	7	2	84	....	....	......	3
SUNDAY......	...	..	..	69	0.10	....	0.10	4..........SUNDAY
	4.7	10	0	39	0.00	....	0.00	5
	7.0	10	4	41	0.06	....	0.06	6
	8.2	10	0	2	0.55	....	0.55	7
	3.2	10	0	98	0.04	....	0 04	8
	6.3	10	0	83	0.00	....	0 00	9
	5.3	10	0	61	0.16	....	0.16	10
SUNDAY......	....	..	..	80	0.00	....	0.00	11 ....SUNDAY
	0.0	0	0	96	0.00	...	0.00	12
	1.5	5	0	81	....	....	....	13
	7.7	10	0	19	....	....	....	14
	1.2	3	0	77	....	....	....	15
	6.8	10	0	4	0.03	....	0.03	16
	3.0	10	0	86	....	....	....	17
SUNDAY......	....	..	.	25	1.45	....	1.45	18..........SUNDAY
	5.0	10	0	18	0.11	....	0.11	19
	3.8	10	0	83	....	....	...	20
	4.7	10	0	63	0.01	....	0.01	21
	4.2	10	0	56	0.05	....	0.05	22
	10 0	10	10	0	1.90	....	1.90	23
	8.5	10	6	51	0.12	....	0.12	24
SUNDAY......	....	..	..	0	0.36	....	0.36	25..........SUNDAY
	6.3	10	0	42	0.22	....	0.22	26
	4.5	10	0	56	0 03	....	0.03	27
	0.8	5	0	90	....	....	....	28
	0.0	0	0	93	....	....	....	29
	1.8	10	0	89	0.00	....	0.00	30
Means...... ..	4.74	8.5	0.9	54.5	6.08	....	6.08	...............Sums.
24 Years mea for and includi this month	5.71	..	..	¶54 33	3.18	....	3.18	24 Years means for and including this month.

sea-level and

Direction.....

Miles ....

f mercury.

eing 100.

Duration in hr

the 4th; the

Mean velocity.

1st, giving a

s.

Greatest m dest day was

23rd and 24th. was 30.452 on

Greatest v 82 on the 18th,

the 18th. aximum rela-

tive humidity was 99 on the 18th, 23rd and 25th. Minimum relative humidity was 56 on the 13th and 20th.

Rain fell on 22 days.

Hail fell on 18th.

Auroras were observed on 2 nights. Lunar halos on 1 night. Lunar coronas on 3 nights.

Fog on 4 days.

Thunder storms on 1st, 2nd, 4th, 9th, 10th, 18th and 19th.

ABSTRACT FOR THE MONTH OF SEPTEMBER, 1898.

Meteorological Observations, McGill College Observatory, Montreal, Canada. Height above sea level, 187 feet, C. H. McLEOD, *Superintendent.*

DAY	THERMOMETER.				BAROMETER.				†Mean pressure of vapor.	‡Mean relative humidity.	Dew Point.	WIND.		SKY CLOUDED IN TENTHS.			Per cent. possible Sunshine.	Rainfall in inches.	Snowfall in inches.	Rain and snow melted.	DAY.
	Mean.	Max.	Min.	Range.	Mean.	§Max.	§Min.	Range.				General direction.	Mean velocity in miles per hour	Mean.	Max.	Min.					
1	65.92	70.8	63.1	7.7	30.0312	30.070	29.937	.073	.5427	84.8	61.3	N.	7.17	8.7	10	2	20	0.23	....	0.23	1
2	69 15	78.8	60.8	18.0	29.8038	30.007	29.651	.356	.6587	91 8	66.5	S.	10.29	5.3	10	0	29	0.66	....	0.66	2
3	74.88	81.3	70 0	11.3	29.7487	29 788	29 651	.137	.7062	82 5	68.8	S.	11.29	4.7	7	2	84	....	....	......	3
SUNDAY.........4	.....	90.3	70.8	19.5	......	......	......	....	.....	....	...	S.	20.17	...	..	..	69	0.10	....	0.10	4...........SUNDAY
5	67.75	76.0	63.5	12.5	29.8290	29.847	29.786	.061	.4970	73.0	58.7	S.	10.21	4.7	10	0	39	0.00	....	0.00	5
6	69.75	76.8	62.4	14.4	29 8402	29.931	29.719	.212	.5940	81 3	63.7	S.	9.04	7.0	10	4	41	0.06	....	0.06	6
7	64.23	72.4	57.3	15 1	29.7200	29 833	29 672	.161	.5620	92.0	61.8	S.	15.17	8.2	10	0	2	0.55	....	0.55	7
8	61.07	68.8	52.0	16.8	30 0350	30 146	29 833	.313	.3865	71 8	51.5	S.	18.21	3.2	10	0	98	0.04	....	0 04	8
9	60.83	66.3	56.6	9.7	30 2687	30.327	30.116	.151	.3960	74 3	52.5	N.	7.13	6.3	10	0	83	0.00	....	0 00	9
10	51.43	58.4	47.8	10.6	30.3932	30.452	30.242	.210	.2943	77 5	44.5	N.	11.04	5.3	10	0	61	0.16	....	0.16	10
SUNDAY.......11	.....	63.8	44 5	19.3	......	......	......	......	......	....	....	W.	18.29	....	..	..	80	0.00	....	0.00	11 ....SUNDAY
12	49.58	55.6	42.8	12.8	30 3635	30.410	30.260	.150	.2547	72.2	40.7	N W.	9 54	0.0	0	0	96	0.00	...	0.00	12
13	55.25	64.8	42.6	22.2	30 2918	30 392	30 240	.152	.3357	77.2	47.7	S.W.	6.17	1.5	5	0	81	....	....	....	13
14	60.03	68.4	51.6	16 8	30.1458	30.240	30 090	.150	.4195	86.7	55.8	S.W.	5.92	7.7	10	0	19	....	....	....	14
15	63 67	72.7	54.3	18.4	30.0015	30 090	29 941	.149	.4747	81 0	57.3	S.	11.21	1.2	3	0	77	....	....	....	15
16	65.20	72.7	61.0	11.7	29.8602	29 941	29 816	.125	.5657	90 8	62 2	S.	13.25	6.8	10	0	4	0.03	....	0.03	16
17	64 35	71.6	57.0	14.6	29.9058	29.933	29 816	.117	.4725	79 0	57 3	S.W.	15.71	3.0	10	0	86	....	....	....	17
SUNDAY........18	...	72.5	56.4	16.1	......	......	.....	......	......	...	....	S.W.	17.50	....	..	..	25	1.45	....	1.45	18...........SUNDAY
19	55.25	60.7	50.4	10.3	29 7515	29.871	29 639	.232	.3305	75 0	47.3	S.W.	24.71	5.0	10	0	18	0.11	....	0.11	19
20	47.13	51.2	43 2	8.0	30 0330	30 233	29 871	.362	.2218	68.7	37.2	W.	17.50	3.8	10	0	83	....	....	...	20
21	51.20	60.7	40.5	20.2	30 2543	30.293	30.190	109	.2757	72.3	42.3	S.W.	15 08	4.7	10	0	63	0.01	....	0.01	21
22	60.40	70.6	49.2	21.4	29 9978	30.190	29.894	.296	.4257	78.7	53.5	S W.	10 50	4.2	10	0	56	0.05	....	0.05	22
23	55.93	62 2	47.6	14.6	29.7153	29 894	29.649	.245	.4423	97.3	55.2	N.	15.88	10 0	10	10	0	1.90	....	1.90	23
24	48.43	56.4	42.0	14.4	30 0002	30 081	29.764	.317	.2818	82 7	43.3	N.W.	21.83	8.5	10	6	51	0.12	....	0.12	24
SUNDAY........25	.....	56.7	46.4	10 3	......	.....	......	......	......	....	....	S.E.	16 04	....	..	..	0	0.36	....	0.36	25...........SUNDAY
26	56.87	65.6	51.9	13.7	29.7582	29.843	29.664	.179	.4063	88.3	53.3	S.E.	13.67	6.3	10	0	42	0.22	....	0.22	26
27	52.88	57.7	46.9	10.8	29 8207	29.926	29.664	.262	.2970	74 0	44 7	W.	16.74	4.5	10	0	56	0 03	....	0.03	27
28	57.08	63.2	49.2	14 0	29.9840	30 016	29 922	.094	.3457	74.2	48.7	S.W.	11.71	0.8	5	0	90	....	....	....	28
29	62.73	71.4	52.5	18.9	30.0345	30.086	29.932	.094	.4192	74.5	54.0	S.W.	17.67	0.0	0	0	93	....	....	....	29
30	66.22	74 7	54.0	20 7	30.0663	30 128	30.015	.113	.5380	83.2	60.8	S.W.	9 50	1.8	10	0	89	0.00	....	0.00	30
Means......	59 89	67.77	52.94	14.83	29.9892	30.0759	29.8894	.1865	.4298	80.19	53 48	S. 43° W.	13 62	4.74	8.5	0.9	54.5	6.08	....	6.08	................Sums.
24 Years means for and including this month	58.55	66 61	50.79	15 83	30.0167	......	......	.180	.3768	......	....	....	s 12 72	5.71	.	..	¶54 33	3.18	....	3.18	24 Years means for and including this month.

ANALYSIS OF WIND RECORD.

Direction......	N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.	CALM.
Miles	718	18		649	2847	3142	1460	961	
Duration in hrs..	80	2		217	217	222	96	49	6
Mean velocity....	89.75	9.00		13.52	13 12	14.15	15.21	19.61	

Greatest mileage in one hour was 40, on the 23rd and 24th.

Greatest velocity in gusts 60 miles per hour on the 18th.

Resultant mileage, 5,665.
Resultant direction, S. 43° W.
Total mileage, 9,795.
Average velocity 13.62 m. p. h.

* Barometer readings reduced to sea-level and temperature 32° Fahrenheit.

§ Observed.

† Pressure of vapour in inches of mercury.

‡ Humidity relative, saturation being 100.

¶ 17 years only. s 12 years only.

The greatest heat was 90.°3 on the 4th; the greatest cold was 40.°5 on the 21st, giving a range of temperature of 49.8 degrees.

Warmest day was the 4th. Coldest day was the 20th. Highest barometer reading was 30.452 on the 10th. Lowest barometer was 29.532 on the 18th, giving a range of 0·920 inches. Maximum relative humidity was 99 on the 18th, 23rd and 25th. Minimum relative humidity was 56 on the 13th and 20th.

Rain fell on 22 days.

Hail fell on 18th.

Auroras were observed on 2 nights. Lunar halos on 1 night. Lunar coronas on 3 nights.

Fog on 4 days.

Thunder storms on 1st, 2nd, 4th, 9th, 10th, 18th and 19th.

OBER, 1898.

vel, 187 feet, C. H. McLEOD, *Superintendent.*

DAY	Sky Clouded In Tenths. Mean.	Max.	Min.	Per cent. possible Sunshine.	Rainfall in inches.	Snowfall in inches.	Rain and snow melted.	DAY.
1	2.7	8	0	80	....	....	....	1
SUNDAY........2	....	..	..	4	....	....	....	2..........SUNDAY
3	8.0	10	0	3	0.99	....	0.99	3
4	6.0	10	0	64	0.03	....	0.03	4
5	7.2	10	0	1	0.23	....	0.23	5
6	1.3	3	0	96	....	....	......	6
7	4.2	10	0	66	....	....	....	7
8	4.3	10	0	54	....	....	....	8
SUNDAY........9	....	..	..	82	....	....	....	9..........SUNDAY
10	2.5	8	0	82	....	....	....	10
11	10.0	10	10	0	0.17	....	0.17	11
12	7.2	10	0	45	0.03	...	0.03	12
13	7.0	10	0	19	....	....	...	13
14	10.0	10	10	0	0.32	....	0 32	14
15	10.0	10	10	0	0.67	0.0	0.67	15
SUNDAY........16	....	..	..	74	....	....	....	16..........SUNDAY
17	2.5	8	0	81	....	....	....	17
18	1.2	8	0	78	....	....	....	18
19	8.3	10	0	0	0.95	....	0.95	19
20	3.3	10	0	49	0.01	....	0.01	20
21	10.0	10	10	0	0.11	....	0.11	21
22	8.3	10	0	0	0.48	....	0.48	22
SUNDAY........23	....	..	..	25	0.05	....	0.05	23.......... SUNDAY
24	8.8	10	5	27	....	....	....	24
25	6.2	10	0	21	....	....	....	25
26	10.0	10	10	0	0.32	....	0.32	26
27	9.5	10	7	16	0.19	0.0	0.19	27
28	6.5	10	3	44	....	....	....	28
29	1 2	7	0	83	....	....	....	29
SUNDAY........30	....	..	..	0	0.02	....	0.02	30..........SUNDAY
31	8.8	10	3	33	0.00	....	0.00	31
Means......	6.34	9.3	2.5	36.4	4.57	0.0	4.57	..............Sums.
24 Years means for and including this month	6.33	..	..	¶41 05	3.02	....	3.14	24 Years means for and including this month.

sea-level and

Direction....... f mercury.

Miles .... being 100.

Duration in hrs.. the 4th; the

Mean velocity.... 9th, giving a

s.

Greatest mile dest day was 27th. was 30.485 on

Greatest velo 9 on the 22nd, the 27th. aximum rela-

tive humidity was 99 on the 3rd, 19th, 20th and 26th. Minimum relative humidity was 46 on the 9th and 10th.

Rain fell on 16 days.

Snow fell on 2 days.

Rain or snow fell on 16 days.

Lunar corona on 1 night. Lunar halos on 4 nights.

Hour frost on 4 days. Fog on 10 days.

ABSTRACT FOR THE MONTH OF OCTOBER, 1898.

Meteorological Observations, McGill College Observatory, Montreal, Canada. Height above sea level, 187 feet, C. H. McLEOD, *Superintendent.*

DAY	THERMOMETER. Mean.	Max.	Min.	Range.	BAROMETER. Mean.	§Max.	§Min.	Range.	†Mean pressure of vapor.	‡Mean relative humidity.	Dew Point.	WIND. General direction.	Mean velocity in miles per hour	SKY CLOUDED IN TENTHS. Mean.	Max.	Min.	Per cent. possible Sunshine.	Rainfall in inches.	Snowfall in inches.	Rain and snow melted.	DAY.
1	66.27	72.8	60.7	12.1	30.3300	30.387	30.128	.259	.4682	72.5	57.2	N.	13.29	2.7	8	0	80	....		....	1
SUNDAY.........2	.....	73.8	56.3	17.5	......	......	......	....	......	....	....	N.W.	10.29	....	..	..	4	....	....	....	2..........SUNDAY
3	67.10	71.7	62.9	8.8	30.1152	30.209	30.015	.194	.6022	90.3	64.2	S.E.	12.75	8.0	10	0	3	0.99	....	0.99	3
4	66.48	73.9	55.2	18.7	30.0948	30.167	30.013	.154	.5022	74.8	57.7	S.W.	14.17	6.0	10	0	64	0.03	....	0.03	4
5	51.80	58.6	49.7	8.9	29.8850	30.137	29.769	.368	.3410	88.2	48.3	N.	16.71	7.2	10	0	1	0.23	....	0.23	5
6	45.23	50.7	40.3	10.4	30.3292	30.389	29.925	.484	.2030	67.2	35.0	N.W.	12.88	1.3	3	0	96	....	....	......	6
7	49.08	56.6	38.5	18.1	30.3143	30.418	30.208	.210	.2618	75.5	41.3	S.W.	6.04	4.2	10	0	66	....	....	....	7
8	51.85	59.6	47.5	12.1	30.0122	30.208	29.931	.277	.2912	76.3	44.0	S.	10.25	4.3	10	0	54	....	....	....	8
SUNDAY.........9	.....	52.8	34.5	18.3	......	......	......	......	......	....	....	N.	14.42	....	..	..	82	....	....	....	9..........SUNDAY
10	38.68	45.6	30.6	15.0	30.3327	30.450	30.190	.260	.1458	62.0	26.5	N.E.	6.71	2.5	8	0	82	....	....	....	10
11	57.23	64.5	40.0	24.5	29.7177	30.190	29.500	.690	.4212	88.7	53.8	S.	21.17	10.0	10	10	0	0.17	....	0.17	11
12	50.77	57.7	41.0	16.7	29.7388	29.937	29.603	.334	.3012	78.7	44.0	S.W.	18.46	7.2	10	0	45	0.03	...	0.03	12
13	39.38	42.5	33.5	9.0	30.0593	30.124	29.937	.187	.1777	73.3	31.5	N.	8.88	7.0	10	0	19	....	....	...	13
14	39.57	43.7	36.8	6.9	30.0127	30.124	29.908	.216	.2165	88.7	36.5	N.	14.75	10.0	10	10	0	0.32	....	0.32	14
15	36.88	40.0	35.1	4.9	29.8117	29.908	29.758	.150	.1963	89.7	34.0	N.	18.71	10.0	10	10	0	0.67	0.0	0.67	15
SUNDAY.........16	.....	49.6	36.5	13.1	......	......	......	......	......	...	....	N.	17.08	....	..	..	74	....	....	....	16..........SUNDAY
17	36.93	42.7	32.5	10.2	30.3668	30.409	30.295	.114	.1783	81.3	31.8	N.E.	12.38	2.5	8	0	81	....	....	....	17
18	39.60	49.8	30.0	19.8	30.3130	30.430	30.229	.201	.1865	77.2	32.7	N.E.	11.42	1.2	8	0	78	....	....	....	18
19	40.05	44.0	34.7	9.3	30.1732	30.254	30.106	.148	.2333	92.7	38.0	N.E.	10.04	8.3	10	0	0	0.95	....	0.95	19
20	45.27	51.2	41.5	9.7	30.2312	30.266	30.106	.160	.2740	90.8	42.5	W.	6.79	3.3	10	0	49	0.01	....	0.01	20
21	45.38	51.4	38.5	12.9	30.0865	30.257	29.835	.422	.2822	92.5	43.3	E.	11.33	10.0	10	10	0	0.11	....	0.11	21
22	52.87	59.8	47.8	12.0	29.4213	29.835	29.219	.616	.3643	90.0	50.0	N.E.	15.67	8.3	10	0	0	0.48	....	0.48	22
SUNDAY.........23	.....	55.0	44.2	10.8	......	......	......	......	......	....	....	S.W.	18.88	....	..	..	25	0.05	....	0.05	23..........SUNDAY
24	49.38	55.7	45.0	10.7	30.1747	30.233	30.080	.153	.2810	79.5	43.3	S.	12.33	8.8	10	5	27	....	....	....	24
25	50.65	56.5	44.0	12.5	30.1163	30.205	29.998	.207	.3022	81.5	45.2	S.	14.46	6.2	10	0	21	....	....	....	25
26	54.27	58.9	49.2	9.7	29.6993	29.998	29.429	.569	.3993	94.0	52.7	S.	15.75	10.0	10	10	0	0.32	....	0.32	26
27	37.37	51.4	32.3	19.1	29.8397	30.253	29.440	.813	.1917	83.2	32.7	S.	30.67	9.5	10	7	16	0.19	0.0	0.19	27
28	32.25	35.8	29.0	6.8	30.4327	30.485	30.253	.232	.1523	83.7	27.8	N.	7.75	6.5	10	3	44	....	....	....	28
29	37.03	46.7	28.3	18.4	30.3340	30.436	30.217	.219	.1853	82.0	32.2	N.	6.79	1.2	7	0	83	....	....	....	29
SUNDAY.........30	.....	42.0	32.0	10.0	......	......	......	......	......	...	....	N.	8.67	....	..	..	0	0.02	....	0.02	30..........SUNDAY
31	39.30	44.9	34.7	10.2	29.9693	30.156	29.859	.297	.1978	82.5	34.3	W.	10.63	8.8	10	3	33	0.00	....	0.00	31
Means...........	46.95	53.55	40.74	12.81	30.0735	30.2256	29.9204	.3052	.2829	82.18	41.56	S. 83° W.	13.23	6.34	9.3	2.5	36.4	4.57	0.0	4.57	...............Sums.
24 Years means for and including this month	45.49	52.50	38.64	13.86	30.0017	......	......	.218	.2454	76.65	....	....	s 13.52	6.33	..	..	¶41.05	3.02	....	3.14	24 Years means for and including this month.

ANALYSIS OF WIND RECORD.

Direction......	N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.	CALM.
Miles	2673	1085	168	1048	2616	965	447	840	
Duration in hrs..	218	108	19	81	146	52	49	65	6
Mean velocity....	12.26	10.05	8.84	12.94	17.92	18.56	9.01	12.92	

Greatest mileage in one hour was 48, on the 27th.

Greatest velocity in gusts 54 miles per hour on the 27th.

Resultant mileage, 48.
Resultant direction, S. 83° W.
Total mileage, 9,842.
Average velocity 13.23 m. p. h.

* Barometer readings reduced to sea-level and temperature 32° Fahrenheit.

§ Observed.

† Pressure of vapour in inches of mercury.

‡ Humidity relative, saturation being 100.

¶ 17 years only. s 12 years only.

The greatest heat was 73.°9 on the 4th; the greatest cold was 28.°3 on the 29th, giving a range of temperature of 45.6 degrees.

Warmest day was the 3rd. Coldest day was the 28th. Highest barometer reading was 30.485 on the 28th. Lowest barometer was 29.219 on the 22nd, giving a range of 1·266 inches. Maximum relative humidity was 99 on the 3rd, 19th, 20th and 26th. Minimum relative humidity was 46 on the 9th and 10th.

Rain fell on 16 days.

Snow fell on 2 days.

Rain or snow fell on 16 days.

Lunar corona on 1 night. Lunar halos on 4 nights.

Hour frost on 4 days. Fog on 10 days.

EMBER, 1898.

vel, 187 feet, C. H. McLEOD, *Superintendent.*

DAY	Sky Clouded in Tenths. Mean.	Max.	Min.	Per cent. possible Sunshine.	Rainfall in inches.	Snowfall in inches.	Rain and snow melted.	DAY.
	6.8	10	0	53	...	....	....	1
	5 7	10	0	22	0.08	....	0.08	2
	0.7	3	0	96	....	....	....	3
	1.0	4	0	92	....	....	......	4
	4.7	10	0	51	0.02	....	0 02	5
SUNDAY.....	...	..	..	81	....	....	....	6..........SUNDAY
	2.8	10	0	60	....	0.0	0.00	7
	1.2	9	0	83	....	....	....	8
	8 3	10	0	24	....	....	....	9
	10 0	10	10	0	....	6.0	0.64	10
	5.3	10	0	9	....	5.6	0.59	11
	2.0	8	0	57	....	....	....	12
SUNDAY.....	..	..	..	20	...	0.2		13 ....SUNDAY
	9.8	10	9	0	0.22	...	0 24	14
	10.0	10	10	0	....	0.1	0.01	15
	10.0	10	10	0	....	....	....	16
	8.3	10	3	1	....	...	....	17
	10 0	10	10	1	0.01	....	0.01	18
	10.0	10	10	0	0.02	....	0.02	19
SUNDAY.....	....	..	.	0	....	....	....	20........ ...SUNDAY
	1.3	6	0	87	...	....	....	21
	1 7	10	0	90	....	....	....	22
	9.7	10	8	3	0.03	0.0	0.03	23
	7.5	10	0	5	....	0.7	0.07	24
	5.0	10	0	33	....	3.1	0.31	25
	6.8	10	0	0	....	....	....	26
SUNDAY.....	....	..	..	36	....	....	....	27.......... SUNDAY
	0.2	1	0	91	....	....	....	28
	3.8	10	0	44	....	....	....	29
	10.0	10	10	00	0.03	....	0.03	30
								31
Means......	5.87	8.9	3.1	34.6	0.51	15.7	2.15	....Sums.
24 Years m for and inclu his month ..	7.29		..	¶28.94	2.33	12.87	3 64	24 Years means for and including this month.

sea-level and

Direction.. . f mercury.

Miles ..... being 100.

Duration in

the 6th; the

Mean velocit 8th, giving a

s.

Greatest ldest day was 6th.

was 30.463 on

Greatest 00 on the 29th, the 6th.

aximum rela-

tive humidity was 99 on the 11th and 19th. Minimum relative humidity was 56 on the 8th.

Rain fell on 8 days.

Snow fell on 8 days.

Rain or snow fell on 14 days.

Lunar halos on 2 nights. Lunar coronas on 5 nights.

Hoar frost on 2 days. Fog on 5 days.

ABSTRACT FOR THE MONTH OF NOVEMBER, 1898.

Meteorological Observations, McGill College Observatory, Montreal, Canada. Height above sea level, 187 feet, C. H. McLEOD, *Superintendent.*

DAY	THERMOMETER. Mean.	Max.	Min.	Range.	*BAROMETER. Mean.	§Max.	§Min.	Range.	†Mean pressure of vapor.	‡Mean relative humidity.	Dew Point.	WIND. General direction.	Mean velocity in miles per hour	SKY CLOUDED IN TENTHS. Mean.	Max.	Min.	Per cent. possible Sunshine.	Rainfall in inches.	Snowfall in inches.	Rain and snow melted.	DAY.
1	35.82	41.2	27.8	13.4	30.2248	30.301	30.072	.229	.1673	78.8	29.8	S. W.	11.75	6.8	10	0	53	..	....	....	1
2	42.65	52.5	37.0	15.5	30.0457	30.337	29.895	.439	.2108	76 7	35 8	S.	23.71	5 7	10	0	22	0.08	...	0.08	2
3	44.30	52.6	32.2	20.4	30 3780	30 422	30.309	.113	.2165	74 5	36.3	S.	20.83	0.7	3	0	96	....	....	....	3
4	46 90	56.2	36.1	20.1	30.3263	30.446	30.174	.272	.2377	74 3	39.0	S.	16.83	1.0	4	0	92	....	....	......	4
5	51.02	55.7	44.4	11.3	29.8490	30.174	29 527	.647	.2778	73 5	42.8	S.	24.92	4.7	10	0	51	0.02	....	0 02	5
SUNDAY.........6	.....	56.8	39.3	17.5	......	.....	......	....	......	....	....	S.	28.17	...	..	..	81	....	....	....	6..........SUNDAY
7	33.57	39.3	29.8	9.5	30.0377	30.197	29 760	.437	.1490	77 5	27.2	S.	19.38	2.8	10	0	60	....	0.0	0.00	7
8	45.12	55.5	29.0	26.5	30.0578	30 197	29 950	.247	.2188	72 5	36.3	S.	21.29	1.2	9	0	83	....	....	....	8
9	34.68	46.2	32.3	13.9	30.4217	30.463	30 179	.284	.1427	70.5	26.0	N.	15.63	8 3	10	0	24	....	....	....	9
10	29.70	32.3	28.6	3.7	30.0818	30 444	29 697	.745	.1433	87 2	26 5	N.	23.75	10 0	10	10	0	....	6.0	0.64	10
11	29.75	34.7	23 7	11 0	29.9090	30 218	29 499	.719	.1455	87.8	26.7	N.	24.00	5.3	10	0	9	....	5.6	0.59	11
12	28.33	34.8	16.7	18.1	30.2342	30.300	30 195	.105	.1358	84 8	24.3	S.E.	19.33	2.0	8	0	57	....	....	....	12
SUNDAY........13	.... .	38.7	28.6	10.1	......	......	......	......	......	....	....	S.	5.50	.	..	..	20	...	0.2		13 ....SUNDAY
14	33.23	37.3	28.5	8 8	29.8103	29 975	29.746	.229	.1765	92 5	31.2	S.W.	8.67	9.8	10	9	0	0.22	...	0 24	14
15	28.77	37.8	19.0	18.8	30 0848	30.137	29.975	.162	.1407	86 5	25.3	S.W	13.25	10.0	10	10	0	....	0.1	0.01	15
16	37.02	39.8	34.8	5.0	30 2327	30 255	30.121	.131	.1952	88 3	34 0	S.W.	7.50	10.0	10	10	0	....	....	....	16
17	36.00	39.8	30 9	8.9	30.1742	30 244	30.112	.130	.1937	91.5	33 7	N.E.	5.54	8.3	10	3	1	....	...	....	17
18	42.88	47.4	36.2	11.2	29 8380	30.112	29.657	455	.2500	90.2	40.2	S.E.	9.92	10 0	10	10	1	0.01	....	0.01	18
19	39.52	45.4	36.8	8 6	29.5380	29.657	29 464	.193	.2272	93 3	37.5	N.	13.58	10.0	10	10	0	0.02	....	0.02	19
SUNDAY........20	...	42.3	37.0	5.3	......	......	......	......	......	...	....	W.	22.13	....	..	.	0	....	....	....	20.......... SUNDAY
21	36 10	40.3	33.2	7.1	30.2235	30 278	30.064	.214	.1605	75 5	29 0	W.	8 33	1.3	6	0	87	...	....	....	21
22	35.33	45.0	28 3	17.6	30 0855	30 261	29.932	329	.1735	83.8	31.0	N.	13.40	1 7	10	0	90	....	....	....	22
23	34.40	41.6	31.3	10.3	30 1085	30.199	29.932	.267	.1648	81.7	29.7	S.W.	17.54	9.7	10	8	3	0.03	0.0	0.03	23
24	29.95	32.3	26.5	5.8	30.1442	30.220	30.024	.196	.1373	82.3	25.3	W	10.04	7.5	10	0	5	....	0.7	0.07	24
25	18.32	28.1	13.2	14.9	30.0480	30.162	29 963	.199	.0837	80 8	13.5	S W.	28.00	5.0	10	0	33	....	3.1	0.31	25
26	13.62	16.8	9.0	7.8	30.1378	30.177	30.097	.080	.0678	83.5	9 8	N.	14.33	6.8	10	0	0	....	....	....	26
SUNDAY........27	.....	22.0	12.0	10 0	......	..	......	......	......	....	....	N.W.	22.92	....	..	..	36	....	....	....	27.......... SUNDAY
28	25.90	31.3	17.2	14.1	29.9470	30.059	29 837	.222	.1010	70.5	18.0	W.	17.21	0.2	1	0	91	....	....	....	28
29	23.08	26.8	17.5	9.3	29 6365	29.837	29.400	.437	.1017	81.8	18.5	N.	6.13	3.8	10	0	44	....	....	....	29
30	27.38	31.4	20.2	11.2	29.4647	29 526	29.400	.126	.1335	89.0	24.3	S.W.	9.79	10.0	10	10	00	0.03	....	0.03	30
31																					31
Means......	33 97	40.09	27 90	12.19	30 0400	30.1767	29.8840	.2927	.1674	81.89	28 92	S. 40½° W.	16 11	5.87	8.9	3.1	34.6	0.51	15.7	2.15	.............Sums.
24 Years means for and including his month	32.51	38.95	26.56	12 40	30.0170	......	. . .	.269	.1605	79.98	....	....	s 16.03	7.29		.	¶28 94	2.33	12.87	3 64	24 Years means for and including this month.

ANALYSIS OF WIND RECORD.

Direction........	N.	N.E.	E.	S E.	S.	S.W.	W.	N.W.	CALM.
Miles	2328	86	235	1216	3178	1834	1711	714	
Duration in hrs..	144	9	34	65	184	114	118	44	8
Mean velocity....	16.17	9.56	6.91	18.71	18.90	16.09	14.50	16.23	

Greatest mileage in one hour was 46, on the 6th.

Greatest velocity in gusts 54 miles per hour on the 6th.

Resultant mileage, 3630.
Resultant direction, S. 40½° W.
Total mileage, 11,602.
Average velocity 16.11 m. p. h.

* Barometer readings reduced to sea-level and temperature 32° Fahrenheit.

§ Observed.

† Pressure of vapour in inches of mercury.

‡ Humidity relative, saturation being 100.

¶ 17 years only. *s* 12 years only.

The greatest heat was 56.°8 on the 6th; the greatest cold was 9.°0 on the 26th, giving a range of temperature of 47.8 degrees.

Warmest day was the 5th. Coldest day was the 26th. Highest barometer reading was 30.463 on the 9th. Lowest barometer was 29.400 on the 29th, giving a range of 1·063 inches. Maximum relative humidity was 99 on the 11th and 19th. Minimum relative humidity was 56 on the 8th.

Rain fell on 8 days.

Snow fell on 8 days.

Rain or snow fell on 14 days.

Lunar halos on 2 nights. Lunar coronas on 5 nights.

Hoar frost on 2 days. Fog on 5 days.

;MBER, 1898.

l, 187 feet, C. H. McLEOD, *Superintendent.*

DAY	Sky Clouded in Tenths. Mean.	Max.	Min.	Per cent. possible Sunshine.	Rainfall in inches.	Snowfall in inches.	Rain and snow melted.	DAY.
	7.7	10	4	1	....	0.4	0.04	1
	4.8	10	0	51	....	0.1	0.01	2
	3.7	10	0	28	....	....	....	3
SUNDAY......	....	..	..	0	....	1.6	0.18	4 ....SUNDAY
	9.8	10	9	0	....	6.3	0.71	5
	7.2	10	0	68	....	1.0	0.10	6
	4.8	10	0	59	....	1.3	0 13	7
	4.7	10	0	5	....	1.6	0.16	8
	8 3	10	0	5	....	0.0	0.00	9
	9.5	10	7	4	....	0.7	0.07	10
SUNDAY......	....	..	..	1	....	2.5	0.25	11..........SUNDAY
	3.5	10	0	9	....	....	....	12
	1.2	7	0	79	....	....	....	13
	8.3	10	0	0	....	0.9	0.09	14
	8.3	10	0	39	....	0.2	0.02	15
	10.0	10	10	0	...	0.2	0.02	16
	10.0	10	10	0	....	0.3	0.03	17
SUNDAY......	....	..	..	4	....	0.2	0.02	18..........SUNDAY
	3.3	10	0	64	....	....	....	19
	10.0	10	10	0	0.30	1.8	0.50	20
	10.0	10	10	0	0.24	....	0.24	21
	10 0	10	10	0	0.21	....	0.21	22
	4.3	10	0	77	0.10	....	0.10	23
	5.2	10	0	28	....	0.0	0.00	24
SUNDAY......	....	..	..	60	....	0.1	0.01	25.......... SUNDAY
	6.7	10	0	51	....	0.0	0.00	26
	10.0	10	10	0	....	0.8	0.08	27
	3.7	10	0	91	....	0.3	0.03	28
	7.3	10	0	0	....	0.6	0.06	29
	9.2	10	5	0	0.14	....	0.14	30
	9.0	10	4	7	....	....	...	31
Means...... ..	7.06	9.9	3.3	23.6	0.99	20.9	3.20	...............Sums.
24 Years mea for and includin this month	6.89	..	..	¶29.12	1.32	23.43	3.59	24 Years means for and including this month.

Direction......
Miles ....
Duration in hrs
Mean velocity..

sea-level and

f mercury.
eing 100.

he 30th ; the
4th, giving a
s.

Greatest mi dest day was
5th. was 30.579 on
Greatest ve 78 on the 5th,
the 5th and 23r ximum rela-

tive humidity was 99 on the 6th, 20th and 21st. Minimum relative humidity was 61 on the 24th.

Rain fell on 5 days.

Snow fell on 22 days.

Rain or snow fell on 26 days.

Lunar halo on 1 night. Lunar corona on 3 nights.

Fog on 5 days.

ABSTRACT FOR THE MONTH OF DECEMBER, 1898.

Meteorological Observations, McGill College Observatory, Montreal, Canada. Height above sea level, 187 feet, C. H. McLEOD, *Superintendent.*

DAY	THERMOMETER.				BAROMETER.				†Mean pressure of vapor.	‡Mean relative humidity.	Dew Point.	WIND.		SKY CLOUDED IN TENTHS.			Per cent. possible Sunshine.	Rainfall in inches.	Snowfall in inches.	Rain and snow melted.	DAY.
	Mean.	Max.	Min.	Range.	Mean.	§Max.	§Min.	Range.				General direction.	Mean velocity in miles per hour	Mean.	Max.	Min.					
1	30.37	32.9	26.3	6.6	29.6432	29.771	29.514	.257	.1420	83.8	26.2	S.W.	21.04	7.7	10	4	1	....	0.4	0.04	1
2	31.13	34.6	26.7	7.9	29.9885	30.157	29.771	.386	.1512	86.0	27.7	S.	16.87	4.8	10	0	51	....	0.1	0.01	2
3	28.08	32.1	25.0	7.1	30.2570	30.274	30.157	.117	.1400	90.8	25.7	N.	10.04	3.7	10	0	28	....	....	....	3
SUNDAY........4	.....	31.8	21.7	10.1	......	......	......	....	......	....	....	N.	13.75	....	..	..	0	....	1.6	0.18	4 ....SUNDAY
5	29.83	32.2	26.4	5.8	29.3093	29.461	29.178	.283	.1545	93.0	28.0	N.	27.71	9.8	10	9	0	....	6.3	0.71	5
6	23.60	29.6	21.7	7.9	29.7432	29.820	29.394	.426	.1078	84.7	19.8	S.W.	21.87	7.2	10	0	68	....	1.0	0.10	6
7	26.77	30.6	22.8	7.8	29.7343	29.815	29.659	.156	.1228	83.8	22.7	S.W.	23.46	4.8	10	0	59	....	1.3	0.13	7
8	19.13	24.1	10.5	13.6	30.0173	30.222	29.815	.407	.0877	81.7	14.5	S.W.	19.54	4.7	10	0	5	....	1.6	0.16	8
9	15.65	21.1	8.9	12.2	30.1772	30.286	29.977	.309	.0683	77.0	9.8	S.W.	23.25	8.3	10	0	5	....	0.0	0.00	9
10	25.42	29.5	16.5	13.0	29.5960	29.977	29.364	.613	.1207	87.3	22.3	S.W.	26.33	9.5	10	7	4	....	0.7	0.07	10
SUNDAY........11	.....	29.0	3.0	26.0	......	......	......	......	......	....	....	W.	26.54	....	..	..	1	....	2.5	0.25	11..........SUNDAY
12	—2.17	3.0	—4.8	7.8	29.7698	29.804	29.713	.091	.0327	82.7	—5.8	N.	8.79	3.5	10	0	9	....	....	....	12
13	—6.08	—3.3	—10.1	6.8	30.0523	30.246	29.786	.460	.0285	87.7	—8.8	S.W.	19.25	1.2	7	0	79	....	....	....	13
14	4.98	13.6	—11.0	24.6	30.2142	30.292	30.151	.141	.0468	83.3	1.2	S.W.	18.13	8.3	10	0	0	....	0.9	0.09	14
15	1.12	10.4	—1.1	11.5	30.4938	30.531	30.292	.239	.0378	83.8	—2.8	N.	13.54	8.3	10	0	39	....	0.2	0.02	15
16	14.00	28.3	2.5	25.8	30.3545	30.480	30.208	.272	.0778	89.2	11.3	S.	12.42	10.0	10	10	0	...	0.2	0.02	16
17	33.50	36.3	28.3	8.0	29.9992	30.208	29.843	.365	.1563	80.8	28.5	S.	19.29	10.0	10	10	0	....	0.3	0.03	17
SUNDAY........18	.....	35.9	9.3	26.6	......	......	......	......	......	...	....	W.	21.17	....	..	..	4	....	0.2	0.02	18..........SUNDAY
19	4.95	9.3	0.8	8.5	30.3650	30.456	30.219	.237	.0450	82.5	1.0	N.	11.33	3.3	10	0	64	....	....	....	19
20	17.68	24.8	7.3	17.5	29.9330	30.219	29.829	.390	.0952	93.7	16.0	N.E.	14.00	10.0	10	10	0	0.30	1.8	0.50	20
21	30.00	37.6	21.3	16.3	29.8013	29.860	29.742	.118	.1582	94.0	28.3	E.	14.25	10.0	10	10	0	0.24	....	0.24	21
22	36.68	38.9	34.4	4.5	29.8245	29.934	29.589	.345	.1893	86.7	33.0	S.	16.46	10.0	10	10	0	0.21	....	0.21	22
23	36.55	40.9	33.6	7.3	29.6390	29.897	29.429	.468	.1682	77.3	29.8	S.	34.00	4.3	10	0	77	0.10	....	0.10	23
24	30.50	35.5	24.4	11.1	29.9632	30.079	29.853	.196	.1268	73.7	23.2	S.W.	24.17	5.2	10	0	28	....	0.0	0.00	24
SUNDAY........25	.....	24.4	9.7	14.7	......	......	......	......	......	....	....	S.W.	12.46	....	..	..	60	....	0.1	0.01	25.......... SUNDAY
26	13.03	24.2	2.8	21.4	30.0877	30.319	29.780	.539	.0700	86.7	10.0	S.E.	8.58	6.7	10	0	51	....	0.0	0.00	26
27	27.88	33.6	23.4	10.2	29.4195	29.780	29.328	.452	.1290	83.7	23.8	S.	21.00	10.0	10	10	0	....	0.8	0.08	27
28	—3.68	27.6	—10.0	37.6	29.9067	30.087	29.393	.694	.0332	88.7	—6.3	S.W.	25.13	3.7	10	0	91	....	0.3	0.03	28
29	0.42	7.3	—10.4	17.7	29.8720	30.074	29.718	.356	.0402	89.3	—2.2	N.	10.38	7.3	10	0	0	....	0.6	0.06	29
30	30.43	41.9	7.3	34.6	29.7723	30.077	29.626	.451	.1560	86.5	26.8	S.W.	21.75	9.2	10	5	0	0.14	....	0.14	30
31	3.68	26.1	—2.8	28.9	30.4622	30.579	30.077	.502	.0447	83.0	—0.3	N.W.	14.04	9.0	10	4	7	....	....	...	31
Means............	18.65	26.57	11.75	14.82	29.9406	30.1002	29.7569	.3433	.1011	85.24	14.94	S. 54¾° W.	18.41	7.06	9.9	3.3	23.6	0.99	20.9	3.20	..............Sums.
24 Years means for and including this month	18.94	26.09	11.76	14.33	30.0313	......	......	.2967	.1001	32.97	....	....	s 16.68	6.89	..	..	¶29.12	1.32	23.43	3.59	24 Years means for and including this month.

ANALYSIS OF WIND RECORD.

Direction........	N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.	CALM.
Miles	2278	121	345	527	1218	7552	1232	421	
Duration in hrs..	170	11	32	37	70	325	69	30	
Mean velocity....	13.40	11.00	10.78	14.24	17.40	23.24	17.85	14.03	

Greatest mileage in one hour was 51, on the 5th.

Greatest velocity in gusts 60 miles per hour on the 5th and 23rd.

Resultant mileage, 7420.
Resultant direction, S. 54¾° W.
Total mileage, 13,694.

* Barometer readings reduced to sea-level and temperature 32° Fahrenheit.

§ Observed.

† Pressure of vapour in inches of mercury.

‡ Humidity relative, saturation being 100.

¶ 17 years only. *s* 12 years only.

The greatest heat was 41.°9 on the 30th; the greatest cold was —11.°0 on the 14th, giving a range of temperature of 52.9 degrees.

Warmest day was the 22nd. Coldest day was the 13th. Highest barometer reading was 30.579 on the 31st. Lowest barometer was 29.178 on the 5th, giving a range of 1·401 inches. Maximum relative humidity was 99 on the 6th, 20th and 21st. Minimum relative humidity was 61 on the 24th.

Rain fell on 5 days.

Snow fell on 22 days.

Rain or snow fell on 26 days.

Lunar halo on 1 night. Lunar corona on 3 nights.

Fog on 5 days.

1898.

Observatior N. 45° 30′ 17″. Longitude $4^h\ 54^m\ 18{\cdot}67^s$ W.

C. H. McLEOD, *Superintendent.*

Month.	Number of days on which rain fell.	Inches of snow.	Number of days on which snow fell.	Inches of rain and snow melted.	No. of days on which rain *and* snow fell.	No. of days on which rain *or* snow fell.	Month.
January	4	62.7	21	6.17	3	22	January
February	3	46.3	21	5.65	1	23	February
March	10	0.9	2	2.64	1	11	March
April	6	1.7	4	1.15	..	10	April
May	16	....	..	2.62	..	16	May
June	19	....	..	5.57	..	19	June
July	13	....	..	2.11	..	13	July
August	22	...	..	2.56	..	22	August
September	22	....	..	6.03	..	22	September
October	16	0.0	2	4.57	2	16	October
November	8	15.7	8	2.15	2	14	November
December	5	20.9	22	3.20	1	26	December
Sums for 1898	144	148.2	80	44.47	10	214	Sums for 1898
Means for 1898	....	....	..	3.71	..	..	Means for 1898
Means for 24 years ending Dec. 31, 1898.	135	119.2	78	39.93	16	202	Means for 24 years ending Dec. 31, 1898.

* Barometer ates that the temperature has been *higher*: "—" that it has been *lower* than the av n Standard time. The anemometer and wind vane are on the summit of Mount

The greatest · Greatest range of the thermometer in one day was 37.°6 on December 28; leas when the mean temperature was 14.°7 below zero. The highest barometer readin e humidity was 30 on April 28 and May 8. The greatest mileage of wind recorded mber 18 and December 5. The total mileage of wind was 125,378. The resultant dir er storms on 30 days; lunar halos on 24 nights; lunar coronas 40 nights; solar h ovember 10.

Note.—The

Meteorological Abstract for the Year 1898.

Observations made at McGill College Observatory, Montreal, Canada. — Height above sea level 187 ft. Latitude N. 45° 30′ 17″. Longitude $4^h\ 54^m\ 18{\cdot}67^s$ W.

C. H. McLEOD, *Superintendent.*

Month.	Thermometer.					* Barometer.				†Mean pressure of vapour.	‡Mean relative humidity.	Mean dew point.	Wind.		Sky clouded per cent.	Per cent. possible bright sunshine	Inches of rain.	Number of days on which rain fell.	Inches of snow.	Number of days on which snow fell.	Inches of rain and snow melted.	No. of days on which rain *and* snow fell.	No. of days on which rain *or* snow fell.	Month.
	Mean.	¶ Deviation from 24 years, means.	Max.	Min.	Mean daily range.	Mean.	Max.	Min.	Mean daily range.				Resultant direction.	Mean velocity in miles per hour.										
January	12.94	+ 0.88	37.3	— 20.9	15.73	29.9978	30.513	29.246	358	.0796	89.7	10.5	S. 76¼° W.	15.1	57	44.0	0.57	4	62.7	21	6.17	3	22	January
February	19.81	+ 4.17	40.7	— 15.3	12.27	30.0447	30.496	29.338	.183	.1063	88.4	17.0	S. 64° W.	16.9	72	30.7	0.55	3	46.3	21	5.65	1	23	February
March	33.95	+ 9.36	58.3	12.9	14.04	30.1492	30.648	29.391	.204	.1536	75.4	26.9	S. 18° W.	17.3	38	61 5	2.55	10	0.9	2	2.64	1	11	March
April	42 84	+ 2.59	66.6	14.1	18.17	29.9554	30.370	29.552	.164	.1740	62.4	30.0	N. 44° W.	13.9	47	58.6	1.60	6	1.7	4	1.15	..	10	April
May	55.77	+ 1.05	79.5	34.5	15.65	29.9048	30.266	29.590	.138	.3363	74.0	46.9	S. 87½° W.	11.4	61	45.3	2.62	16	....	..	2.62	..	16	May
June	64.80	— 0.04	82.3	46 0	16.31	29.9388	30.336	29.271	.209	.4694	75.3	56.4	S. 65¼° W.	11.8	58	49.2	5.57	19	....	..	5.57	..	19	June
July	70.56	+ 1.65	90.4	48.0	17.88	29.9853	30.469	29.601	.178	.5494	71.8	60.0	S. 39¾° W.	12.1	31	73.1	2.11	13	....	..	2.11	..	13	July
August	67.47	+ 0.85	81.9	49.0	15.06	29.8991	30.202	29.609	.134	.5298	79.0	60.4	S. 24° W.	12.1	62	46.2	2.56	22	...	..	2.56	..	22	August
September	59.89	+ 1.34	90.3	40.5	14.83	29.9892	30.452	29.532	.187	.4298	80.2	53.5	S. 43° W.	13.6	47	54 5	6.08	22	....	..	6.08	..	22	September
October	46.95	+ 1.46	73.9	28 3	12.81	30.0735	30.485	29.219	.305	.2829	82.2	41.6	S. 83° W.	13.2	63	36.4	4.57	16	0.0	2	4.57	2	16	October
November	33.97	+ 1.46	56.8	9.0	12.19	30.0400	30.463	29.400	.293	.1674	81.9	28.9	S. 40½° W.	16.1	59	34.6	0.51	8	15.7	8	2.15	2	14	November
December	18.65	— 0.29	41.9	— 11.0	14.82	29.9406	30.579	29.178	.343	.1011	85.2	14.9	S. 51¾° W.	18.4	71	23.6	0.99	5	20.9	22	3.20	1	26	December
Sums for 1898	...	....	....	....	....	....	....	....	....	....	...	....		....	....	....	29.68	144	148.2	80	44.47	10	214	Sums for 1898
Means for 1898	43.97	+ 2.010	....	....	14.98	29.9932	....	....	.2247	.2816	78.79	37.25	S. 38° W.	14.25	55.5	46.48	....	....	....	..	3.71	..	..	Means for 1898
Means for 24 years ending Dec. 31, 1898.	41.93	....	....	....	...	29.9808	....	....	....	.2537	75.18	....	....	α 15.04	60.2	§45.81	28.23	135	119.2	78	39.93	16	202	Means for 24 years ending Dec. 31, 1898.

* Barometer readings reduced to 32° Fah. and to sea level. † Inches of mercury. ‡ Saturation 100. § For 17 years only. α For 12 years only. ¶ "+" indicates that the temperature has been *higher*: "—" that it has been *lower* than the average for 24 years inclusive of 1898. The monthly means are derived from readings taken every 4th hour, beginning with 3 h. 0 m. Eastern Standard time. The anemometer and wind vane are on the summit of Mount Royal, 57 feet above the ground and 810 feet above the sea level.

The greatest heat was 90.4° on July 3; the greatest cold was 20.9° below zero on January 30. The extreme range of temperature was therefore 111.°3. Greatest range of the thermometer in one day was 37.°6 on December 28; least range was 3.°7 on November 10. The warmest day was July 3, when the mean temperature was 82.°0. The coldest day was January 30, when the mean temperature was 14.°7 below zero. The highest barometer reading was 30.648 on March 26, lowest barometer reading was 29.178 on December 5, giving a range of 1.470 inches for the year. The lowest relative humidity was 30 on April 28 and May 8. The greatest mileage of wind recorded in one hour was 55 miles on March 13, and the greatest velocity in gusts was at the rate of 60 miles per hour on February 1, March 13, September 18 and December 5. The total mileage of wind was 125,378. The resultant direction of the wind for the year was S. 38° W., and the resultant mileage 40,020. Auroras were observed on 8 nights; fog on 49 days; thunder storms on 30 days; lunar halos on 24 nights; lunar coronas 40 nights; solar halos on 2 days. The sleighing of the winter commenced in the city on November 11. The first appreciable snowfall of the autumn was on November 10.

NOTE.—The yearly means of the above are the averages of the monthly means, except for the velocity of the wind.

Published quarterly; Price $3.00 the Volume of eight numbers.

VOLUME VIII. NUMBER 2.

THE CANADIAN RECORD OF SCIENCE

INCLUDING THE PROCEEDINGS OF
THE NATURAL HISTORY SOCIETY OF MONTREAL,
AND REPLACING

THE CANADIAN NATURALIST.

CONTENTS.

PAGE

Studies in the Geology of the Vicinity of Montreal which might be undertaken by Members of the Natural History Society. By F. D. ADAMS, Ph.D... 65

Phenological Observations in Canada. By A. H. MACKAY, LL.D., F.R.S.C. 71

Botany in the Island of Montreal. By ROBERT CAMPBELL, M.A., D.D...... 84

The Lake-on-the-Mountain near Picton, Ont. By A. T. DRUMMOND, LL.D. 90

The Parent-Rock of the Diamond in South Africa. By T. G. Bonney, D.Sc., LL.D., V.P.R.S.......... 95

Proceedings of the Natural History Society 114

Book Notice:

An Illustrated Flora of the Northern United States, Canada, and the British Possessions, from Newfoundland to the Parallel of the Southern Boundary of Virginia, and from the Atlantic Ocean Westward to the 102nd Meridian. By NATHANIEL LORD BRITTON, Ph.D., and HON. ADDISON BROWN.......... 134

MONTREAL:
PUBLISHED BY THE NATURAL HISTORY SOCIETY.

LONDON, ENGLAND: COLLINS, 157 Great Portland St.

BOSTON, MASS.: A. A. WATERMAN & Co., 36 Bromfield St.

1899.

THE

CANADIAN RECORD

OF SCIENCE.

VOL. VIII. JULY, 1899. No. 2.

Studies in the Geology of the Vicinity of Montreal which might be undertaken by Members of the Natural History Society.

By Prof. Frank D. Adams, Ph.D.

Although much has been done towards working out the geology of the vicinity of Montreal, still more remains to be done before our knowledge of the subject is at all complete. The geological relations, which are in the main simple, nevertheless present such a mass of detail that much time and patient work on the part of many observers will be required before we shall understand fully the structure and the past history of our Island.

Much of this work is of such a character that it can be easily carried out by members of the Natural History Society, and it is in the hope of enlisting some of our members in the work that it is proposed in the present paper to point out very briefly some of the chief lines of investigation which present themselves.

The district about the city is underlain chiefly by nearly horizontal strata of Lower Silurian age. These in many places where they are well exposed, contain an abundance of fossil remains; in fact the limestone strata are entirely of organic origin. Each of the several formations presents its special fauna, composed of creatures all of which have been long extinct, and which are therefore, for the most part very different from the forms of life now inhabiting our globe. Before a thorough knowledge of each of these several faunas can be obtained and their relations to one another satisfactorily established, large collections of fossils must be made from the several formations, so that we may have as nearly as possible all the forms which are present in these successive oceanic deposits. For these purposes complete collections should be made of all the fossils to be found in the various quarries about the city, as, for instance, the Mile End quarries, and those at Pointe Claire and St. Martin's Junction. In this connection the small occurrences of limestone at the water edge on the south side of St. Helen's Island are of especial interest, as being very much more recent than any of the other limestones in this part of the Province, and a thorough knowledge of these fossils is for this and for many other reasons of the greatest interest.

The principal fossils occurring in the quarries about the city are figured and described in the Geology of Canada, published by the Geological Survey of Canada in 1863, a copy of which is to be found in the library of the Society, while lists of the fossils found up to the present time in St. Helen's Island rocks are given by Mr. Donald and Dr. Deeks in two papers which have already appeared in the CANADIAN RECORD OF SCIENCE.

For those members of the Society particularly interested in the ancient volcanic phenomena displayed in the vicinity of Montreal, Mount Royal affords abundant opportunity for work and study. The "Mountain," as is well known, is the root or remnant of an old volcano, wasted and worn down through successive long geological ages, by the continuous action of rain, frost and the other agents of decay. The piles of volcanic ashes, the crater, the lava streams and other superficial features have long since disappeared; only the hard basal portion of the mountain has survived; even now it is year by year falling to pieces, as can be seen at the foot of all the steep slopes on the mountain side, notably that opposite the head of McTavish Street.

There were, speaking generally, three stages in the history of the activity of the mountain, marked by the outpouring of three different classes of rock. Each of these can still be recognized and studied, and much remains to be learned concerning them. At the first eruption a dark-coloured basic rock was poured out, represented by the main body of Mount Royal, as seen in all the cuttings on the upper part of the mountain and in the cemeteries. This is a rock found in but few other places in the world, and known as Theralite or Essexite. On looking at a fresh fracture it is seen to be composed of constituents, some of which are colourless and some of which are black. The colourless ones are feldspar and nepheline, the black ones pyroxene and hornblende. The relative proportion of these minerals varies from place to place, in that part of the mountain occupied by this rock, the rock being in some places dull gray in colour, but in others black. It often shows a distinct flow structure which it acquired when moving up through the throat of the volcano while still in a semi-fluid condition.

After the rock of this first eruption had cooled, becoming hard and solid, it was rent asunder and shattered, undoubtedly with the accompaniment of violent earthquakes. On a line which runs along the back of the mountain and up through this shattered zone there came a second eruption, of rock of a different character. This is much lighter in colour, a pale gray, and is seen excellently exposed in the great quarry worked by the Corporation for road material at the back of the mountain at

Outremont. This rock is a nepheline syenite, and contains so much nepheline that if a little of it be finely powdered and boiled with acid for a few minutes it will pass into a mass of thick jelly.

The final outburst of volcanic energy on the part of Mount Royal is represented by the swarm of narrow dykes or walls of igneous rock which cut not only through the limestones of the region but also through the rocks of both of the former eruptions just referred to. These, although erupted during the final stage, are not all absolutely identical in age; in fact, in the excavation made for the reservoir on Peel Street some seven distinct sets of dykes, each cutting across, and therefore more recent than the previous ones, could be seen. These dykes are composed of a variety of rocks; all of them are very rare and found in but few other places in the world.

Now, although detailed study of these rocks requires some special knowledge of the methods of modern petrography, no study of the region can be made until the necessary materials for it have been collected. The collection of such materials, in itself an occupation by no means devoid of interest, might easily be undertaken by members of the Society, and the collections, if carefully labelled and deposited in the Society's Museum, would always be available for detailed study. Such a detailed study is now being undertaken by Dr. Harrington and the writer, who would be glad to examine and describe any carefully collected material.

It is from the dykes of the third eruption that collections of the greatest value can be made, especially where these are exposed from time to time in cuttings and excavations which are subsequently filled in again, and the exposures thus rendered inaccessible. In collecting specimens from such dykes, the width of the dyke, measured across it, that is, at right angles to its dip, if it be not vertical, should be noted, as also the direction in which the dyke runs across the surface, and its relative age as compared with the dykes which it cuts, which age may be ascertained by examining the intersection of the two dykes and noticing which is broken across and cut through by the other. Collections from a series of dykes of different ages which cut one another, if accompanied by a note as to which each cuts and is cut by will always be of great value.

Mount Royal itself offers a most excellent opportunity for the detailed study of one of the great problems of modern geology—that of the mutual relation of igneous magmas in volcanic centres, and the collecting of material for study as above outlined would be a real contribution toward the solution of the problem.

Again, for those members of the Society whose interest lies more particularly in the domain of mineralogy, there is a field of especial interest in the Corporation quarry, above mentioned, at Outremont. Here in the cracks and crevasses of the nepheline syenite and the limestone near its contact with the igneous rock, a number of very rare and strange minerals have been found, and a careful search would probably be well repaid by the discovery of additional specimens, and possibly of entirely new species.

Another series of very interesting geological problems and studies are presented by the "Drift" which mantles the surface of the Island and constitutes its soil. This is the most recent of our geological deposits, and is well exposed in almost every excavation made in and about the city. It has been well described by Sir William Dawson in his book entitled "The Canadian Ice Age," but fresh information is continually to be obtained from new openings. Such new openings should in every case be studied, the order of succession of the various strata noted, and their respective thickness recorded. In this way information may often be obtained which later on it would be impossible to procure.

These drift deposits are, moreover, often highly fossiliferous, a great many species, especially of sea shells, occurring in them. Such occurrences are of the greatest importance, and should always be noted, the precise locality and, if possible, the height above sea-level or the relative height as compared with some fixed point, as, for instance, the McGill College Observatory, being ascertained. The presence of boulders of any peculiar, rare or striking variety of rock, at any point, is also worthy of attention, as it is often possible by means of these to determine the local direction of the ice flow during glacial time.

All information concerning the deep artesian borings put down from time to time in and about the city is of the greatest value, and should be communicated to the Society. Samples of the borings from various depths should always be secured if possible, and carefully preserved.

And, finally, the study of the influence of the geological structure of the vicinity upon the topography of the city and upon its history and development will be found to be of the greatest interest. The very location of the city, the courses of its streets and the distribution of its population will be found to have been directly influenced by geological causes, which often date back almost to the beginning of geological time.

It will thus be seen that the members of our Society have presented to them a host of geological problems, to the solution of which they may make contributions of permanent value.

PHENOLOGICAL OBSERVATIONS IN CANADA.

By A. H. MACKAY, LL.D , F.R.S.C.

In 1890, Section IV of the Royal Society of Canada passed the following resolution :

" That the various Natural History and Scientific Societies affiliated with the Royal Society be requested by it to obtain accurate records in their individual localities of meteorological phenomena, dates of the first appearance of birds, of the leafing and flowering of certain plants, and of any events of scientific interest for collation and publication in the Transactions of the Society."

Schedules for the recording of such observations were sent to the said societies, but local observers did not become interested to any considerable extent. In 1891 the Botanical Club of Canada was organized by the said Section of the Royal Society, and one of the departments of botanical work undertaken by the Club was the stimulation of these phenological observations.

In 1892 nine observers in Nova Scotia sent in reports; one from Yarmouth County, one from Lunenburg County, one from Hants County, four from King's County, and two from Cumberland County.

In 1893 there were thirteen reports sent in ; ten from Nova Scotia, and three from New Brunswick.

In 1894 there were seventeen reports; eleven from Nova Scotia, one from Prince Edward Island, four from New Brunswick, and one from Manitoba.

In 1895 there were twenty-five reports ; ten from Nova Scotia, one from Prince Edward Island, six from New Brunswick, three from Ontario, two from Manitoba, one from Assiniboia, one from Alberta, and one from British Columbia.

In 1896 there were nineteen reports ; eleven from Nova Scotia, one from Prince Edward Island, two from New

Brunswick, two from Ontario, one from Manitoba, one from Assiniboia, and one from British Columbia.

In 1897 there were fifteen reports; seven from Nova Scotia, one from Prince Edward Island, two from Ontario, two from Manitoba, one from Assiniboia, and two from British Columbia.

By this time the idea was extensively taken up in the public Schools of the province of Nova Scotia, the pupils of a whole school section or district being the observers, under the direction and criticism of the teacher. The observations were a part of the prescribed "Nature Studies" in all schools, although the recording of them in the Phenological Records of the locality and the sending of a duplicate of the observations to the Inspector to be transmitted to the Education Office, were entirely voluntary. While the schedule of the Botanical Club had a list of about sixty objects for the observation of their first occurrence each season, the schedule of the public schools had over one hundred objects on its list, with instructions and a column for the observation of (1) the first occurrence and (2) when each began to be common. Over two hundred fairly well filled schedules were sent in from as many localities throughout the province.

In 1898, members of the Botanical Club sent in thirteen reports on the new schedule; eight from Nova Scotia, one from Prince Edward Island, one from Ontario, one from Assiniboia, one from Alberta, and one from British Columbia. But over seven hundred were sent in from as many school sections throughout the province of Nova Scotia, fairly distributed over every county.

I quote the following from the directions and cautions printed on the back of the schedule for recording these "Local Nature Observations" to illustrate the conditions under which the work is done:

"This sheet is provided for the purpose of aiding teachers to interest their pupils in observing the times of the regular procession of natural phenomena each season. First, it may help the teacher in doing some of the 'Nature' lesson work in the Course of Study; secondly, it may aid in procuring valuable information for the locality and province. Two copies are provided for each teacher who wishes to conduct such observations, *one* to be attached to the school register, so as to be preserved as the property of the section for reference from year to year: the *other* to be sent in with the Return to the Inspector, who will transmit it to the Superintendent for examination, and compilation if desirable.

"What is desired is to have recorded in these forms, the dates of the *first* leafing, flowering and fruiting of plants and trees; the *first* appearance in the locality of birds migrating north in spring or south in autumn, etc. While the objects specified here are given so as to enable comparison to be made between the different sections of the province, it is very desirable that all other local phenomena of a similar kind be recorded. Each locality has a *flora, fauna, climate*, etc., more or less distinctly its own; and the more common trees, shrubs, plants, crops, etc., are those which will be most valuable from a local point of view in comparing the characters of a series of seasons.

"Teachers will find it one of the most convenient means for the stimulation of pupils in observing all natural phenomena when going *to* and *from* the school, some of the pupils radiating as far as two miles from the school room. The 'nature study' under these conditions would be mainly undertaken at the most convenient time, thus not encroaching on school time; while on the other hand it will tend to break up the monotony of school travel, fill an idle and wearisome hour with interest, and be one of the most valuable forms of educational discipline. The eyes of a whole school daily passing over a whole school district would let very little escape notice, especially if the first observer of each annually recurring phenomenon would receive credit as the first observer of it for the year. The observations will be accurate, as the facts will have to be demonstrated by the most undoubted evidence, such as the bringing of the specimens to the school when possible or necessary.

"To all observers the following most important, most essential principles of recording are emphasized: Better *no date,* NO RECORD, than a WRONG ONE or a DOUBTFUL one. Sports out of season, due to very local conditions not common to at least a small field, should not be recorded except parenthetically. The date to be recorded for the purposes of compilation with those of other localities should be the *first* of the *many* of its kind following immediately after, etc. For instance, a butterfly emerging from its chrysalis in a sheltered cranny by a southern window in January would not be an indication of the general climate, but of the peculiarly heated nook in which the chrysalis was sheltered; nor would a flower in a semi-artificial, warm shelter, give the date required. When these sports out of season occur, they might also be recorded, but within a parenthesis to indicate the peculiarity of some of the conditions affecting their early appearance."

The tendency to error is quite observable in a study of the whole of these schedules. The most serious is characteristic of the solitary observer who goes out for his walk of observation perhaps not more than once or twice a week. His plants appear to flower by weekly or semi-weekly spurts; and if certain plants are rare in his locality he may not see them in bloom until, may be, more than a week after they have been in full flower. In the school observations this tendency to error is entirely eliminated, for numbers of individuals are daily wandering to and from school every day with their eyes open for everything, especially when the discoverer of each new phenomenon for the season wins a credit of some kind before the whole school.

Again, the tyro botanist is at a disadvantage, for he does not know where to look for the rarer species, and when he accidentally comes across them they may have been in flower for some time. It is very likely that the average dates of the flowering of plants in Nova Scotia in the various counties may be slightly affected by this source of error, the counties having the oldest and most enthusiastic botanists appearing to be earlier in season. This may account for the unexpectedly advanced position of Pictou county in the table following.

Then there is the accident of local land inclination or shelter, for the warm intervals on the southern slope of the hill is earlier than the northern slope. To estimate these local effects, the schedules from each county in Nova Scotia from this year forward are to be classified into localities: (1) on the coast, (2) low inlands, and (3) highlands.

And lastly, some individual plants are naturally earlier than others even when in similar localities, and in the same individual certain twigs and branches are earlier than others. To check such peculiarities an attempt is made to fix the date when the flowering of each species may be said to be "becoming common." So that we have the two series of observations for each individual, the "first appearance" and the "becoming common."

So much for the history of the work and the general lines upon which it is being conducted.

Assuming the observers to be symmetrically placed in a country, to be competent and careful, and to put exactly the same interpretation on what constitutes the "first appearance" and "when becoming common," the averaging of the various observations would give us phenological norms for the comparison of a very important character of the country with that of another, and more especially for the comparison of one season with another in the same country, which after a series of years would contribute to the solution of the problem of the secular variation of climate.

In order to deal mathematically with phenological dates, averages or means, it is necessary to indicate dates and average or mean dates in terms of the day of the year instead of the days of the month. For the conversion and reconversion of such dates, all that is necessary to make it convenient, is to have before the eye a list of the months of the year with the number of the day of the year corresponding to the last day of each month, thus:

DAY OF THE YEAR CORRESPONDING TO THE LAST DAY OF EACH MONTH.

January	31	July	212
February	59	August	243
March	90	September	273
April	120	October	304
May	151	November	334
June	181	December	356

For leap years each number except that for January would be simply increased by a unit. The 24th of May would be simply converted to the annual date by adding 24 to the last day of April, thus: $120+24=144$. The 165th day of the year would be found by subtracting the next smallest number in the table from the date, thus: $165-151$ (May) $=14$ (June).

Now, we may consider a phenological date to be a sort of mathematical function of variables, several of which are already being very systematically and accurately observed and recorded by the meteorological departments of most countries, such as the variations of temperature, of atmospheric pressure, sunshine, precipitation. Then there are local constants, such as latitude, elevation, slope, proximity of bodies of water, and character of the soil. All of these influences affect the phenological date, and conversely the date may be considered as a summation or integration of all these and other more or less unknown elements. We find that in the month of April the season is advancing more rapidly this year than last year, while in May or a portion of May it may be advancing less rapidly according to the varying balance of the meteorological conditions affecting the organisms. Averages of the dates of early flowering plants, for instance, during one season might be compared with those of another season. Averages of a normally later series of flowers might be similarly treated. But to compare one spring with another spring, a series of typical flowers normally flowering in succession from the earliest date to the latest might be taken. Such an average or mean for comparison we might for convenience call a phenological norm or phenochron (a phenological *time* ordinate). Phenochrons for comparison or for the plotting of phenological curves should be based on the same number of observations taken at the same stations under similar conditions, and if they are to correctly represent any district of considerable extent, the stations should be symmetrically distributed. The following table, compiled from the observations taken by members of the Botanical Club, is defective in two respects, although we should grant that the observations individually taken were all correctly made on exactly the same lines. Twenty objects most generally observed were selected from the schedules, and we have a series of seven years, from 1892 to 1898. But the average dates for 1892 were based on observations made at nine stations, none of which were in the eastern half of the province or towards the extreme north. In later years there was a less number of southern and a greater number of northern stations. This illustrates the defect of the asymmetry of the distribution of stations. Again, while in 1892, for instance, the whole nine stations made observations on all or many of these 20 phenomena, there were many other phenomena observed at only a few stations. This defect is practically one of asymmetry also, for as the observation of the migration of birds was omitted in the most northern station this year, the average dates of these phenomena are really those of a more southern latitude than those of the other phenomena. The phenological norm or phenochrons for each year must therefore be in error to a certain extent. But the table is given here to illustrate such results as have been obtained. Following it will be given phenochron for each county of the province of Nova Scotia, based on ten plants normally flowering from the first of April to the first of June, at ten different stations in each county.

MEAN OF TWENTY PHENOLOGICAL OBSERVATIONS, NOVA SCOTIA, FOR THE SEVEN YEARS, 1892 TO 1898.

Species common to the Tables of the seven years. (First appearance).	Average Date 1892.	Average Date 1893.	Average Date 1894.	Average Date 1895.	Average Date 1896.	Average Date 1897.	Average Date 1898.	Seven-year Normal Date or Phenochron of each species.	
Mayflower, flower.	98	108	104.7	107.00	102.70	106	93.14	102.79	12 Apr.
Alder, "	..102	114	116.3	103.8	107.55	119	103.50	109.45	19 "
Aspen, "	..131	123	122.2	117.5	121.90	128	118.66	123.18	3 May
Maple, "	..123	130	126.3	123.85	124.55	124.8	121.80	124.90	4 "
Strawberry, "	..129	133	131.6	128.55	128.50	126.5	125.75	128.99	8 "
Dog-tooth V., "	..135	136	132.2	125	128.50	131	126	130.53	10 "
Cherry (Cult.) "	..146	142	146.3	136.6	143.00	146	141.80	143.10	23 "
Indian Pear, "	..145	144	146	138.35	141.65	141.8	140.71	142.50	22 "
Cherry (Wild) "	..150	144	147	138.15	145.25	142.6	143.20	144.31	24 "
Apple, "	..146	146	152.1	143.7	151.10	155.3	148.40	148.94	28 "
Lilac, "	..154	160	162.3	153.5	160.50	157	155.14	157.49	6 June
Hawthorn, "	..163	160	160.3	148.75	160.25	156	158	158.04	7 "
Wild Goose......	54	88	70.6	78.00	80.00	80	73.80	74.91	15 Mar.
Robin......	96	94	73.2	99.30	96.14	91	58	86.81	27 "
Song Sparrow....	99	115	79	96.65	94.66	95.6	71	92.99	2 Apr.
Frogs piping.....	105	113	112.8	110.55	106.30	113.2	101.80	108.95	18 "
Swallow	106	119	119	125.75	117.76	(117.5)	(117.5)	(117.50)	27 "
Kingfisher..	128	137	128.7	127.50	122.00	141.6	130.50	130.76	10 May
Humming Bird...	143	159	143.0	137.25	139.30	143	143.50	144.01	24 "
Night Hawk. ...	150	144	158.8	148.00	154.33	165.5	145.30	152.28	1 June
Phenological Norm or Phenochron of each year...	125.15	130.45	126.62	124.39	126.30	129.07	120.88	126.12	
(*i.e.*) May........	5th	10th	6th	4th	6th	9th	30 Ap.	6 May	6 May

Were the above table based on perfectly even and symmetrical elements, as indicated before, we could say that the biological, or more properly speaking, phenological condition of the province on the 5th of May, 1892, occurred on the 10th in 1893, on the 6th in 1894, on the 4th in

1895, on the 6th in 1896, on the 9th in 1897, and on the 30th April in 1898. The normal for the seven years is 6th of May. The early and late seasons, so far as the twenty objects considered are concerned, would be instantly seen and measured by comparing its phenochron with the normal for the series of years—the phenochron of the year with the phenochron of the series of seven years in this case.

Below is a table of phenochrons for the flowering of ten plants in each county, and for each county, for the spring of 1898 in Nova Scotia, based on ten of the best sets of observations made in each county. The first column is the average date of the "first flowering" observed, the second is the average date when the "flowering was considered to be becoming common." The counties are arranged in the order of their phenochrons based on the average of both columns.

	YARMOUTH.		ANNAPOLIS.		KING'S.	
	130.88		132.22		134.19	
Mayflower	83.0	100.7	89.2	103.8	93.9	104.7
Blue Violet	113.7	126.5	122.5	130.3	122.1	133.1
Red Maple	120.6	129.1	119.0	130.2	117.7	129.2
Dandelion	113.6	126.4	120.2	130.1	124.0	134.4
Strawberry	115.0	130.6	122.3	131.3	116.6	136.5
Wild Red Cherry	137.9	146.9	134.7	142.0	141.3	146.9
Buttercup	131.5	145.3	142.6	150.7	140.3	151.0
Indian Pear	139.5	144.9	136.2	140.0	139.8	143.7
Apple	142.6	152.5	142.2	147.2	144.5	151.5
Lilac	154.7	162.7	151.8	158.1	152.5	160.2
	125.21	136.56	128.07	136.37	129.27	139.12

	DIGBY.		HANTS.		SHELBURNE.	
	134.27		134.97		135.13	
Mayflower	92.4	104.4	96.0	109.3	86.1	102.9
Blue Violet	122.8	132.9	122.8	131.2	120.9	128.7
Red Maple	127 9	134.8	119.2	127.0	122.7	131.5
Dandelion	111.9	127.1	124.0	133.2	121.8	129.8
Strawberry	117.5	132.1	123.4	133.5	126.0	135.4
Wild Red Cherry	140.7	150.9	141.1	145.8	144.7	150.5
Buttercup	145.4	155.8	140.3	152.5	139.9	152.1
Indian Pear	138.4	143.7	140.2	144.5	139.2	145.1
Apple	141.6	150.5	146.2	151.5	146.8	153.2
Lilac	151.7	163.0	156.0	161.8	159.0	166.4
	129.03	139.52	130.92	139.03	130.71	139.56

	PICTOU.		LUNENBURG.		QUEEN'S.	
	135.41		135.43		135.72	
Mayflower	97.9	111.6	93.4	105.5	90.8	112.0
Blue Violet	121.2	133.4	119.1	132.2	123.4	131.0
Red Maple	122.3	132.3	116.9	127.1	119.4	128.0
Dandelion	120.4	132.3	126.2	134.4	126.2	133.2
Strawberry	124.2	135.5	123.8	133.9	125.4	133.8
Wild Red Cherry	143.3	148.8	140.8	146.2	140.8	145.4
Buttercup	142.0	149.6	149.5	158.0	148.8	157.2
Indian Pear	139.2	144.5	138.2	143.7	139.0	144.6
Apple	146.4	151.7	145 0	151.3	142.6	150.2
Lilac	152.3	159.3	159.2	164.8	157.6	165.0
	130.92	139.90	131.16	139.71	131.40	140.04

	COLCHESTER.		HALIFAX.		CUMBERLAND.	
	137.23		137.29		139.20	
Mayflower	96.8	110.5	92.8	107.2	101.4	111.7
Blue Violet	125.6	136.2	123.7	131.8	132.0	139.0
Red Maple	125.6	133.9	122.7	129.7	130.4	136.1
Dandelion	125.3	134.8	124.7	132.4	131.1	137.8
Strawberry	125.5	136.5	124.9	134.0	130.9	138.8
Wild Red Cherry	141.1	146.6	146.6	151.4	142.7	146.9
Buttercup	148.0	156.8	148.4	156.5	147.1	155.7
Indian Pear	142.5	148.2	139.7	144.7	139.8	146.1
Apple	145.4	151.4	150.4	155.6	147.1	151.3
Lilac	153.7	160.2	161.0	167.7	155.6	162.5
	132.95	141.51	133.49	141.10	135.81	142.59

	ANTIGONISH.		CAPE BRETON.		GUYSBORO.	
	140.93		143.05		143.28	
Mayflower	106.2	120.8	101.5	114.8	100.2	124.2
Blue Violet	130.2	135.6	131.2	137.9	132.5	141.2
Red Maple	129.6	134.2	133.9	141.6	126.3	138.0
Dandelion	130.0	132.6	130.2	136.5	125 2	139.2
Strawberry	120.6	136.8	129.2	141.2	130.2	140.5
Wild Red Cherry	146.8	152.8	151.9	158.7	148.2	151.5
Buttercup	149.0	157.2	153.5	160.2	154.3	164.7
Indian Pear	143.6	147.8	144.9	150.1	146.5	149.8
Apple	154.2	158.8	155.6	160.5	152.0	161.0
Lilac	162.6	169.2	160.9	166.8	167.7	172.7
	134.28	144.58	139.28	146.83	138.31	148.26

	INVERNESS.		RICHMOND.		VICTORIA.	
	145.07		146.65		147.97	
Mayflower..........	111.0	122.4	105.2	121.7	108.2	121.6
Blue Violet..........	126.9	139.4	132.9	142.0	131·1	138.3
Red Maple	141.7	149.0	137.0	143.2	146.0	150.4
Dandelion	125.8	139.9	134.7	142.4	134.2	142.5
Strawberry..........	129.4	142.0	135.5	145.9	134.4	145.3
Wild Red Cherry....	146.0	154.2	149.2	156.9	152.7	159.1
Buttercup..........	154.9	164.1	152.9	162.9	152.6	162.3
Indian Pear.	136.0	151.3	146.0	154.4	148.6	157.3
Apple	153.6	162.2	161.4	167.6	159.5	164.2
Lilac....	171.3	180.3	166.4	174.9	172.5	178.7
	139.66	150.48	142.12	151.19	143.98	151 97

An interesting irregularity in the phenochrons of the different counties is shown in nearly every part of this table. Their order is not parallel in the different counties. Very often it is reversed. As the phenochrons are averages of ten observations, it cannot be laid altogether to the charge of defective observation. The rarity of certain species in certain counties, or in the districts in which the observations were made, tends to make the phenochron later, for the plants may be in flower several days before they may be met with. But the character of the soil, the elevation, the slope, etc., must have had some influence. And, then, may it not be possible that the same species may develop a tendency to an earlier or later maturing in different regions? These are questions which careful future observations may help to answer.

To illustrate the effect of asymmetry of stations on the phenochrons of a large district or country, I select five of the best-observed plants, giving first their phenochrons for a period of seven years, 1892 to 1898, based on the few and irregularly distributed stations of the Botanical Club of Canada; giving secondly their phenochrons for the year 1898, based on the observations made at the eight stations, Berwick, Windsor, Halifax, Musquodoboit, Wallace, Pictou, New Glasgow and Port Hawkesbury; and giving thirdly their phenochrons derived from 180 stations, ten in each of the eighteen counties of the province, observed in connection with the public schools of the province.

First Flowering of the	Seven Year Phenochrons. Botanical Club.	Phenochrons for 1898. Botanical Club.	Phenochrons for 1898. 180 Schools.
Mayflower	103.0	93.1	97.0
Maple	125.0	121.8	126.0
Strawberry	129.1	125.7	125.3
Amelanchier	142.6	140.7	140.9
Lilac	155.3	155.3	159.2
General Phenochrons	131.0	127.3	129.7

From the general phenochrons we infer that the spring of 1898 in the province of Nova Scotia was according to the Botanical Club 3.7 days earlier than the average of the seven years preceding, and according to the Schools only 1.3 days earlier. But what is the cause of this difference of 2.4 days between the Club and the Schools? Not defective observation, but the fact that of the eight stations of the Botanical Club nearly all were either southern or central, while those of the Schools were evenly distributed from Cape Sable to Cape North.

To conclude this brief exhibit of the progress of phenological observations, I give a few from those made by the Botanical Club extending across Canada.

CANADA, 1898.

	Nova Scotia.	Muskoka, Ontario.	Pheasant Forks, Assa.	Olds, Alberta.	Vancouver, B.C.
Frogs (first piping)	101.8	98	112	106	41
Dandelion (first flowering)	124.4	121	150	153	84
Strawberry "	125.7	130	142	142	96
Wild Red Cherry "	143.2	136	161	...	110
Apple "	148.4	146	...	...	116
Lilac "	155.1	147	182	...	...

To further illustrate what has been done and what has not been done, I give the figures for each of the above six phenomena, so far as obtained, for Nova Scotia, New Brunswick, Ontario (Muskoka and Niagara), Winnipeg, Pheasant Forks in Assiniboia, Olds in Alberta, and Vancouver in British Columbia, for the series of four years from 1895 to 1898.

CANADA, 1895 TO 1898.

Year.	N.S.	N.B.	Ontario.	Winnipeg.	Ph. Forks.	Olds.	Vancouver.
			FROGS (FIRST PIPING).				
1895	110.6	120	106.5	92.5	...	98	53
1896	106.3	116	104.5	112	115	...	50
1897	113.2	...	92	104	105	...	33
1898	101.8	...	98	...	112	106	41
			DANDELION (FIRST FLOWERING).				
1895	125.4	131	118.5	123	...	143	99
1896	128.5	133	121.5	...	149	...	88
1897	132.4	...	118	135	...	...	89
1898	124.4	...	121	...	150	153	84
			STRAWBERRY (FIRST FLOWERING).				
1895	128.5	126.8	126	129	...	136	110
1896	128.5	128.5	127.5	144	134	...	102
1897	126.6	...	128.5	140	140	...	89
1898	125.7	...	130	...	142	142	96
			WILD RED CHERRY (FIRST FLOWERING).				
1895	139.8	139.5	128	...	...	...	124
1896	145.2	144	130	...	...	...	126
1897	142.6	...	137.5	140	...	...	111
1898	143.2	...	146	...	...	...	116
			APPLE (FIRST FLOWERING).				
1895	143.7	145	129	128	...	...	...
1896	151.1	152	131.5	...	...	...	126
1897	155.3	...	143	...	...	...	117
1898	148.4	...	146	...	...	...	116
			LILAC (FIRST FLOWERING).				
1895	153.7	150	137.5	136	...	...	125
1896	160.5	158	133.5	...	...	...	136
1897	157	...	148	145	...	...	131
1898	155.1	...	147	...	182	...	...

The blanks in the tables above show that the great difficulty is to obtain observers who can keep up their observations regularly for a series of years.

It would take up too much space to reprint here the schedule for the recording of these observations and its accompanying directions. They have been published in the report of the Botanical Club to the Royal Society, in whose Transactions they may be seen; and in the *Journal of Education,* Nova Scotia. In the Transactions of the Nova Scotia Institute of Science, the average county phenochrons of the province for the flowering of ten plants are plotted to scale so as to show the character of the curves.

In conclusion, I may say that this present year about 800 schedules have been sent in, classified as covering districts on (1) the sea coast, or (2) the low inlands, or (3) the interior highlands of each county of the province of Nova Scotia. This work is altogether voluntary on the part of the schools, and the Inspectors report it as being the most valuable stimulus yet given to direct teachers and pupils to the active study of nature—to the elements of the natural sciences underlying the industrial development of the country. It also tends to develop the habit of accurate observation, as necessary to a successful literary or professional career as to the industrial occupations.

Botany in the Island of Montreal.

A paper read before the Natural History Society of Montreal, March 27th, 1899, by Robert Campbell, M.A., D.D.

A glance at the map shows that the Island of Montreal is favourably situated for the production of a large and varied flora. It is a well-known fact that rivers perform an important part in the distribution of plant life. Seeds float on the water and are sometimes stranded before their germ vitality is destroyed. Boughs, bearing fruit, are wafted to our shores, and acquire a new *habitat,* it may be, for the species. Even boats and barges may be the effective agents of conveying to our island the originals of the numerous varieties of foreign plants now found flourishing among us. Railways, too, are joining in this distributive agency. At Point St. Charles several introduced plants grow luxuriantly, the seed of which the Grand Trunk no doubt first carried thither; and any observant person who travels by the Canada Pacific will find growing along its line in the Eastern Provinces not a few species whose native home is in the Western Prairies; and *vice versa*, our eastern plants are making their way westward, aided by the same agency. Then, birds, it is established, carry seeds both on their claws and in their crops; and Mount Royal, it is well known, is a favourite temporary resting-place for birds of passage, as well as an attractive whole season's residence for not a few of the species that come annually northward for breeding purposes. They, too, have doubtless brought their quota of the plants belonging to other latitudes and longitudes that have made their home on our island.

To the Ottawa and its tributaries we owe most likely the somewhat numerous northern species that are collected in the district; while the St. Lawrence, fed by streams not only from Western Ontario, but also from the States bordering on its south shores, and the great inland lakes, from which it obtains its waters, casts upon our shores the germs of species which originally belonged to a warmer temperature.

The geological conditions obtaining in the island of Montreal are no less favourable than the geographical for a rich flora. There are first the alluvial plains, bounded by the present shoreline, formed by the recession of the waters which at one time covered no inconsiderable portion of what is now the island, forming a succession of terraces. These constitute the splendid agricultural lands of the district, and of course sustain a well-developed and varied plant-life. The great expanse of limestone underlying so much of the island affords a fine bed for a flora to which that particular rock is partial; while the slopes of Mount Royal, crowned with its dyked eruptive rocks, offer a great variety of soils, each of which nurses its own favourite series of plants. There is still a good deal of the original forest on the island, and under its protection the native flora continues to abound. There are also several swamps and peat-mosses stocked with those distinctive species to which they give support; while a large part of the island is under cultivation, affording abundant scope for the maintenance of that gradually increasing variety of plants which delight in the open. It may be added in this connection that the insular situation of the district, surrounded as it is by a considerable body of water, secures for it a modified temperature; while the varied aspects of the mountain, looking in the direction of every point in the compass, offer as many varieties of climate, and these encourage the growth of a correspondingly varied flora.

Having thus set forth the features of Montreal Island which make it a most promising field for botanical research, the next matter to engage our attention is to enquire what has been done towards observing and reporting on its plant-life. As regards the collecting and cataloguing of its local flora, Montreal had the start of every other place in the Dominion. Dr. Holmes, afterwards the first Professor of Botany in McGill College, between the years 1820 and 1823, made a very large collection, especially of the Phenogamous plants of the district. Of course he had the advantage of being able to make use of the work done by others who had made observations on the flora of the Province, notably Kalm, Michaud and Pursh. But besides this, he had paid special attention as a young physician to the flora of Britain and France, and, therefore, occupied an advantageous position for entering upon his self-imposed task, but one which happily inured to the laying of an excellent foundation for the botany of the district. Considering the state of this department of science at that time, Dr. Holmes must be accorded the credit of being both an enthusiastic collector and a careful and accurate observer. His herbarium, constituting the original nucleus of the splendid collection of plants in the Redpath Museum of McGill University, will always be quoted as showing the main body of the plant-life of this district, here at the present time, as well as eighty years ago. Dr. Holmes was one of the founders of the Natural History Society of Montreal, and in his lifetime Botany secured a fair share of the attention of the members of the society. From the year 1823 onwards, until the inauguration of the Geological Survey under Sir William Logan, and the advent of Sir William Dawson as Principal of McGill College, there seems to have been little original work done in the way of collecting and classifying the flora of the Montreal district. The scope of the Geological Survey at first did not embrace reports on the botany of the country; but the geologists all found that there was a constant relation between the strata they examined and the flora to be found growing on them, as well as between the flora and fauna; and so the group of naturalists whom Sir William Logan gathered around him, inspired and encouraged by Sir William Dawson, began also to make notes of the plant-life they encountered in their geological excursions. Some army officers and old Hudson Bay employees who had been botanical collectors in their respective fields of operations, also came to reside in Montreal and reinforced the number of persons interested in this branch of science. In these several ways our city was exceptionally favoured beyond any centre in the British Provinces, as regards the prosecution of a knowledge of botany, up to about thirty years ago. It was well on in the fifties that the late Dr. George Lawson came to Canada to be a Professor of Botany, first in Queen's College, Kingston, and afterwards in Dalhousie College, Halifax; and his advent gave a prodigious impulse to the study of the flora of the country. A host of young naturalists grew up around him, among others, Professor Macoun, the now famous head of the Botanical Department of the Geological Survey, Dr. A. T. Drummond, Dr. John Bell, and Dr. A. H. Mackay, of Halifax. Montreal, however, kept up its reputation in this line by the work and writings of Mr. D. A. P. Watt, Dr. Kemp and others, special mention being made of Mr. D'Urban, of the Geological Survey. Mr. D. R. McCord wrote a monogram on the Ferns of Canada, embracing, of course, those of the Montreal district, and this was followed by "Notes on Canadian Ferns" by Mr. J. B. Goode, Vol. IX (New Series), p. 49 (1879); but the next most important contribution to the Botany of Canada, since Dr. Holmes' collection was made, was that of Mr. Watt, published in the *Canadian Naturalist and Geologist* in 1864. This embraced a list of the Acrogens of the country, so far as they had then been discovered and determined. In making this list Mr. Watt was assisted by Mr. J. Macoun and others, Mr. A. T. Drummond having placed a very complete catalogue of the lichens of Canada at his disposal. The next considerable addition to the knowledge of the local flora was made by Professor Penhallow, who reported on the plants he found growing on St. Helen's Island in 1891. The present writer began to make notes on the botany of the district in 1885, and has continued to do so up to the present time. Taking Dr. Holmes' list as the basis of his observations, he has found every plant on that list, with the exception of about ten species, which, with the destruction of the forests and the draining of the swamps that existed eighty years ago, have either become wholly extinct or at least very rare in this neighbourhood. But he has been able to report a great many additional species, some of which, no doubt, then grew on the island, although they had escaped Dr. Holmes' observation, many of which, however, have been introduced since 1820. Collections spread over a period of thirteen years may be expected to be more complete than such as were confined to three or four years, which seems to have been the duration of Dr.

Holmes' activity in this connection. Besides, Dr. Holmes' investigations barely touched on the *Juncaceæ*, the *Gramineæ* and the *Cyperaceæ*, three important families on which the writer, in conjunction with Dr. Harold B. Cushing, of Montreal, has made a pretty thorough report. The Phanerogamous plants of the island, it may be said, are now fairly well known, and have been pretty fully catalogued. The same may be said of the Ferns, Club-mosses and Horsetails. Dr. H. B. Cushing reported on the former in the RECORD OF SCIENCE, Vol. VI., No. 8, p. 488, while the writer has described them, along with all the ferns to be found in Eastern Canada, in the magazine published by the Horticultural Society of Montreal.

And now it remains to point out the desiderata of the botany of the district. The whole domain of the local Acrogens has yet to be reported on, with the exception of the ferns, horsetails and club-mosses. The Fungi, the Mosses, the Lichens, the Charæ and the Hepaticæ of the island of Montreal are still in large measure an unknown quantity. In Mr. Watt's catalogue and in the later and completer lists of Professor Macoun, there is no distinction made between the Acrogens of the district and those of the rest of the Dominion, so that there is here an inviting field for local botanists to enter. And a rich harvest awaits them. Professor Macoun informs me that he has found no fewer than 200 mosses in the neighbourhood of Ottawa. The district of Montreal may be expected to yield at least as large a number. And, then, in the department of microscopic Fungi the field of observation is almost unlimited. The enthusiastic microscopists of the society cannot do better than turn their attention to this vast field at present lying waste for lack of some one to cultivate it, and thus render effective service to our botanical section.

What is necessary is that the work remaining to be done should be divided up,—that some of the members of the society undertake to collect and report on the larger Fungi, others on the microscopic Fungi, others on the mosses, others on the lichens, others on the Hepaticæ, and others on the Charæ. By such a division of labour there would be a prospect of having the local flora catalogued within a reasonably short time; whereas, if only one or two take part in the work, it will take a generation to complete it. The Natural History Society will not be true to its responsibilities, nor arise to its opportunities, nor fulfil its functions, until it is seized of at least the main facts relating to the Geology, the Zoology and the Botany of the district.

The Lake-on-the-Mountain near Picton, Ont.

By A. T. Drummond, LL.D.

Imagine a cliff about 180 feet in height, rising almost perpendicularly from the steamboat landing at Glenora on the Bay of Quinté, and immediately on the top, within 300 feet from the edge, but shut in by a fringe of trees on its shore, a lake of clear, fresh water about one and a half miles long with a width of about three-quarters of a mile! Journeying up the zigzag roadway to the top of the cliff, as the eye wanders over the wide expanse of country to the northward, with, in the foreground, the lovely Bay of Quinté, and the deep and broad inlets which branch from it on either side, and, on this sunny, cloudless day, the alternate and contrasting effects of intensely blue water, green grain fields and patches of woods, one gradually realizes that here probably is the finest scenic effect in Central Ontario. This beautiful view is the first point of interest; turning around, close at hand, is found this curious lake perched on the top of the cliff. Its waters are continually flowing out to give the power which runs the Glenora Mills; its inflow is invisible and yet is steadily maintained from month to month and from year to year.

Various opinions have been hazarded in accounting for the inflow. Whilst the surface of the lake is nearly 180 feet above the level of the Bay of Quinté, the bottom is likewise 80 feet above that level. The source of inflow must therefore be sought for in some locality at any rate 200 feet higher than Lake Ontario. A subterranean connection with Lake Erie is a common theory in the surrounding district, but this is based on an inaccurate knowledge of the intervening geological levels and structure. One investigator, again, thinks he has found its source in the State of Ohio. Still others attribute it to springs nearer home. There is ample room for speculation, but it would be safer to attribute the source of the inflow to districts, comparatively nearer at hand, among the Trenton and Black River Limestones, in the higher ground on the northern side of the Bay of Quinté here. Immediately east of Napanee, the Grand Trunk Railway is 127 feet above Lake Ontario, and thence north-eastward there is a steady rise in the limestone area and beyond it into the Laurentian, Sharbot Lake being 389 feet above Lake Ontario, and the dip of the limestone rocks is favourable. That the source of the inflow is not attributable to springs from higher ground in Prince Edward County seems to some extent established by the fact that during the long drought in the months of August and September of this year the level of the lake changed but to a small extent. This drought prevailed seriously in the townships fronting on the Bay of Quinté, whilst further back a fair amount of rain fell. Mr. F. S. Wilson, of Glenora, one of the proprietors of the mills there, to whom I was indebted for courtesies, and on whose authority the height of the lake above the Bay of Quinté is given, wrote to me on September 18th last in reply to my enquiry as to the effect of last summer's drought: "I have watched the level of the water in the lake here and cannot see that the unusually dry weather has affected it to any great extent. During this season of the year and for the summer months, the water draws down about so much each week. This draft may vary a trifle owing to the state of the weather; if very hot and dry the draft appears greater, which I account for by evaporation and no surface water going in in the shape of rain."

On the 28th July last I visited the lake for the purpose of ascertaining its depth and temperature, and their bearing on the origin of the inflow. The northern and eastern portions of the lake, embracing perhaps one-third of the whole area, were found to be shallow, with a rocky, slowly-shelving bottom. Towards the centre of the lake, the depth drops to about 50 feet. Proceeding thence in a south-westerly direction and at about one-quarter of a mile from the south-westerly shore, the depth is 75 feet; at 500 feet from this shore it is 99 feet; and at 200 feet from it, 93 feet. This south-western shore, which rises here precipitously to about 25 feet above the water line, appears to form a ragged cliff of probably 125 feet in height, the bottom of which is at the bottom of the lake. Proceeding from this point a quarter of a mile towards the westerly end of the lake and keeping 100 feet from the shore, the depth was found to be 72 feet, whilst 500 feet off the extreme west end of the lake the depth was 60 feet. The easterly side of the lake towards the southern shore shows considerable depths likewise. At a half of a mile from this end and 400 feet from the south shore, the bottom was reached at 96 feet, but, as this east end is approached, the water somewhat suddenly shallows, and at 300 to 400 feet from the shore reeds begin to appear. Apparently an area about one mile long by one-quarter to half a mile broad forms a sudden depression in the lake of towards 100 feet in depth, but shallowing to 60 feet as the south-west end of the lake is reached. That it arises from a fault in the Trenton limestone here is very probable, and the forces which gave rise to this fault have extended over a sufficiently wide area to give some subterranean connection with higher ground very many miles away.

The results of the readings of the thermometer were even more interesting. Whilst the waters of the Bay of Quinté would be slightly warmer than those of the main body of Lake Ontario, the difference would not be great, and for the purpose of comparison with temperature results in the Lake-on-the-Mountain, readings in the main channel opposite Kingston may be taken as fairly representing the temperatures of the waters of both the Bay of Quinté and Lake Ontario at similar depths. In this main channel, during August of this year, whilst the surface temperature ranged generally around 72° F., the bottom temperature at a depth of 78 feet was $56\frac{1}{2}$° to $57\frac{1}{2}$° F. Last year, on August 18th, at 4.25 p.m., and under about the same conditions of sky, the water in the same channel was $74\frac{1}{2}$° F. at the surface and 72° F. at a depth of 54 feet, and on 25th July, 1889, 67° F. at a depth of 72 feet—the water in this main channel during 1899 being much colder beneath the surface than usual. At the Lake-on-the-Mountain, on the other hand, on the day of my visit, with the air bright and warm and but few clouds in the sky, the results of numerous readings showed the temperature of the surface water to be $74\frac{1}{4}$° F.; at 30 feet depth, $69\frac{1}{2}$° F.; at 45 feet, 47° F.; at 60 feet, $43\frac{1}{2}$° F.; at 72 feet, $43\frac{1}{4}$° F.; and at 99 feet, 42° F. Whilst the surface of the Lake-on-the-Mountain is thus not very different in temperature from the surface of the main channel at Kingston, the temperature at a depth of 78 feet was about 15 degrees colder than at a similar depth at Kingston this year, and 24 degrees colder than at this depth in 1889.

The striking fact is shown by these results at Glenora that for the first thirty feet of depth there is comparatively little change in the temperature of the water; that at between thirty and forty-five feet there is a rapid fall in the temperature of twenty-two and a half degrees; whilst between forty-five feet and the bottom at ninety-nine feet the further fall is only five degrees. In Lake Memphremagog, which is a deep-water lake lying in a higher altitude, in the lap of the mountains in the south-eastern sections of the province of Quebec, I found in August, 1892, the temperature of the surface water varying between 71° and 74° F. according to time of day and clearness of sky; at 36 feet depth, 57° F.; at 72 feet, 51° F.; at 288 feet, 48° F.; and at 324 feet, 44¾° F. Thus at 72 feet the Lake-on-the-Mountain waters were about eight degrees colder than those of Lake Memphremagog in the year named, and the bottom temperature at ninety-nine feet was actually nearly three degrees colder than the Memphremagog waters at three hundred and twenty-four feet depth.

The deeper waters of Lake Memphremagog, I have elsewhere suggested, do not mingle with the warmer surface waters. These—derived from the mountain streams and, more directly, from the rains—continue their course down the lake, like a surface river, over the colder waters beneath, until they discharge into the Magog River. Here at the Lake-on-the-Mountain it can hardly be suggested that the deeper waters are more or less stationary, as the height above the Bay of Quinté and the general dip of the rocks in the district rather imply that the inflow is at or near the bottom and through small subterranean crevices that must be much deeper still. The low temperature of these deeper waters would seem to show that the inflow comes from considerable depths and, especially, from a great distance away, but that it is not a large inflow is evident, not only by the outflow, which can be accommodated in a pipe rather more than two feet in diameter, but also by the fact that the inflowing colder water is not sufficient in volume to control in summer the temperature of the upper thirty feet of the waters of the lake.

The general conclusions of the paper may be stated thus:

That the extreme depth of the lake is about one hundred feet.

That the temperature of the bottom is 42° F., and that the fall in the temperature between thirty feet and the bottom is twenty-seven and a half degrees, most of this fall taking place between thirty feet and forty-five feet.

That the primary cause of the lake was probably a widened fault in the Trenton limestone, the same force giving rise at the same time, no doubt, to subterranean crevices beneath, extending over a wide area, and enabling distant waters to gradually find a passage to the lake.

That the source of the waters of the lake is to be looked for in the higher limestone area to the north eastward of the Grand Trunk Railway as it passes through the counties of Frontenac and Addington.

(In view of the present situation in South Africa, the following article will be found especially interesting,—apart from the inherent scientific value of the paper.)

The Parent-Rock of the Diamond in South Africa.[1]

By Professor T. G. Bonney, D.Sc., LL.D., V.P.R.S.

So much has been written on the occurrence of diamonds in South Africa that a very few words may suffice as preface to this communication. References to many papers on the subject are given in "The Genesis and Matrix of the Diamond" (1897), by the late Professor H. Carvill Lewis,[2] and others have been published since

[1] A Paper read before the Royal Society, June 1, 1899.

[2] Edited by the present writer.

that date.[1] It may suffice to say that the diamond, first discovered in 1867 in gravels on the Orange River, was found three years later in certain peculiar deposits, which occur locally in a region where the dominant rock is dark shale, sometimes interbedded with hard grits, or associated with igneous rocks allied to basalt. These deposits occupy areas irregularly circular in outline, and bearing a general resemblance to volcanic necks. The diamantiferous material, near the surface, is soft, yellowish in color, and obviously much decomposed; at a greater depth it assumes a dull greenish to bluish tint, and becomes harder. At the well-known De Beers Mine, near Kimberley, the works in 1898 had been carried to a depth of about 1,500 feet, and the diamantiferous material, for at least the last 100 yards, was not less hard than an ordinary limestone. It has a brecciated aspect, the dark, very minutely granular, matrix being composed mainly of serpentine (about four-fifths of the whole), and of a carbonate of lime (with some magnesia and a little iron). In this matrix are embedded grains of the following minerals:—Olivine, enstatite, smaragdite, chrome-diopside (omphacite of some authors), a brown mica, garnet (mostly pyrope, but more than one variety observed), magnetite, chromite, ilmenite, with several other minerals much more sparsely distributed.

Rock fragments are also present, variable in size, but commonly not exceeding about an inch in diameter, as well as in quantity. These occasionally, but not generally, are rather abundant. In some cases they are chips of the neighboring black shale, but in others they are greyish-coloured with a somewhat porcelainised aspect. The latter are generally sub-angular in form, and exter-

1 Jules Garnier, *Geol. South Africa Trans.*, 1897, p. 91; H. S. Harger, *ibid.*, p. 124. See also W. G. Atherstone, *ibid.*. 1896, p, 76; L. De Launay, *Compt. Read.*, 1897, cxxv., 335. The last author, in "Les Diamants du Cap" (Paris, 1897) gives a very full account of the mines, but an even better one will be found in Max Bauer, "Edelsteinkunde" Leipzic, 1896, p. 208).

nally banded or bordered with a darker tint; crystalline rocks have also been noticed, though these appear to be far from common, such as granite, diorite, and varietes of eclogite.[1] As to the genesis of the diamond, more than one opinion has been expressed. Professor Lewis regarded the matrix as a porphyritic form of peridotite, once a lava, now serpentinised,[2] in which the diamond had been formed by the action of the molten rock on some carbonaceous material (probably the Karoo shale). Others regarded the matrix as a true breccia, comparing it with the agglomerates in volcanic rocks. But among the latter, some thought that the diamond had been produced *in situ* by the action of steam or hot water in a subsequent solfataric stage of the volcano, while others (including myself) held that it had been formed, like the garnets, pyroxenes, &c., in some deep-seated holocrystalline mass which had been scattered by explosions.[3]

The specimens which I am about to describe were obtained at the Newlands Mines, West Griqualand; from 40 to 42 miles from Kimberley, almost due N.W. Here the workmen occasionally came across well-rounded boulder-like masses of rather coarsely crystalline rock, studded with garnets, which are sometimes about a foot in diameter. Specimens of these were found or obtained by Mr. G. Trubenbach, the London manager of the Newlands Diamond Mine Company, during a visit to the mines in 1897. His interest had already been aroused by picking up a specimen, presently to be noticed, in which some small diamonds occurred, very closely associated with a garnet; so the boulders were brought back by him to

1 A. W. Stelnzer, "Sitzungsber. u Abhandl. der Isis" (Dresden), 1893 (April), p. 71, calls attention to the fact that these show signs at attrition and that they range in size from a few cubic millimetres upwards, being sometimes large boulders. Among the materials (at Kimberley) he mentions both granite and eclogite.

2 For the rock itself he proposed the name "kimberlite."

3 In other words, that the volcano (as occasionally has happened) had ejected little or no lava or scoria, discharging only steam and hot water, with shattered rock. This view is held by Max Bauer, in "Edelsteinkunde," p. 225, which however, I had not seen when this paper was written.

England. On careful examination a small diamond was detected on the surface of one of these. On breaking the boulder others were revealed. The most interesting fragment was sent by Mr. Trubenbach to Sir W. Crookes, who showed it to me. Examination with a hand lens convinced me that the rock could not be a concretion of the "blue ground," but was truly holocrystalline and allied to the eclogites. Sir W. Crookes generously waived his own claim to study the specimen, and obtained for me permission from Mr. Trubenbach to have slices cut from it. I gladly take this opportunity of expressing my gratitude to both gentlemen; to Sir W. Crookes for allowing me to carry out this interesting investigation, and to Mr. Trubenbach for his great liberality in placing at my disposal a considerable suite of specimens (including other boulders) from the Newlands mines, and for the trouble which he has taken in affording me the necessary information.

Prior to the discovery, just mentioned, one or two instances had occurred at the De Beers Mine of a diamond apparently enclosed by or projecting into a pyrope. One such, the garnet being the size of a rather large pea, is in the collection at Freiberg (Saxony), to which it was presented in 1892.[1]

The specimen found by Mr. Trubenbach at the Newlands mine was a piece of blue ground, with a pyrope projecting from one angle. A small, apparently broken, diamond seems embedded at the top. The others (five) are well crystallised, two on one side, three almost in contact on the other. The pyrope (which has a kelyphite rim) seems to be indented by two, but to have once included the others, as they are in contact with the unaltered mineral. We were thus brought so far as to associate the diamond with the pyrope; though this

[1] A. W. Stelzner, "Sitzungber. der Isis zu Dresden," 1893, s. 85, and R. Beck *Zeitish. f. Praktische Geologie*, 1898 (May, p. 163).

proved no more than the presence of garnets in the parent rock of the diamond, and thus made the eclogite (already known to occur) highly probable, for, as observed by Professor R. Beck,[1] the specimen itself is blue ground. In confirmation of his statement I pulverised a fragment,[2] and find that the powder corresponds with the matrix of the blue ground when similarly treated. The latest discoveries enable me to complete the chain of evidence

Eclogite Boulders containing Diamonds.

The first named, that containing several diamonds, is a fragment (perhaps from a quarter to a third) of a boulder, which probably was ellipsoidal in shape, two of the axes being nearly equal and the third distinctly the longest. We may infer that it was rounded from a roughly rectangular block, since the curved surfaces are slightly flatter in the middle parts. The axial lengths in the fragment (prior to removing a piece from one end) were approximately 4 in. by 3 in. by 2 in. The rock is coarsely granular, apparently composed of two green-coloured minerals, one darker than the other (possibly only different states of a single mineral), and of rich resin-pink coloured garnets, varying in size from a hemp-seed to a pea, with slightly irregular distribution. The outer surface of the boulder, except for a very small "step" on one side, is smooth, the garnets barely, if at all projecting. The latter are covered with a rather soft, dark skin, sometimes slightly thicker than the thumb nail, which often has partly fallen off. This, as can be seen on the broken surfaces, becomes less conspicuous in the inner part of the boulder, and is sometimes invisible to the unaided eye. Two small diamonds are exposed on the curved outer surface, one about half, the other about one fifth of an

1 *Ut suprà.*

2 I could not advise Mr. Trubenbach to have a slice cut from the specimen, as I feared it might be injured, but he kindly detached a little fragment from the opposite end to that named above, which I have thus examined.

inch from the edge of the cross fracture. On the latter surface, nearly an inch below the last named, three small diamonds appear to lie in a line touching one another, and near them are two others,[1] all four within a space about three-quarters of an inch square; an eighth diamond is about an inch and a half away (on the same face); a ninth, about one-fifth of an inch from the top edge; and a tenth occurs on the larger cross-fractured surface, but near to the edge of the other one. These diamonds are octahedra in form, generally with stepped faces—one, at least, apparently twinned—perfectly colourless, with brilliant lustre; the largest being quite 0.15 inch from apex to apex, the smallest not exceeding 0.05 inch. All seem to be embedded in the green part of the rock. As the outer part of the boulder looks rather more decomposed than the inner, I had a piece removed from one end, thus enabling me to study the mass to a depth of more than an inch from the surface, and examined a strip, about 4 inches long, in a series of five slices.

The late Professor Lewis has given, in the volume already mentioned, so full an account of the minerals which occur in the "blue ground," that it will be needless on the present occasion to do more than refer to his descriptions,[2] only calling attention to any variations in the mineral constituents and their association in these eclogites. These constituents are :—

1. (*a*) *Garnet* (Pyrope.)—In the slice these appear a light tawny or yellowish red tint, retaining this tint (though much lighter) under the mioroscope.[3] They are generally clear, with frequent and irregular cracks, but are occasionally traversed by wavy bands of minute en-

[1] It is possible that these two form a twin crystal, but I think they are separate. As the point is unimportant, I have not attempted to clear away the matrix.

[2] We must also not forget the paper by Professor Maskelyne and Dr. Flight (*Quart. Journ. Geol. Soc.*, vol. xxx., p. 406), in which several of these minerals are described, analysed, and identified. In fact, the authors ascertained everything that was possible with the materials then obtainable.

[3] Unless it is expressly stated, the use of a 1-inch objective may be assumed.

closures of a pale brown filmy mineral, which is rather irregular in outline, very feebly pleochroic, and gives with crossed nicols fairly bright polarisation tints. Similar minerals sometimes have formed along the cracks. They are probably mica, or possibly chlorite, and indicate incipient decomposition. The garnets towards the outside of the boulder, as already said, are enveloped in a "skin," and the microscope shows that it usually exists inside, though there it is thinner. In the former case it is generally browner in colour and more distinctly crystalline, corresponding in cleavage, pleochroism, &c., with a mica of the biotite group; in the latter it is greener and more filmy with an aggregate habit, and seems to project into the garnet. I regard it as due to decomposition, a form of the well-known kelyphite rim, sometimes a mica, sometimes a chlorite, possibly now and then associated with a little minute hornblende. In a few cases a "rim" is brown in the outer part and green within. The constituents tend to a parallel rather than a radial grouping. The garnets occasionally contain minute branching root-like enclosures grouped in bands. Though these act on polarised light, I regard them empty cavities, and attribute this to diffraction.

(*b*) *Chrome-diopside.*—The mineral described under that name by Professor Lewis, and referred to by others as omphacite or sahlite. The individuals are sometimes about a quarter of an inch long. In thin slices it is a pale dullish green colour, inclining to olive; under the microscope, a pale sea-green, with a trace of pleochroism. It has one strongly marked cleavage, not, however, nearly so close as in ordinary diallage, and a second weaker, sometimes approximately at right angles to it.[1] On examining flakes, obtained by crushing, I find the strong cleavage to be clinopinacoïdal and the other probably basal,

[1] One may give a general idea of their relative importance by comparing them to the columns and cross-joints in some basalts.

and obtain on a clinopinacoïd an extinction of 35° with a prism edge. It is, in fact, identical with the pyroxene described by Professor Lewis[1] as chromediopside. In it (though rarely) small rounded enclosures of a greenish mineral aggregate much blackened with opacite. I regard them as alteration products of a ferriferous olivine. This diopside, at the exterior and along cracks, is often converted into a minutely granular to fibrous mineral, which gives a "dusty" aspect to that part of the crystal when viewed with transmitted light, and a whitish-green one with reflected light. This often terminates in a minutely acicular fringe, piercing the original diopside. Its grains occasionally are a little larger, showing a cleavage, dull green in colour, fairly pleochroic, and having the extinction of hornblende. A process of secondary change, as in uralite, is no doubt indicated. Now and then a tiny film of brown mica occurs in this part or even in a crack in the diopside.

It is this alteration product which gives the mottled aspect mentioned above as visible to the unaided eye, so this is not indicative of a third important constituent in the original rock. In one of the slices the mica just named attains a larger size (about 0.03 inch across), has a fairly idiomorphic (hexagonal prism) outline, and is not restricted to the margin of the garnet. In this case it is generally associated with calcite,[2] which it tends to surround, and that in one place encloses a radiating acicular mineral (? a zeolite), in another the calcite, or some other carbonate, is mixed with a serpentinous material. Distinct granules of iron oxide are practically absent from the slices, though here and there it may be indicated by some opacite. I have not found spinel, or rutile, zircon, or pseudobrookite. In fact, putting aside the diamonds,

1 *Loc. cit.*, p. 21.

2 From the facts I think it probably of secondary origin. It reminds me sometimes of the brown mica produced by contact metamorphism.

the rock in its unaltered condition was a coarsely holocrystalline mixture of chrome-diopside and garnet, with a few small enclosures of olivine,—in other words, it was a variety of eclogite and of igneous origin.[1]

2. A fragment (probably about one quarter) of a flattish ovoid boulder.—The two broken surfaces, which are nearly at right angles, measure 5 and 5½ inches, roughly, and it is about 3¾ inches high. The rock very closely resembles the one just described, except that mica occurs rather oftener and in larger flakes; perhaps the garnets (here also not quite regularly distributed) are slightly more numerous. The outer surface is not quite so well preserved, though enough remains to show that it also has been smooth, and a few thin veins of a white mineral (calcite ?) traverse the rock. On this surface, near the meeting of the two fractures, and exposed by the removal of a little material (*i. e.*, it might originally have been just hidden) is a diamond (octahedron), apparently about 0.1 inch in diameter. On one side it rests against a pyrope, the adjacent surface of which is incurved; the two minerals being parted by the dull green-coloured kelyphite rim of the latter, which is about 0.03 inch in thickness. Thin sections of this boulder correspond almost exactly with those from the other, the garnets showing precisely the same tints, though traces of a cleavage (roughly parallel throughout) are perceptible on close inspection, and are distinct under the microscope. In garnet such a structure commonly indicates pressure, and the general parallelism accords with this explanation, but the other constituents show no signs of crushing. The "kelyphite" rims to the garnets are perhaps slightly broader, and the brown mica passes into a green (chlorite ?)

1 I am, of course, aware that eclogite, in the past, has been regarded by some geologists as a metamorphic rock. Apart from the fact that several rocks once assigned to this class are now, with good reason, regarded as igneous, I have had several opportunites of studying eclogite, and have no doubt as to its origin. Take away the alkali from a magma with the chemical composition of a diorite, and the result would be garnets in place of felspar, *i e.*, an eclogite.

mineral, and occupies cracks in the garnet a little more frequently, but, as before, the constituents tend to lie parallel rather than radially. One or two of the diopsides show fine oscillatory twinning. The cracks are occupied with calcite or some altered carbonate. There is no real difference between this eclogite and the last-named one.

Eclogite Boulders without Diamonds.

3. Part of a boulder, which must have been about a foot in diameter.—In macroscopic aspect it presents a general resemblance to the rocks described above, with, however, the possibility of a second green constituent. This is not confirmed on microscopic examination. The rock consists, practically, of pyrope and diopside, as already described, except that the negative crystals are rather unusually conspicuous in the latter. Into the details of these, as the point seems not to have any bearing on the present investigation, I do not purpose to enter.

4. A fragment, more irregular in form than the others, measures, very roughly, about 7 in. by $4\frac{3}{4}$ in. by $3\frac{1}{2}$ in. It retains a good piece of the outer surface, which, though now a little corroded, was once smooth. The rock, which is rather decomposed and crumbly, consists chiefly of three minerals; garnet, not quite so large, paler and more pink in colour than the last-named; an emerald green pyroxene, and a yellowish or greenish grey, platy to fibrous mineral, suggestive of a second more altered pyroxene. In thin slices the paler and pinker tint of the garnet is very perceptible, as well as the tendency to a rude and generally parallel cleavage. But we find in it, under the microscope, a few microlithic enclosures, of an apparently colourless mineral, which occurs in long prisms crossed at about 70° by an occasional transverse cleavage, and extinguishing at an angle of about 26° with the longer edge. Many of the cracks exhibit slight de-

composition, starting from them, and are sometimes occupied by calcite. The pyroxene, under the microscope, hardly differs from the one already described, except that the green tint is slightly richer and one or two crystals contain the small dark brown negative crystals, common in hypersthene and diallag. The dominant cleavage, as before, is along the clinopinacoïd.[1]

The third mineral proves to be an altered enstatite, but I leave the details for the present as it is better preserved in another rock. A fourth constituent is also present, but more sparingly, viz., a pale brown mica, only moderately pleochroic (phlogophite ?). It occurs generally in plates, averaging about 0.1 inch long. The minerals appear to have formed in the following order: *(a)* garnet, *(b)*diopside, *(c)* mica, *(d)* enstatite. As before, iron oxides are very inconspicuous; there may be a grain or two (small) of serpentinised olivine. The marked presence of enstatite distinguishes this rock from the others, but it differs from the eulysites by the substitution of that mineral for olivine, and so links those rocks to the more ordinary eclogites. The occurrence of a little mica indicates the presence of a small amount of an alkali in the magma. If necessary we may name it newlandite, but personally I should prefer to call it an enstatite-eclogite, for I think the coinage of fresh titles more often a bane than a boon to science.

5. This boulder is almost perfect, except that the general flatness of one side indicates either traces of an old fracture or considerable loss by crumbling. The surface has been smooth, but it has suffered from unequal weathering of the minerals. Its girth, in three directions at right angles, is approximately $20\frac{1}{2}$ in. by $19\frac{1}{2}$ in. by $17\frac{1}{2}$ in. It appears only to differ from the last-described in

[1] As noticed by Professor Lewis, *ut suprà*, p. 22, in the diopside, the prism cleavage has practically disappeared, and a clinopinacoïdal cleavage replaces the orthopinacoïdal usual in diallage.

having its garnets a shade more purple, and in an approach to a banded structure; the diopside being rather more abundant in a middle zone, the garnet in one, the enstatite in the other of the outer zones. Being satisfied that it is merely a variety of the last-described rock, I have preferred to leave it as an intact boulder.

6. The next fragment, measuring about 3 in. by $2\frac{1}{4}$ in. by 2 in. and retaining part of its smooth outer surface, is labelled "Found in the yellow ground of No. 2 mine,[1] 50 feet deep." Though it is much more decomposed than the others, the purplish garnet, the emerald-green pyroxene, the altered enstatite (here very rotten), and a flake or two of phlogophite (?) are easily made out. It is obviously a more decomposed specimen of the rock represented by the two preceding specimens.

7. The last of this group of specimens is a rock fragment,[2] measuring about $3\frac{1}{2}$ in. by 2 in. in length and breadth, and slightly exceeding an inch in greatest thickness. Its outline is irregular, being determined by the fracture of the predominant diallage-like mineral. The crystals of this run large, an inch or more in length, breadth, and thickness. It is greyish-green in colour, having one dominant cleavage, with a sub-metallic lustre, and close subordinate cleavages, giving a somewhat fibrous aspect to that surface. Between these large crystalline lumps, numerous small, ill-defined garnets (pyrope) seem crowded, so as to form fairly continuous partings, generally hardly 0.1 inch in thickness. As the readiness with which the rather soft pyroxenic constituent split away made it improbable that a good slice could be cut, and I was reluctant to injure the specimen, I contented myself with detaching a few flakes of this constituent for microscopic work, since the determination of its identity was sufficient

[1] The others come from another mine (No. 1).

[2] I am informed that this was not part of a boulder, but came out of the "blue ground" nearly in its present condition.

for my purpose. These show the mineral to have one easy cleavage and a rather fibrous structure; they give straight extinction parallel with this. As the usual rings and brushes can be seen on the face of easy cleavage, the mineral belongs to the bastite group. The same is true of the enstatite in boulder (4), though, as it is slightly more fibrous, and not in quite so good a condition, the optical picture is less distinct. Thus we may name the rock from which the present specimen has been broken, a garnet-bearing bastitite.

8. This specimen, said to be a fragment of a boulder, is very different from the rest. It is a compact greenish grey rock containing enclosures, which give it the aspect, at first sight, of a pebbly mudstone. Microscopic examination shows it to be a compact felspathic diabase, with vesicles, which have been filled up with calcite, chlorites, and other secondary minerals (probably zeolites), but not to have any special interest. Its relations appear to be with the rocks occurring in a conglomerate which we shall mention in a later paragraph.

The "Blue Ground" and Associated Rocks.

Two areas of diamantiferous rock are now being worked at the Newlands Mines. The shape of the one which supplied most of the specimens described in this paper is irregular, and, so far as I know, exceptional. Its outline at the surface may be roughly compared to a rounded triangle into the base of which the point of a rather short shuttle is thrust, the greatest breadth of the two being about equal. Exploratory workings at a depth of 300 feet show that the former area rather quickly narrows, and the latter terminates in clefts; the "blue ground," in fact, appears to fill a fissure, broadening in two places to vents which have been traced for some distance underground southwards from the principal mass of diamantiferous rock, as represented in the annexed section.

An igneous rock, occurs on either side. It is compact, a greenish gray in colour, not unlike some of the less acid Welsh felstones. Under the microscope it is found to be much affected by secondary mineral changes: the iron oxides alone being in good preservation. A few small crystals of decomposed felspar are scattered in a yet more decomposed matrix, of which the minor details are uninteresting. The rock may be classed with the compact, rather felspathic, diabases. These, farther to the south, turn off rather sharply to east and west.

In the interval, about 12 feet in width, between walls of this diabase, ribs of the "blue," and a mudstone alternate, the thickest one of the former being from 3 to 4 feet in width, and the inner part of it is in better preservation than the outer. Specimens have been examined from the heart of the mass (vii), a part outside it (vi), and the exterior portion (v). The first (vii) in texture, hardness, and colour, reminds me a little of the dark serpentine found north of Cadgwith, in Cornwall. In this matrix roundish spots occur, some darker than it, others a yellow-green colour, besides a few angular whitish spots. The block is traversed by two or three thin calcareous veins. Specimen (vi), while generally similar, is more decomposed, and apparently contains some fragments of shale. Specimen (v) has a stratified aspect, being a dull grey faintly mottled rock, with streaky, dark, rather carbonaceous-looking bands; the origin being doubtful, till it is seen under the microscope. A fourth specimen (iii) shows the mudstone traversed by a vein of rather pale-coloured decomposed "blue," not exceeding an inch in thickness. A fifth (ii) is from near the diabase on the western side, a dark compact rock, faintly mottled, here and there presenting a slight resemblance to a "blue" traversed by thin veins of a carbonate; and sixth (iv) from a like position on the opposite side is a generally similar rock, but with wider veins filled with more coarsely crystalline calcite. The last specimen represents the "blue" in the "neck," a few yards to the north and at the same level (300 feet). This, inferior in preservation to the first named, includes numerous rounded fragments a little darker than the matrix, with others, angular to subangular, some also darker and some lighter than it.

A brief summary of the results of microscopic examination may suffice, as these rocks do not materially differ from specimens obtained in the De Beers mine, of which I have published a full account (*Geol. Mag.*, 1895, p. 492, and 1897, p. 448.)

The matrix is a mixture, in slightly variable quantities, of granules of calcite or dolomite, serpentine, pyroxene, and iron oxides, in which occur flakes with fairly idiomorphic outlines of a warm-brown mica, moderately pleochroic, corresponding with that described (*Geol. Mag.*, 1897, pp. 450, 451) in one or two specimens from De Beers Mine. The prisms are about 0.002 inch in diameter, and sometimes nearly as thick. This mica, which, as stated in a former paper, I consider a secondary product, occurs abundantly in all the specimens, but in that from the interior (on the whole the best preserved rock) it is locally assuming a green colour, no doubt by hydration. In the specimens from the thick rib, the one last named contains mineral grains and rock fragments, except for a few flakes of the usual mica. The former are a mixture of two fibrous minerals, the larger part corresponding with actinolite; the rest, giving lower polarisation tints, may be serpentine. This fact, and structures suggestive of the former presence of a cleavage more regular than that of olivine, make it more probable that diopside was the original mineral. Though iron oxide is present in specks and rods (especially in the worst preserved specimen), this occurs either in the outer part, or as though it had been deposited along cleavage planes. In the thin rib of "blue" (iii) some of the grains are composed partly of a fibrous mineral, as above described, and partly of a clear one, which often affords rather rich polarisation tints, and presents some resemblance to quartz. Its precise nature is difficult to determine, owing to the absence of distinctive characters, but I believe it to be of secondary origin. Rock fragments are not common in the first (interior) specimen (vii); one, however, is probably an altered shale, and another possibly a limestone. This is bordered by a pale pyroxenic mineral piercing into the grains of calcite. In the second specimen (vi) fragments are rather common; among them are those of diabase, ranging from fine to coarse, one specimen of the latter, originally, perhaps, an inch in diameter, showing an ophitic structure; felspar and augite both being rather altered, seemingly by infiltration, and one small fragment resembles a subcrystalline limestone. Specimen (v) does not materially differ, but seems to contain more carbonate than the others. The dark streaking is due to grains of iron oxide or serpentine with much opacite; rock fragments few and small. Specimen (iii) from the thin vein contains a very few small rock fragments, mudstone, or shale, more or less altered, possibly also a compact diabase. The "country rock" is a mudstone, consisting of small chips of quartz and felspar, variable in size, embedded in a dusty matrix, including a carbonate, which is more abundant within about a fiftieth of an inch from the junction. The part is slightly stained, but I was unable to detect any signs of contact metamorphism. Specimens (ii) and (iv) are generally similar, but the former contains some small rounded bits of varieties of diabase, and one may represent a crystalline limestone. The veins are filled with calcite and other secondary products, and are bordered by a very thin film of a brown micaceous mineral, like that described as often permeating the "blue." Both specimens suggest micro-mineralogical changes, such as might be produced by the passage of hot water.

Other specimens of the sedimentary rock in the immediate neighbourhood of the blue have been forwarded to me by Mr. Trubenbach, one, from the adit on the southern side of the section mentioned above, is a grey mudstone, containing a flattish rectangular pebble, of a dark green compact rock. Two others are from No. 2 mine, or about 700 yards to the south-west. One, struck in the shaft at a depth of 200 feet, is a conglomerate, composed of well-rounded rock fragments, with some scattered grains of quartz. Each of the former is bordered by a zone of the crystalline carbonate (impure calcite), and the interstices are filled, sometimes by a clearer variety of the same, but more often by some minutely granular secondary product. Of the rock fragments, one is a sub-crystalline dolomitic limestone; two, perhaps, are chalcedony; the remainder are igneous; the majority being varieties of the diabase, sometimes rather decomposed; the rest trachytes, mainly andesites. Their general aspect and the not unfrequent presence of vesicles (now filled with viridite) suggests that they have been furnished by lava-flows. Another specimen, obtained in the same working at a depth of 400 feet, is a rather felspathic diabase, not unlike one of the varieties in the conglomerate. It is a good deal decomposed, is not improbably from a lava-flow, but does not call for a minute description.

Conclusion.

Thus the diamond has been traced up to an igneous rock. The "blue ground" is not the birthplace either of it or of the garnets, pyroxenes, olivine, and other minerals, more or less fragmental, which it incorporates. The diamond is a constituent of the eclogite, just as much as a zircon may be a constituent of a granite or a syenite. Its regular form suggests not only that it was the first mineral to crystallise in the magma, but also a further possibility. Though the occurence of diamonds in rocks with a high percentage of silica (itacolumite, granite, etc.) has been asserted, the statement needs corroboration. This form of crystallised carbon, hitherto has been found only in meteoric iron (Canyon Diablo), and has been produced artificially by Moissan and others with the same metal as matrix. But in eclogite the silica percentage is at least as high as in dolerite; hence it is difficult to understand how so small an amount of carbon escaped oxidation. I had always expected that a peridotite (as supposed by Professor Lewis), if not a material yet more basic, would prove to be the birth-place of the diamond. Can it possibly be a derivative mineral, even in the eclogite? Had it already crystallised out of a more basic magma,[1] which, however, was still molten, when one more acid was injected, and the mixture became such as to form eclogite? But I content myself with indicating a difficulty, and suggesting a possibility; the fact itself is indisputable: that the diamond occurs, though rather sporadically, as a constituent of an eclogite, which rock, according to the ordinary rules of inference, must be regarded as its birth-place.

This discovery closes another controversy, viz.: that concerning the nature of the "Hard blue" of the miners (Kimberlite of Professor Lewis), in which the diamond is usually found. The boulders described in this paper are truly water worn. The idea that they have been rounded by a sort of "cup and ball" game played by a volcano may be dismissed as practically impossible. Any such process would take a long time, but the absence of true scoria implies that the explosive phase was a brief one. They resemble stones which have travelled for several miles down a mountain torrent, and must have been derived from a coarse conglomerate, manufactured by either a strong stream or the waves of a sea from frag-

1 This, however, cannot have been very rich in iron, because diopside does not contain much of that constituent.

ments obtained from more ancient crystalline rocks.[1] The "washings,"[2] a parcel of which I received from Mr. Trubenbach, also show that the boulders are really water worn. Besides two unworn pieces of pyrite and a rough bit of eclogite, about three quarters of an inch in diameter, the pyroxenic constituent of which was a bright emerald green (? smaragdite), I find part of a subangular fragment of chrome-diopside associated with two or three flakes of the usual mica, a well rounded garnet fully 0.6 inch across, and half a well worn pebble of eclogite, about one inch long and half an inch thick. The rounded water-worn look of the great majority of the smaller constituents (chiefly garnets and pyroxenes), about the size of hemp seed, is very obvious. I had suspected some of the grains washings from the De Beers Mines to have been similarly treated; but here it is indubitable, indeed many of the dark green specimens are so smooth outside that they could only be identified after fracture. The ordinary diopside can, however, be recognized, with some of a clearer and brighter green. Most of the garnets are pyropes, but a few resemble essonite. I find also some grains of iron oxide and of vein quartz. Thus, the presence of water-worn fragments, large and small, in considerable abundance, shows the "blue ground" to be a true breccia, produced by the destruction of various rocks (some of them crystalline, others sedimentary, but occasionally including water-worn boulders of the former)—*i.e.*, a result of shattering explosions, followed by solfataric action. Hence the name Kimberlite must disappear from the list

1 As these eclogites are very coarsely crystalline, we are justified in assuming they were once deep-seated rocks, and so much more ancient than the date of the conglomerate. To prevent any misunderstanding, I may repeat that the matrix from which these boulders were taken (at various depths, from nearly 100 to about 300 feet) cannot be any alluvial deposit, but is the typical "blue ground," practically identical with that in the Kimberly mines.

2 The name is given to the mineral residue left after washing away the decomposed matrix of the "blue ground."

of the peridotites, and even from petrological literature, unless it be retained for this remarkable type of breccia.

Boulders, such as we have described, might be expected to occur at the base of the sedimentary series, in proximity to a crystalline floor. The Karoo beds in South Africa, as is well known, are underlain in many places by a coarse conglomerate of considerable thickness and great extent, called the Dwyka conglomerate, which is supposed to be Permian or Permo-carboniferous in age. It crops out from beneath the Karoo beds at no great distance from the diamond-bearing district, and very probably extends beneath it. If this deposit has supplied the boulders, the date of the genesis of the diamond is carried back, at the very least, to Palæozoic ages, and possibly to a still earlier era in the earth's history.

Proceedings of the Natural History Society.

Session 1898–99.

The first meeting of the Society for the present session took place with the Entomological Society of Ontario, holding their annual meeting in our city and in our rooms and museum, on November 8th.

The usual monthly meeting was held in the library, November 28th, 1898, at eight o'clock.

The President, Frank D. Adams, Ph.D., in the chair.

There were also present, Messrs. H. McLaren, Rev. R. Campbell, D.D., J. B. Williams, E. T. Chambers, Albt. Holden, Dr. H. B. Cushing, Prof. McBride, Prof. Donald, H. H. Lyman, and sixteen other gentlemen and several ladies.

Rev. Dr. Campbell read a letter from Sir Sanford Fleming *in re* a testimonial fund to Mrs. Traill, the authoress. Dr. Campbell volunteered to set the matter before a committee of ladies.

The Librarian, Mr. E. T. Chambers, then reported that there were between 200 and 300 unbound volumes collected, awaiting the means to pay for their binding. He also expressed a wish that all of our library was properly catalogued for reference.

The Hon. Curator's report was read, telling of work during the summer and up to the present date, and suggesting many useful things to be done.

The reports were received.

On motion of Rev. Dr. Campbell, seconded by Mr. E. T. Chambers, resolved: That the thanks of the Society be tendered to the donor (Dr. Springle) for a large Horned Owl (alive).

It was moved by Rev. Dr. Campbell, seconded by Mr. J. B. Williams, that the rule be suspended and that the following be elected members of the Society as recommended by the Council, viz:

Messrs. Henry G. Vennor and G. H. A. Stevenson as associate, and W. M. Ramsay, G. C. Dunlop, Lachlan Gibb and Auguste Byarelle as ordinary members. Carried.

The business of the evening being completed, the Rev. Dr. Campbell gave his special communication on "The Asters and Golden Rods of Montreal"—over fifty (50) specimens—which was listened to with great interest, and the specimens examined by all those present.

Prof. MacBride and Dr. H. B. Cushing drew attention to the trouble in collecting and arranging them, and expressed the hope that Dr. Campbell would still further pursue his researches. The nomenclature of the plants was according to the determinations of the Torrey Club. Dr. Adams, on behalf of the Society, thanked Dr. Campbell for his paper.

Prof. Adams then vacated the chair, Dr. Campbell taking it at his request, while Prof. Adams gave his paper "On the origin of certain Iron Ores," illustrated by a specimen of Iron recently presented to the "Peter Redpath Museum." Prof. Donald offered a few remarks on this highly interesting and instructive communication, after which the thanks of the meeting were tendered to Prof. Adams.

The meeting then adjourned.

The third meeting of the Society for the session of 1898–99 was held in the library, January 30th, 1899, at eight o'clock. The President of the Society, Prof. Frank D. Adams, in the chair. There were also present, Prof. MacBride, Messrs. E. T. Chambers, H. McLaren, J. B. Picken, Capt. W. Ross, J. A. U. Beaudry, F. S. Jackson and seven others.

The minutes of last meeting were read and confirmed.

The committee on canvass for funds reported progress, and, as a result, some new members.

Dr. Campbell reported that the list of Somerville lectures was now complete, and that the first would be given on Feb. 16th next.

The following specimens were added to the museum since last meeting:

Two specimens of Mantis-like Neuroptera (*Mantispa brunnea*), donor, Mr. A. F. Winn.

Interior cells of wasp's nest from Dundas Co., Ont., by W. E. Deeks, M.D.; a specimen of Clarke's Nutcracker (*Picicorvus Columbianus*) received in exchange from Mr. Jas. H. Fleming, and a Tarantula spider from West Africa, donated by Dr. J. A. Springle.

A vote of thanks was moved by Mr. J. B. Williams and seconded by Mr. E. T. Chambers. Carried.

The Librarian, Mr. E. T. Chambers, reported that some 50 more volumes had been added to the library, some of which awaited binding.

On motion of Mr. C. S. J. Phillips, seconded by Mr. H. McLaren, the rule was suspended and Mrs. W. A. P. Chipman and Messrs. Dumouchal, R. Wilson-Smith and Thomas Fyshe were elected, the first-named associate and the other three ordinary members.

The routine business being finished, Prof. Adams in a few remarks introduced the subjects that would be considered at the next few meetings; Prof. MacBride's being the first, viz: "Zoological problems for the Natural History Society of Montreal."

Prof. MacBride then delivered his very interesting and highly instructive communication, which he said should be called "Study of Evolution in Action." After some remarks by those present a hearty vote of thanks was given to Prof. MacBride.

The meeting then adjourned.

The fourth meeting of the Society was held February 27th, 1899. Dr. Frank D. Adams, the President, in the chair. There were also present, Prof. E. W. McBride, Rev. R. Campbell, Messrs. J. A. U. Beaudry, F.W. Richards, A. Holden, H. McLaren, E. T. Chambers, J. B. Williams, Dr. A. Fisher and a number of others.

The minutes of last meeting were read and confirmed.

Rev. Dr. Campbell reported on behalf of the Lecture Committee, and stated that the Somerville Course was an unqualified success, and great interest was taken in all the subjects.

The Curator reported the following donation:

Series of Mounted Plants collected in the vicinity of Montreal, by Rev. Robt. Campbell, M.A., D.D.

The Librarian, Mr. E. T. Chambers, also reported having received a number of books as contributions to the library.

It was moved by Mr. F. W. Richards, seconded by Rev. Dr. Campbell, that the rules be suspended and the following be elected as members of the Society. Carried.

Associates—Mr. Geo. Moore, Miss Phillips, Miss Fairley, Miss Cameron, Mr. J. H. Leclair, Dr. A. Fisher; Ordinary—Messrs. J. Murray, P. S. Ross, A. E. Norris, Dr. H. B. Yates, Angus W. Hooper, F. Gascoigne, A. C. Lyman, Alfred Griffin; Life—Geo. Iles.

Rev. R. Campbell then took the chair, Dr. Frank D. Adams having vacated same to deliver his paper, entitled "Problems for the Natural History Society, in connection with the Geology of the vicinity of Montreal."

At the close of the lecture a discussion took place; Prof. E. W. MacBride making some interesting remarks.

A hearty vote of thanks was tendered to Dr. Adams for what proved to be a most interesting lecture, and calculated to stimulate members to take a greater interest in that interesting study,—Geology.

The fifth monthly meeting of the Society was held March 27th, 1899, Mr. A. Holden occupying the chair. There were also present, Messrs. J. A. U. Beaudry, F. W. Richards, J. B. Williams, J. Gardner, Dr. E. D. Blackader, E. T. Chambers, Rev. R. Campbell, D.D., Dr. Cushing, A. Byarelle and a number of strangers.

Minutes of last meeting were read and confirmed.

The Report of Council was taken as read.

A communication was read from the Royal Society of Canada *re* appointing a delegate to attend the general meeting. Left over to next meeting.

The following donations were reported by the Curator:

A collection of North American Birds' Eggs, consisting of one hundred and seventeen specimens. Donor, Mr. C. N. Sonne.

A Spanish Silver Coin of Charles III, also one Chinese and one Japanese Coin. Donor, Mrs. Alfred Griffin.

Confederate Bill (1861) for $50.00. Donor, Mr. Reginald Davidson.

Two Ferns. Donor, Mr. J. B. Goode.

The rules having been suspended, on motion of Rev. Dr. Campbell, seconded by Mr. Jas. Gardner, the following members were elected :

Associates—Miss Bickley, Mrs. A. P. Drummond.

Ordinary—Mrs. A. R. Oughtred.

Rev. R. Campbell, D.D., then read his paper, entitled "What remains to be done for the Botany of the District of Montreal." He stated that Montreal was peculiarly fortunate as a place for flora from all parts. He also outlined what had been done in the past and what still remained to be done by a little effort in the future. He also gave many practical suggestions to those interested in the study of Botany.

Remarks were made by the Chairman, also by the following: Dr. Cushing, Messrs. E.T. Chambers, J. B. Williams, Dr. E. D. Blackader, Jas. Gardner and F. W. Richards.

The above discussion suggested Saturday afternoon excursions. This matter was left over till next meeting.

A vote of thanks to Dr. Campbell was then moved by Mr. J. B. Williams, seconded by Mr. F. W. Richards. Carried unanimously.

The meeting then adjourned.

The sixth monthly meeting of the Society was held April 24th, 1899, Dr. Wesley Mills in the chair. Also present: Messrs. P. S. Ross, Judge Würtele, J. B. Williams, J. A. U. Beaudry, H. McLaren, C. T. Williams, E. T. Chambers, Rev. Dr. Campbell, R. W. McLachlan, Dr. Fisher and others, 20 persons in all.

Minutes of last meeting read and confirmed.

DONATIONS.—Shells and pieces of Indian Pottery from Picton, Ont., by Drummond Price.

Coral and pieces of Stalactite, by Reginald Davidson.

Dried Leaves, Shells and Sea-Urchins, by Douglas Black.

1 Red-throated Loon, by F. C. Fairbanks.

King Eider, male and female, by F. C. Fairbanks.

Tail of Horse Mackerel, by F. C. Fairbanks.

Walking Stick made from a Cabbage Stem, by F. C. Fairbanks.

Collection of Mounted Plants from British Columbia and N.W.T., by Rev. R. Campbell, D.D.

Case of Insects (18 specimens) by F. C. Emberson.

A vote of thanks to the donors was moved by Mr. E. T. Chambers, seconded by Mr. J. B. Williams, and carried.

Rev. Dr. Campbell presented to the Society 300 botanical specimens from the Rocky Mountains, collected by himself. A special vote of thanks was very cordially passed on motion of Mr. H. McLaren, seconded by Mr. J. A. U. Beaudry.

The rule was suspended on motion of Mr. A. Holden, seconded by Mr. J. B. Williams, and the following were elected as members:

Associate—Lydia A. Sinclair and Isabel G. McBratney.

A special communication of a very interesting character by Mr. J. B. Williams on " The Color of Birds in Relation to Age, Sex, Season and Inheritance," was then made to the Society, which led to a discussion and questions by Messrs. R. W. McLachlan, Dr. Wesley Mills and others. A very hearty vote of thanks was extended to Mr. Williams on motion of Rev. Dr. Campbell, seconded by E. T. Chambers.

ANNUAL MEETING.

MONTREAL, 29th May, 1899.

The annual meeting was called for this evening, and on motion was adjourned until Monday evening, June 5th.

The following were present: Rev. Robt. Campbell, D.D., Capt. W. Ross, J. H. Joseph, Alfred Griffin, J. B. Williams, J. Hooper, Jos. Fortier, C. S. J. Phillips, A. Holden, Frank Gascoigne, H. E. Vennor, Dr. Birkett.

June 5th, 1899.

The adjourned annual meeting, according to resolution, was held this evening in the hall of the institution, at eight o'clock. The President, Frank D. Adams, Ph.D., F.R.S.C., in the chair. There were also present: Messrs. Albert Holden, J. H. Joseph, J. A. U. Beaudry, J. S. Buchan, C. T. Williams, Hon. Justice Würtele, Rev. Robt Campbell, D.D., H. McLaren, F. W. Richards, Jos. Fortier, Edgar Judge, P. S. Ross, Rev. G. Colborne Heine, G. M. Todd, G. Moore, Alfred Griffin, E. T. Chambers and Chas. S. J. Phillips.

The minutes of the last annual meeting were read and confirmed.

The following donations to the museum were reported by the Curator:

Nest and Eggs of Chestnut-sided Warbler, by Mr. E. D. Wintle.

1 Ammonite found at Outremont, near Montreal, by Walter Wilshire.

1 Ichneumon Fly (with long spines), by Dr. J. A. Springle.

2 Barnacles off a Whale's Back, by Mrs. P. Shoufeld.

The reading of the different annual reports was then proceeded with, viz:

Chairman of Council.

Treasurer.

House Committee.

Curator.

Librarian.

Editing Committee (no report).

All of which, with the exception of the last one, are on fyle.

The President then made a very excellent and encouraging address, and stated that he laid down the office held by him for the past two years with a measure of regret, and promising his hearty co-operation as far as lay in his power for the future.

It was then moved by the Hon. Mr. Justice Würtele and seconded by the Rev. Robt. Campbell, M.A., D.D., that the annual reports be received and adopted, and that they be printed in the forthcoming issue of the RECORD OF SCIENCE.

Dr. Campbell made excuse for Mr. A. Brodie in the non-issuance of the RECORD OF SCIENCE, owing to his illness and his duties at the University taking up so much of his time, and said that the publication of the first number of the new volume was under way; an effort was being made to get more contributors to it. The financial report was also encouraging.

Mr. J. S. Buchan added a few well-timed words, advocating the organizing of a series of Saturday afternoon excursions so as to excite interest for Natural History in the young; also recommended that the RECORD OF SCIENCE be made more of a popular magazine. The motion was then put to the meeting and carried unanimously.

A request was made by Dr. Leprohon through the Recording Secretary to authorize the signing of a requisition for the Montreal Street Railway extension up Beaver Hall Hill to St. Catherine Street *via* University. On motion of Mr. Jos. Fortier, seconded by Mr. H. McLaren, it was resolved that the Recording Secretary be authorized to sign the requisition, providing that the rails do not go further west on Dorchester Street than University, nor further north than St. Catherine on the same street.

MEMBERS.—The rule being suspended on motion, Mr. M. Waring Davis was then elected an associate member on motion of Mr. F. W. Richards, seconded by Mr. A. Holden.

Mr. F. W. Richards, the Treasurer, then referred to the fact that the Council had granted leave of absence to Mr. Alfred Griffin, our Superintendent, to go to England this coming summer, and testified to the good work and efforts of Mr. Griffin and his faithfulness, and moved, seconded by Mr. E. T. Chambers, that a grant of twenty-five dollars be made to Mr. Griffin towards the expenses of his trip across. After some very favourable remarks *in re* our Superintendent, it was moved in amendment by Hon. Mr. Justice Würtele, seconded by J. A. U. Beaudry, that the amount be fifty dollars. It was carried unanimously.

The President then appointed Messrs. Albert Holden and F. W. Richards scrutineers.

The election of officers was then proceeded with.

Hon. President.—It was moved by Mr. Chas. S. J. Phillips, seconded by Mr. J. S. Buchan, that Sir J. Wm. Dawson, LL.D., F.R.S., F.R.S.C., &c., be Hon. President. Carried unanimously by a standing vote.

President.—Rev. Dr. Campbell nominated, seconded by Mr. F. W. Richards, Prof. T. Wesley Mills, M.A., M.D., as President. There being no other nomination, he was declared elected by acclamation.

Vice-Presidents.—The ballot was then taken for Vice-Presidents, which resulted as follows: Lord Strathcona, Rev. Robt. Campbell, D.D., Frank D. Adams, Ph.D., B. J. Harrington, Ph.D., Messrs. C. T. Williams, J. H. Joseph, Hon. Justice Würtele, Walter Drake and H. H. Lyman.

On motion, one vote was cast for the office of Recording Secretary, and Mr. Chas. S. J. Phillips was re-elected.

On motion, one vote was cast for Mr. J. S. Buchan as Corresponding Secretary; elected unanimously.

On motion of Judge Würtele, seconded by Mr. C. T. Williams, Mr. Alfred Griffin was elected as Superintendent and Curator.

On motion, one ballot was cast for Mr. F. W. Richards as Treasurer.

Members of Council.—As a result of the ballot, the following were elected as the Council for the ensuing session: Messrs. Albert Holden, J. A. U. Beaudry, E. T. Chambers, Joseph Fortier, Rev. G. Colborne Heine, Edgar Judge, Prof. E. W. MacBride, H. McLaren, Geo. Sumner.

It was moved by Dr. Campbell and seconded by Mr. J.

Harper that the by-law be suspended, and that the Editing Committee be appointed by the Council. Carried.

Mr. E. T. Chambers was elected as Librarian by acclamation.

On motion, Mr. Justice Würtele was requested to take the chair, when the following was proposed as a vote of thanks to the retiring President:

Moved by the Rev. Robt. Campbell, M.A., D.D., and seconded by Mr. J. S. Buchan, B.C.L., that a very hearty vote of thanks be and is hereby tendered to Prof. Frank D. Adams, Ph.D., the retiring President, for the admirable manner in which he has filled the office for the past two years and for the great assistance given and time spent for the advancement of the aims and objects of this Society. The motion was carried unanimously.

After a few remarks by Dr. Adams the meeting adjourned.

The Chairman of Council begs to submit the following report for the year ending May 30th, 1899.

During the year eight meetings of Council have been held, at which reports of the different Committees were received and all other business of the Society discussed, before being submitted to the regular monthly meetings of the Society.

The regular monthly meetings have been held as usual.

The October meeting was postponed to November 8th, on which date a Conversazione was held in connection with the Montreal Branch of the Entomological Society of Ontario, which proved most successful.

The average attendance of the meetings has been larger than formerly, and the interest taken by the members and their friends seems to have greatly increased.

The papers read were as follows:

November 28th.—The Asters and Golden Rods of Montreal. Rev. R. Campbell, D.D.

The Origin of certain Iron Ores. Prof. F. D. Adams.

January 30th, 1899.—Study of Evolution in Action. Prof. E. W. MacBride, M.A., B.Sc.

February 27th.—Geology of the Vicinity of Montreal. Prof. F. D. Adams.

March 27th.—What remains to be done for the Botany of the District of Montreal. Rev. R. Campbell, D.D.

April 24th.—The Color of Birds in relation to Age, Sex, Season and Inheritance. J. B. Williams, F.Z.S.

Somerville Course.—There were seven lectures given this year, as follows:

Thursday, February 16th.—"Hydraulic Mining," by Prof. J. Bonsall Porter, E.M.Am., Ph.D.

Thursday, February 23rd.—"Wireless Telegraphy," by Prof. E. Rutherford, M.A., B.Sc.

Thursday, March 2nd.—"Creatures of Other Days," by Prof. Frank D. Adams, M.A.Sc., Ph.D., President of the Natural History Society.

Thursday, March 9th.—"The Canals of Canada," by Mr. J. G. G. Kerry, M.A., E.A.M.

Thursday, March 16th.—"New Gases of the Atmosphere," by Prof. J. Wallace Walker, M.A., Ph.D.

Thursday, March 23rd.—"Water-Power Development," by Prof. R. B. Owens, E.E., Vice-President American Society of Engineers.

Thursday, March 30th.—"The Food of Fishes," by Prof. E. W. MacBride, M.A., B.Sc.

There were eight half-hour lectures to young people on Saturday afternoons, all of which were well attended, as follows:

March 4th.—"Kingfishers and Cuckoos." J. B. Williams, F.Z.S.

March 11th.—"Carlo and his Master." Dr. Wesley Mills.

March 18th.—"The Honey Bee." C. T. Williams.

March 25th.—"How Plants Live." Miss C. M. Derick.

April 7th.—"My Holidays in the Country." Rev. Thomas W. Fyles.

April 15th.—"How to know Plants." Rev. Robt. Campbell, D.D.

April 22nd.—"Corals." J. B. Picken.

April 29th.—"Ocean Currents." Capt. W. Ross.

April 29th.—"The Elephant and the Mammoth." E. T. Chambers.

All the above lectures were arranged for by the Lecture Committee, who will report on the same.

Thirty-three new members have been elected during the year,—22 ordinary, 10 associate and one life member. Some have resigned and others have been removed by death.

The number of visitors to the Museum has largely increased, owing, no doubt, to its being open free to the public on Wednesday afternoons and all day Saturday.

The Annual Field Day was held on June 4th at Rigaud Mountain, and was attended by about 170 members and their friends, who were received at the station by the Seigneur of Rigaud, Mr. A. C. de Lery Macdonald, who entertained a number of the party at the Manor House.

The Society is indebted to Mr. Griffin, the Superintendent, for the work he has done in securing many new members, and in the increased interest he has taken in the welfare of the Society during the past year. Permission has been granted to Mr. Griffin to visit his home in England during the summer months.

The different Committees will report to you on the work done by them during the year.

Respectfully submitted,

A. Holden,
Chairman of Council.

Natural History Society of Montreal,

in account with

F. W. Richards, *Hon. Treas.*

Cash Summary for Year Ending May 29th, 1899.

Receipts.

To Balance cash on hand	$ 49 57
" Rents.	767 00
" Members' Subscriptions	542 00
" Loan Merchants Bank	492 60
" Donations	225 00
" Entrance Fees to Museum	30 35
" Insurance, Fire Loss	10 00
	$2116 52

Expenditure.

By Superintendent's Salary and Commission	$ 498 00
" Repairs and Renovations	319 45
" Sundry Expenses	178 24
" Light	165 16
" Record of Science	164 43
" Museum	163 94
" Returned Loan 1898	150 00
" Fuel	146 41
" Printing	76 30
" Lecture and Conversazione	47 50
" City Tax	33 95
" Interest Merchants Bank	10 31
" Cash on hand	162 83
	$2116 52

Audited and found in accordance with the records of the Association.

(Signed) Philip S. Ross, C.A.
H. McLaren.

Montreal, 5th June, 1899.

Museum Report for 1898–99.

Gentlemen,—The principal work done to the Museum during the past year has been the re-arrangement of the Shell Collection, which consists of about 4000 specimens. All of them (except Col. Bulger's collection from Port

Blair) have been cleaned, re-arranged and grouped together in their families, which have been labelled with their English and scientific names. The Montreal specimens have been taken out from the other Canadian series and grouped by themselves, so that they form an interesting "Local Collection."

Our series of Fossils, which occupy the corresponding cases on the other side of the Museum, greatly need to be cleaned, re-arranged and labelled in the same way that the shells have been.

The drawers of the Insect Cabinet, which contain the Canadian Butterflies, have been re-arranged so as to make room in the proper place for all recently-obtained specimens, and a number of the foreign *Lepidoptera* have been named.

Since the month of December, when the Council decided that the funds were not sufficient to allow of the Curator continuing work at the Museum, no work has been attempted save the naming and arranging to some extent of new specimens presented to the Museum, and it has been necessary to do away with the aquarium and some of the live snakes, which required continual care to keep them in a proper state.

Mr. Griffin has taken care of the muskrat and large owl since December, and they are both doing well, but we have no proper accommodation for a large bird like the owl, and it will be difficult to prevent its being a nuisance during the hot weather on account of the smell.

The donations and additions have been reported at the monthly meetings of the Society, and need not be repeated in detail. The most valuable presentations during the year have been Corals and Shells from Miss Fanny Joseph, Birds' Eggs from Mr. C. N. Sonne, and Plants from the Rev. Dr. Campbell.

The Museum Committee arranged for the usual course of Lectures to Children during March and April.

A very interesting and instructive series were given by different members and friends, four of which were illustrated by the electric lantern, The attendance was very large during March, but April seems to be too late a time for them, as the attendance was not so good after the Easter holidays.

The number of visitors to the Museum on Saturday (the free day) has often been very large, and on this day and Wednesday afternoons the total for the year has probably been about four thousand persons. The attendance on other days, when admission is charged, has been about four hundred visitors and members.

The Wednesday afternoon attendance has lately rather fallen off, owing partly to the fact that the notice boards, announcing that afternoon as free, were wrenched down and stolen from the porch in the month of January last.

The Insect Exhibition, which remained at the Museum for three days after the Entomological Conversazione, was a remarkably interesting and valuable one, but, owing partly to the bad weather, the attendance during those days was not very large.

All of which is respectfully submitted.

J. B. Williams,
Chairman of Museum Committee.

86 Union Avenue,
Montreal, June 5th, 1899.

Report of the Honorary Librarian.

The Library Committee has not had occasion to meet during the past year. The time of the Librarian has been taken up with acknowledging the exchanges, making up incomplete volumes for binding, and preparing the catalogue. Much time during the illness of the Superintendent was unavoidably lost, as without his assistance very little could be done.

Your Librarian is pleased to report that increasing interest is being taken in the Library by the members, and much more use will be made of it when it is known what scarce and valuable works are to be found in it. In this connection I am glad to state that a permanent catalogue is now well in hand. After much consideration the card system has been adopted. It becomes of use as the work goes on, and from it a printed catalogue can be easily got up on any arrangement that may be decided upon. Two of the cases are finished, and the cards will be at once arranged in alphabetical order. I must here acknowledge the great assistance received from Mr. Griffin, without whose ready and intelligent help the work I have mentioned could not have been performed. The other cases will be taken in hand at once, but the assistance of some of the members of the Society is asked in the arrangement and cataloguing the contents of the two cases containing works in the French and German languages.

Above 300 volumes of exchanges are now waiting for the binder. It is a pity that these volumes, which contain very important papers on recent science, should not be more available for the use of members in consequence of their waiting to be bound in volumes for so long a time after their publication.

The cases being filled, more shelving is urgently required, and it would be to the interest of the Society if the Council could at an early period make a liberal grant to the Library for new cases and for binding the volumes mentioned.

Respectfully submitted,

E. T. CHAMBERS,
Hon. Librarian.

PRESIDENT'S ADDRESS.

This, I take it, should be a brief review of the work of the Society during the past year, containing possibly suggestions for the betterment of the Society's work in the year to come.

Detailed reports on the Society's work in its various departments are now before you, and I wish merely to touch upon certain phases of it.

The Society's work has during the past year been in many ways very satisfactory,—let us hope that next year its weak parts may be strengthened, and that it may be satisfactory in *all* respects.

Our Natural History Society here is placed in a position quite different to that of many similar societies elsewhere.

Our summer is short, and all field work must be concentrated in it. During our long winter our studies must be continued indoors.

Now, our indoor work for the furtherance of Natural History is well done.

It may be stated to consist of three courses of lectures (with discussions on the same), adapted to three different classes of our community, together with studies in the Museum.

These are our (1) monthly meetings, where papers on the more serious aspects of Natural History are presented; (2) the Somerville lectures, a popular course of lectures adapted to the public at large; and (3) our Saturday afternoon talks to young people.

The Somerville course this year consisted of lectures on various scientific topics of especial interest to us at present. They were good and were well attended. The improved facility for illustrating them, due to our new electric lantern, was marked.

The Saturday afternoon talks to young people were also good and were much appreciated, having been better attended than on any previous year, the lecture hall having been crowded repeatedly.

Our Museum also has done excellent work for us. The number of visitors to it this year has about doubled in number, as many as 300 persons having visited it on a single Saturday.

The attendance at the regular monthly meetings has, however, remained about the same, and might be improved.

In summer, however, our work is practically at a standstill, one single excursion and our Museum being our only educating influence at work.

In other societies there are field classes in which, under the leadership of competent and enthusiastic instructors, the actual living face of nature is studied, and members of the society work and learn for themselves.

This is the best means of awakening a real interest in Natural History.

Such classes would not only instruct our young people and awaken in them a real interest in our sciences, but the discussion of the various things seen and specimens collected would be a source of life to our meetings all winter. This is, I believe, what our Society chiefly wants. There are many among our members who take a passive interest in the subject; we want more who are active and who will be workers. Why cannot, for instance, all our teachers in Natural Science in our schools be brought in touch with our Society, in this and other ways, and our Society be thus really strengthened in this its weakest part?

Something along this line, I might humbly suggest to the incoming Council, might be attempted by the Society during the coming year. The work might well be undertaken by the local association of our naturalists, and the result would be the bringing out of new workers, as it is for this that the Society exists. Why cannot arrangements be made during the summer months for field class work in the several departments.

I do not think it is well to lean too much on McGill University and be too frequent in our calls upon her. Professors of McGill gave (most of them not numbers of the Society) half of all the papers and lectures for the season last year. They gave the whole of the Somerville lectures, two of the lectures to children, and half the papers printed at the March meeting.

This is not a natural state of affairs. It is well that the Science Professors should aid our Society to a certain extent, but it is not right that they should be called upon to do so much of its work. The Society should, I believe, rely more upon itself and do its own work, instead of calling upon outsiders to work for it.

The RECORD OF SCIENCE has not appeared during the past year. Something must be done about it at once. We are now receiving all our exchanges and sending nothing for them. This, of course, is really dishonest, and if the RECORD is not continued notice must be given to our exchanges to that effect. If the RECORD goes our library goes with it.

We need for the continuation of the RECORD, first, financial support, and secondly, an editor who is able to devote the very considerable amount of time necessary to maintain a really good publication. If this can be supplied, publication of our RECORD, which has been, without the least doubt, a great source of strength to our Society, can be resumed.

Our appeal for financial help has not, I regret to say, been pushed with that vigour of which it is worthy. I am free to confess this, as I feel that I am one of the delinquents in this matter. The responses in the quarters where the appeal has been made, however, were in many cases so generous that we should be moved to real exertion in this matter, which is one of the greatest importance to us. With the loss of the grant from the Quebec Government, we have to rely entirely on our own resources, and giving, as we do, so much—free of charge to the public—we have reason to believe that those amongst them who are blessed with the means of giving will in their turn be generous to us.

We should not, however, put off this matter any longer—the time to act is *now*.

Without such aid our work *must* be crippled, and some of it must be stopped.

And finally, in resigning my honourable position as President of the Society, which I have held for the past two years, I have to thank the members of the Council and the Society at large for the large measure of aid which has always been extended to me in my work, I know that my successor will discharge the duties of the office much more efficiently than I have done, and that under him the Society will take a new lease of life.

Book Notice.

An Illustrated Flora of the Northern United States, Canada, and the British Possessions, from Newfoundland to the Parallel of the Southern Boundary of Virginia, and from the Atlantic Ocean Westward to the 102nd Meridian.—By Nathaniel Lord Britton, Ph.D., Emeritus Professor of Botany in Columbia University, and Director-in-Chief of the New York Botanical Garden, and Hon. Addison Brown, President of the Torrey Botanical Club. In three volumes. New York: Charles Scribner's Sons, 1898.

This is an epoch-making work in relation to the science of Botany. It will greatly help to popularize the study of the flora of the North American continent, doing for it what Bentham and Hooker's Handbook has done for the flora of Great Britain and Ireland. These volumes are an immense boon, especially to amateur botanists. Written descriptions, however accurate, do not convey to the mind so clear a conception of what a plant is like as the figured illustrations in black and white do. There is still plenty of work for the student to do after he has been put on the track of the family or genus to which a specimen belongs, through the help of the outlines furnished by these volumes. He must study the plant in detail, in order to make sure that the specimen in hand corresponds with that figured in the book and described in the text. These three volumes have taken eight years to prepare, and they have been produced with great care and at enormous cost, as will be understood when the fact is stated that no fewer than 4162 species, including 81 in an appendix to the third volume, are described and figured in them, while Bentham and Hooker's Handbook of the British Flora embraces only 1309 species. Not more than one-fourth of the plants described in this work have ever before been figured, and whatever was previously done in this connection was only in scattered monographs or local collections.

The first volume opens with a description of the Ferns and their allies, the *Pteridophyta*, and the third volume ends with the *Compositæ*. This plan reverses the order of the older treatises in Botany, which began with the higher forms of plant-life and concluded with the lower; but it is undoubtedly the true scientific method to proceed from the study of the simple to that of the more complex productions of the earth, and the authors of this work have done wisely in following the leadings of nature in this matter. Engler and Prantl of Germany had already led the way in this desirable reform. Britton and Brown have also followed the lead of these German authors as to the divisions into genera, greatly increasing their number, and correspondingly decreasing the number of species and varieties ranged under them respectively. It may be said that this is an arbitrary proceeding on the part of the botanists of the day. But much of the distribution into genera and species is largely matter of opinion as to what differences are to be deemed determinative ; and this much may be said for the work before us and its German prototype, that, in lessening the number of species and varieties compared under one genus, it greatly facilitates the study of specimens, and whatever contributes to that end is to be welcomed. It is not without a feeling of reluctance that those accustomed to use Gray's "Manual of the Botany of the Northern United States" will lay it aside in favour of this new work. No one familiar with the "Manual" will ever cease to be grateful to its author. It has done noble service. But science is progressive, and we must advance with the times.

The code of nomenclature adopted by the authors of this work is that devised by the Paris Botanical Congress of 1867, modified by the rules agreed upon by the Botanical Club of the American Association for the Advancement of Science in 1892 and 1893, and published by the Torrey Club in 1894. Starting with the "Species Plantarum" of Linnæus, published in 1753, priority is asserted as the fundamental law of nomenclature. Plants removed from one genus to another retain their original specific name. A name already appropriated is not allowed to be applied to another plant. Parentheses are employed to show where a plant has been transferred from one genus to another. Specific names derived from persons or places begin with capitals; also when a former generic name is reduced to the rank of a species, its history is traced by the use of a capital. When a variety is mentioned, it is added to the specific name, without any prefix, and there is no comma before the name of the authority.

The changes which these rules will make necessary will not all be readily accepted. For instance, the substitution of "Dryopteris" for "Aspidium" fern collectors will be disposed to resist; yet, if the principle pursued by our authors is scientifically sound, they did well to follow it thoroughly, even when it leads to somewhat startling changes that will be inconvenient to the older botanists.

Having consulted these three volumes very extensively in relation to the flora of the district of Montreal, we are in a position to say that, so far as the botany of Quebec is concerned, and, indeed, that of all Canada, this work is a prodigious advance upon anything hitherto published. A great many species grow with us which are not credited to the province; but the authors can scarcely be blamed for such omissions, if those having the means of information on the subject failed to furnish it. Nor are the descriptions faultless, at least so far as applies to those species which are found among us; although the errors we have detected are mainly those of defect rather than of positive statement.

This great work is brought out in a style worthy of the eminent publishing house that has given it to the world; and we trust that its enterprising venture has been sufficiently remunerative to warrant botanists in looking forward to an extension of the undertaking, so that we may have the pleasure of welcoming from the same firm a volume or volumes dealing also with the *Bryophyta* and *Thallophyta*.

R. C.

UARY, 1899.

1, 187 feet, C. H. McLEOD, *Superintendent.*

DAY	Sky Clouded in Tenths. Mean.	Max.	Min.	Per cent. possible Sunshine.	Rainfall in inches.	Snowfall in inches.	Rain and snow melted	DAY.
SUNDAY........	...	..	..	92	....	....	....	1..........SUNDAY
	5.7	10	0	19	....	0.5	0.03	2
	8.3	10	0	0	....	0.1	0.01	3
	10.0	10	10	0	0.91	..	0.91	4
	5.5	10	0	43	0.07	0.0	0.07	5
	8.3	10	0	0	....	6.1	0.61	6
	8.0	10	0	25	....	1.6	0.16	7
SUNDAY........	....	..	..	28	....	4.2	0.42	8 ....SUNDAY
	3.2	10	0	28	....	0.1	0.01	9
	0.0	0	0	92	....	....	....	10
	0.0	0	0	92	....	....	....	11
	1.5	7	0	58	...	..	....	12
	8.3	10	0	0	...	1.2	0.12	13
	10.0	10	10	0	0.94	2.2	1.24	14
SUNDAY........	....	..	..	0	....	3.4	0.36	15..........SUNDAY
	8.8	10	6	7	....	....	....	16
	7.8	10	0	17	0.00	0.5	0.05	17
	0.0	0	0	96	....	....	...	18
	0.0	0	0	94	....	...	....	19
	5.2	10	0	37	....	0.1	0.01	20
	10.0	10	10	1	....	0.4	0.04	21
SUNDAY.......	....	..	.	0	....	0.4	0.04	22......... SUNDAY
	3.7	10	0	86	....	...	....	23
	10.0	10	10	0	0.11	....	0.11	24
	1.7	10	0	98	....	....	....	25
	10.0	10	10	0	....	1.3	0.13	26
	1.0	5	0	86	....	2.1	0.21	27
	8.3	10	0	0	....	0.0	0.00	28
SUNDAY........	....	..	..	94	....	0.8	0.08	29...........SUNDAY
	2.2	5	0	37	....	0.1	0.01	30
	2.2	10	0	95	....	....	....	31
Means...... ...	5.37	8.0	2.2	39.5	2.03	25.1	4.62	...............Sums.
25 Years mean for and includin this month	6.26	.	..	¶35.23	0.84	29.88	3.67	25 Years means for and including this month.

Direction......	
Miles	
Duration in hrs	
Mean velocity.	

sea-level and

mercury.
eing 100.

he 5th ; the
)th, giving a

Greatest m lest day was
27th. was 30.777 on
Greatest v on the 26th,
the 27th. ximum rela-

tive humidity was 99 on the 4th and 14th. Minimum relative humidity was 55 on the 24th.

Rain fell on 5 days.

Snow fell on 19 days.

Rain or snow fell on 21 days.

Lunar corona on 8 nights. Mock suns on the 27th.

Fog on 6 days.

ABSTRACT FOR THE MONTH OF JANUARY, 1899.

Meteorological Observations, McGill College Observatory, Montreal, Canada. Height above sea level, 187 feet, C. H. McLEOD, *Superintendent.*

DAY	THERMOMETER.				BAROMETER.				†Mean pressure of vapor.	‡Mean relative humidity.	Dew Point.	WIND.		SKY CLOUDED IN TENTHS.			Per cent. possible Sunshine.	Rainfall in inches.	Snowfall in inches.	Rain and snow melted	DAY.
	Mean.	Max.	Min.	Range.	Mean.	§Max.	§Min.	Range.				General direction.	Mean velocity in miles per hour	Mean.	Max.	Min.					
SUNDAY........1	.....	— 0.7	—11.7	11.0	......	......	.....	......	......	....	....	S.W.	14.63	...	..	..	92	....	....	....	1..........SUNDAY
2	7 90	16.9	— 9.2	26.1	30.6088	30.777	30 416	.361	..0575	86 7	4.8	S.	14.67	5.7	10	0	19	....	0.5	0.03	2
3	20.50	27.9	13.6	14.3	30 3482	30 416	30.285	.131	.0943	85 2	16 7	S.E.	12.33	8.3	10	0	0	....	0.1	0.01	3
4	29.20	39.3	13 2	26.1	29.6865	30 285	29.540	.745	.1608	95 3	28 0	S.E.	19.09	10.0	10	10	0	0.91	...	0 91	4
5	34 25	49.0	22.3	26.7	29 9562	30 354	29 534	.820	.1530	72.3	26.3	S.W.	31.92	5 5	10	0	43	0.07	0.0	0.07	5
6	19.72	22.3	17.5	4.8	30 0617	30 404	29 544	.860	.0922	86 5	16.3	N.	16.38	8.3	10	0	0	....	6.1	0.61	6
7	16.65	21 3	9.4	11.9	29.7748	30.069	29 530	.539	.0748	79 0	11.3	S.W.	29.54	8.0	10	0	25	....	1.6	0.16	7
SUNDAY........8	.....	30.0	1.2	28.8	......	.....	......	......	......	....	....	S.W.	21.21	....	..	..	28	....	4.2	0.42	8..........SUNDAY
9	— 3.52	30.6	—12.2	42.8	30.3742	30.479	30.200	279	.0315	83 8	— 7.2	S.W.	13.92	3.2	10	0	28	....	0.1	0.01	9
10	—13.43	—10.2	—19.4	9.2	30 6222	30.656	30 479	.207	.0198	87.0	—10.2	S W.	24.79	0.0	0	0	92	....	....	....	10
11	— 7.18	— 1.1	—14.2	13 1	30.7310	30.771	30 645	.126	.0270	86 5	—10.3	S.W.	22.58	0 0	0	0	92	....	....	....	11
12	1.67	8.3	— 5.6	13.9	30 5862	30 693	30.496	.197	.0360	77.7	— 4.0	N.E.	9 54	1.5	7	0	58	...	..	....	12
13	9.45	22 4	— 1.7	24.1	30 3 27	30 496	30.108	.388	.0608	83 3	5.5	N.	11.63	8.3	10	0	0	...	1.2	0.12	13
14	27.57	34.3	21.9	12 4	29.6568	30.108	29.236	.872	.1457	96.2	26 8	N.	8 63	10.0	10	10	0	0.94	2.2	1.24	14
SUNDAY........15	... .	35.3	26.0	9.3	......	......	......	......	......	....	....	N.	11.83	....	..	..	0	....	3.4	0.36	15..........SUNDAY
16	33.02	37.8	28.9	8.9	29.8992	30 027	29 768	.259	.1523	81 2	27.7	S.E.	9.50	8.8	10	6	7	....	....	....	16
17	27.95	36.3	19.0	17.3	29.7862	30.001	29.656	.345	.1355	86 2	24.5	S.W.	16.71	7.8	10	0	17	0 00	0.5	0.05	17
18	5.13	19.0	0.8	18.2	30.2903	30.367	30 001	366	.0432	78.8	— 0.2	W.	20.42	0 0	0	0	96	....	....	...	18
19	12.73	23.8	1.3	22 5	30 2937	30.393	30.203	.190	0617	76.5	7 0	S.W.	26.17	0.0	0	0	94	....	....	....	19
20	22 93	30.5	10.2	20.3	30.0960	30.203	29.994	209	.1080	84 7	19.2	S.W.	15.96	5.2	10	0	37	....	0.1	0.01	20
21	31.75	35.2	28.2	7.0	29.7103	29.994	29.473	.521	.1538	85 5	28.0	S.	16 50	10.0	10	10	1	....	0.4	0.04	21
SUNDAY........22	.....	35.5	30.1	5.4	......	......	.....	......	......	...	....	S.	25.00	...	..	.	0	....	0.4	0.04	22.........SUNDAY
23	23.25	30.1	17.5	12.6	30.0423	30.148	29.867	.281	.1023	81 7	18.8	S.W.	16.92	3 7	10	0	86	....	...	....	23
24	32.90	37.2	27.5	9.7	29.5897	29.867	29 524	.343	.1417	74.7	25 5	S.	20 79	10.0	10	10	0	0.11	....	0.11	24
25	14.48	29.0	5.8	23.2	29 7705	29 901	29.519	.472	.0678	77.7	8.8	W	17.04	1.7	10	0	98	....	....	....	25
26	13.72	33 8	0.4	33.4	29 5928	29.991	29 219	.772	.0807	90 0	11 3	N.E.	15.00	10 0	10	10	0	....	1 3	0 13	26
27	— 0.15	34 7	—10.7	45.4	29 7730	30.111	29.219	.892	.0437	88.2	— 2 8	S.W.	36.13	1.0	5	0	86	....	2.1	0.21	27
28	7.45	16.0	—11.2	27.2	29.8750	30 111	29 700	.411	.0528	80.7	2.7	S.W.	15.04	8.3	10	0	0	....	0 0	0.00	28
SUNDAY........29	.....	17.2	— 6.6	23.8	......	......	......	......	......	....	....	S.W.	20.00	....	..	..	94	....	0.8	0.08	29..........SUNDAY
30	— 1.40	8.1	—16.7	24 8	29 9847	30.053	29 919	.134	.0343	82.7	— 5.8	S.W.	14.88	2.2	5	0	37	....	0.1	0.01	30
31	3.58	8.5	— 3.5	12.0	30.1310	30.198	30.053	.145	.0388	75.3	— 2.8	S.W.	8.29	2.2	10	0	95	....	....	....	31
Means........	14 24	24.46	5.55	18.91	30 0671	30.2690	29.8511	.4179	.0835	83.21	10 00	S. 46° W.	17 97	5.37	3.0	2.2	39.5	2.03	25.1	4.62	..............Sums.
25 Years means for and including this month	12.14	20.51	4.30	16.20	30.0562	......	......	.3285	.0737	82.07	....	....	s 16 74	6.26	.	..	¶35.23	0 84	29.88	3.67	25 Years means for and including this month.

ANALYSIS OF WIND RECORD.

Direction......	N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.	CALM.
Miles	711	891	190	1273	2578	6555	823	347	
Duration in hrs..	63	63	21	83	109	315	51	30	9
Mean velocity....	11.29	14.14	9.05	15.34	23.65	20.81	16.13	11.57	

Greatest mileage in one hour was 54, on the 27th.

Greatest velocity in gusts 60 miles per hour on the 27th.

Resultant mileage, 7440.
Resultant direction, S. 46° W.
Total mileage, 13,368.

* Barometer readings reduced to sea-level and temperature 32° Fahrenheit.

§ Observed.

† Pressure of vapour in inches of mercury.

‡ Humidity relative, saturation being 100.

¶ 18 years only. *s* 13 years only.

The greatest heat was 49°.0 on the 5th; the greatest cold was —19.°4 on the 10th, giving a range of temperature of 68.4 degrees.

Warmest day was the 5th. Coldest day was the 10th. Highest barometer reading was 30.777 on the 2nd. Lowest barometer was 29.219 on the 26th, giving a range of 1·558 inches. Maximum relative humidity was 99 on the 4th and 14th. Minimum relative humidity was 55 on the 24th.

Rain fell on 5 days.

Snow fell on 19 days.

Rain or snow fell on 21 days.

Lunar corona on 8 nights. Mock suns on the 27th.

Fog on 6 days.

RUARY, 1899.

l, 187 feet, C. H. McLEOD, *Superintendent.*

DAY	Sky Clouded in Tenths. Mean.	Max.	Min.	Per cent. possible Sunshine.	Rainfall in inches.	Snowfall in inches.	Rain and snow melted.	DAY.
	3.3	10	0	93	....	0.2	0.02	1
	0.3	2	0	82	....	0.8	0.08	2
	8.3	10	0	0	....	0.6	0.06	3
	3.3	10	0	49	....	0.2	0.02	4
SUNDAY.......	....	..	..	54	....	0.1	0.01	5..........SUNDAY
	2.0	10	0	75	....	....	....	6
	0.7	2	0	92	....	....	....	7
	10.0	10	10	0	....	2.4	0.24	8
	3.8	10	0	74	....	0.1	0.01	9
	4.5	8	0	0	....	....	....	10
	0.0	0	0	98	....	....	....	11
SUNDAY.......	....	..	..	87	....	....	....	12..........SUNDAY
	8.3	10	0	0	....	0.0	0.00	13
	3.2	10	0	87	....	0.0	0.00	14
	8.3	10	0	0	....	0.4	0.04	15
	4.7	10	2	82	....	....	....	16
	7.3	10	4	34	....	....	....	17
	10.0	10	10	0	0.02	...	0.02	18
SUNDAY.......	....	..	..	44	....	0.0	0.00	19..........SUNDAY
	8.8	10	5	13	0.01	1.6	0.17	20
	8.3	10	0	33	....	....	....	21
	10.0	10	10	0	0.23	2.5	0.66	22
	6.3	10	2	83	....	0.0	0.00	23
	0.2	1	0	100	....	....	....	24
	0.0	0	0	98	....	....	....	25
SUNDAY.......	....	..	..	0	0.03	0.0	0.03	26..........SUNDAY
	9.0	10	5	6	0.25	0.2	0.27	27
	5.7	10	0	73	....	....	....	28
Means...... ..	5.26	8.0	2.0	48.4	0.54	9.1	1.63	...............Sums.
25 Years mea[ns] for and includi[ng] this month	5.91	..	..	¶41.91	0.74	23.80	2.98	25 Years means for and including this month.

Direction.....
Miles ....
Duration in hr[s]
Mean velocity.

Greatest mi[...]
9th.

Greatest vel[...]
the 9th.

sea-level and

f mercury.
being 100.

the 27th ; the
lth, giving a
s.
[...]est day was
[...]as 30.573 on
[...]2[...]n the 22nd,
M[...]um rela-

tive humidity was 97 on the 7th, 8th, 9th and 22nd.
Minimum relative humidity was 51 on the 25th.

Rain fell on 5 days.

Snow fell on 16 days.

Rain or snow fell on 17 days.

Auroras were observed on 2 nights.

Lunar halo on 1 nignt.

Lunar coronas on 3 nights. Mock suns on the 9th.

Fog on 3 days.

ABSTRACT FOR THE MONTH OF FEBRUARY, 1899.

Meteorological Observations, McGill College Observatory, Montreal, Canada. Height above sea level, 187 feet, C. H. McLEOD, *Superintendent.*

DAY	THERMOMETER. Mean.	THERMOMETER. Max.	THERMOMETER. Min.	THERMOMETER. Range.	BAROMETER. Mean.	BAROMETER. §Max.	BAROMETER. §Min.	BAROMETER. Range.	†Mean pressure of vapor.	‡Mean relative humidity.	Dew Point.
1	4.88	11.4	— 3.7	15.1	30.1520	30.248	30.059	.189	.0417	77.0	— 1.2
2	12.20	16.4	6.6	9.8	30.1955	30.240	30.130	.110	.0573	76.5	6.0
3	7.18	15.3	— 1.2	16.5	30.0298	30.240	29.876	.364	.0550	90 2	4.8
4	11.37	16.7	6.9	9.8	30.0262	30.165	29.876	.289	.0615	85.0	7.5
SUNDAY........ 5	.....	19.5	6.0	13.5	......	......	......	......	......	....	....
6	8.43	16.1	4.1	12.0	30.1347	30.199	30.056	.143	.0478	74.5	2.3
7	3.22	8.9	— 2.7	11.6	30.0455	30.100	29 977	.123	.0422	84 7	— 0.7
8	3.57	7.5	— 0.5	8.0	29.6310	29.977	29 463	.514	.0485	94.7	2.3
9	0.63	4.5	— 2.0	6.5	29.6273	29.815	29.493	.322	.0380	86.2	— 3.0
10	— 6.50	— 2.0	—11.3	9.3	30.1027	30.287	29.815	.472	.0287	88.7	— 9.2
11	— 7.68	— 2.8	—13.1	10.3	30 4805	30.540	30.287	.253	.0258	85.8	—11.0
SUNDAY........12	.....	1.6	—11.7	13.3	......	......	......	......	......	.....	....
13	1.88	8.1	— 3.7	11.8	30.0170	30.333	29.617	.716	.0360	75 8	— 4.2
14	10.05	14.1	7.8	6.3	29.9460	30.274	29.617	.657	.0458	67.0	1.2
15	15.80	24.6	3.0	21.6	30.2612	30.363	30.126	.237	.0718	77.8	10.2
16	31.33	36.6	24 6	12.0	30.1052	30.210	29.948	.262	.1248	71.3	23.0
17	33.17	39.2	24.7	14.5	29.8103	29.948	29.759	.189	.1390	73.3	25.5
18	37.10	40.5	35.2	5.3	29.7292	29.819	29.579	.240	.1898	85.8	33.3
SUNDAY........19	.....	38.5	26.5	12.0	......	......	......	......	......	....	....
20	34.88	39.5	26.0	13.5	29.4428	29.520	29 389	.131	.1762	86 8	31.3
21	34.30	36.8	32.2	4.6	29.6853	29.740	29.520	.220	.1482	74 5	27.0
22	33.80	39.1	29.8	9.3	29.3952	29.673	29.274	.399	.1700	87.3	30.3
23	25.12	31.6	14.3	17.3	29.6778	29.884	29.467	.417	.1057	76.8	19.0
24	12.63	18.2	6.8	11.4	30.1878	30.370	29.884	.486	.0550	71.0	4.8
25	15.77	21.8	8.6	13.2	30.5230	30.573	30.370	.203	.0582	64.2	5.7
SUNDAY........26	.....	33.6	10.0	23.6	......	......	......	......	......	...	....
27	34.77	41.0	29.3	11.7	29.6803	29.791	29 595	.196	.1613	79.0	28.8
28	29.17	36.2	19.0	17.2	29.7605	29.998	29.497	.501	.1202	73.7	22.0
Means..........	16.13	21.88	9.70	12.18	29.9436	30.0961	29.7781	.3180	.0854	79'48	10.65
25 Years means for and including this month	15.66	23.64	7.40	16.24	30.0269	......	......	.309	.0838	80.25	....

WIND. General direction.	WIND. Mean velocity in miles per hour	SKY CLOUDED IN TENTHS. Mean.	SKY CLOUDED IN TENTHS. Max.	SKY CLOUDED IN TENTHS. Min.	Per cent. possible Sunshine.	Rainfall in inches.	Snowfall in inches.	Rain and snow melted.	DAY.
S.W.	17.63	3.3	10	0	93	....	0.2	0.02	1
S.	15.58	0.3	2	0	82	....	0.8	0.08	2
N.	10.08	8.3	10	0	0	....	0.6	0.06	3
N.	10.84	3.3	10	0	49	....	0.2	0.02	4
S.	13.88	....	..	..	54	....	0.1	0.01	5............SUNDAY
S.W.	11.00	2.0	10	0	75	....	....	....	6
N.	7.75	0.7	2	0	92	....	....	....	7
N.W.	22.08	10.0	10	10	0	....	2.4	0.24	8
S.W.	31.96	3.8	10	0	74	....	0.1	0.01	9
S.W.	32.21	4.5	8	0	0	....	....	....	10
S.W.	23.75	0.0	0	0	98	....	....	....	11
W.	11.08	....	..	..	87	....	....	....	12............SUNDAY
W.	7.21	8.3	10	0	0	....	0.0	0.00	13
S.W.	24.46	3.2	10	0	87	....	0.0	0.00	14
S.W.	18.21	8.3	10	0	0	....	0.4	0.04	15
S.	19.08	4.7	10	2	82	....	....	....	16
S.W.	15.00	7.3	10	4	34	....	....	....	17
S.W.	15.25	10.0	10	10	0	0.02	...	0.02	18
S.W.	20.92	....	..	..	44	....	0.0	0.00	19............SUNDAY
S.W.	21.71	8.8	10	5	13	0.01	1.6	0.17	20
W.	11 38	8.3	10	0	33	....	....	....	21
S.W.	19.88	10.0	10	10	0	0.23	2.5	0.66	22
S.W.	24.67	6.3	10	2	83	....	0.0	0.00	23
S.W.	34.13	0.2	1	0	100	....	....	....	24
W.	13.54	0.0	0	0	98	....	....	....	25
S.E.	19.04	....	..	..	0	0.03	0.0	0.03	26........... SUNDAY
S.	25.13	9.0	10	5	6	0.25	0.2	0.27	27
S.E.	22.13	5.7	10	0	73	....	....	....	28
S. 45½° W.	18.56	5.26	8.0	2.0	48.4	0.54	9.1	1.63	...............Sums.
....	s 18.17	5.91	..	..	¶41.91	0 74	23.80	2.98	25 Years means for and including this month.

ANALYSIS OF WIND RECORD.

Direction........	N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.	CALM.
Miles	654	205	61	794	1636	7272	1000	847	
Duration in hrs..	56	16	13	41	91	319	82	52	2
Mean velocity....	11.68	12.81	4.69	19.37	17 98	22.79	12.22	16.29	

Greatest mileage in one hour was 44, on the 9th.

Greatest velocity in gusts 48 miles per hour on the 9th.

Resultant mileage, 8450

Resultant direction, S. 45½° W.

Total mileage, 12,469.

Average velocity, 18.56 m.p.h.

* Barometer readings reduced to sea-level and temperature 32° Fahrenheit.

§ Observed.

† Pressure of vapour in inches of mercury.

‡ Humidity relative, saturation being 100.

¶ 18 years only. s 13 years only.

The greatest heat was 41°.0 on the 27th; the greatest cold was —13.°1 on the 11th, giving a range of temperature of 54.1 degrees.

Warmest day was the 18th. Coldest day was the 11th. Highest barometer reading was 30.573 on the 25th. Lowest barometer was 29.274 on the 22nd, giving a range of 1.299 inches. Maximum relative humidity was 97 on the 7th, 8th, 9th and 22nd. Minimum relative humidity was 51 on the 25th.

Rain fell on 5 days.

Snow fell on 16 days.

Rain or snow fell on 17 days.

Auroras were observed on 2 nights.

Lunar halo on 1 night.

Lunar coronas on 3 nights. Mock suns on the 9th.

Fog on 3 days.

ABSTRACT FOR THE MONTH OF MARCH, 1899.

Meteorological Observations, McGill College Observatory, Montreal, Canada. Height above sea level, 187 feet, C. H. McLEOD, *Superintendent.*

DAY	THERMOMETER. Mean.	THERMOMETER. Max.	THERMOMETER. Min.	THERMOMETER. Range.	BAROMETER. Mean.	BAROMETER. §Max.	BAROMETER. §Min.	BAROMETER. Range.	†Mean pressure of vapor.	‡Mean relative humidity.	Dew Point.	WIND. General direction.	WIND. Mean velocity in miles per hour	SKY CLOUDED IN TENTHS. Mean.	SKY CLOUDED IN TENTHS. Max.	SKY CLOUDED IN TENTHS. Min.	Per cent. possible Sunshine.	Rainfall in inches.	Snowfall in inches.	Rain and snow melted.	DAY.
1	25.47	37.0	20.7	16.3	29.9212	30.090	29.497	.593	.0973	68.8	16.8	S. W.	23.46	4.2	10	0	99	....	0.0	0.00	1
2	24.88	30.8	16.8	14.0	30.1153	30.148	30.082	.066	.1100	80.3	20 0	N.E.	9.29	5.8	10	0	57	....	0.0	0 00	2
3	29.47	35.1	24.7	10.4	30.1102	30.153	30.074	.079	.1442	88 2	26.5	N.E.	6 88	8.3	10	0	24	....	....	....	3
4	33.75	36.3	30.3	6.0	30 0312	30.091	29.964	.127	.1838	94.8	32.5	E.	11.13	10.0	10	10	0	0.17	0.9	0.29	4
SUNDAY........ 5	.....	42.5	27.8	14.7	......	......	......	......	......	....	....	S.W.	20.42	....	..	..	0	0.45	1.0	0.65	5............SUNDAY
6	23.78	31.1	17.6	13.5	29.9973	30.137	29 726	.411	.0957	74 3	17.2	S W.	22.00	0 0	0	0	98	....	...	...	6
7	18.10	24.5	16.7	7.8	29.9298	30.137	29 815	.322	.0868	87.8	15.2	N.	36.88	8.3	10	0	0	....	3.0	0.30	7
8	17.92	21.0	15.5	5.5	30.0513	30.211	29.815	.396	.0757	77.8	12.0	W.	27.13	2.8	10	0	73	....	0.2	0.02	8
9	16.28	21.5	10.4	11.1	30.1673	30.222	30.094	.128	.0805	87.7	13.7	N.E.	4.50	5.0	10	0	0	....	0.6	0 06	9
10	20.53	26.1	10.2	15.9	30.3708	30.451	30.189	.262	.0920	83.2	16.2	N.E.	6.63	6.3	10	0	53	..	....	....	10
11	32.02	38.1	22.4	15.7	29 9568	30.333	29.815	.518	.1627	88.7	29.0	S.E.	17.88	10.0	10	10	0	0.03	0.5	0.11	11
SUNDAY........12	.....	37.7	31.5	3.8	......	......	......	......	......	....	....	N.W.	14.46	....	..	..	0	0.28	....	0.28	12............SUNDAY
13	23.65	31.7	18.7	13.0	30 1977	30.442	29.812	.630	.0947	73 0	16.5	N.W.	13.92	8.3	10	4	59	....	0.0	0.00	13
14	19.28	23.2	16.6	6.6	30.5355	30.583	30.442	.141	.0797	76.2	13.3	N.	10.17	4.0	10	0	53	....	...	....	14
15	25.05	32.5	11 6	20.9	29.9712	30.538	29.543	.995	.1260	89.8	21 5	N.E.	20.33	9.7	10	8	0	....	8.5	1.70	15
16	20.37	32.5	6.0	26.2	29.9638	30.283	29.528	.755	.0945	77 0	14.3	W	22.88	3.8	10	0	71	....	1.5	0.15	16
17	1.45	6.8	— 5.0	11.8	30.3838	30.456	30.283	.173	.0357	77.7	— 4.3	N.W.	9.17	0 0	0	0	96	....	....		17
18	6.65	14.8	— 5.0	19.8	29.9412	30.318	29.631	.687	.0540	87.7	3.8	N.	18 00	8.3	10	0	5	....	3.2	0.32	18
SUNDAY........19	.....	27.5	11.9	15.6	......	......	......	......	......	....	....	N.	10.38	....	..	..	0	0.32	6.2	0.94	19............SUNDAY
20	17.28	24.9	12.7	12.2	29.5650	30.007	29 085	.922	.0765	79.2	12.0	S.E.	14.79	7.2	10	4	42	....	1.0	0.10	20
21	11.60	16.3	3.3	13.0	30.3325	30.415	30.007	.408	.0507	68 5	3.2	S.	11 21	4.0	10	0	86	....	....	....	21
22	22.02	30.8	11.1	19.7	30.1493	30.286	30 025	.261	.1130	91.8	20.0	N.	11.38	8.3	10	0	0	....	1 5	0.15	22
23	28.02	33.2	23.5	9.7	29.7390	30.025	29.676	.349	.1335	86.7	24 5	S.W.	18.04	8.8	10	3	0	0.09	7.1	1.18	23
24	20.52	24.0	15.5	8.5	29.8447	29 919	29.713	.206	.0922	83.7	16.3	S.	14.75	9 2	10	7	31	....	0.3	0 03	24
25	20.77	26.2	7.8	18.4	29.8747	29.953	29.781	.172	.0880	79.3	15.5	S.E.	12.13	2.0	10	0	91	....	..	....	25
SUNDAY........26	.....	29.7	10.6	19.1	......	......	......	......	......	....	....	W.	12.50	....	..	..	74	....	0.0	0.00	26.......... SUNDAY
27	27.70	33.5	22.9	10.6	30.1825	30.218	30 099	.119	.1167	77.0	21.5	S.	3.29	6.3	10	0	19	0.29	0.0	0.29	27
28	29.85	37.7	21.3	16.4	29 8347	30.184	29.372	.812	.1433	84.5	26.2	N.	3.67	6.7	10	0	0	0.60	8.2	1.96	28
29	28.73	34.6	23.8	10.8	29.1305	29.372	28.998	.374	.1465	91.0	26.7	E.	24.83	8.7	10	3	0	....	....	....	29
30	25.92	31.6	20.2	11.4	29.6062	29.747	29.312	.435	.1122	79.2	25.0	W.	33.00	2.8	10	0	88	....	....	....	30
31	27.13	32.4	19.7	12.7	29.7083	29.747	29.688	.059	.1097	73.5	20.2	W.	20 42	2 5	10	0	96	....	....	....	31
Means......	22.16	29.20	15.86	13.34	29.9856	30.1654	29.7802	.3852	.1035	81.76	17 64	N. 75¾ W.	15.66	5.97	9.3	1.8	39.2	2.23	43.7	8.53	...............Sums.
25 Years means for and including this month	15.66	31.64	17.10	14.55	29.9762	......	......	.270	.1105	76.64	....	....	s 17.66	5.90	..	..	¶46 87	1 14	23.49	3.58	25 Years means for and including this month.

ANALYSIS OF WIND RECORD.

Direction.......	N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.	CALM.
Miles	2103	1263	634	1455	491	2470	2241	995	
Duration in hrs..	157	101	49	102	58	107	102	51	17
Mean velocity....	13.39	12.50	12.94	14.26	8.64	23.08	21.97	19.51	

Greatest mileage in one hour was 51, on the 6th.

Greatest velocity in gusts 66 miles per hour on the 6th.

Resultant mileage, 2215
Resultant direction, N. 75¾° W.
Total mileage, 11,652.
Average velocity, 15.66 m.p.h.

* Barometer readings reduced to sea-level and temperature 32° Fahrenheit.

§ Observed.

† Pressure of vapour in inches of mercury.

‡ Humidity relative, saturation being 100.

¶ 18 years only. s 13 years only.

The greatest heat was 42°.5 on the 5th; the greatest cold was —5.°0 on the 17th & 18th, giving a range of temperature of 47.5 degrees.

Warmest day was the 5th. Coldest day was the 17th. Highest barometer reading was 30.583 on the 14th. Lowest barometer was 28.998 on the 29th, giving a range of 1.585 inches. Maximum relative humidity was 99 on the 15th and 19th. Minimum relative humidity was 52 on the 1st and 16th.

Rain fell on 8 days.
Snow fell on 20 days.
Rain or snow fell on 21 days.
Auroras were observed on 1 night.
Lunar halo on 3 nights.
Lunar coronas on 4 nights.
Fog on 7 days.

ABSTRACT FOR THE MONTH OF APRIL, 1899.

Meteorological Observations, McGill College Observatory, Montreal, Canada. Height above sea level, 187 feet, C. H. McLEOD, *Superintendent.*

DAY	THERMOMETER. Mean.	Max.	Min.	Range.	*BAROMETER. Mean.	§Max.	§Min.	Range.
1	29.33	35.2	25.0	10.2	29.7230	29.786	29.677	.109
SUNDAY........ 2	.....	35.9	22.2	13.7	......	......	......	......
3	33.35	38.6	27.0	11.6	30.0008	30.085	29.907	.178
4	30.28	35.3	26.0	9.3	30.1502	30.187	30.085	.102
5	30.12	36.6	21.5	15.1	30.3337	30.379	30.187	.192
6	32.98	40.8	23.1	17.7	30.3385	30.409	30.244	.165
7	35.80	42.6	29.8	12.8	30.0713	30.244	29.931	.313
8	34.38	36.6	32.6	4.0	29.5523	29 931	29.479	.452
SUNDAY........ 9	.....	35.6	31.0	4.6	......	......	......	......
10	31.62	36.6	26.5	10 1	30.0603	30.192	29 922	.270
11	36.23	42.2	26.4	15.8	30 2248	30.324	30.124	.200
12	36.02	39.2	32.5	6.7	29.8622	30.124	29.758	.366
13	41.98	47.7	32.4	15.3	29 8932	29.938	29.774	.164
14	44.08	52.6	36.3	16.3	29.7588	29 919	29.624	.295
15	41.83	46.8	36 3	10.5	29.8985	29.930	29.853	.077
SUNDAY........16	.....	46.7	33.7	13.0	......	......	......	......
17	42.28	48.7	32.9	15.8	29.9950	30.082	29.906	.176
18	46.65	56.2	36.1	20.1	30.1183	30.156	30.080	.076
19	47.47	56.3	34.2	22.1	30.0460	30 080	30.008	.072
20	51.28	57.8	45.3	12.5	30.0877	30.099	30.050	049
21	44.40	53.5	35.9	17.0	30.2285	30 270	30 090	.180
22	50.90	60.4	37.2	23.2	30.2032	30.260	30.163	.097
SUNDAY........23	.....	60.5	43.9	16.6	......	......	......	......
24	49.58	60.3	37.5	22.8	30.1282	30.243	29 998	.245
25	54.68	69.2	42.9	26.3	29.9557	30.015	29.908	.107
26	50.80	59.2	44.6	14.6	30.0153	30.078	29.940	.138
27	51.98	65.7	36.0	29.7	30.1402	30.196	30.078	.118
28	59.65	71.4	47.8	23.6	30 0740	30.146	29.997	.149
29	63.60	75.7	52 5	23.2	30.0700	30.120	30.021	.099
SUNDAY........30	.....	82.0	58.7	23.3	......	......	......	......
Means..........	42.85	50.86	34.93	15 94	30.0372	30.1277	29.9522	.1756
25 Years means for and including this month	40.35	48.88	32.56	16.32	29.9634	......	......	.2012

†Mean pressure of vapor.	‡Mean relative humidity.	Dew Point.	WIND. General direction.	Mean velocity in miles per hour	SKY CLOUDED IN TENTHS. Mean.	Max.	Min.	Per cent. possible Sunshine.	Rainfall in inches.	Snowfall in inches.	Rain and snow melted.	DAY.
.1222	74 8	22.7	S.W.	27.71	8.0	10	4	57	....	0.00	0.00	1
......	....	....	S.W.	25.58	...	..	..	13	....	...	....	2..........SUNDAY
.1493	78.3	27.2	S.W.	18.67	4.7	10	0	91	....	....	...	3
.1105	65.3	20 3	N.W.	13.58	0.0	0	0	96	....	....	....	4
.1122	66 5	20.5	N.	11.67	0 0	0	0	96	....	....	....	5
.1363	72.7	25.0	S.	8.12	2.0	10	0	80	....	....	..	6
.1573	74.3	28.5	S.E.	8.71	9.2	10	5	20	0.04	....	0.04	7
.1915	96.3	33.3	N.	11.42	10.0	10	10	00	0.83	1.2	1.02	8
......	....	....	S.W.	21.29	....	..	..	00	0.12	0.7	0.19	9..........SUNDAY
.1242	70 5	23.0	S.W.	16.58	0.0	0	0	95	....	..	....	10
.1243	58.8	23.0	S.	8.58	1.3	5	0	94	..	....	....	11
.1705	80.8	30.3	S.E.	12.29	10.0	10	10	00	0.12	....	0.12	12
.2040	76.7	35.2	S.W.	17.00	5.7	10	0	47	0.01	....	0.01	13
.2293	79.5	37.8	S.W.	18.08	7.0	10	0	30	0.11	....	0.11	14
.1552	61.2	28.2	W.	20.04	1.2	7	0	97	....	....	....	15
......	....	....	N.W.	14.04	....	..	..	87	....	....	....	16..........SUNDAY
.1378	52.2	25.5	S.W.	16 58	1.5	5	0	92	....	....	....	17
.1680	53 0	29.8	N.E.	7.58	1.0	5	0	88	....	....	....	18
.2227	66.0	36.8	N.	11.96	4.2	10	0	63	0 00	....	0.00	19
.2617	69.7	41.3	S.	16.25	7.8	10	2	69	0 05	....	0 05	20
.2458	83 7	39.5	N.	10.04	6.0	10	0	19	0.05	....	0 05	21
.2873	77 0	43 5	S.	9.12	3 2	7	0	41	0.00	....	0.00	22
......	...	....	N.W.	10 54	....	--	..	98	...	....	...	23.......... SUNDAY
.2392	65.7	38.3	N.W.	8.29	0.2	1	0	98	....	....	....	24
.3445	79.2	48.2	N.	9.67	7.8	10	2	41	0.02	....	0 02	25
.3083	81.8	45.3	N.W.	9.50	2 8	10	0	72	0.02	....	0.02	26
.2528	64.0	39.7	N.	8.21	0.0	0	0	97	....	....	....	27
.3023	60.3	45.0	S.E.	15.21	1.8	7	0	88	....	....	.. .	28
.3472	58.3	48.5	S.	13.12	4 5	10	0	57	....	...	....	29
......	...	....	S.W.	10 87	...	..	..	64	0.00	.. .	0 00	30..........SUNDAY
.2042	70.67	33 46	S. 45¼° W.	13 63	4.00	7.1	1.3	63.0	1.37	1.9	1.63	..............Sums.
.1742	67.12	....	....	s 16.24	5.67	..	..	¶52.16	1 63	5.48	2.19	25 Years means for and including this month.

ANALYSIS OF WIND RECORD.

Direction......	N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.	CALM.
Miles	1439	153	353	687	1760	3927	964	450	
Duration in hrs..	141	22	33	46	151	222	63	37	5
Mean velocity....	10.21	6.95	10.70	14.93	11 66	17.69	15.30	12.16	

Greatest mileage in one hour was 35, on the 14th.

Greatest velocity in gusts 36 miles per hour on the 14th.

Resultant mileage, 4435
Resultant direction, S. 45¼° W.
Total mileage, 9,733.
Average velocity, 13.68 m.p.h.

* Barometer readings reduced to sea-level and temperature 32° Fahrenheit.

§ Observed.

† Pressure of vapour in inches of mercury.

‡ Humidity relative, saturation being 100.

¶ 18 years only. s 13 years only.

The greatest heat was 82°.0 on the 30th; the greatest cold was 21.°5 on the 5th, giving a range of temperature of 60.5 degrees.

Warmest day was the 30th. Coldest day was the 2nd. Highest barometer reading was 30.409 on the 6th. Lowest barometer was 29.479 on the 8th, giving a range of .930 inches. Maximum relative humidity was 98 on the 8th. Minimum relative humidity was 41 on the 11th, 18th and 28th.

Rain fell on 13 days.
Snow fell on 3 days.
Rain or snow fell on 14 days.
Lunar halo on 1 night.
Lunar coronas on 4 nights.
Fog on 6 days.
Thunder on 30th.

[M]AY, 1899.

[…], 187 feet, C. H. McLEOD, *Superintendent.*

DAY	Sky Clouded in Tenths. Mean.	Max.	Min.	Per cent. possible Sunshine.	Rainfall in inches.	Snowfall in inches.	Rain and snow melted.	DAY.
	8.7	10	5	13	0.02	...	0.02	1
	6.7	10	0	46	0.06	...	0.06	2
	1.8	10	0	95	0.00	....	0.00	3
	0.0	0	0	98	....	....	....	4
	2.0	10	0	98	....	....	....	5
	4.5	9	0	35	....	....	....	6
SUNDAY........	....	..	..	97	....	....	....	7 ....SUNDAY
	2.3	6	0	98	....	....	...	8
	0 0	0	0	96	....	...	....	9
	0.2	1	0	98	....	....	....	10
	5.8	10	0	37	0.35	..	0.35	11
	1.3	5	0	98	....	....	....	12
	6.0	10	0	46	0.12	....	0.12	13
SUNDAY........	....	..	..	98	...	....	....	14..........SUNDAY
	3.0	10	0	80	....	....	....	15
	4.0	10	0	54	....	....	....	16
	1.7	8	0	100	....	....	....	17
	10.0	10	10	00	0.06	....	0.06	18
	10.0	10	10	05	0.01	....	0.01	19
	10.0	10	10	03	0.05	....	0.05	20
SUNDAY.......	....	..	..	31	....	....	....	21.......... SUNDAY
	8 7	10	3	00	....	....	....	22
	4.3	10	0	86	....	....	.. .	23
	0.0	0	0	96	....	....	....	24
	2 5	10	0	93	....	....	....	25
	6.2	10	0	74	0.02	....	0 02	26
	10.0	10	10	00	0.57	....	0.57	27
SUNDAY.......	....	-	..	64	0.01	....	0.01	28..........SUNDAY
	6 8	10	0	18	0.22	....	0.22	29
	7.2	10	0	37	0.10	....	0.10	30
	3.0	10	0	98	0.00	..	0.00	31
Means...... ...	4.69	8.11	1.77	61.03	1.59	....	1.59	................Sums.
25 Years mean[s] for and includin[g] this month	6.10	..	..	¶50 87	2.91	....	2.96	25 Years means for and including this month.

Direction.....	
Miles	
Duration in hr[s]	
Mean velocity.	

sea-level and

[o]f mercury.

[b]eing 100.

the 31st; the

[g]iving a range

Greatest m[…]dest day was

30th. […] was 30.264 on

Resultant […]11 on the 11th,

Resultant [m]aximum rela-

tive humidity was 99 on the 27th. Minimum relative humidity was 31 on the 24th.

Rain fell on 14 days.

Auroras were observed on 3 nights.

Lunar corona on the 21st.

Thunderstorm on the 2nd.

Lightning on the 27th.

ABSTRACT FOR THE MONTH OF MAY, 1899.

Meteorological Observations, McGill College Observatory, Montreal, Canada. Height above sea level, 187 feet, C. H. McLEOD, *Superintendent.*

DAY	THERMOMETER.				*BAROMETER.				†Mean pressure of vapor.	‡Mean relative humidity.	Dew Point.	*a* WIND.		SKY CLOUDED IN TENTHS.			Per cent. possible Sunshine.	Rainfall in inches.	Snowfall in inches.	Rain and snow melted.	DAY.
	Mean.	Max.	Min.	Range.	Mean.	§Max.	§Min.	Range.				General direction.	Mean velocity in miles per hour	Mean.	Max.	Min.					
1	57.15	65.0	50.4	14.6	29.9572	29.997	29.929	.068	.3955	84.0	52.3	N.W.	12.21	8.7	10	5	13	0.02	...	0.02	1
2	53.73	69.3	45.4	23.9	29.8855	29.961	29.826	.135	.3327	81.0	47.2	N.	13.92	6.7	10	0	46	0.06	...	0.06	2
3	48.17	56.8	41.9	14.9	30.2167	30.263	29.961	.302	.2015	60.5	34.5	N.	22.75	1.8	10	0	95	0.00	....	0.00	3
4	49.02	61.3	36.0	25.3	30.2157	30.306	30.123	.183	.1625	45.8	29.0	N.	10.92	0.0	0	0	98	....	....	....	4
5	53.05	64.6	39.0	25.6	30.1845	30.253	30.136	.117	.2232	55.5	37.0	N.	9.42	2.0	10	0	98	....	....	....	5
6	58.55	69.5	43.7	25.8	30.0868	30.213	29.981	.232	.2717	56.0	42.3	S.W.	13.29	4.5	9	0	35	....	....	....	6
SUNDAY........ 7	.....	67.4	51.5	15.9	......	......	......	......	......	....	....	S.W.	11.50	....	..	..	97	....	....	....	7 ....SUNDAY
8	58.23	69.9	44.2	25.7	29.8327	29.983	29.731	.252	.2378	60.5	44.0	N.	7.46	2.3	6	0	98	....	....	...	8
9	54.88	65.3	47.1	18.2	29.9073	29.987	29.755	.232	.2380	55.5	38.8	N.W.	15.29	0.0	0	0	96	....	...	....	9
10	58.30	69.8	46.1	23.7	30.0203	30.099	29.949	.150	.2775	55.5	41.8	S.	10.21	0.2	1	0	93	....	....	....	10
11	56.37	70.3	48.5	21.8	29.7362	29.949	29.611	.338	.3387	75.3	47.7	S.W.	18.42	5.8	10	0	37	0.35	..	0.35	11
12	60.33	69.7	47.1	22.6	29.8348	29.870	29.765	.105	.3477	67.3	49.2	S.W.	13.25	1.3	5	0	98	....	....	....	12
13	59.15	71.2	49.5	21.7	29.7998	29.501	29.696	.205	.3535	70.5	49.0	S.E.	18.96	6.0	10	0	46	0.12	....	0.12	13
SUNDAY........14	.....	57.4	41.8	15.6	......	......	......	......	......	....	....	S.W.	21.58	....	..	..	98	...	....	....	14..........SUNDAY
15	49.40	58.2	41.1	17.1	30.0858	30.160	30.026	.134	.1995	55.8	34.0	S.W.	10.92	3.0	10	0	80	....	....	....	15
16	50.30	59.5	40.2	19.3	29.9787	30.095	29.885	.210	.2270	61.7	37.2	S.W.	10.92	4.0	10	0	54	....	....	....	16
17	51.18	61.5	38.4	23.1	30.0575	30.132	29.958	.174	.2555	67.0	40.3	N.	12.33	1.7	8	0	100	....	....	....	17
18	50.27	55.4	45.2	10.2	29.9613	30.132	29.892	.240	.3002	82.7	44.7	S.E.	15.75	10.0	10	10	00	0.06	....	0.06	18
19	50.50	54.5	46.9	7.6	29.8748	29.893	29.857	.036	.3240	88.5	47.2	W.	3.87	10.0	10	10	05	0.01	....	0.01	19
20	49.67	56.0	47.0	9.0	29.8670	29.928	29.836	.092	.3232	91.0	47.2	S.E.	10.04	10.0	10	10	03	0.05	....	0.05	20
SUNDAY....... 21	.....	61.8	46.0	15.8	......	......	......	......	......	....	....	S.E.	9.37	....	..	..	31	....	....	....	21.......... SUNDAY
22	53.50	60.4	45.3	15.1	30.1482	30.171	30.124	.047	.2918	71.0	44.2	S.E.	6.21	8.7	10	3	00	....	....	....	22
23	62.70	72.3	51.8	20.5	30.1940	30.236	30.161	.075	.3155	55.5	46.0	N.W.	7.29	4.3	10	0	86	....	....	....	23
24	64.75	76.9	51.1	25.8	30.1782	30.264	30.106	.158	.3403	58.0	43.0	W.	7.54	0.0	0	0	96	....	....	....	24
25	66.43	76.6	56.8	19.8	30.0372	30.157	30.000	.157	.3105	48.2	45.8	N.W.	22.71	2.5	10	0	93	....	....	....	25
26	66.67	77.3	59.2	18.1	29.9623	30.029	29.864	.165	.4373	67.3	55.0	N.W.	23.04	6.2	10	0	74	0.02	....	0.02	26
27	53.92	63.7	48.0	15.7	29.8592	29.868	29.847	.021	.3733	89.5	50.7	N.E.	21.54	10.0	10	10	00	0.57	....	0.57	27
SUNDAY........28	.....	64.7	47.3	17.4	......	......	......	......	......	...	....	N.E.	16.08	....	..	.	64	0.01	....	0.01	28 ....SUNDAY
29	59.33	70.2	55.1	15.1	29.9313	30.039	29.810	.229	.4442	87.5	55.7	N.E.	5.62	6.8	10	0	18	0.22	....	0.22	29
30	63.75	70.7	56.6	14.1	29.7252	29.810	29.670	.140	.4730	85.3	57.3	W.	23.50	7.2	10	0	37	0.10	....	0.10	30
31	67.73	78.4	56.2	22.2	29.6188	29.896	29.720	.176	.4545	68.2	56.3	N.W.	11.71	3.0	10	0	98	0.00	..	0.00	31
Means...........	56.58	65.99	47.24	18.75	29.9706	30.0590	29.8970	.1620	.3241	68.13	45.27	N. 64¼° W.	13.47	4.69	8.11	1.77	61.03	1.59	...	1.59	..............Sums.
25 Years means for and including this month......	54.79	64.10	45.89	18.20	29.9330	......	......	.168	.2916	66.38	....	....	§ 14.19	6.10	.	..	¶50.87	2.91	....	2.96	25 Years means for and including this month.

a ANALYSIS OF WIND RECORD.

Direction......	N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.	CALM.
Miles	1832	935	81	1367	692	1543	1608	1965	
Duration in hrs..	144	72	8	110	50	104	123	121	12
Mean velocity....	12.72	12.99	10.12	12.43	13.84	14.84	13.07	16.24	

Greatest mileage in one hour was 36, on the 30th.

Resultant mileage, 2030

Resultant direction, N. 64¼° W.

Total mileage, 10,023.

a wind records from the 18th to the 31st are from the City Hall.

* Barometer readings reduced to sea-level and temperature 32° Fahrenheit.

§ Observed.

† Pressure of vapour in inches of mercury.

‡ Humidity relative, saturation being 100.

¶ 18 years only. § 13 years only.

The greatest heat was 78°.4 on the 31st; the greatest cold was 36.°0 on the 4th, giving a range of temperature of 42.4 degrees.

Warmest day was the 31st. Coldest day was the 3rd. Highest barometer reading was 30.264 on the 24th. Lowest barometer was 29.611 on the 11th, giving a range of 0.653 inches. Maximum relative humidity was 99 on the 27th. Minimum relative humidity was 31 on the 24th.

Rain fell on 14 days.

Auroras were observed on 3 nights.

Lunar corona on the 21st.

Thunderstorm on the 2nd.

Lightning on the 27th.

NE, 1899.

M, 187 feet, C. H. McLEOD, *Superintendent.*

DAY	Sky Clouded in Tenths. Mean.	Max.	Min.	Per cent. possible Sunshine.	Rainfall in inches.	Snowfall in inches.	Rain and snow melted.	DAY.
1	7.0	10	0	68	0.00	...	0.00	1
2	6.2	10	0	47	....	...	....	2
3	4.7	10	0	52	....	....	....	3
SUNDAY........ 4	....	..	..	1	0.01	....	0.01	4 ....SUNDAY
5	6.7	10	0	73	0.82	....	0.82	5
6	4.5	10	0	77	....	....	....	6
7	7.8	10	5	37	0.00	....	0.00	7
8	3.8	10	0	74	0.07	....	0.07	8
9	3.5	7	0	85	....	....	....	9
1	1.7	4	0	94	....	...	....	10
SUNDAY........1	....	..	..	100	....	....	....	11..........SUNDAY
1	4.0	10	0	57	0.01	....	0.01	12
1	2 0	7	0	89	....	....	....	13
1	8.8	10	7	42	0.00	....	0.00	14
1	10.0	10	10	0	0.28	....	0.28	15
1	8.2	10	0	3	0.29	....	0.29	16
1	1.5	7	0	87	0.02	....	0.02	17
SUNDAY........1	....	..	..	89	....	....	....	18......... .SUNDAY
1	3.7	9	0	81	0.05	....	0.05	19
2	7.0	10	0	50	0.53	....	0.53	20
2	4.7	9	0	62	0.11	....	0.11	21
2	5.0	10	0	46	....	....	....	22
2	7.7	10	0	50	0.02	....	0.02	23
2	2.8	8	0	93	...	....	....	24
SUNDAY........2	....	..	..	91	0.00	....	0.00	25..........SUNDAY
2	1.5	4	0	92	....	....	....	26
2	5.7	10	1	74	....	....	....	27
2	7.2	10	0	03	0.25	....	0.25	28
2	3.7	9	0	96	....	....	.. .	29
3	0.3	3	0	99	....	....	....	30
Means...... ...	4.99	8.73	0.88	63.73	2.46	....	2.46	................Sums.
25 Years mean for and including this month	5.59	..	..	¶53.85	3.558	....	3.558	25 Years means for and including this month.

Direction......	
Miles	
Duration in hrs	
Mean velocity.	

sea-level and

f mercury.
eing 100.

the 5th ; the
iving a range

Greatest m dest day was
8th. was 30.227 on
Resultant 1 on the 20th,
Resultant dire ximum rela-

tive humidity was 99 on the 8th. Minimum relative humidity was 30 on the 29th.

Rain fell on 16 days.

Auroras were observed on 2 nights.

Lunar coronas on the 16th, 18th and 24th.

Fog on 1 day.

Thunderstorms on the 5th, 20th and 23rd.

ABSTRACT FOR THE MONTH OF JUNE, 1899.

Meteorological Observations, McGill College Observatory, Montreal, Canada. Height above sea level, 187 feet, C. H. McLEOD, *Superintendent.*

DAY	THERMOMETER.				*BAROMETER.				†Mean pressure of vapor.	‡Mean relative humidity.	Dew Point.	*a* WIND.		SKY CLOUDED IN TENTHS.			Per cent. possible Sunshine.	Rainfall in inches.	Snowfall in inches.	Rain and snow melted.	DAY.
	Mean.	Max.	Min.	Range.	Mean.	§Max.	§Min.	Range.				General direction.	Mean velocity in miles per hour	Mean.	Max.	Min.					
1	72.60	81.0	63.0	18.0	29.6917	29.727	29.657	.070	.5783	73.0	63.2	W.	17.62	7 0	10	0	68	0.00	...	0.00	1
2	66 00	73.2	61.0	12.2	29.9082	29.954	29.727	.227	.4365	68.5	54.8	W.	10.21	6.2	10	0	47	....	...	....	2
3	63.57	70.8	56.0	14.8	30.0727	30.127	29.954	.173	.3205	54.7	46 5	N.W.	9.92	4.7	10	0	52	....	....	....	3
SUNDAY........ 4	.....	66.0	55.0	11.0	......	......	......	......	......	....	....	N.W.	2.12	....	..	..	1	0.01	....	0.01	4 ....SUNDAY
5	73.87	87.0	58.5	28.5	29.7588	29.814	29.718	.096	.6228	75 8	64.8	W.	20.12	6.7	10	0	73	0.82	....	0.82	5
6	75.90	86.7	68.6	18.1	29 7602	29 856	29.711	.145	.6158	69.7	64.7	W.	23.58	4.5	10	0	77	....	....	....	6
7	62.28	71.6	55.5	16.1	29.8942	30.005	29.738	.267	.4552	81.5	56.2	S.E.	10.62	7.8	10	5	37	0.00	....	0.00	7
8	70.58	80.3	59.5	20.8	29.6760	29.756	29 641	.115	.5580	74.7	61.3	W.	21.46	3.8	10	0	74	0.07	....	0.07	8
9	63.82	71.9	57.5	14.4	29.8535	29 934	29.756	.178	.3413	58.2	48.2	N.W.	21.00	3.5	7	0	85	....	....	....	9
10	60.50	68.1	52.2	15 9	30.0048	30.034	29.934	.100	.2830	54.7	43.3	W.	11.00	1.7	4	0	94	....	...	....	10
SUNDAY........11	.....	75 0	54.2	20.8	......	......	......	......	......	....	....	W.	6.75	....	..	..	100	....	....	....	11...........SUNDAY
12	68 00	79.6	55.0	24.6	29.9538	30.063	29.875	.188	.4855	69 8	57.3	S.E.	4.62	4.0	10	0	57	0.01	....	0.01	12
13	76.43	86.9	64.0	22.9	29.8618	29.942	29.787	.155	.6590	73.2	66.8	W.	15.83	2 0	7	0	89	....	....	....	13
14	71.48	78.5	64.7	13 8	29.8837	29.943	29.799	.144	.5800	74.5	62.8	S.E.	16.58	8.8	10	7	42	0.00	....	0.00	14
15	59.70	64 8	57 3	7.5	29.7748	29.908	29.741	.167	.4818	94.0	57.8	S.E.	6.66	10.0	10	10	0	0.28	....	0.28	15
16	56.05	60.2	52.3	7.9	29.9097	30.066	29 754	.312	.3912	86.7	52.0	W.	15.25	8.2	10	0	3	0.29	....	0.29	16
17	65.53	76.7	52.2	24.5	30.1042	30.132	30.066	.066	.4013	64.2	52.8	W.	6.50	1.5	7	0	87	0.02	....	0.02	17
SUNDAY........18	.....	79.2	59.3	19.9	......	......	......	......	......	....	....	W.	10.75	....	..	..	89	....	....	....	18.......... SUNDAY
19	67.10	76.5	60.0	16.5	29 8762	29 921	29.834	.087	.4535	69.5	56.2	N.W.	8.08	3.7	9	0	81	0.05	....	0.05	19
20	66.80	80.5	60.0	20.5	29.6325	29.849	29.491	.358	.4833	73.3	57.8	S.W.	16.37	7.0	10	0	50	0.53	....	0.53	20
21	61.78	68.9	55.3	13.6	29.8730	30 134	29.645	.489	.3703	68.0	51.3	N.W.	19.50	4.7	9	0	62	0.11	....	0.11	21
22	62 08	70.7	51.0	19.7	30.1813	30.227	30.134	.093	.3780	68.2	51.3	N.	4.21	5.0	10	0	46	....	....	....	22
23	67.68	79.8	56.6	23.2	29.9977	30.160	29.918	.242	.5073	74.7	59.7	S.W.	10.21	7.7	10	0	50	0.02	....	0.02	23
24	72.27	81.0	62.0	19.0	29 9970	30.063	29.945	.118	.4430	56.8	55.3	S.W.	19.21	2.8	8	0	93	...	....	....	24
SUNDAY........25	.....	78.5	61.2	17.3	......	......	......	......	......	....	....	S.W.	13.17	....	..	..	91	0.00	....	0.00	25...........SUNDAY
26	64.93	72.9	57.3	15.6	30.0832	30.135	30.045	.090	.3645	60.0	50.2	S.W.	10.21	1.5	4	0	92	....	....	....	26
27	63.53	71.6	52.5	19.1	30 0580	30.089	30 028	.061	.3600	62.5	50.0	S W.	10 37	5.7	10	1	74	....	....	....	27
28	56.15	59 9	53.0	6.9	29.9742	30.060	29 942	.118	.3790	84.2	51.2	N.	6.21	7.2	10	0	03	0.25	....	0.25	28
29	63.58	72 9	53 0	19.9	29.9673	30.111	29.881	.230	.2798	49.2	42.7	S.W.	18.87	3.7	9	0	96	....	....	.. .	29
30	63.03	73.2	53.2	20.0	30.1098	30.140	30.073	.067	.2737	46.8	42.2	S.W.	16.83	0.3	3	0	99	....	....	....	30
Means......	65.97	74.79	57.36	17.43	29.9175	30.0058	29.8382	.1675	.4426	68.71	54 63	S 86½ W.	12.79	4.99	8.73	0.88	63.73	2.46	....	2.46	................Sums.
25 Years means for and including this month	64.89	73.63	56.37	17 26	29.9066	......	......	.1530	.4359	69.98	....	....	S 13.03	5.59	..	..	¶53 85	3.558	....	3.558	25 Years means for and including this month.

a ANALYSIS OF WIND RECORD.

Direction.......	N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.	CALM.
Miles	376	71	....	871	272	2196	3069	2354	
Duration in hrs..	53	17	....	94	31	141	203	135	46
Mean velocity....	7.09	4.18	....	9.27	8.77	15.57	15.12	17.44	

Greatest mileage in one hour was 38, on the 8th.

Resultant mileage, 5630

Resultant direction, S. 86½° W.

Total mileage, 9,209.

a wind records from the 1st to the 19th are from the City Hall.

* Barometer readings reduced to sea-level and temperature 32° Fahrenheit.

§ Observed.

† Pressure of vapour in inches of mercury.

‡ Humidity relative, saturation being 100.

¶ 18 years only. s 13 years only.

The greatest heat was 87°.0 on the 5th; the greatest cold was 51.°0 on the 22nd, giving a range of temperature of 36.0 degrees.

Warmest day was the 5th. Coldest day was the 16th. Highest barometer reading was 30.227 on the 22nd. Lowest barometer was 29.491 on the 20th, giving a range of 0.736 inches. Maximum relative humidity was 99 on the 8th. Minimum relative humidity was 30 on the 29th.

Rain fell on 16 days.

Auroras were observed on 2 nights.

Lunar coronas on the 16th, 18th and 24th.

Fog on 1 day.

Thunderstorms on the 5th, 20th and 23rd.

CONTENTS.

PAGE

Sir John William Dawson. By PROF. FRANK D. ADAMS 137
Letter of late Sir William Dawson 148
The Subdivisions of the Carboniferous System in Eastern Canada. By H. M. AMI, M.A., D.Sc., F.G.S 149
The Flora of the Rocky Mountains. By REV. ROBERT CAMPBELL, M.A., D.D. 163
North American Golden Rods. By REV. ROBERT CAMPBELL, M.A., D.D.... 192
Notes and Comments. By H. M, AMI, M.A., D.Sc., F.G.S 195
Book Notices 198

MONTREAL:

PUBLISHED BY THE NATURAL HISTORY SOCIETY.

LONDON, ENGLAND: COLLINS, 157 Great Portland St.

BOSTON, MASS.: A. A. WATERMAN & Co., 36 Bromfield St.

1900.

Joseph Fortier.
Rev. G. Colborne Heine, B.A.
H. McLaren.
Geo. Sumner.

Editing and Exchange Committee:

Rev. Robt. Campbell, M.A., D.D., *Chairman.*

Frank D. Adams, Ph.D., F.R.S.C.
J. S. Buchan, B.C.L.
Prof. J. T. Donald.
A. T. Drummond, LL.D., Kingston, Ont.
H. H. Lyman, M.A.
Prof. E. W. McBride, M.A., B.Sc.
G. F. Matthew, St. John, N.B.
T. Wesley Mills, M.A., M.D.
J. F. Whiteaves, Ottawa, Ont.

Library Committee:

E. T. Chambers, *Chairman.*

J. A. U. Beaudry, C.E.
Walter Drake.
Joseph Fortier,
Alfred Griffin.
G. M. Tod.
C. T. Williams.
A. F. Winn.

Museum Committee:

A. F. Winn, *Chairman.*

Rev. Robt. Campbell, M.A., D.D.
G. A. Dunlop.
O. E. LeRoy, B.A.
H. H. Lyman, M.A.
Prof. E. W. McBride, M.A., B.Sc.
J. B. Picken.

Field Work Committee:

C. T. Williams, *Chairman.*

Frank D. Adams, Ph.D., F.R.S.C.
J. S. Buchan, B.C.L.
Rev. Robt. Campbell, M.A., D.D.
Albert Holden.
H. H. Lyman, M.A.
Prof. E. W. McBride, M.A., B.Sc.
J. B. Picken.
F. W. Richards.

Lecture Committee:

Chas. S. J. Phillips, *Chairman.*

Rev. Robt. Campbell, M.A., D.D.
Prof. John Cox, M.A.
Walter Drake.
N. N. Evans, M.A.Sc.
B. J. Harrington, Ph.D., F.R.S.C.
Rev. G. Colborne Heine, B.A.
Edgar Judge.
T. Wesley Mills, M.A., M.D.
Hon. Justice Würtele.

House Committee:

Albert Holden, *Chairman.*

H. McLaren.
C. T. Williams.

Membership Committee:

Walter Drake, *Chairman.*

J. A. U. Beaudry, C.E.
Rev. Robt. Campbell, M.A., D.D.
Albert Holden.
Edgar Judge.
H. McLaren.
Chas. S. J. Phillips.
Geo. Sumner.
C. T. Williams.

Superintendent:

Alfred Griffin.

THE LATE SIR JOHN WILLIAM DAWSON, C.M.G., F.R.S., LL.D., D.C.L.

THE

CANADIAN RECORD

OF SCIENCE.

VOL. VIII. JANUARY, 1900. No. 3.

SIR JOHN WILLIAM DAWSON.

By Prof. Frank D. Adams.

In Sir William Dawson there has passed away the last survivor of that distinguished group of naturalists which in the earlier part of this century achieved for science in America such brilliant results and such widespread recognition—men whose range of knowledge was almost encyclopædic, and many of whom made valuable contributions to science in widely separated fields. The environment of the man of science has now changed, and the older type of naturalist seems unfortunately about to disappear.

Sir John William Dawson was a native of Nova Scotia, a Province which has produced more than its share of the Canadians who have risen to eminence in the various walks of life, having been born at Pictou on October 13th, 1820. He died at Montreal on November 19th, 1899, at the age of 79.

His father, James Dawson, was a native of Aberdeen, Scotland, and came to Nova Scotia to fill a position in a leading business house in Pictou, and on the termination of his engagement began business there on his own account.

While still at school in Pictou, at the age of 12, he developed a love for Natural Science, inherited from his father, and made large collections of fossil plants from the Nova Scotia coal measures, so well exposed about his native place. He speaks of himself at the time as being a "moderately diligent but not a specially brilliant pupil." On leaving school he studied at Pictou Academy, and subsequently at the University of Edinburgh. While at the former seat of learning, at the age of 16, he read before the local Natural History Society his first paper, having the somewhat ambitious title "On the Structure and History of the Earth." He returned to Nova Scotia in 1847, and two years later went to Halifax to give a course of lectures on Natural History subjects in connection with Dalhousie College, and organized classes for practical work in mineralogy and palæontology. These were attended by students, citizens and pupils of higher schools, a foreshadowing of university extension. In 1850, at the age of 30, having already attracted some attention by the publication of a number of papers, reports and lectures, he was appointed Superintendent of Education for Nova Scotia. From this time he became known in his native province as an indefatigable promoter of educational progress and a founder of educational institutions. His work in connection with this position obliged him to travel continually through all parts of the Province, and on these journeys he accumulated that immense mass of information concerning the geology and mineral resources of Nova Scotia, which are incorporated in his largest work, that entitled Acadian Geology.

Sir Charles Lyell, in 1841, on his first visit to America, met Sir William, and was by him conducted to many places of geological interest in Nova Scotia, and on his subsequent visit in 1852 they together continued their studies in Nova Scotian Geology.

About this time the governing body of McGill College at Montreal were looking about for some one fitted to assume the Principalship of the Institution, and to re-organize it.

The College, founded by Royal Charter in 1821, had made but slow progress in its earlier years, and was at this time, through litigation and other causes, almost in a state of collapse. Sir William—then Mr. Dawson—was pointed out to the Governors of the College by Sir Edmund Head, then Governor-General of Canada, as a man who, if his services could be secured, was eminently fitted to undertake the task of reconstructing the University. In the meantime, ignorant of all this, he was prosecuting a candidature for the chair of Natural History in his Alma Mater, the University of Edinburgh, rendered vacant by the death of Professor Edward Forbes, and in which he was strongly supported by the leading geologists of the time. By a strange coincidence, just as he was about to leave Halifax for England in connection with this candidature, intelligence arrived that the Edinburgh chair had been filled at an earlier date than his friends had anticipated, and at the same time a letter was received offering him the Principalship of McGill.

The services of Mr. Dawson were accordingly secured, and in 1855 he assumed the Principalship of McGill College, stipulating at the same time that the chair of Natural History should be assigned to him.

Sir William Logan, in a letter to his brother, James Logan, dated November 29th, 1855, writes as follows:—"I see by the newspapers that my friend, Mr. Dawson, has been regularly installed as Principal of McGill College. He will be a support to the Survey, for he is really a man of science."

Nearly forty years later, Sir William, in reviewing the progress of the University in one of the Annual University Lectures, spoke as follows :—

" When I accepted the Principalship of McGill I had not been in Montreal, and knew the College and men connected with it only by reputation. Materially, it was represented by two blocks of unfinished and partly ruinous buildings standing amid a wilderness of excavators' and masons' rubbish, overgrown with weeds and bushes. The grounds were unfenced and pastured at will by herds of cattle, which not only cropped the grass but browsed on the shrubs, leaving unhurt only one great elm, which stands as the " founder's tree," and a few old oaks and butternuts, most of which had to give place to our new buildings. The only access from the town was by a circuitous and ungraded cart-track almost impassable at night. The buildings had been abandoned, and the classes of the Faculty of Arts were held in the upper story of a brick building in the town, the lower part of which was occupied by the High School. I had been promised a residence, and this I found was to be a portion of one of the detached buildings aforesaid, the present east wing. It had been very imperfectly finished, and was destitute of nearly every requisite of civilized life, and in front of it was a bank of rubbish and loose stones, with a swamp below, while the interior was in an indescribable state of dust and disrepair. Still we felt that the Governors had done the best they could under the circumstances, and we took possession as early as possible.

So far out of town were the College grounds at that time that the tradesmen in town frequently declined to send to the College goods purchased from them, stating that they " could not be expected to deliver goods in the country."

The teaching staff of the University as he found it consisted of three faculties, those of Law, Medicine and Arts. The Faculty of Law, then recently organized, had two professors and two lecturers. The Faculty of Medicine, the oldest and most prosperous of the three, had ten professors and a demonstrator. The Faculty of Arts had four professors and a lecturer, and all of these except one gave only a part of their time to College work.

When it is remembered that the University has now one hundred and twenty professors and instructors of various grades and an equipment which is in all departments fairly good, and in some of them unsurpassed, some idea may be gained of the progress which the institution made under Sir William Dawson's care and guidance.

As Professor of Natural Science Sir William at this time delivered courses in Chemistry, Botany, Zoology and Geology, and Natural Science became a very favorite study among the students, for he was an excellent lecturer, and his enthusiasm for these studies was communicated to all who heard him. As years went on the instruction in the first three of these subjects was undertaken by others, and a special chair of Geology and Palæontology was endowed by his old friend and coworker, Sir William Logan, a chair which he held until his final retirement. His teaching work, however, formed but a small part of his daily labors. In addition to administering the affairs of the University, he was first and foremost in every movement to further education in the province, and no educational board was complete without him. He was the Honorary President of the Natural History Society, and not only never missed a meeting or a field day, but also contributed a very large number of very valuable papers to the *Canadian Naturalist* and the *Record of Science.* He also identified himself closely with many other societies in Montreal, and spared neither time nor labor on their behalf.

Over and above all this he found time to carry out original work along several lines, achieving most valuable results—as well as to write many popular works on science, more especially in its relation to religion. Original investigation he always considered to be one of the chief duties and pleasures of a man of science. Most of his work along these lines was done during his summer vacations; in fact, he was led to accept the position of Principal in McGill chiefly by the fact that the vacations gave him leisure and opportunity for work of this kind.

He was always very progressive in his ideas relative to the scope and development of University teaching, and was continually urging the endowment of new chairs and the broadening of University work, so that all young men wishing to train themselves for the higher walks of life might in the University find their need supplied. As an instance of this it may be mentioned that so far back as 1858 he succeeded in establishing a school of Civil Engineering, which after a severe struggle for five years succumbed to some unfriendly legislation.

"Some men may regard these efforts as failures which should not be referred to," said Sir William in an address delivered in 1870. "For my own part, I am not ashamed of them; there is not one of them which is not important to the material progress of this country, and there is not one of them which by us or by others will not at length be successfully carried out. I do not despair of any of them, and I am prepared should I remain in this University to watch for the opportunity to revive them when favorable circumstances shall occur. We wait for some Canadian Lawrence or Sheffield to endow for us a Scientific School like those of Harvard or Yale, which have contributed so greatly to the wealth and progress of New England." Before many years the great benefactor appeared, and, through Sir William Macdonald's princely gifts, it became possible to revive the old Civil Engineering and Chemistry Schools and develop them into the present Faculty of Applied Science with its numerous departmeets, its full staff of instructors and excellent equipment.

Sir William Dawson, furthermore, never hesitated, if funds were not forthcoming in sufficient amount for those purposes, to subscribe large sums out of his own limited private means, and he was also the continual helper of needy students desiring to avail themselves of the University's teaching.

The Peter Redpath Museum may be said to owe its existence to his untiring labors and to the very considerable amounts of money which he spent upon its collection.

Sir William's attainments and the value of his contributions to science were widely recognized, and he was elected an honorary or corresponding member of many learned societies on both sides of the Atlantic. He was made a Fellow of the Geological Society of London in 1854 and the Royal Society in 1862. He was the first President of the Royal Society of Canada, and has occupied the same position in the Geological Society of America and in both the British and American Associations for the Advancement of Science. He was made a C.M.G. in 1883 and a Knight Bachelor in the following year.

After a long life of continuous labor, Sir William's health in 1893 became seriously impaired, and it became necessary for him to lay aside his work for a time and go abroad. Failing to recover his strength, however, he resigned his position as Principal in June, 1893, and retired from active work. During the later years of his life his strength gradually ebbed away, and what little work he could undertake consisted in arranging his collections and working up some unfinished papers. Several of these were published in 1894 and 1895, but the years of quiet labor in his favorite pursuits to which he looked forward at this time were cut short by a series of sharp attacks culminating in partial paralysis, which forbade further effort. During the past few years from time to time his strength rallied somewhat, and he attempted to resume his work. Only a few days before his death he penned a short essay on the Gold of Ophir. He passed away on the 19th of last month, very peacefully and without pain. We may say, in the words of Dr. Peterson, his successor in the Principalship of the University: "For such a painless passing out of life no note of sorrow need be struck. There is no sting in a death like his; the grave is not his conqueror. Rather has death been swallowed up in victory—the victory of a full and complete life, marked by earnest endeavor, untiring industry, continuous devotion and self-sacrifice, together with an abiding and ever-present sense of dependence on the will of Heaven. His work was done, to quote the great Puritan's noble line, 'As ever in his great Taskmaster's eye.'"

Lady Dawson, with three sons and two daughters, survive him, of whom the eldest, Dr. George M. Dawson, the present Director of the Geological Survey of Canada, has inherited his father's love for geological studies, and has achieved wide distinction in the world of science.

Sir William's first original contribution to science was a paper read before the Wernerian Society of Edinburgh in 1841, on a species of field mouse found in Nova Scotia. From that time onward he was a continuous contributor to scientific journals and to the publications of various learned societies. His papers were very numerous, and covered a wide range of subjects in the domain of Natural History. No less than 128 titles are recorded under his name in the Royal Society's Catalogue. The most important work of his earlier years was an extended study of the geology of the Maritime Provinces of the Dominion of Canada. His results are embodied in his Acadian Geology, already mentioned, a volume of nearly 1,000 pages, accompanied by a colored geological map of Nova Scotia, which has passed through four editions. In writing to Sir William in 1868, Sir Charles Lyell says of this work, "I have been reading it steadily and with increased pleasure and profit. It is so full of original observation and sound theoretical views that it must, I think, make its way, and will certainly be highly prized by the more advanced scientific readers." It is the most complete account which we have of the geology of Nova Scotia, New Brunswick and Prince Edward Island, although since it appeared large portions of these provinces have been mapped in detail by the Geological Survey of Canada, and Sir William's conclusions modified in some particulars. In carrying out this work Sir William paid especial attention to the Palæontology of the Carboniferous system and to the whole question of the nature and mode of accumulation of coal. He subsequently studied the Palæontology of the Devonian and Upper Silurian Systems of Canada, discovering many new and important forms of plant life, as well as that of the Tertiary of Southern British Columbia, the results of these studies appearing in the publications of the Canadian Geological Survey. He also contributed a volume entitled "The Geological History of Plants" to "Appleton's International Scientific Series." In 1863 he published his Air Breathers of the Coal Period, in which were collected the results of many years' study in the fossil batrachians and the land animals of the coal measures of Nova Scotia. The earliest known remains of microsauria were then discovered by him in the interior of decayed tree stumps in the coal measures of South Joggins. The results of his later studies in these creatures were embodied in a series of subsequent papers which appeared from time to time.

On taking up his residence in Montreal his attention was attracted to the remarkable development of pleistocene deposits exposed in the vicinity of the city, and he undertook a detailed study of them, and especially of the remarkably rich fossil fauna which they contain. He also studied subsequently the pleistocene deposits of the Lower St. Lawrence, and instituted comparisons between them and the present fauna of the Gulf of St. Lawrence and of the Labrador coast. The results of these studies appeared in a series of papers as the work progressed, and were finally embodied in a volume entitled "The Canadian Ice Age," which was issued in 1893 as one of the publications of the Peter Redpath Museum of McGill University. This is one of the most important contributions to the palæontology of the pleistocene which has hitherto appeared.

Sir William's name is also associated with the renowned Eozoon Canadense, discovered by the Geological Survey of Canada in the Grenville limestones of the Canadian Laurentian, and described by him in 1864 as a gigantic foraminifer. Concerning this remarkable object there has been a widespread controversy and a great divergence of opinion. Some of the most experienced observers in the lower forms of life, such as Carpenter, accepted it as of organic origin, while others considered it to be inorganic. And, while the balance of opinion now probably favors the latter view, its resemblance microscopically to certain organic forms is certainly most remarkable. The literature of this subject, which includes many papers by Sir William, is quite voluminous, but the chief facts are summed up in his book, entitled "The Dawn of Life," which appeared in 1875.

Sir William was also a prolific writer of popular works on various geological topics. Among these may be mentioned his "Story of the Earth and Man," his "Fossil Men and their Modern Representatives," his "Meeting Place of Geology and History," and his "Modern Science and Bible Lands." These books, all written in a very entertaining style, had a wide circle of readers, and many of them passed through several editions.

Other volumes from his pen, as well as many papers contributed to various religious publications, treated of the relation of science and religion. One of the earliest of these was entitled "Archaia," and dealt with the relations of historical geology to the Mosaic account of the Creation. In others he considered the relation of the evolutionary hypothesis to religious thought. He was always, but especially in his earlier years, a strong opponent of the Theory of Evolution, and vigorously combated it. Being above all things deeply religious and considering the evolutionary explanation of the origin of the universe to be contrary to the teachings of Scripture, he refused to accept it. This was, after all, but the weakness of a strong man. It did not, however, tend to enhance his reputation among men of science, who are commonly willing to let truth work out its own results, knowing that apparent contradictions are merely indications that the whole truth has not been discovered.

These works on the relation of science and religion met a popular need, and were of great comfort to many a pious soul who feared that the whole framework of faith was being swept away by the advancement of science. Their value, however, was not permanent, and they are not the works by which Sir William Dawson will be remembered. His reputation is founded on the great contributions to our permanent stock of knowledge which he has made, and which are embodied in his works on pure science, representing achievements of which any man might well be proud.

Sir William had a courteous or rather a courtly manner, based on a genuine consideration for all. He was respected and beloved by all who knew him, and especially endeared himself to all who studied under him. The pre-eminent note of his character was simplicity and singleness of purpose. His loss will be felt especially in the Institution with which he was long connected, but his name has been perpetuated in connection with the geological department of his University by the establishment of a second chair in geology, to be known as the Dawson Chair, which has just been endowed in his memory by Sir William Macdonald.

The following letter will be read with interest, as the last communication to the Natural History Society of Montreal, made by the late Sir William Dawson. It shows the high regard in which he held the Society and the value he attached to its work. It may be counted his dying testimony to the importance to Montreal of such an institution and a call to the citizens to rally around it and secure its prosperity. Sir William's last spoken word to the friends of the Society, on the occasion of the conversazione held under the auspices of the late Governor-General, the Earl of Aberdeen, was by way of advocating the creation of a small endowment fund for the Society, a beginning of which has since been made and which it will be the continued aim of the Society to raise :—

LITTLE METIS, June 17, 1899.

" MY DEAR SIR,—I beg to thank you, and through you the Natural History Society, for your kind communication of the 9th, and for the honor the Society has again conferred on me. I deeply regret that illness prevented me from taking an active part in the work of the Society, and from enjoying the pleasure of personal association with its members. Should it please God to restore my strength sufficiently it will give me much pleasure to contribute what I can to its work. I have, however, at present little expectation of this.

" I rejoice to see from the report of the annual meeting that the Society continues to grow in public estimation, and trust that the increasing appreciation of the value of natural history studies to the industrial interests of the Dominion may tend still further in this direction, and may cause our Government more fully to emulate that of the United States in the practical cultivation of natural history, at least for its industrial uses.

"I shall be pleased if you will kindly present this note to the Society at an early meeting.

"Yours, very sincerely,

"J. WM. DAWSON.

"J. S. Buchan, Esq., Corresponding Secretary, N. H. S."

NOTES ON SOME OF THE FORMATIONS BELONGING TO THE CARBONIFEROUS SYSTEM IN EASTERN CANADA.

By H. M. AMI, M.A., D.Sc., F.G.S.

Considerable discussion has arisen of late amongst European as well as North American geologists as to where certain series of sedimentary strata occurring near the summit of the Palæozoic should be placed, in the Carboniferous system or in the Devonian.

Whether certain other geological formations, occurring in the Maritime Provinces of Canada, such as occur in the New Glasgow District of Pictou County, should be described as Permian or classed as Upper Carboniferous or Permo-Carboniferous, constitutes another problem. It is not within the province of this paper, however, to discuss this latter question, but before very long, it is hoped, it will form the subject of another paper.

Where to draw the line between the Carboniferous and Devonian systems in Eastern Canada is therefore the question at issue. It is the purpose of the writer to enter this field of enquiry without any leaning or bias to any one view, but to take up the evidence as it appears to him and as it was collected by him during the last four years in the counties of Pictou, Colchester, Cumberland, Antigonish, Hants and Kings in Nova Scotia, referring to other localities only as the occasion may require.

Opinions varied and numerous have been given by many writers. These were consulted merely with the purpose of obtaining such notes of records of observations as might help to throw light upon the problem.

Sir William Dawson, Sir Charles Lyell, Abram Gesner, Dr. Jackson, Prof. Alger, Prof. J.P. Lesley, MM. de Koninck and de Verneuil, Hugh Fletcher, Esq., Dr. R. W. Ells, Henry S. Poole, Esq., Richard Brown, Esq., Prof. T. Rupert Jones, F.R.S., Rev. T. Kirby, J. W. Salter, Esq., Dr. Henry Woodward, Dr. G. F. Matthew, Prof. Bailey, Mr. A. Smith Woodward, Mr. Robert Kidston and Prof. David White have all contributed to the literature of this interesting controversy.

I shall not attempt to review the difference of opinion which may exist between what may be termed the two schools of geology in this matter—the Murchisonian—whose characteristics of the Devonian age are based more especially upon the life-zones or palæontological evidence which the formations under discussion hold, or the Sedgwickian, which paid more immediate attention to the stratigraphical succession and defined the Devonian on this basis without the use of fossils.

From a considerable study of the origin or genesis of the various geological formations in question, of the cycles of constructive forms noticed in them, the periods of erosion noted, together with the life-zones which these formations contain, and which mark them, one has been able to arrive at a conclusion, which, it is hoped, will be in accord with the views of the rest of the world, so that whatever interpretation is given to the Carboniferous system in one continent, the same should hold good for another; so also with the Devonian system.

Just as Time was a constant factor in the evolution or history of the Carboniferous system on this planet, and that the amount of time involved must be a more or less definite period—so also was Life a constant factor; and the several sub-divisions of the Carboniferous system—the Eo-, Meso- and Neo-Carboniferous must be marked by corresponding series of life-zones in the same system.

No difficulty has been experienced in separating or uniting the various geological formations in the counties of Nova Scotia (mentioned above) nor of understanding their taxonomic relations. The most excellent work of Mr. Hugh Fletcher, of the Geological Survey of Canada, who kindly furnished me with maps and plans of the region in question, shows clearly the true and natural order of sequence of the formations. The main difference relates to the horizon of the series of sediments, hitherto known and designated by Mr. Fletcher as the Union and Riversdale series. Are they Carboniferous or are they Devonian? Mr. Fletcher would place them in the Devonian. On palæontological as well as on structural grounds I would include them in the Carboniferous. The various formations of the Carboniferous system do not form an unbroken succession of sedimentary strata in the disputed region of Pictou, Colchester and adjacent counties. Dislocations and unconformities appear on every hand. Outcrops of formations, constituting cycles of constructive forms, marking peculiar physical conditions of deposition followed by periods of erosion and subsequent depositions occur at various horizons, and were it not for their entombed fossils it would be practically impossible to state in which of the sub-divisions of the Palæozoic column to place them.

Inasmuch as sedimentation, as marked by cycles of constructive forms was not continuous, the basis or principle upon which the separation of the different members of the series is made must obtain chiefly in the palæontological evidence collected in the various members of the stratigraphical series, which latter, though not perfect, is, nevertheless, known as to its order.

It is a universally accepted principle in Geology that similarity and identity of organic forms occurring in certain geological formations or portions of formations assist us in uniting series of sediments as part and parcel of one system, whilst dissimilarity enables one to separate series of sediments from which they were derived.

A Standard series of life-zones belonging to the Carboniferous system can be very easily prepared, and in order that it can be taken as typical, it must be in accord with the consensus of opinion with the rest of the world, based upon records of observation and comparison. It must in no wise contain an assemblage of types which are different from those everywhere held to be of Carboniferous age. Fortunately for the geologist in Nova Scotia, (unconformities and breaks in the succession of strata not considered), there is abundant evidence of life of various orders and classes entombed in the various formations.

There is in Cumberland County one grand and continuous section of strata of the Carboniferous system from Minudie south, forming the succession known as the "Joggins Section," described in detail by Sir Wm. Logan and subsequently by Sir Wm. Dawson and Dr. R. W. Ells. It extends from Minudie to McCarren's Cove along the Joggins shore. This forms one Standard Section. No other such exists in Nova

Scotia. In the United States not less than seven Standard Sections have been described in various fields:—Pennsylvania, Virginia, Ohio, Missouri and other States. These all have their peculiar characters and may be described as local or provincial Standards or series.

Notwithstanding the fact that each particular basin of Carboniferous rocks or sediments may have had its own peculiar condition of sedimentation, which led to peculiar local differences existing between the several basins, there can be no doubt at all regarding the series belonging to the Carboniferous system. The results obtained in Great Britain, France, Belgium, Germany, Russia and other countries in the Eastern Hemisphere constitute a basis for the proper definition and classification of the formations which may be described in Nova Scotia or elsewhere as Carboniferous.

Such a standard series as the consensus of opinion in the world has established as marking the Carboniferous system must be a term which includes within its extension the various members of the different local series under examination.

Unequal amounts and quality in sedimentation in different districts led to interesting differences in the mode of preservation and plentifulness or scarcity of palæontological evidence which has led to a distinctive feature in the study of the correlation of strata of Nova Scotia. It has been conceded that in the case of the Joggins section in Nova Scotia sedimentation was very rapid and the 14,000 feet of strata, there deposited, in a perfectly unbroken succession, may have taken less time actually to be laid down than a few hundred feet of shales and sandstones belonging to the same system in another section.

It follows from this that local series of Carboniferous strata may be of very great thickness, others comparatively thin. It is possible for the whole system of the Carboniferous to be unusually extensive in its development in a certain locality (as has certainly been the case in Nova

Scotia), whilst the sediments of the same age in Pennsylvania are known to be much thinner. Evidence of rapid sedimentation in Carboniferous times in Canada is clearly seen in the Eo-Carboniferous of Colchester and Pictou counties in Nova Scotia as represented by the Union and Riversdale formations there developed. Ripple-marked surfaces and shallow water indications on all sides are constantly recurring. Hundreds of feet of an unbroken succession of strata, beautifully marked by ripples and wind action, also by the footprints and trails of reptilian and other animals, occur also in strata referred by Mr. Fletcher to the same geological horizon as the rocks of the Union and Riversdale at Parrsboro, Five Islands, along the Harrington River and elsewhere. This indicates very rapid deposition or sedimentation along a fast sinking floor.

The main reason for introducing this argument is to combat the view advanced in certain quarters that, by placing the Union and Riversdale formations into the Carboniferous system, we would make the latter an unwieldy system and take away from the underlying Devonian system, robbing it of a great portion of its sediments. It now behooves to state what are the successive series of sediments which belong to the Carboniferous system in Nova Scotia and what are the reasons for placing them in that system.

I.—The Eo-Carboniferous.

In this, the basal series of the Carboniferous system, I would place the Union and Riversdale series of sediments, which are well and extensively developed in Pictou, Colchester and Cumberland Counties at Union and Riversdale, along the Harrington River, Moose River (Cumberland County), Archibald Brook, Oliver's Mills, McKay's (East River, Pictou) and numerous other localities, besides the Early Carboniferous plant and fish-bearing beds of the "Horton Formation."

The Terms Union and Riversdale I would raise to the degree of formations, as they are easily recognized over wide areas, geographically, and characterized by a well-defined fauna and flora, at least as far as the Riversdale formation is concerned, the overlying Union formation proving rather destitute of fossil organic remains.

These two together carry a remarkable flora and fauna, which cannot be mistaken as one truly appertaining to the Carboniferous system, inasmuch as the types are all akin and generically related to types in the productive coal measures higher up in the system.

I have no hesitation in stating that in the Union and Riversdale formations we have obtained in Nova Scotia a fauna and flora which, while not as extensive nor as varied as that obtained in the productive coal measures, are nevertheless remarkably similar, consisting of a series of sediments, terrigenous in character, and for the most part estuarine, forming carbonaceous shales and sandstones, underclays and conglomerates, constituting a series of strata, which, having begun in Early Carboniferous time, were interrupted, then an encroachment of the Carboniferous Sea occurred, in which marine conditions prevailed, and limestones were deposited, holding abundance of shells and other fossil organic remains characteristic of a salt-water fauna. These constitute the Windsor and Hopewell formations.

These limestones were followed by the newer and later productive coal measures characterized by terrigenous deposits also and enclosing a fauna and flora, whose affinities are remarkably akin to the forms found in the Eo-Carboniferous, giving the following succession :—

III.	Coal Measures Millstone Grit	......Estuarine..	Land plants, land animals and Estuarine forms.
II.	Hopewell formation..	Estuarine..	Insects and plants and Estuarine forms.
	Windsor "	....	Marine fossils, corals, shells, etc.
I.	Union formation Riversdale "	....Estuarine..	Land plants, land animals and Estuarine forms.

As evidence of the similarity of forms peculiar to the Eo-Carboniferous of Colchester and Pictou Counties and the Coal Measures of the same region, let us take the following forms, noted on page 181 of the "Summary Report of the Geological Survey Department for 1898."

INSECTA.—The Neuropterous insect, whose wing was obtained in the I. C. R. cuttings east of Riversdale and Campbell's Siding, is referred to a Carboniferous genus by Prof. Charles Brongniart, of Paris.

PHYLLOPODA.—The numerous specmens of *Leaia* and *Estheria,* from the shales of the Riversdale formation of Colchester, Pictou and Cumberland Counties. are very similar to the forms described from the Coal Measures of Pictou County and also from the Coal Measures of the United States. All the species of *Leaia* recorded in North America so far are referred to the Coal Measures.* This genus was abundant in early Carboniferous times, as may be gathered from those specimens which were obtained by me in the red, black and grey shales of the Union and Riversdale formations of Nova Scotia and referred to the Eo-Carboniferous.

CRUSTACEA.—Several specimens of a new genus and new species of one of the Podophthalmata and Xiphosura occur in the Harrington River and Riversdale collections in Colchester County. These Crustaceans are highly characteristic of the Carboniferous system in Europe and America, and their occurrence at this horizon, together with their generic characters, point to them as prototypes of higher forms found in the subsequent cycle of sedimentation and in the series of sediments referred to the Coal Measures above. One of these Crustaceans has been recently described by Dr. Henry Woodward and Prof. T. R. Jones of London as *Bellinurus grandævus,* and these well-known authorities have no hesitation in placing the sediments from which they came in the Carboniferous.

* Miller, Cat. N. Amer. Pal. Foss.

Amphibia.—Of these animals there are numerous footprints and trails in the collections of the Geological Survey or National Museum at Ottawa, belonging to the genus Sauropus and of gigantic size. All other traces of this genus known in America are referred to the Carboniferous system.

In his "Geology, Chemical, Physical and Stratigraphical," Oxford, 1888, Prestwich gives a table "Showing the character and distribution of the species of organic remains in the several main groups of the Palæozoic series in the British Area." Under the head of Amphibians (including footprints) he notes the occurrence of these in the Carboniferous, but none in the Devonian.

Miller, in his Catalogue of North American Palæozoic Fossils, does not record a single Amphibian from rocks older than the Carboniferous and the genera occurring in the Riversdale formation are identical or similar to those found in the Carboniferous of other regions of North America.

Dana, in his "Manual of Geology," Geikie, in his "Manual" also, and all the leading writers on North American Geology and Palæontology, agree in placing the genera of fossils, to which I have referred the footprints from Parrsboro and Harrington River, Cumberland and Colchester County from the Riversdale formation as Carboniferous. Hylopus Logani and Sauropus Dawsoni, N. Sp., are two of the forms discovered in these disputed formations.

Lamelli branchiata.—Of these the most conspicuous are the *Anthracomyæ* of Salter, which Sir Wm. Dawson described under the name of *Naiadites.* These shells are abundant in the Coal Measures of the Joggins, Springhill and Sydney Coal Basins of Nova Scotia, also in certain portions of Virginia and other coal areas of the United States, not to speak of their occurrence in the Carboniferous of England and France and many other countries of Europe. They occur in bands in the Riversdale formation at Riversdale and in numerous outcrops along the banks of the Harrington River on the dividing line between Colchester and Cumberland Counties, and the term "Naiadites Bands" is applicable to these Eo-Carboniferous bands, which are usually associated with Ostracoda of the genus Carbonia and other allied genera of Carboniferous facies, just as the term is applicable to them in the Coal Measures above. All writers on Geology and Palæontology concur in placing these shells in the Carboniferous. All the species recorded from the United States are referred to the Coal Measures, and those from the Union and Riversdale formations of Colchester and Cumberland Counties of Nova Scotia are Eo-Carboniferous. It will thus be seen that the palæontological evidence adduced in the zoological collections so far obtained from the Union and Riversdale formations of Nova Scotia, including Insects, Phyllopods, Crustaceans, Amphibians and Lamelli branchiata, are all types which are markedly akin to types well known to occur in the Carboniferous of other countries and more than that even in the Coal Measures of the same.

As regards the evidence adduced from the flora collected in the strata which afforded the forms of animal life just cited above, it can be truly said that it also has a decided Carboniferous facies. The genera Asterophyllites, Sphenopteris, Alethopteris, Cardiopteris, Stigmaria, Calamites, Poacites, Cordaites are all well represented. Mr. Robert Kidston, of Stirling, Scotland, and author of the British Museum Catalogue of Carboniferous Plants, has examined the forms sent him and reports that he is satisfied that the flora is truly Carboniferous.

The following are some of the species of fossil plants obtained by the writer and submitted to Mr. Robert Kidston, F.R.S., F.G.S., of Stirling, Scotland, for determination :—

(I.) From the *Riversdale formation,* in rather fine-grained arenaceous or clay shales from cuttings along the Intercolonial Railway of Canada, between Union Siding and West River Station, Colchester County :—

PLANTÆ.

1. Asterophyllites acicularis, Dawson (= Calamocladus equisetiformis, Schlothuni, Sp.).
2. Neuropteris, Sp.
3. Sphenopteris marginata, Dawson.
4. Alethopteris, Sp., allied to *Alethopteris* valida, Boulay.
5. Cordaites principalis, Germar Sp.
6. Cordaites Robbii, Dawson.
7. Cyclopteris (Nephropteris) varia, Dawson.
8. Calamites, Sp. (?)
9. Cardiocarpum cornutum, Dawson.

(II.) From the shales and sandstones of the *Riversdale formation* as it developed along the Harrington River, on the boundary between the counties of Colchester and Cumberland, near Lower Five Islands :—

1. Astrophyllites acicularis, Dawson.
2. Calamites, Sp.
3. Sphenopteris dilatata, Lindley and Hutton.
4. Sphenopteris Harttii, Dawson.
5. Sphenopteris splendens, Dawson.
6. Sphenopteris marginata, Dawson (?).
7. Sphenopteris, Sp.
8. Aneimites valida, Dawson.
9. Adiantides (?) or (?) Archæopteris.
10. Neuropteris, Sp.
11. Alethopteris discrepans, Dawson (= Alethopteris decurrens, Artis Sp.).
12. Cyperites-like leaves.
13. Cardiocarpum cornutum, Dawson.
14. Psilophyton (?) glabrum, Dawson.

Quite independently, Prof. David White, of the Smithsonian Institution and United States Geological Survey at Washington, arrived at the same conclusion in January, 1898, when he kindly examined the collections then in our possession at Ottawa, and referred the forms to the Carboniferous system, which view Mr. Kidston subsequently and also quite independently corroborated. It is not to be wondered at that on studying the affinities and relations of the fossil plants of Riversdale, McKay's Head, Harrington River, etc., of the Riversdale formation, Sir William Dawson placed them in the Millstone Grit formation, so intimate were the relations of these to the plants of the Coal Measures. The flora and fauna of the Riversdale formation must now be classed as Eo-Carboniferous, as the rocks in which they occur clearly underlie the marine limestones of the Windsor formation. These limestones have been carefully described and mapped out by Mr. Hugh Fletcher in their association with the gypsum beds of Nova Scotia.

II. THE MARINE SEDIMENTS.—In the district of Nova Scotia, under examination, besides the Eo-Carboniferous formation of Union and Riversdale, consisting of red shales and sandstones and conglomerates, more or less strongly cemented, overlying darker coloured gray and black or greenish and rusty shales as defined by Mr. H. Fletcher, constituting one of the cycles of sedimentation in the system, there occur the marine limestones in an unconformable series.

These marine limestones hold abundance of fossil organic remains, *e.g.*, on the East Branch of the East River of Pictou at Springville, at Brookfield, and at Windsor, N.S., where the series is highly fossiliferous and the forms are very well preserved.

Hence the term "Windsor Series," employed by Sir Wm. Dawson, which deserves to constitute a typical formation or phase of this Carboniferous limestone under the name *Windsor formation.*

Just where to place the *Windsor formation* in the column of Palæozoic formations has not yet been definitely ascertained. Whether it is to be classed as one of the Eo-Carboniferous sediments or whether it constitutes a factor or part of what may be termed according to Prof. H. S. Williams's very appropriate classification—Meso-

Carboniferous—is the question occupying our minds during the present collecting season.

It appears from evidence at hand that these limestones do not constitute the base of the Carboniferous system in the Maritime Provinces, although they contain the earliest types of Marine Carboniferous seen in Eastern Canada. The occurrence of this formation in certain definite areas of Nova Scotia marks a cessation of the conditions existing in the areas which these limestones cover, indicating that the sea or Atlantic waters in Carboniferous times extended over the Eo-Carboniferous deposits previously laid down, which had been subjected to elevation and erosion previous to their being overlaid, whilst the vegetation and climate of this period did not probably change very materially during this period of submergence and encroachment of the sea. A period of elevation then followed in which sandstones and shales were deposited, to be followed later again by sandstones, the shales and coal seams peculiar to the Coal Measures and Millstone grit underlying them.

The terrigenous origin and nature of the Coal Measures need not be described. The flora and fauna they hold mark estuarine conditions existing and prevailing with a luxuriant growth of plants on land with various kinds of animals in the water and on land also.

A brief summary of the succession of the sediments in the Carboniferous of Nova Scotia in Pictou and Colchester and Cumberland Counties in part would give the following succession arranged in ascending order :—

I. Riversdale and Union Formations, with volcanic rocks and associated strata constituting one series, consisting of red sandstones, shales and conglomerates with carbonaceous shales and sandstones, with occasional bands of calcareous matter, besides diorite and other basic rocks, which together measure upwards of 10,000 feet in thickness, the equivalent of the Calciferous Sandstones of Great Britain.

II. An unconformity.

III. The Windsor Limestones and Gypsums.

IV. The Hopewell Sandstones, shales and marls, which constitute another series of strata which overlie the Union and Riversdale formations, and are in turn overlaid unconformably (?) by the millstone grit and coal measures in certain portions of Pictou County.

(An unconformity is supposed to occur here, but I have not detected it. I did not observe any unconformity between the Millstone grit and the underlying strata in the Joggins near Downing's Cove, but a gradual passage of strata from what has been termed (anteriorly) Lower Carboniferous into millstone grit and coal measures.)

V. The millstone grit formation of Westville, Skinner's Brook, Pictou County, N.S., and Joggins, etc.

(An unconformity occurs here in certain portions of Pictou County, as, for example, on Blackwood Brook, opposite New Glasgow, where the upturned edges of the millstone grit (Logan) are overlaid by the New Glasgow conglomerates of Fraser's Mountain, etc.; whereas, in other portions, the millstone grit is directly superimposed by the productive coal measures, Westville and Stellarton, where the Acadia and other seams are being so extensively developed.)

These two geological areas give us two series of sediments with the following succession to the millstone grit (VI.):

A	B
V. Millstone grit.	V. Millstone grit.
VI. Coal measures.	VI. Unconformity.
	VII. New Glasgow conglomerate.
	VIII. Spirorbis limestone.
	IX. Smelt Brook carbonaceous shales and sandstones.
	X. Pictou sandstones.
	XI. Cape John red sandstones and conglomerates.

In ascending order, the successive geological formations to which the following provisional names are given, may be thus classified :—(1) the Riversdale formation; (2) the Union formation; (3) the Windsor formation; (4) the Hopewell formation; (5) the Westville formation (millstone grit); (6) Stellarton formation (coal measures of Westville, Stellarton and Thorburn); (7) the New Glasgow formation (conglomerates of New Glasgow, Fraser's Mountain, etc.); (8) Merigomish (Small's Brook) formation (*Spirorbis arietina* beds); (9) Smelt Brook formation; (10) Pictou formation (McKeen's Quarries, etc.); (11) Cape John formation, River John and Cape John.

Formations.			Northern Areas.	Southern and Western Areas.
Neo-Carboniferous.	Cape John.	Neo-Carb.	Cape John sandstone, etc.	
	Pictou.		Pictou freestone, etc.	
	Smelt Brook.		Smelt Brook shale, etc.	
	Merigomish.		Spirorbis limestone.	
	New Glasgow.		New Glasgow conglomerate.	
		Meso-Carb.	*Unconformity.*	Coal measures.
Meso-Carboniferous.	Stellarton.		Millstone grit.	Millstone grit.
	Westville.		*Unconformity ?*	*Unconformity* (?)
	Hopewell and Windsor.			Hopewell sandstones, etc., and Windsor form.
Eo-Carboniferous.	Union.	Eo-Carb.		*Unconformity.* Union.
	Riversdale.			Riversdale and Horton.

Sept. 6th, 1899.

The Flora of the Rocky Mountains.

By Rev. Robert Campbell, M.A., D.D.

The Rocky Mountain region is the botanist's paradise. The route through the Rocky, Selkirk and Coast ranges, taken by the Canadian Pacific Railway, is a very wonderland even to the ordinary tourist. He is carried through scenery awful in its impressiveness. Even one who has climbed Goatfell and Ben Lawers in "bonnie Scotland," or looked forth from the top of the Righi in the light of the full moon and stood on that celebrated eminence watching for the glorious sunrise, finds a series of surprises and new sensations awaiting him, from the moment the shadowy outlines of the mountains begin to loom out from the surrounding clouds, after he has left Calgary, until he has gone through Kicking Horse Pass and over the Fraser River. The Himalayas of India may surpass our western mountains in grandeur, but certainly the Alps do not, while the highest of the British mountains are but babies in comparison. The vastness of their number and the greatness of the territory over which they extend, as beheld from one of the higher peaks, well earned for the scene the description of one of our eloquent statesmen as a "sea of mountains." What with the admirably conducted hotels established by the Railway Company at Banff, Field, Glacier, North Bend, and at other points of interest, a stay at any or all of these places affords an incomparable holiday, even for the ordinary tourist. When to the attractions of the superb scenery of the route there is added the element of scientific interest, a visit to the Rockies and Selkirks becomes an unforgettable, a perpetual joy. It may be taken for granted that the botanist is not insensible to the general beauties of nature, although he has an eye for detail. But while he drinks in as much as others of the delight which fine scenery yields, he alone is sensible of the enchantment proceeding from the rich flora which decks the mountain slopes and valleys bordering on the railway track during the summer months. Roaming among those blooming treasures affords a delight, of which the uninitiated have no conception.

From a scientific point of view, the flora found on mountains everywhere is of special interest. Geologists tell us that the lofty portions of the world were the first to emerge from under the primeval waters; and it follows that the earliest vegetation that took root on the earth was on the mountain tops and sides. The ambition of every collector of plants, in consequence, is to visit mountain ranges and possess himself of the species to be found thereon; and the favorite excursions of botanical societies are always to hills. The mountain flora has characteristics of its own, and long before there was any thought that a railway would skim over the western prairies and penetrate the passes of the Rockies and

Selkirks, those regions were a land of enchantment to men of science, who, in spite of the difficulties encountered in reaching it, attained the object of their desire and have recorded the delight they experienced when they at last set foot upon it. It was a serious holiday to make out the distant prairies and western mountains in the days when David Douglas, Thomas Nuttall, Robert Brown, Sir John Richardson and Thomas Drummond visited them. Only fifty years ago it took the late Professor Agassiz several weeks to travel from Boston to the shores of Lake Superior and back again, when, in pursuit of knowledge, he made a summer excursion to that then little known region, scientifically considered.

There are many species met with in Manitoba, the Territories and the valleys of the mountains that are common to the east, and of these no account is taken in the subjoined list. But there is a tendency to specific differences in the genera which becomes gradually apparent as one travels westward. This is especially true of the flora of the plains. As to the plant life of the Rocky Mountains, it closely resembles that of other mountains of similar height, where corresponding climatic conditions obtain.

As we travel westward over the Territories, unfamiliar species multiply with bewildering rapidity, so that it tasks one's resources to cure properly at night the specimens collected in the day time. But such embarassment is delighful to one bent on making new acquisitions. His is a constant joy in having to determine what the new species are which he happens on day by day. His task is, indeed, rendered comparatively difficult by the fact that eastern classification proves of little service to him. Even Scribners' recently issued volumes carry him only as far as the 102nd Meridian. Coulter's flora of California is helpful, and Professor Macoun's Catalogue may afford hints as to what the species are, although it does not describe them. But in the main the botanist has to fall back upon the descriptions of Nuttall, Douglas, Robert Brown, Richardson and Drummond, and as these authorities are not easy of access, many specimens have to be set aside when one is on the field for further study. Thus there is accumulated material for delightful future investigation, in prosecuting which months afterwards, it may be, the joys of the excursion are gone over again.

It was in the month of June, 1897, that the plants classified below were mainly collected. Some of them were obtained earlier and later, and sent by friends—a few from California, although they also belong to the mountain and coast ranges within Canadian territory. Altogether this western collection, now deposited in the Cabinet of the Natural History Museum, embraces about 300 species, any of which are seldom met with in the neighborhood of Montreal.

GRAMINEÆ.

ANDROPOGON L. Sp.

Andropogon Scoparius Michx.—*Broom Beardgrass.*—Broadview. June.

ANTHOXANTHUM L. Sp.

Anthoxanthum odoratum L.—*Sweet Vernal Grass.*—Laggan. June.

SAVASTANA Schrank.

Savastana alpina (S.W.) Scribner.—*Alpine Holygrass.*—Banff. June.

STIPA L. Sp.

Stipa comata Trin. and Rupr.—*Western Stipa.*—Kamloops. June.

Stipa Spartea Trin.—*Porcupine Grass.*—Wolseley. June.

PHLEUM L. Sp.

Phleum alpinum L.—*Mountain Phleum.*—Banff. June.

SPOROBOLUS R. Br.

Sporobolus cuspidatus (Torr.) Wood.—*Prairie Rush-grass.*—Broadview. June.

BECKMANNIA Host.

Beckmannia erucæformis (L.) Host.—*Beckmannia.*—Medicine Hat. June.

DISTICHLIS Raf.

Distichlis spicata (L.) Greene.—*Marsh Spike-grass.*—Kananaskis. June.

BROMUS L. Sp.

Bromus erectus Huds.—*Upright Brome-grass.*—Calgary. June.

Bromus racemosus L.—*Brome-grass.*—Banff. June.

AGROPYRON J. Gærtn.

Agropyron dasystachyum (Hook) Vasey.—*Northern Wheat-grass.*—Canmore. June.

Agropyron divergens Nees.—*Spreading Wheat-grass.*—Banff. June.

CYPERACEÆ J. St. Hil.

CAREX L. Sp.

Carex Goodenovii J. Gay.—*Goodenough's Sedge.*—Lake Louise. June.

JUNCACEÆ Vent.

JUNCOIDES Adans.

Juncoides nivale (Læst.) Coville.—*Arctic Wood-rush.*—Lake Louise. June.

MELANTHACEÆ R. Br.

TOFIELDIA Huds.

Tofieldia palustris Huds.—*Scottish Asphodel.*—Lake Louise. June.

ZYGADENUS Michx.

Zygadenus Nuttallii (A. Gray) S. Wats.—*Nuttall's Zygadenus.*—Banff. June.

LILIACEÆ Adans.

ALLIUM L. Sp.

Allium cernuum Roth.—*Nodding Wild Onion.*—Manitoba. June.

Allium stellatum Ker.—*Prairie Wild Onion.*—Qu'-Appelle. June.

Allium Canadense L.—*Meadow Garlic.*—Wolseley. July.

LILIUM L. Sp.

Lilium umbellatum Pursh.—*Western Red Lily.*—Kananaskis. June.

UNIFOLIUM Adans.

Unifolium liliaceum Greene.—*Star-flowered Solomon's Seal.*—Revelstoke. June.

SALIX L. Sp.

Salix petiolaris J. E. Smith.—*Slender Willow.*—Broadview. June.

Salix argyrocarpa Anders.—*Silver Willow.*—Calgary. June.

Salix desertorum Richards.—*Desert Willow.*—Winnipeg. June.

Salix glauca L.—*Northern Willow.*—Broadview. June.

Salix candida Fluegge.—*Hoary Willow.*—June.

Salix Uva-Ursi Pursh.—*Bearberry Willow.*—June.

BETULACEÆ Agardh.

BETULA L. Sp.

Betula glandulosa Michx.—*Glandular Birch.*—Laggan. June.

SANTALACEÆ R. Br.

COMANDRA Nutt.

Comandra umbellata (L.) Nutt.—*Bastard Toad-flax.*—Broadview. June.

POLYGONACEÆ Lindl.

RUMEX L. Sp.

Rumex Venosus Pursh.—*Veined Dock.*—Calgary. June.

Rumex pauciflorus Nutt.—*Few-flowered Dock.*—Donald. June.

OXYRIA Hill.

Oxyria digyna (L.) Camptdera.—*Mountain Sorrel.*—Donald. June.

POLYGONUM L. Sp.

Polygonum emersum (Michx.) Britton.—*Swamp Persicaria.*—Manitoba. July.

CHENOPODIACEÆ Dumort.

CHENOPODIUM L. Sp.

Chenopodium Berlandieri Moq.—*Berlandier's Goosefoot.*—Calgary. June.

ATRIPLEX L. Sp.

Atriplex argentea Nutt.—*Silvery Orache.*—Swift Current. June.

SARCOBATUS Nees.

Sarcobatus Vermiculatus (Hook.) Torr.—*Grease-wood.* —Gleichen. June.

DONDIA Adans.

Dondia depressa (Pursh.) Britton.— *Western Blite.*— Swift Current. June.

CARYOPHYLLACEÆ Reichenb.

SILENE L. Sp.

Silene acaulis L.—*Moss Campion.*—Wolseley. June.

Silene Douglasii Hook.—*Douglas Catchfly.*—Revelstoke. June.

VACCARIA Medic.

Vaccaria Vaccaria (L.) Britton.—*Cow-herb.*—Canmore. June, 1897.

ALSINE L. Sp.

Alsine umbellata Turez.—*Umbelled Stitchwort.*—Banff. June.

SAGINA L. Sp.

Sagina decumbens (Ell) T. and G.—*Decumbent Pearlwort.*—Wolseley. June.

Sagina saginoides (L.) Britton.—*Arctic Pearlwort.*— Laggan. June.

ARENARIA L. Sp.

Arenaria biflora (L.) S. Wats.—*Arctic Sandwort.*— Glacier. June.

RANUNCULACEÆ Juss.

AQUILEGIA L. Sp.

Aquilegia formosa Fisch.—*Wild Columbine.*—Donald. June.

Aquilegia brevistyla Hook.—*Small-flowered Columbine.*—Winnipeg. June.

ANEMONE L. Sp.

Anemone parviflora Michx.—*Northern Anemone.*—Laggan. June.

Anemone multifida Poir.—*Cutleaved Anemone.*—Banff. June.

Anemone cylindrica A. Gray.—*Longfruited Anemone.* Canmore. June.

Anemone occidentalis Watson.—*Western Anemone.*—North Bend. June.

Anemone narcissiflora L.—*Alpine Windflower.*—Bow River. April.

PULSATILLA Adans.

Pulsatilla hirsutissima (Pursh.) Britton.—*Nuttall's Pasqueflower.*—Wolseley. April.

RANUNCULUS L. Sp.

Ranunculus pedatifidus J. E. Smith.—*Northern Buttercup.*—Wolseley. June.

BATRACHIUM S. F. Gray.

Batrachium divaricatum (Schrank) Wimm.—*Stiff White Water Crowfoot.*—Gleichen. June.

THALICTRUM L. Sp.

Thalictrum Venulosum Trelease.—*Veiny Meadow Rue.*—Winnipeg. June.

PAPAVERACEÆ B. Juss.

PAPAVER L. Sp.

Papaver nudicaule L.—*Alpine Poppy.*—Western slope. April.

Papaver alpinum L.—*Arctic Poppy.*—Glacier. June

CAPNOIDES Adans.

Capnoides aureum occidentalis Gray.—*Golden Corydalis.*—Banff. June.

CRUCIFERÆ B. Juss.

CORONOPUS Gaertn.

Coronopus didymus (L.) J. E. Smith.—*Lesser Wart-cress.* —Banff. June.

SISYMBRIUM L. Sp.

Sisymbrium altissimum L.—*Tall Sisymbrium.*— Qu'-Appelle Hill. June.

BRASSICA L. Sp.

Brassica arvensis (L.) B. S. P.—*Charlock.*—Near Winnipeg. June.

RORIPA Scop.

Roripa trachycarpum Gray.—*Shortfruited Cress.*—Manitoba. July.

CARDAMINE L. Sp.

Cardamine hirsuta L.—*Hairy Bitter-cress.*—Banff. June.

Cardamine Pennsylvanica Muhl.—*Pennsylvania Bitter-cress.* June.

NESLIA Desv.

Neslia paniculata (L.) Desv.—*Neslia.*—Railway track near Winnipeg. June.

DRABA L. Sp.

Draba cuneifolia Nutt.— *Wedgeleaved Whitlow-grass.*—Calgary. June.

Draba Fladnizensis Wulf.— *White Arctic Whitlow-grass.*—Banff. June.

DRABA NIVALIS LILJ.—*Yellow Arctic Whitlow-grass*—Wolseley. June.

DRABA INCANA L.—*Hoary Whitlow-grass*—Banff. June

SOPHIA ADANS.

SOPHIA INCISA (ENGELM) GREENE.—*Western Tansy-Mustard.*—Canmore. June.

SOPHIA HARTWEGIANA (FOURN.) GREENE.—*Hartweg's Tansy-Mustard.*—Canmore. June.

ARABIS L. SP.

ARABIS VIRGINICA (L.) TRELEASE.—*Virginia Rock-cress.*—Qu'Appelle Valley. June.

ARABIS HUMIFUSA (J.VAHL.) S.WATS.—*Arctic Rock-cress.*—Laggan. June.

ARABIS PATENS SULLIV.—*Spreading Rock-cress.*—Winnipeg. June.

ARABIS HIRSUTA (L.) SCOP.—*Hairy Rock-cress.*—Calgary. June.

ARABIS BRACHYCARPA (T. & G.) BRITTON.—*Purple Rock-cress.*—Qu'Appelle Valley. June.

ARABIS HOLBŒLLII HORNEM.—*Holbœll's Rock-cress.*—Banff. June.

ERYSIMUM L. SP.

ERYSIMUM INCONSPICUUM (S. WATS.) MACM.—*Small Erysimum.*—Wolseley. June.

ERYSIMUM SYRTICOLUM SHELDON.—*Sand Erysimum.*—Canmore. June.

ERYSIMUM ASPERUM D.C.—*Western Wallflower.*—Calgary. June.

CAPPARIDACEÆ LINDL.

CLEOME L. SP.

CLEOME SERRULATA PURSH.—*Pink Cleome.*—Broadview. June.

CRASSULACEÆ D. C.

SEDUM L. Sp.

Sedum stenopetalum Pursh.—*Narrow-petaled Stonecrop.*—Banff. June.

SAXIFRAGACEÆ Dumort.

Saxifraga Aizoon Jacq.—*Livelong Saxifrage.*—Schreiber. June.

Saxifraga nivalis L.—*Clustered Alpine Saxifrage.*—Lake Louise. June.

Saxifraga stellaris L.—*Starry Saxifrage.*—Revelstoke. June.

HEUCHERA L. Sp.

Heuchera parvifolia Nutt.—*Small-leaved Heuchera.*—Canmore. June.

Heuchera hispida hirsuticaulis Wheelock.—*Hairy Heuchera.*—Calgary. June.

Heuchera cylindriaca Dougl.—*Smooth Heuchera.*—North Bend. June.

PHILADELPHUS L. Sp.

Philadelphus Lewisii Pursh.—*Lewis' Mock Orange.*—North Bend. June.

Philadelphus Gordonianus Lindl.—*Gordon's Mock Orange.*—North Bend. June.

GROSSULARIACEÆ Dumort.

RIBES L. Sp.

Ribes lacustre (Pers.) Poir.—*Swamp Gooseberry.*—Calgary. June.

ROSACEÆ B. Juss.

SPIRÆA L. Sp.

Spiræa corymbosa Raf.—*Corymbed Spiræa.*—Laggan. June.

ARUNCUS Adans.

Aruncus Aruncus (L.) Karst.—*Goat's-beard.*—North Bend. June.

RUBUS L. Sp.

Rubus parviflorus Nutt.—*Salmon-berry.*—Revelstoke. June.

Rubus arcticus L.—*Arctic Bramble.*—Banff. June.

POTENTILLA L. Sp.

Potentilla Hippiana Lehm.—*Woolly Cinquefoil.*—Canmore. June.

Potentilla Pennsylvanica bipinnitafida (Dougl.) T. and G.—*Prairie Cinquefoil.*—Broadview. June.

Potentilla Pennsylvanica strigosa Pursh.—*Prairie Cinquefoil.*—Wolseley. July.

Potentilla multifida L.—*Cutleaved Cinquefoil.*—Manitoba. July.

SIBBALDIA L. Sp.

Sibbaldia procumbens L.—*Sibbaldia.*—Wolseley. June.

GEUM L. Sp.

Geum ciliatum Pursh.—*Longplumed Purple Avens.*—Burnside. June.

ROSA L. Sp.

Rosa Setigera Michx.—*Prairie Rose.*—Calgary. June.

Rosa acicularis Lindl.—*Prickly Rose.*—Medicine Hat. June.

Rosa Arkansana Porter.—*Arkansas Rose.*—Broadview. June.

Rosa Woodsii Lindl.—*Woods' Rose.*—Calgary. June.

POMACEÆ L.

SORBUS L. Sp.

Sorbus sambucifolia (C. and S.) Roem.—*Western Mountain Ash.*—Calgary. June.

MIMOSACEÆ Reichenb.

ACACIA ADANS.

Acacia filiculoides (Cav.) Trelease.—*Prairie Acacia.*—Pacific slope. May.

PAPILIONACEÆ L.

THERMOPSIS R. Br.

Thermopsis rhombifolia (Nutt.) Richards.—*Prairie Thermopsis.*—Calgary. June.

LUPINUS L. Sp.

Lupinus argenteus Pursh.—*Silvery Lupine.*—Pacific slope. May.

PSORALEA L. Sp.

Psoralea argophylla Pursh.—*Silver-leaf Psoralea.*—Canmore. June.

Psoralea hypogæa Nutt.—*Small Indian Bread-root.*—Broadview. June.

AMORPHA L. Sp.

Amorpha nana Nutt.—*Fragrant False Indigo.*—Manitoba. May.

KUHNISTERA Lam.

Kuhnistera purpurea (Vent.) MacM.—*Violet Prairie Clover.*—Wolseley. July.

ASTRAGALUS L. Sp.

Astragalus crassicarpus Nutt.—*Ground Plum.*—Broadview. June.

Astragalus Plattensis Nutt.—*Platte Milk Vetch.*—Canmore. June.

Astragalus mollissimus Torr.—*Woolly Crazy Weed.*—Canmore. June.

Astragalus Carolinianus L.—*Carolina Milk Vetch.*—Canmore. June.

Astragalus adsurgens Pall.—*Ascending Milk Vetch.*—Broadview. June.

Astragalus Hypoglottis L.—*Purple Milk Vetch.*—Wolseley. June.

Astragalus racemosus Pursh.—*Racemose Milk Vetch.*—Kananaskis. June.

Astragalus bisulcatus (Hook) A. Gray.—*Two-grooved Milk Vetch.*—Canmore. June.

Astragalus pectinatus (Hook) Dougl.—*Narrow-leaved Milk Vetch.*—Wolseley. June.

Astragalus gracilis Nutt.—*Slender Milk Vetch.*—Broadview. June.

Astragalus flexuosus (Hook) Dougl.—*Flexile Milk Vetch.*—Kananaskis. June.

Astragalus elegans (Hook) Britton.—*Pretty Milk Vetch.*—Canmore. June.

Astragalus aboriginorum Richards.—*Indian Milk Vetch.*—Calgary. June.

OROPHOCA Britton.

Orophoca cæspitosa (Nutt.) Britton.—*Sessile-flowered Milk Vetch.*—Broadview. June.

SPIESIA Neck.

Spiesia multiceps (Nutt.) Kuntze.—*Tufted Oxytrope.*—Kananaskis. June.

SPIESIA CAMPESTRIS (L.) KUNTZE.—*Yellow Oxytrope.*—Canmore. June.

SPIESIA LAMBERTI (PURSH.) KUNTZE.—*Stemless Locoweed.*—Canmore. June.

SPIESIA SPLENDENS (DOUGL.) KUNTZE.—*Showy Oxytrope.*—Broadview. June.

HEDYSARUM L. SP.

HEDYSARUM AMERICANUM (MICHX.) BRITTON.—*Hedysarum.*—Laggan. June.

HEDYSARUM MACKENZII RICHARDS.—*Mackenzie's Hedysarum.*—Field. June.

LESPEDEZA MICHX.

LESPEDEZA HIRTA (L.) ELL.—*Hairy Bush-clover.*—Manitoba. August.

VICIA L. SP.

VICIA AMERICANA MUHL.—*American Vetch.*—North Bend. June.

VICIA LINEARIS (NUTT.) GREENE.—*Narrow-leaved Pea Vine.*—Broadview. July.

LATHYRUS L. SP.

LATHYRUS VENOSUS MUHL.—*Veiny Pea.*—Calgary. June.

LATHYRUS DECAPHYLLUS PURSH.—*Prairie Vetchling.*—Broadview. June.

LATHYRUS ORNATUS NUTT.—*Showy Vetchling.*—Calgary. June.

GERANIACEÆ J. ST. HIL.

GERANIUM L. SP.

GERANIUM FREMONTII PARRYI INGELM.—*Crane'sbill.*—Pacific slope. May.

GERANIUM RICHARDSONI FISCH. AND MEY.—*Richardson's Geranium.*—Donald. June.

GERANIUM INCISUM NUTT.—*Cutleaved Geranium.*—Pacific slope. May.

ERODIUM L'HER.

ERODIUM CICUTARIUM (L.) L'HER.—*Hemlock Stork'sbill.*—Pacific slope. May.

MALVACEÆ NECK.

MALVASTRUM A. GRAY.

MALVASTRUM COCCINEUM (PURSH.) A. GRAY.—*Red False Mallow,*—Wolseley. June.

VIOLACEÆ D.C.

VIOLA L. SP.

VIOLA ROTUNDIFOLIA MICHX.—*Round-leaved Violet.*—Wolseley. May.

VIOLA PALUSTRIS L.—*Marsh Violet.*—Lake Louise. June.

VIOLA SELKIRKII PURSH.—*Selkirk's Violet.*—Lake Louise. June.

VIOLA CANINA ADUNCA GRAY.—*Curved Dog Violet.*—Banff. June.

VIOLA CANINA LONGIPES WATSON.—*Longstalked Dog Violet.*—Banff. June.

VIOLA ARENARIA D.C.—*Sand Violet.*—Wolseley. June.

LOASACEÆ REICHENB.

MENTZELIA L. SP.

MENTZELIA DECAPETALA (PURSH.) URBAN AND GILG.—*Night Flower.*—Medicine Hat. August.

CACTACEÆ Lindl.

OPUNTIA Mill.

Opuntia fragilis (Nutt.) Haw.—*Brittle Opuntia.*—Gleichen. June.

ELEAGNACEÆ Lindl.

Eleagnus argentea Pursh.—*Silver-berry.*—Broadview. June.

LEPARGYRÆA Raf.

Lepargyræa Canadensis (L.) Greene.—*Canadian Buffalo-berry.*—Winnipeg. June.

ONAGRACEÆ Dumort.

EPILOBIUM L. Sp.

Epilobium alpinum L.—*Alpine Willow-herb.*—Banff. June.

Epilobium anagallidifolium Lam.—*Pimpernel Willow-herb.*—Laggan. June.

Epilobium paniculatum Nutt.—*Panicled Willow-herb.*—Kananaskis. June.

Epilobium tetragonum L.—*Square Willow-herb*—Glacier. June.

ANOGRA Spach.

Anogra albicaulis (Pursh.) Britton.—*Prairie Evening Primrose.*—Wolseley. June.

Anogra pallida (Lindl.) Britton.—*White-stemmed Evening Primrose.*—Wolseley. June.

GAURA L. Sp.

Gaura coccinea Pursh.—*Scarlet Gaura.*—Wolseley. June.

UMBELLIFERÆ B. Juss.

PEUCEDANUM L. Sp.

Peucedanum villosum Nutt.—*Hairy Parsley.*—Pilot Mound. May.

THASPIUM Nutt.

Thaspium trifoliatum aureum (Nutt.) Britton.—*Golden Alexanders.*—Portage La Prairie. June.

PYROLACEÆ Agardh.

PYROLA L. Sp.

Pyrola rotundifolia pumila Hornem.—*Small round-leaved Wintergreen.*—Banff. June.

Pyrola uliginosa Torr.—*Bog Wintergreen.*—Lake Louise. June.

Pyrola minor L.—*Lesser Wintergreen.*—Laggan. June.

ERICACEÆ D.C.

MENZIESIA J. E. Smith.

Menziesia glabella A. Gray.—*Smooth Menziesia.*—Donald. June.

CHAMÆCISTUS Œder.

Chamæcistus procumbens (L.) Kuntze.—*Alpine Azalea.*—Tunnel Mountain, Banff. June.

KALMIA L. Sp.

Kalmia glauca Ait.—*Swamp Laurel.*—Lake Louise. June.

PHYLLODICE Salisb.

Phyllodice cœrulea (L.) Gren. and God.—*Mountain Heath.*—Tunnel Mountain, Banff. June.

BRYANTHUS Steller.

Bryanthus empetriformis Gray.—*Rose Mountain Heath.*—Near Lake Louise. June.

CASSIOPE D. Don.

Cassiope tetragona (L.) D. Do .—*Four-angled Moss-plant.*—Tunnel Mountain, Banff. June.

VACCINIACEÆ Lindl.

VACCINIUM L. Sp.

Vaccinium uliginosum L.—*Great Bilberry.*—Nepigon. June.

Vaccinium cæspitosum Michx.—*Dwarf Bilberry.*—Near Lake Louise. June.

Vaccinium Pennsylvanicum Lane.—*Lowbush Blueberry.* Calgary. June.

PRIMULACEÆ Vent.

PRIMULA L. Sp.

Primula Mistassinica Michx.—*Dwarf Canadian Primrose.*—Banff. June.

Primula Parryi Gray.—*Parry's Primrose.*—Pacific Slope. April.

DODECATHEON L. Sp.

Dodecatheon Meadia L.—*Shooting Star.*—Banff. June.

GENTIANACEÆ Dumort.

GENTIANA L. Sp.

Gentiana propinqua Richards.—*Four-parted Gentian.*—Field. June.

Gentiana quinquefolia L.—*Stiff Gentian.*—Banff. June.

Gentiana Forwoodii Gray.—*Oblong-leaved Gentian.*—Kananaskis. June.

CUSCUTACEÆ Dumort.

CUSCUTA L. Sp.

Cuscuta compacta Juss.—*Compact Dodder.*—Manitoba. July.

BORRAGINACEÆ Lindl.

LAPPULA Mœnch.

Lappula Texana (Scheele) Britton.—*Hairy Stickseed.*—Broadview. August.

Lappula floribunda (Lehm.) Geeene.—*Large-flowered Stickseed.*—Calgary. June.

OREOCARYA Greene.

Oreocarya glomerata (Pursh.) Greene.—*Clustered Oreocarya.*—Canmore. June.

Oreocarya sericea (A. Gray) Greene.—*Low Oreocarya.*—Gleichen. June.

MERTENSIA Roth.

Mertensia Paniculata (Ait.) Don.—*Tall Lungwort.*—Canmore. June.

Mertensia lanceolata (Pursh.) D. C.—*Lance-leaved Lungwort.*—Canmore. June.

LITHOSPERMUM L. Sp.

Lithospermum canescens (Michx.) Lehm.—*Hoary Puccoon.*—Medicine Hat. June.

LABIATÆ B. Juss.

AGASTACHE Clayt.

Agastache anethiodora (Nutt.) Britton.—*Fragrant Giant Hyssop.*—Wolseley. August.

DRACHOCEPHALUM L. Sp.

Dracocephalum parviflorum Nutt.—*American Dragon-head.*—Winnipeg. June.

PHYSOSTEGIA Benth.

Physostegia parviflora Nutt.—*Purple Lion's-heart.*—Wolseley. July.

MONARDA L. Sp.

Monarda fistulosa mollis Benth.—*Horse Mint.*—Manitoba. August.

Monarda scabra Beck.—*Pale Wild Bergamot.*—Broadview. July.

MENTHA L. Sp.

Mentha aquatica L.—*Water Mint.*—Manitoba. July.

SOLANACEÆ Pers.

PHYSALIS L. Sp.

Physalis pumila Nutt.—*Low Ground Cherry.*—Near Lake Louise. June.

SCROPHULARIACEÆ Lindl.

PENTSTEMON Soland.

Pentstemon Menziesii Nutt.—*Menzies' Beard-tongue.*—Wolseley. June.

Pentstemon albidus Nutt.—*White-flowered Beard-tongue.*—Manitoba. July.

PENTSTEMON CONFERTUS DOUGL.—*Douglass' Beard-tongue.* Banff. June.

PENTSTEMON CONFERTUS CÆRULEO-PURPUREUS GRAY.—Trundle Mountain, Banff. June.

PENTSTEMON GRACILIS NUTT.—*Slender Beard-tongue*—Broadview. August.

PENTSTEMON ANGUSTIFOLIUS PURSH.—*Pale-blue Beard-tongue.*—Stephen. June.

MIMULUS L. SP.

MIMULUS MOSCHATUS DOUGL.— *Musk-flower.*— Revelstoke. June.

MIMULUS LEWESII PURSH.—*Lewis' Monkey flower.*—Rocky Mountains. July.

ILYSANTHES RAF.

ILYSANTHES GRATIOLOIDES (L.) BENTH.—*Long-stalked False Pimpernel.*—Calgary. June.

VERONICA L. SP.

VERONICA ALPINA L.—*Alpine Speedwell.*—Laggan. June.

CASTILLEJA MUTIS.

CASTILLEJA COCCINEA (L.) SPRENG.—*Scarlet Painted Cup.*—Manitoba. July.

CASTILLEJA INDIVISA ENGELM.—*Entire-leaved Painted Cup.*—Laggan. June.

CASTILLEJA MINOR A. GRAY.—*Small-flowered Painted Cup.*—Laggan. June.

CASTILLEJA ACUMINATA (PURSH.) SPRENG.—*Lance-leaved Painted Cup.*—Canmore. June.

CASTILLEJA PARVIFLORA BONG.—*Small-flowered Painted Cup.*—Pacific slope. May.

PEDICULARIS L. Sp.

Pedicularis Grœnlandica Retz.—*Long-beaked Pedicularis.*—Banff. June.

LENTIBULARIACEÆ Lindl.

PINGUICULA L. Sp.

Pinguicula Vulgaris L.—*Butterwort.*—Banff. June.

PLANTAGINACEÆ Lindl.

PLANTAGO L. Sp.

Plantago lanceolata L.—*Ribwort.*—Calgary. June

RUBIACEÆ B. Juss.

HOUSTONIA L. Sp.

Houstonia longifolia Gaertn.—*Long-leaved Houstonia.*—Manitoba. July.

GALIUM L. Sp.

Galium boreale L.—*Northern Bedstraw.* — Laggan. June.

Galium tinctorum L.—*Stiff Marsh Bedstraw.*—Wolseley.

Galium spurium L.—*Lesser-Goosegrass.*—Kananaskis. June.

CAPRIFOLIACEÆ Vent.

VIBURNUM L. Sp.

Viburnum pubescens (Ait.) Pursh. — *Downy-leaved Arrow wood.*—Winnipeg. June.

SYMPHORICARPUS JUSS.

SYMPHORICARFUS RACEMOSUS MICHX.—*Snowberry.*—Calgary. June.

SYMPHORICARPUS PAUCIFLORUS (ROBBINS) BRITTON.—*Low Snowberry.*—Calgary. June.

SYMPHORICARPUS OCCIDENTALIS HOOK.—*Wolfberry.*—Laggan. June.

SYMPHORICARPUS OREOPHILUS GRAY.—*Mountain Snowberry.*

LONICERA L. SP.

LONICERA SULLIVANTII A. GRAY.—*Sullivant's Honeysuckle.*

LONICERA CŒRULEA L.—*Mountain Fly Honeysuckle.*

LONICERA INVOLUCRATA (RICHARDS.) BANKS.—*Involucred Fly Honeysuckle.*—Glacier. June.

VALERIANACEÆ BATSCH.

VALERIANA L. SP.

VALERIANA PAUCIFLORA MICHX.—*Large-flowered Valerian.*—Qu'Appelle Hill. June.

VALERIANA SYLVATICA BANKS. — *Wood Valerian.*—Revelstoke. June.

VALERIANA SITCHENSIS BONG.—*Mountain Valerian.*—Laggan. June.

CICHORIACEÆ REICHARB.

PTILORIA RAF.

PTILORIA TENUIFLORA (TORR) RAF. — *White-plumed Ptiloria.*—Gleichen. June.

TARAXACUM HALL.

TARAXACUM TARAXACUM ALPINUM (KOCH) PORTER.—*Alpine Blowball.*—Glacier. June.

LACTUCA L. Sp.

LACTUCA SAGITTIFOLIA ELL.—*Arrow-leaved Lettuce.*—Qu'Appelle Hill. June.

AGOSERIS RAF.

AGOSERIS GLAUCA (PURSH.) GREENE.—*Large-flowered Agoseris.*—Bow River Valley. June.

HIERACIUM L. Sp.

HIERACIUM LONGIPILUM TORR.—*Long-bearded Hawkweed.*—Qu'Appelle Hill. June.

COMPOSITÆ ADANS.

LACINIARIA HILL.

LACINIARIA PUNCTATA (HOOK.) KUNTZE.—*Dotted Button-Snakeroot.*—Wolseley. September.

LACINIARIA ACIDOTA (ENGELM and GRAY) KUNTZE.—*Slender Button-Snakeroot.* Broadview. September.

LACINIARIA PYCNOSTACHYA (MICHX) KUNTZE.—*Prairie Button-Snakeroot.*—Broadview. August.

LACINIARIA SCARIOSA (L.) HILL.—*Large Button-Snakeroot.*—Broadview. August.

GRINDELIA WILLD.

GRINDELIA SQUARROSA (PURSH.) DUNAL.—*Broad-leaved Gum-plant.*—Canmore. June.

CHRYSOPSIS NUTT.

CHRYSOPSIS VILLOSA (PURSH.) NUTT.—*Hairy Golden Aster.*—Broadview. June.

CHRYSOPSIS VILLOSA CANESCENS GRAY.—*Hoary Golden Aster.*—Trundle Mt., Banff. June.

CHRYSOPSIS HISPIDA (HOOK.) NUTT.—*Hispid Golden Aster.*—Wolseley. June.

ERIOCARPUM NUTT.

ERIOCARPUM SPINULOSUM (NUTT.) GREENE.—*Cut-leaved Eriocarpum.*—Broadview. August.

SOLIDAGO L. SP.

SOLIDAGO JUNCEA AIT.—*Early or Sharp-toothed Golden-rod.*—Revelstoke. June.

SOLIDAGO RIGIDA L.—*Stiff Golden-rod.*—Broadview. August.

SOLIDAGO RIDDELII FRANK.—*Riddell's Golden-rod.*—Ellisboro. June.

SOLIDAGO NANA NUTT.—*Dwarf Golden-rod.*—Calgary. June.

EUTHAMIA NUTT.

EUTHAMIA CAROLINIANA (L.) GREENE.—*Slender fragrant Golden-rod.*—Calgary. June.

TOWNSENDIA HOOK.

TOWNSENDIA GRANDIFLORA NUTT.—*Large-flowered Townsendia.*—Medicine Hat.

ASTER L. SP.

ASTER LÆVIS L.—*Smooth aster.*—Manitoba. September.

ASTER JUNCEUS AIT.—*Rush aster.*—Calgary. July.

LEUCELENE GREENE.

LEUCELENE ERICOIDES (TORR.) GREENE.—*Rose Heath Aster.*—Manitoba. July.

MACHERANTHERA NEES.

MACHERANTHERA TANACETIFOLIA (H. B. K.) NEES.—*Tansy Aster.*—Calgary. June.

ERIGERON L. SP.

ERIGERON ASPER NUTT.—*Rough Erigeron.*—Calgary. June.

ERIGERON SUBTRINERVIS RYDBERG.—*Three-nerved Fleabane.*—Broadview. June.

ERIGERON CÆSPITOSUS NUTT.—*Tufted erigeron.*—Field. June.

ERIGERON PUMILIS NUTT.—*Low Fleabane.*—Near Lake Louise. June.

FILAGO L. SP.

FILAGO PROLIFERA (NUTT.) BRITTON.—*Filago.*—Manitoba. August.

ANTENNARIA GAERTN.

ANTENNARIA DIOICA (L.) GAERTN.—*Pink Cudweed.*—Banff. June.

ANTENNARIA DIMORPHA (NUTT.) T. & G.—*Low Everlasting.*—Broadview. June.

RATIBIDA RAF.

RATIBIDA COLUMNARIS (SIMS.) D. DON.—*Long-headed Coneflower.*—Medicine Hat. June.

BRAUNERIA NECK.

BRAUNERIA PALLIDA (NUTT.) BRITTON.—*Pale Purple Coneflower.*—Broadview. June.

HELIANTHUS L. SP.

HELIANTHUS ANNUUS L.—*Common Sunflower.*—Regina. June.

HELIANTHUS PETIOLARIS NUTT.—*Prairie Sunflower.*—Field. June.

VERBESINA L. SP.

VERBESINA HELIANTHOIDES MICHX.—*Sunflower Crownbeard.*—Manitoba. July.

COREOPSIS L. SP.

COREOPSIS CRASSIFOLIA AIT.—*Thick-leaved Tickseed.*—Broadview. June.

HYMENOPAPPUS L'Her.

Hymenopappus flavescens A. Gray.—*Woolly Yellow Hymenopappus.*—Pacific slope. May.

Hymenopappus filifolius Hook.—*Low Tufted Hymenopappus.*—Qu'Appelle Hill. June.

GAILLARDIA Fong.

Gaillardia aristata Pursh.—*Great-flowered Gaillardia.*—Calgary. June.

Gaillardia pulchella Fong.—*Showy Gaillardia.*—Broadview. June.

THYMOPHYLLA Lag.

Thymophylla aurea (A. Gray) Greene.—*Thyme-leaf.*—Trundle Mt., Banff. June.

ARTEMISIA L. Sp.

Artemisia Canadensis Michx.—*Canada Wormwood.*—Manitoba, July.

Artemisia frigida Willd.—*Pasture Sage-Brush.*—Gleichen. June.

Artemisia gnaphalodes Nutt.—*Western Mugwort.*—Manitoba. July.

ARNICA L. Sp.

Arnica cordifolia Hook.—*Heart-leaf Arnica.*—Laggan. June.

Arnica latifolia Boug.—*Broad-leaved Arnica.*—Laggan. June.

Arnica Chamissonis Less.—*Chamisso's Arnica.*—Laggan. June.

SENECIO L. Sp.

Senecio triangularis Hook. — *Mountain Senecio.*—Field. June.

Senecio frigidus Less.—*Arctic Senecio.*—Lake Louise. June.

SENECIO INTIGERRIMUS NUTT.—*Entire-leaved Groundsel.* —Kananaskis. June.

SENECIO LUGENS RICHARDS.—*Black-tipped Groundsel.*—Canmore. June.

SENECIO CANUS HOOK.—*Silvery Groundsel.*—Broadview. June.

SENECIO PLATTENSIS NUTT.—*Prairie Ragwort.*—Ellisboro. June.

SENECIO DISCOIDEUS (HOOK.) BRITTON.—*Northern Squaw-weed.*—Wolseley. June.

SENECIO COMPACTUS (A. GRAY) RYDBERG.—*Western Squaw-weed.*—Kananaskis. June.

SENECIO AUREUS PARVIFLORUS (PURSH.) BRITTON.—*Small-flowered Squaw-weed.*—Laggan. June.

SENECIO PALUSTRIS HOOK.—*Marsh Groundsel.*—Manitoba. July.

CNICUS L. SP.

CNICUS ERIOCEPHALUS GRAY.—*Woolly-headed Thistle.*—Pacific slope. May.

NORTH AMERICAN GOLDEN RODS.

By REV. ROBERT CAMPBELL, M.A., D.D.

The Golden-rods are not only the most in evidence of our late summer and early autumn wild flowers, but they are also intrinsically the finest of them all. They are the glory of the field and forest borders, and quite eclipse any genus that Great Britain can show at the corresponding season of the year. Students of botany who may not be in a position to roam over the whole domain of our native flora might well find occupation in collecting and examining this genus alone. The number of species within reach of the city is very large, and then the determination of them can scarcely yet be held as fixed. There is room for further investigation. What are now counted varieties may have yet to be ranked as species, when they are more completely differentiated, as the result of further examination. Our Museum has in its botanical cabinet the following species and varieties of Solidagos and Euthamias, and the publication of the list may serve those who would like to make a study of this showy and interesting family of plants. It will give them a good start to have a look over these specimens:—

SOLIDAGO L. Sp.

1. Solidago squarrosa Muhl.—*Stout Ragged Golden-rod.*—Cacouna and Cap-a-L'aigle. August.

2. Solidago cæsia L.—*Blue-stemmed Golden-rod.*—Mount Royal Park. August.

3. Solidago cæsia axillaris (Pursh) A. Gray.—*Axil-leaved, Blue-stemmed Golden-rod.*—Mount Royal Park. August.

4. Solidago bicolor L.—*White Golden-rod.*—Mount Royal Park. September.

5. Solidago hispida Muhl. — *Hairy Golden-rod.*—Mount Royal Park. September.

6. Solidago erecta Pursh.—*Slender Golden-rod.*—Ithaca, N.Y. August, 1898.

7. Solidago Monticola T. & G.—*Mountain Golden-rod.* Alleghany Mountains, near Olean, N.Y. August, 1898.

8. Solidago macrophylla Pursh.—*Large-leaved Golden-rod.*—Cap-a-L'aigle. August.

9. Solidago puberula Nutt.—*Downy Golden-rod.*—Cap-a-L'aigle. August.

10. Solidago uliginosa Nutt.—*Bog Golden-rod.*—St. Michel Marsh. September.

11. Solidago Virgaurea L.—*European Golden-rod.*—Mount Royal Park. September.

12. SOLIDAGO VIRGAUREA DEANI PORTER. — *Dean's Golden-rod* —Mount Royal Park. September.

13. SOLIDAGO SEMPERVIRENS L.—*Seaside Golden-rod.*—Cap-a-L'aigle and Bic. August,

14. SOLIDAGO ODORA AIT.—*Sweet Golden-rod.*—Olean, N.Y. August, 1898.

15. SOLIDAGO RUGOSA MILL.—*Wrinkle-leaved Golden-rod.* Common. Island of Montreal. September.

16. SOLIDAGO PATULA MUHL.—*Spreading Golden-rod.* Ithaca, N.Y. August, 1898.

17. SOLIDAGO NEGLECTA T. & G.—*Swamp Golden-rod.* Cacouna. August, 1896.

18. SOLIDAGO JUNCEA AIT.—*Early Golden-rod.*—Kingston. August, 1896.

19. SOLIDAGO JUNCEA SCABRELLA T. & G.—*Rough Sharp-toothed Golden-rod.*—Niles, Illinois. September, 1893.

20. SOLIDAGO JUNCEA RAMOSA PORTER & BRITTON.—*Branched sharp-toothed Golden-rod.*—Olean. August, 1898.

21. SOLIDAGO RUPESTRIS RAF.—*Rock Golden-rod.*—Clifton Springs, N.Y. August, 1898.

22. SOLIDAGO SEROTINA AIT.—*Late Golden-rod.*—Mount Royal Park. September.

23. SOLIDAGO SEROTINA GIGANTEA (AIT.) A. GRAY.—*Stout late Golden-rod.*—Island of Montreal.

24. SOLIDAGO CANADENSIS L.—*Canada Golden-rod.*—Common everywhere. August.

25. SOLIDAGO CANADENSIS PROCERA (AIT.) T. & G.—*Hoary Canada Golden-rod.*—Mount Royal Park.

26. SOLIDAGO CANADENSIS GLABRATA PORTER.—*Smooth Canada Golden-rod.*—Mount Royal Park. August.

27. SOLIDAGO CANADENSIS SCABRIUSCULA PORTER.—*Rough-leaved Canada Golden-rod.*—Ithaca, N.Y. August, 1898.

28. SOLIDAGO RIGIDA L.—*Stiff-leaved Golden-rod.* Broadview. August.

29. Solidago Riddelii Frank.—*Riddell's Golden-Rod.* Ellisboro, Manitoba. June.

30. Solidago nana Nutt.—*Dwarf Golden-rod.*—Calgary. June, 1897.

EUTHAMIA Nutt.

1. Euthamia graminifolia (L.) Nutt.—*Bushy Golden-rod.*—Common everywhere. August.

2. Euthamia Caroliniana (L.) Greene. — *Slender fragrant Golden-rod.*—Calgary. June.

Notes and Comments.

"The Devonian System in Canada." Being an address by J. F. Whiteaves, F.G.S., Palæontologist and Zoologist of the Geological Survey of Canada, as Vice-President and Chairman of Section E (Geology and Geography) of the American Association for the Advancement of Science. Delivered August 21st, 1899. Published as separate by Amer. Assoc. Adv. Sc., 48th Ann. (Columbus meeting). 31 pp. The Chemical Publishing Company, Easton, Pa., 1899.

Mr. Whiteaves begins by defining the term "Devonian" according to Sedgwick and Murchison in 1839, ascribing to Londsdale the distinction of having established it in December, 1837, on purely palæontological grounds. He goes on and considers the progress made in Canada up to the present, making the following geographical divisions :—

I. The Maritime Provinces and Quebec.

Touching Nova Scotia and New Brunswick geology, much obscurity still exists, but no attempt is made to clear the mist from the complicated problems involved in that portion of Canada. Mr. Whiteaves gives the views of Dr. Abram Gesner, Sir Wm. Dawson, Dr. Honeyman, Dr. R. W. Ells and Mr. Hugh Fletcher without comments. The views of Prof. David White, of the U.S. National Museum at Washington, of Mr. Robert Kidston, of Stirling, Scotland, on certain fossiliferous rock-formatious occurring unconformably below the marine carboniferous limestones of Eastern Canada, are added as those of specialists who base their opinions upon the evidence afforded by the fossil organic remains entombed in the rocky formations, which by Gesner, Fletcher and Ells are called Devonian, and by Sir Wm. Dawson and the writer as Carboniferous.

On independent grounds Dr. White and Mr. Kidston corroborated the

Carboniferous views of the subject, and since the publication of this "Address" the views of Mr. A. Smith Woodward and of Dr. Henry Woodward and Prof. T. Rupert Jones have been received, and further corroborate the views held by Dr. White and Mr. Kidston. The Mispec and Lancaster formations of New Brunswick hold the same taxonomic relation to the other palæozoic sediments of the geological column in New Brunswick that the Union and Riversdale formations do in Nova Scotia. The flora and fauna of both are practically identical—the ferns, worms and insects, etc., of the former are found in the latter, and must be referred to one and the same horizon. From this it would appear that much of what has been called Devonian in New Brunswick will have to go up into the Carboniferous system and certain measures in Nova Scotia placed in the Millstone Grit formation, viz , the "Millstone Grit of Riversdale, etc.," will have to go down from the Middle or Meso-Carboniferous to the Early or Eo-Carboniferous. It will thus bring the palæozoic sediments of New Brunswick and Nova Scotia which belong to the same Eo-Carboniferous period in the same position in the geological column of rock-formations—a place which both from stratigraphical as well as from palæontological evidence they hold. There is no divergence of opinion between the stratigraphical geologists and the palæontologists as to the position of "rocks of Union and Riversdale" in the sequence of geological formations. The only point at issue is where to draw the dividing line between the Carboniferous and the Devonian. Mr. Fletcher, in his Nova Scotia work, draws the line at the base of the limestone or marine series. I would draw the line below the Union and Riversdale formations on the ground that the entire character of the abundant fauna and flora these formations contain, viz., erect trees, ferns, calamites, lycopodiaceous plants, ostracoda, insects, worms, crustacea in great variety, lamelli branchiata, reptilian remains, etc., etc., have a true Carboniferous *facies*, and can only be classed as Carboniferous in order to be placed in what is recognized the world over as a portion of that system which is marked by coal and coaly strata deposited in shallow water, lagoons and estuaries in which many of the land plants and animals as well as many of the aquatic plants and animals of that period lie buried or on which the latter have left their footprints. The high-class flora and abundant fauna of air-breathers of the St. John plant-bearing-beds (=Lancaster formation) are in my estimation Carboniferous rather than Devonian as to their affinities when compared with the types already recorded from European as well as American equivalents.

One of the characteristic features of the rocks of the Mispec and Lancaster formations of New Brunswick is that of metamorphism, and this feature it is which gives rise to a suggestion of apparent antiquity.

This factor is evidently a relative one as well as one of local significance, and cannot enter into this argument except with the greatest caution.

In the Summary Rep. of the Geol. Survey for 1897–98, published previous to this Address, the views of the writer on this subject were sufficiently clearly demonstrated to have been referred to.

There are marine sediments of true Devonian age in New Brunswick not referred to by Mr. Whiteaves.

Regarding the Province of Quebec, on p. 16 Mr. Whiteaves quotes Mr. Schuchert as authority for the statement that the limestones of St. Helen's Island, opposite Montreal, belong to "the Hamilton formation of Ontario and New York, and not to the Lower Helderburg," as held by Sir William Dawson, Prof. Donald, Dr. W. E. Deeks, Dr. Ells and the writer. This statement surely needs correction.

Numerous localities and areas recognized as Devonian in the Peninsula of Gaspé and described by Dr. Ells and the writer as Devonian in the Reports of Progress of the Geological Survey for 1880-1-2 and 1882-3-4 are not mentioned in connection with the progress and advancement of geological enquiry in this Province. The record of the discovery of a Meso-Devonian fauna similar to the lamelli branchiata fauna of the Hamilton formation of New York State in the sandstones of Grande Carrière Brook, Gaspé, are of sufficient importance to be noted.

II. Ontario and Keewatin, and III. Manitoba and the N-W. Territories.

In these districts Mr. Whiteaves has done considerable work, especially in the Hamilton fauna of Ontario and the Meso and Neo-Devonian of Manitoba, Keewatin and the Mackenzie River Basin. His writings are embodied in the Reports of Progress of the Geological Survey of Canada and in "Contributions to Canadian Palæontology."

In the Rocky Mountains region of Canada only preliminary work has as yet been done. The numerous and interesting collections made by Dr. Dawson, Mr. Tyrrell, Mr. McConnell and others in the Crow's Nest, Kootanie and North Saskatchewan Rivers and Valleys have been examined in part by Mr. Whiteaves, and also in 1883 and 1884 and 1886 by the writer. No mention is made of the results obtained in the study of the Devonian fossils of the Kootanie and Crow's Nest Passes some years ago in the Reports of Progress of the Geological Survey of Canada and embodied in Dr. Dawson's "Reconnaissance Map of the Rocky Mountain Region of Canada."

Prof. Meek's work, the work by Dr. Bell, Mr. McConnell and other explorers in the Mackenzie, Athabasca and Clearwater Rivers are all referred to by Mr. Whiteaves, and in a terse paragraph he sums up the knowledge of the Devonian rocks of the Dominion as a whole. He shows also how our knowledge of the fossils of the Devonian of Nova Scotia is still in its infancy, and how in the Rocky Mountains of Alberta the Carboniferous and the Devonian have not been in every instance distinguishable, and our knowledge of the Devonian fossils of Keewatin and the James's Bay region needs to be amplified.

There remains, however, yet to be shown what rock-formations and fossiliferous sediments of Nova Scotia there exist (if any) which are of true Devonian age, besides the marine Devonian strata of the Siluro-Devonian area and axis of Annapolis and Kings Counties in that Province.

H. M. Ami.

Book Notices.

Report on the Geology and Natural Resources of the area included by the Nipissing and Temiscaming Map Sheets, comprising portions of the District of Nipissing, Ontario, and of the County of Pontiac, Quebec. By Alfred Ernest Barlow, M.A., Geological Survey of Canada. Part I., Annual Report, Vol. X., 1899. pp. 301.

This report, accompanied by two well executed maps on a scale of four miles to the inch, and covering an area of 6912 square miles of the northern Protaxis of the Dominion of Canada, is a valuable addition to the literature of the Pre-Cambrian of North America, and is a further instalment of the work which is being systematically carried forward by the Dominion Geological Survey on these older rocks. The two maps, constituting what are known as sheets Nos. 131 and 138 of the Canadian Series, lie in the Upper Ottawa district along the border of the two Provinces of Quebec and Ontario, and comprise portions of both. Lake Nipissing and Lakes Temagami, Temiscaming and Keepawa, as well as many small bodies of water, are included in the area, and afford along their shores especially good opportunities for the prosecution of geological work.

After presenting a general account of the early explorations in this region, some of which date back almost to the time of the earliest settlement of the country by the French, and of previous surveys, the Physical Features of the country are described. The area is a great uneven or gently undulating rocky plateau, sloping somewhat to the east and south-east, having a general elevation of 900 to 1200 feet above sea level, the level being so nearly uniform that hills 50 to 100 feet higher are conspicuous topographical features. This peneplain is traversed in a north and south direction along one line by a very deep and narrow rocky gorge, in which lie Lake Temiscaming and the Ottawa River. The hills or cliffs rise to a height of 400 to 600 feet from the water on either side, while the water of the lake is 400 feet deep, the bottom of the gorge being filled with a fine silt. The depression is thus at least 1000 feet deep and represents a great cañon similar to those which are found on the margin of the northern Protaxis at so many other points. Several smaller rivers also occupy similar depressions. "The detailed examination of the region, however, amply demonstrates that the sculpturing to which the surface owes its present configuration was practically completed long before the advent of the glacial epoch, and that the main valleys, especially those of the Ottawa and Mattawa Rivers, were in existence long prior to the deposition of the Palæozoic sediments." With the exception of some comparatively small areas occupied by Palæozoic outliers, ranging in age from Black River to Niagara, the district is underlain by rocks of Laurentian and Huronian Age. The Laurentian, with the exception of a few small occurrences, is represented exclusively by the Fundamental Gneiss, a mass of granitic and dioritic rocks, usually possessing a foliated structure in which are many streaks, bands or inclusions of basic character, allied to diorites or diabases in composition, and representing either basic segregations from the granitic magma or portions of basic intrusions caught up in it. This Fundamental Gneiss, it is believed, probably represents the original crust of the earth, which has undergone successive fusions and re-cementations before reaching its present condition. In placing these rocks at the base of the series it is not intended to assert that they stand for any distinct or prolonged period of geological time, nor to affirm that these rocks in their present condition and with the foliation which they now possess antedate those of the Huronian System. This, as is shown, is not the case in many, or even probably in most instances.

The chemical and mineralogical composition of the gneisses as well as the character and origin of their foliation and the genetic relation of their associated pegmatites are considered at length and many interesting facts brought forward which cannot here be further discussed.

The Grenville Series, so extensively developed further south, is in this northern area represented only by a few very small and unimportant occurrences of highly crystalline limestone and a single occurrence of gneiss. They occur isolated from one another and surrounded by Fundamental Gneiss on every side, and are referred to the Grenville Series on account of their identity in petrographical character with the areas of this formation immediately to the south.

The district also includes large tracts of country underlain by pyroclastic and epiclastic rocks, forming a north-easterly extension of the development of the "typical" Huronian area on the north shore of Lake Huron. At one place on Lake Temiscaming these Huronian rocks are found resting upon the floor of Fundamental Gneiss on which they were originally deposited, and of whose detritus they are made up —everywhere else the Fundamental Gneiss has been refused or softened and penetrates the superincumbent Huronian. The total thickness of the Huronian in the area is about eighteen hundred feet, made up as follows: 1. Breccia-conglomerate, 600 feet. 2. Shales and slatygreywackes, 100 feet. 3. Quartzose grit or Arkose, 1100 feet. Associated with these Huronian sediments are numerous intrusions of galbro and diabase, some of which pass over gradually into flesh-red granites, representing, it is believed, portions of one and the same magma.

No attempt is made in this report to correlate the Grenville Series and the Huronian of the area, as the facts are insufficient to warrant the attempt. And it may be remarked incidentally in this connection that a statement made on page 415 of the current volume of the *Journal of Geology,* in reviewing some other recent papers on the Canadian Pre-Cambrian, is scarcely correct. The statement is as follows:

"The succession and correlation proposed in the above papers by Adams and Barlow and by Ells are fundamentally different from the traditional one which has been held in Canada for many years. The first departure is in placing the Grenville and Hastings series as equivalent to the Huronian."

In the papers in question this correlation was not definitely made, but it was stated in reference to the Hastings Series that "Both lithographically and stratigraphically the rocks bear a striking resemblance to rocks mapped as Huronian in the region to the north and north-east of Lake Huron, and it seems very likely that the identity of the two series may eventually be established. The two areas, however, are rather widely separated geographically, and the greatest care will have to be exercised in attempting such a correlation."[1] Even if the correlation had been established no fundamental departure would have been made. What had frequently been conjectured by Canadian geologists would have been proved. The further statement made by the Reviewer that "Ells places with the Huronian all the sedimentary rocks of Eastern Canada" is also manifestly inaccurate, seeing that while it might terminate the controversy concerning the upward extension of the Huronian to include in that system the whole Palæozoic succession, Ells certainly did not advocate this course.

The Palæozoic outliers in this area and especially that of Niagara age are of exceptional interest. Geographically this outlying patch of Niagara is so widely separated from any other locality where rocks of this age are now known to exist, that it has been a question as to whether it was formerly connected with the occurrences about Hudson Bay or with those about Lake Ontario. The strata are highly fossiliferous, and the palæontological evidence presented seems to prove that the seas in which the Niagara sediments of the Winnipeg basin and of Hudson Bay were deposited were practically continuous, while both were separated from the Temiscaming basin and the region to the south-west.

The Pleistocene history of the region seems to consist of a period of glaciation by a great ice sheet, followed by a profound submergence, during which time the ocean invaded a large portion of the Ottawa

1 *American Journal of Science,* Vol. III., March, 1897, p. 177.

valley, forming a marine gulf rivalling in extent the similar invasions of the sea in Palæozoic times. The direction of motion of the ice varies from S. 7° W. to S. 18° W.

The report also contains much information concerning the fauna, flora and timber resources of the district, and has appendices giving Lists of Elevations and Catalogues of the Palæozoic Fossils.

FRANK D. ADAMS.

GEOLOGICAL SURVEY OF CANADA. C. M. DAWSON, C.M.G., LL.D., Director. Contributions to Canadian Palæontology, Vol. IV., Part I. A Revision of the Genera and Species of Canadian Palæozoic Corals. The Madreporaria Perforata and the Alayonaria, by LAWRENCE M. LAMBE, F.G.S., Assistant Palæontologist. Ottawa, 1899.

Corals, as is well known, form a large proportion of the fossils found in the Palæozoic rocks of Canada. Unfortunately, however, the classification and nomenclature of these corals have long been in a state of some confusion. With a view to remedying this, Mr. Lambe has undertaken a revision of the genera and species. The present report on the Madreporaria Perforata and the Alayonaria, this brochure of 96 pages with five plates, forms the first part of the fourth volume of "Contributions to Canadian Palæontology." A second part, now in course of preparation and to be illustrated by thirteen plates, is intended to conclude the revision of this class so far as present material permits.

The publication will be of much value to all members of the Montreal Natural History Society who are interested in the palæontology of this vicinity, and Mr. Lambe deserves the thanks of all Canadian naturalists for the careful and painstaking manner in which he had carried out the work which has been entrusted to him.

F. D. A.

GEOLOGICAL SURVEY OF CANADA. By GEORGE MERCER DAWSON, C.M.G., F.R.S., etc., Director. Annual Report. (New Series.) Vol. X. Ottawa, December, 1899.

This volume, comprising 1,046 pages of text accompanied by eight maps and illustrated by twelve plates and a number of figures in the text, has just been issued by the Department and forms publication No. 679 of the Catalogue of volumes published by the Canadian Survey. It is addressed to the Hon. Clifford Sifton, M.P., Minister of the Interior, and contains many valuable reports of exploratory and geological surveys, both in the little known districts of Canada, as well as in the densely populated and older provinces of the Dominion of Canada. The volume opens with a "Summary Report of the Operations of the Geological Survey for 1897," by the Director.

This report describes the various publications issued durlng the year, the geological information on the Yukon District, Museum and office work, and also the result of boring operations in Northern Alberta. The Director also gives reports of explorations and surveys in British Columbia, Manitoba, Ontario, Quebec, Hudson Strait, New Brunswick and Nova Scotia. It is followed by Mr. McInnes's report "On the Geology of the Area covered by the Seine River and Lake Shebandowan Map-Sheets," in the gold-bearing series of Northern Ontario. The Laurentian, Couchich and Keewatin Steep Rock series, and Animikie series of rock formations occurring in that district are described and their contents carefully noted. The localities which are productive and of economic value receive special attentlon and notes on the glacial geology are also included. This forms Report II. of the volume.

"Report on the Area included by the Nipissing and Temiscaming Map-Sheets," by Mr. A. E. Barlow, forms Report I. of this volume, and comprises 302 pages of text, including two appendices: (1) "List of Elevations"; (2) "On some Cambro-Silurian and Silurian Fossils from the Lake Temiscaming, Lake Nipissing and Mattawa Outliers," by Henry M. Ami, of the palæontological staff. Mr. Barlow's report forms a very complete study of an important area of archæan rocks, in which he has described the main geological features with a great deal of pains, and gone into details of the composition of the gneisses met in the Laurentian of the area in question, together with their petrographical relations; also in the "Grenville series" as developed and recognized by him in that district.

The Huronian system is then discussed, and the breccia-conglomerates, the diabase and gabbro and granites met with carefully described, along with their relations to the post-Archæan eruptives. He then devotes the succeeding chapters to a description of the Cambro-Silurian, Silurian and Pleistocene areas included within the two maps of the district examined. and has a chapter on "Economic Geology" describing the valuable deposits of gold, silver, nickel, copper, iron and other minerals occurring there. Regional descriptions follow, which will prove of great value to prospectors and miners in a district, full of beautiful lakes and waterfalls and magnificent scenery, and holding economic minerals of untold wealth.

Report J, by Mr. R. Chalmers, "On the Surface Geology and Auriferous Deposits of South-eastern Quebec," contains upwards of 160 pages of very valuable reading and illustrations, with statistics of the gold production of the Beauce and Chaudière River region of Quebec. The pleistocene marine shore-lines, the rivers and lakes, the denudation that has taken place, together with the action and products of the Appalachian glacier, the Laurentide ice, and that of the local glaciers, as well as of floating ice, are all discussed. The gold-bearing region is then described. This includes the history of mining in the Gilbert River, River du Loup, Famine River, Mill River, Slate Creek, Main Chaudière Valley, Little Ditton River, etc. The probable source of the alluvial gold is then given by the author.

"The Mineral Resources of New Brunswick," by Professor L. W. Bailey, forms Report M of this volume and is a most welcome report. This province ought to receive as well as give more attention to the materials of economic value, which occur in the earth's crust as it is developed in that portion of the Dominion of Canada by the sea. The geological formations, in which iron, copper, nickel, antimony, lead, silver, manganese, coal, bituminous shales, graphite, peat, gypsum, granites, marbles, dolomites, ornamental stones, infusorial earths, mineral springs, and various other materials of economic value to man are to be found, are described, and the mode of occurrence of these useful materials given, together with their locations. A map of the minerals of the province accompanies the report.

Report S contains the customary and useful report of the "Section of Mineral Statistics and Mines," by E. D. Ingall. It contains upwards of 200 pages of valuable notes on all the economic minerals of Canada from all the provinces, and tables of their value and of the amount produced and exported or consumed at home.

The volume contains a very complete index, which adds greatly to its value.

H. M. Ami.

—*Ex. Science, New Series, Vol. XI., No. 268, pp. 266-268.*

ˈLY, 1899.

M|, 187 feet, C. H. McLEOD, *Superintendent.*

DAY	Sky Clouded in Tenths. Mean.	Max.	Min.	Per cent. possible Sunshine.	Rainfall in inches.	Snowfall in inches.	Rain and snow melted.	DAY.
1	4.0	8	0	84	....	....	....	1
SUNDAY........ 2	....	..	..	70	....	....	....	2..........SUNDAY
3	6.5	10	0	74	0.01	....	0.01	3
4	7.0	10	0	65	0.03	...	0.03	4
5	9.2	10	6	58	0.74	....	0.74	5
6	10.0	10	10	16	1.24	....	1.24	6
7	3.7	10	0	86	....	....	....	7
8	10.0	10	10	05	0.67	....	0.67	8
SUNDAY........ 9	....	..	..	00	1.15	....	1.15	9..........SUNDAY
10	0.2	1	0	97	....	....	....	10
11	6.8	10	0	54	0.03	....	0.03	11
12	3.7	10	1	88	0.17	....	0.17	12
13	7.3	10	0	56	0.04	....	0.04	13
14	4.2	9	0	77	0.17	....	0.17	14
15	4.5	10	0	92	....	....	...	15
SUNDAY........16	....	..	..	00	0.05	....	0.05	16..........SUNDAY
17	8.5	10	4	55	1.29	....	1.29	17
18	6.5	10	0	82	0.15	....	0.15	18
19	6.5	10	3	82	0.05	....	0.05	19
20	5.0	10	0	82	0.00	....	0.00	20
21	10.0	10	10	00	1.23	....	1.23	21
22	6.5	10	0	30	0.00	....	0.00	22
SUNDAY........23	....	..	..	79	....	....	....	23..........SUNDAY
24	1.8	8	0	98	....	....	....	24
25	4.3	10	0	88	0.00	....	0.00	25
26	5.2	10	0	76	0.04	....	0.04	26
27	5.3	10	0	78	0.66	....	0.66	27
28	1.8	7	0	93	....	....	.. .	28
29	4.2	10	0	76	...	....	....	29
SUNDAY........30	....	..	..	55	0.00	....	0.00	30..........SUNDAY
31	4.2	9	0	73	....	....	....	31
Means...........	5.65	9.31	1.69	63.52	7.72	....	7.72	...............Sums.
25 Years means for and including this month	5.34	..	..	¶59.59	4.126	....	4.126	25 Years means for and including this month.

sea-level and

Direction........ f mercury.

Miles .... being 100.

Duration in hrs.. the 3rd ; the

Mean velocity.... iving a range

Greatest mile ldest day was
9th. was 30.163 on

Greatest velo 90 on the 27th,
on the 9th and 27 aximum rela-

tive humidity was 99 on the 5th, 6th, 17th and 21st.
Minimum relative humidity was 38 on the 3rd.

Rain fell on 21 days.

Auroras were observed on 1 night.

Lunar corona on the 23rd.

Fog on 2 days.

Thunderstorms on the 5th, 21st and 27th.

ABSTRACT FOR THE MONTH OF JULY, 1899.

Meteorological Observations, McGill College Observatory, Montreal, Canada. Height above sea level, 187 feet, C. H. McLEOD, *Superintendent.*

DAY	THERMOMETER.				*BAROMETER.				†Mean pressure of vapor.	‡Mean relative humidity.	Dew Point.	WIND.		SKY CLOUDED IN TENTHS.			Per cent. possible Sunshine.	Rainfall in inches.	Snowfall in inches.	Rain and snow melted.	DAY.
	Mean.	Max.	Min.	Range.	Mean.	§Max.	§Min.	Range.				General direction.	Mean velocity in miles per hour	Mean.	Max.	Min.					
1	70.13	80.9	54.0	26.9	29.9928	30.127	29.884	.243	.3970	54 0	52.3	S.W.	26.75	4.0	8	0	84	....	....	....	1
SUNDAY........ 2	.....	83.9	62.1	21.8	......	......	......	......	......	....	....	S.W.	21.58	....	..	..	70	....	....	....	2..........SUNDAY
3	74.88	84.4	66.8	17.6	29.9458	29 981	29.917	.064	.4918	58 0	58.5	S.W.	11.92	6.5	10	0	74	0.01	....	0.01	3
4	75.35	84.2	68.7	15.5	29.9507	30 012	29 904	.108	.6528	74 8	66 7	S.W.	9.71	7.0	10	0	65	0.03	...	0.03	4
5	73.72	83.2	65.3	17.9	29.8945	29.952	29.812	.140	.6873	83.3	68.0	E.	6.58	9.2	10	6	58	0.74	....	0.74	5
6	66 98	77.5	61.5	16.0	29.8175	29 914	29 746	.168	.6020	90 0	63.8	N.W.	13.58	10.0	10	10	16	1.24	....	1.24	6
7	66.92	75 1	57.8	17.3	29.9427	29.956	29.935	.021	.5055	77 5	59.2	N.W.	5.12	3.7	10	0	86	....	....	....	7
8	65.40	71.6	61 0	10.6	29.8157	29.925	29.733	.192	.5882	94.0	63.7	S.E.	11.25	10.0	10	10	05	0.67	....	0.67	8
SUNDAY........ 9	.....	65.8	60.3	5.5	......	......	......	......	......	....	....	W.	18.71	....	..	..	00	1.15	....	1.15	9..........SUNDAY
10	70.17	80.6	58.4	22.2	29.8928	29 934	29.862	.072	.5162	70.8	59.8	S.W.	13.96	0.2	1	0	97	....	....	....	10
11	70.28	80.8	63.0	17 8	29.9425	29.991	29.893	.093	.4977	67.8	58.7	S.W.	18.71	6.8	10	0	54	0.03	....	0.03	11
12	68.52	78.6	58.6	20.0	29.8585	29.926	29 800	.126	.4927	71.2	58.3	S.W.	17.87	3.7	10	1	88	0.17	....	0.17	12
13	62.90	72.6	53.0	19.6	29.8162	29.882	29.781	.101	.4367	76.0	55 0	S.W.	18.54	7.3	10	0	56	0.04	....	0.04	13
14	69 22	78.3	61.2	17 1	29.8033	29 824	29.773	.051	.5128	72.3	59.7	S.W.	12.12	4.2	9	0	77	0.17	....	0.17	14
15	73.87	82.5	63.3	19.2	29 8733	29.899	29.855	.044	.5457	65.8	61.3	S.W.	10.12	4.5	10	0	92	....	....	...	15
SUNDAY........16	.....	74.3	66.6	7.7	......	......	......	......	......	....	....	S.E.	12.67	....	..	..	00	0.05	....	0.05	16..........SUNDAY
17	70.48	79.1	65.5	13.6	29.7420	29.773	29 710	.063	.6342	85.3	65.8	S.W.	12.00	8 5	10	4	55	1.29	....	1.29	17
18	68.08	79.2	61.1	18.1	29.7453	29 815	29.670	.145	.5193	77.2	59.8	S.W.	17.29	6.5	10	0	82	0.15	....	0.15	18
19	56.32	63.5	51.1	12.4	29.8470	29 931	29 771	.160	.3127	69.3	46.0	S.W.	14.75	6.5	10	3	82	0.05	....	0.05	19
20	62.17	69.7	52.0	17.7	29.9543	30.004	29.862	.142	.3375	61.5	48.0	S.W.	10.83	5.0	10	0	82	0.00	....	0.00	20
21	60.67	64 5	56.4	8.1	29.7917	29 949	29.696	.253	.4927	92.3	58.3	N.W.	15.62	10 0	10	10	00	1.23	....	1.23	21
22	57.65	64.2	53 6	10.6	30.1138	30.163	30.018	.145	.3787	80.3	51.3	N.E.	7.42	6.5	10	0	30	0.00	....	0.00	22
SUNDAY........23	.....	71.3	54.1	17.2	......	......	......	......	......	....	....	E.	2.92	....	..	..	79	....	....	....	23..........SUNDAY
24	69.22	79 0	57.2	21.8	30.1087	30.159	30.044	.115	.5348	74.5	60.5	S.E.	9.66	1.8	8	0	98	....	....	....	24
25	71.78	81.0	65.0	16.0	29.9392	30.078	29.815	.263	.5838	75.5	63.2	S.E.	16.21	4.3	10	0	88	0.00	...	0 00	25
26	73.68	82.0	67.1	14.9	29.7330	29 795	29.693	.102	.6437	78.8	66.0	S.W.	15.37	5.2	10	0	76	0.04	....	0.04	26
27	69.58	78.7	64.0	14.7	29.7070	29.866	29.590	.276	.5373	74.7	60.7	S.W.	19.50	5.3	10	0	78	0.66	....	0.66	27
28	71.35	79.0	64.0	15.0	29.9170	29.936	29 904	.032	.5082	66.0	59.2	S.W.	12.54	1.8	7	0	93	....	....	.. .	28
29	73.80	82.6	61.1	21.5	29.7822	29.935	29.621	.314	.5702	68.0	62.3	S.	11.46	4.2	10	0	76	...	....	....	29
SUNDAY........30	.....	73.1	55.0	18.1	......	......	......	......	......	....	....	S.W.	19.58	....	..	..	55	0.00	....	0.00	30..........SUNDAY
31	62.87	72.8	52.0	20.8	29.8538	29 904	29.819	.085	.4068	71.2	53.0	S.W.	17.04	4 2	9	0	73	....	....	....	31
Means..........	68.31	76.58	60.03	16.55	29.8762	29.9473	29.8120	.1353	.5149	74.23	59.20	S 45¼° W.	13.92	5.65	9.31	1.69	63.52	7.72	....	7.72	..............Sums.
25 Years means for and including this month	68.88	77.37	60.76	16.62	29.8977	......	......	.142	.5057	71.57	....	....	s 12.89	5.34	..	..	¶59.59	4.126	....	4.126	25 Years means for and including this month.

ANALYSIS OF WIND RECORD.

Direction........	N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.	CALM.
Miles	338	180	123	1020	811	6195	764	932	
Duration in hrs..	32	26	24	76	74	389	48	65	10
Mean velocity....	10.56	6.92	5.12	13.42	10 96	15.92	15.92	14.34	

Greatest mileage in one hour was 34, on the 9th.

Greatest velocity in gusts, 36 miles per hour on the 9th and 27th.

Resultant mileage, 6,795.
Resultant direction, S. 45¼° W.
Total mileage, 10,363.

* Barometer readings reduced to sea-level and temperature 32° Fahrenheit.

§ Observed.

† Pressure of vapour in inches of mercury.

‡ Humidity relative, saturation being 100.

¶ 18 years only. s 13 years only.

The greatest heat was 84°.4 on the 3rd; the greatest cold was 51.°1 on the 19th giving a range of temperature of 33.3 degrees.

Warmest day was the 4th. Coldest day was the 19th. Highest barometer reading was 30.163 on the 22nd. Lowest barometer was 29.590 on the 27th, giving a range of 0.573 inches. Maximum relative humidity was 99 on the 5th, 6th, 17th and 21st. Minimum relative humidity was 38 on the 3rd.

Rain fell on 21 days.

Auroras were observed on 1 night.

Lunar corona on the 23rd.

Fog on 2 days.

Thunderstorms on the 5th, 21st and 27th.

GUST, 1899.

, 187 feet, C. H. McLEOD, *Superintendent.*

DAY	Sky Clouded in Tenths. Mean.	Max.	Min.	Per cent. possible Sunshine.	Rainfall in inches.	Snowfall in inches.	Rain and snow melted.	DAY.
	1.0	5	0	98	....	....	....	1
	8.2	10	0	7	0.26	....	0.26	2
	4.5	10	0	45	....	...	....	3
	4.5	10	0	59	....	....	....	4
	5.2	10	0	80	....	....	....	5
SUNDAY........	....	..	..	98	....	....	....	6..........SUNDAY
	7.0	10	4	80	....	....	....	7
	6.0	10	0	79	....	....	....	8
	4.3	10	0	85	....	....	.. .	9
	8.5	10	0	1	0.00	....	0.00	10
	7.8	10	0	9	0.00	....	0.00	11
	7.2	10	0	15	0.04	....	0.04	12
SUNDAY........	....	..	..	61	0.08	....	0.08	13..........SUNDAY
	0.0	0	0	97	....	....	....	14
	0.5	3	0	93	....	....	....	15
	0 0	1	0	90	....	....	....	16
	0.8	5	0	87	....	....	....	17
	1.8	9	0	83	....	....	....	18
	3.5	9	0	60	0.37	....	0.37	19
SUNDAY........	....	..	..	87	....	....	....	20..........SUNDAY
	5 3	10	0	71	0.88	....	0.88	21
	9.8	10	9	13	0.80	....	0.80	22
	9.8	10	9	5	0.03	....	0.03	23
	9.2	10	7	25	0.03	....	0.03	24
	6.0	10	0	68	0.03	....	0.03	25
	0.5	2	0	95	....	....	....	26
SUNDAY........	....	..	..	78	....	....	....	27..........SUNDAY
	1.8	5	0	83	....	....	....	28
	1.2	7	0	78	....	....	....	29
	0.5	1	0	86	....	....	....	30
	5.3	9	0	78	....	....	....	31
Means........ ...	4.45	7.63	1.07	64.32	2.52	....	2.52	...............Sums.
25 Years mean for and includin this month	5.71	..	..	¶58.14	3.52	....	3.52	25 Years means for and including this month.

Direction......
Miles ....
Duration in hrs.
Mean velocity..

sea-level and

f mercury.

being 100.

the 21st ; the

iving a range

Greatest mil 19th.

ldest day was was 30.270 on 23 on the 21st,

Greatest ve on the 19th.

aximum rela-

tive humidity was 98 on the 22nd, 23rd and 23th. Minimum relative humidity was 34 on the 21st.

Rain fell on 11 days.

Lunar coronas on the 19th, 20th and 21st.

Fog on 1 day.

Thunderstorms on the 2nd, 12th, 21st and 22nd.

ABSTRACT FOR THE MONTH OF AUGUST, 1899.

Meteorological Observations, McGill College Observatory, Montreal, Canada. Height above sea level, 187 feet, C. H. McLEOD, *Superintendent.*

DAY	THERMOMETER. Mean.	Max.	Min.	Range.	*BAROMETER. Mean.	§Max.	§Min.	Range.	†Mean pressure of vapor.	‡Mean relative humidity.	Dew Point.	*a* WIND. General direction.	Mean velocity in miles per hour	SKY CLOUDED IN TENTHS. Mean.	Max.	Min.	Per cent. possible Sunshine.	Rainfall in inches.	Snowfall in inches.	Rain and snow melted.	DAY.
1	70.97	80.1	60.4	19.7	29.9760	29.994	29.943	.051	.5243	69.5	60.2	S.W.	12.62	1.0	5	0	98	....	....	....	1
2	67.67	77.9	62.4	15.5	29.9053	30.010	29.845	.165	.5678	84.3	62.5	S.	13.04	8.2	10	0	7	0.26	....	0.26	2
3	70.00	77.2	61.6	15.6	29.8727	29.918	29.833	.085	.6027	82.7	64.2	S.W.	7.46	4.5	10	0	45	....	...	....	3
4	74.63	83.2	65.9	17.3	29.7598	29.834	29.690	.144	.6505	75.8	66.3	S.W.	8.96	4.5	10	0	59	....	....	....	4
5	73.77	82.0	67.7	14.3	29.7093	29.747	29.676	.071	.5795	69.3	62.8	S.W.	14.17	5.2	10	0	80	....	....	....	5
SUNDAY........ 6	......	75.3	62.3	13.0	......	......	......	......	......	....	....	S.W.	13.50	....	..	..	98	....	....	....	6...........SUNDAY
7	62.40	69.0	56.9	12.1	29.8887	29.899	29.872	.027	.3363	61.0	48.2	S.W.	13.46	7.0	10	4	80	....	....	....	7
8	58.62	65.5	52.7	12.8	29.9267	29.970	29.906	.064	.2720	56.2	42.3	N.W.	16.37	6.0	10	0	79	....	....	....	8
9	60.97	69.0	52.2	16.8	29.9808	30.022	29.944	.078	.3650	67.8	50.2	S.W.	7.50	4.3	10	0	85	....	....	....	9
10	61.97	68.6	57.5	11.1	29.8997	29.967	29.858	.109	.4163	75.2	53.7	S.E.	10.54	8.5	10	0	1	0.00	....	0.00	10
11	65.95	72.4	61.1	11.3	29.8408	29.885	29.802	.083	.4847	76.5	58.0	S.E.	14.79	7.8	10	0	9	0.00	....	0.00	11
12	69.67	79.4	61.5	17.9	29.7217	29.869	29.642	.227	.6015	83.3	64.2	S.E.	17.37	7.2	10	0	15	0.04	....	0.04	12
SUNDAY........13	......	73.4	57.2	16.2	......	......	......	......	......	....	....	S.W.	17.29	....	..	..	61	0.08	....	0.08	13...........SUNDAY
14	59.57	69.0	51.4	17.6	30.1102	30.180	30.059	.121	.2803	56.2	43.3	N.W.	11.58	0.0	0	0	97	....	....	....	14
15	63.65	71.9	51.2	20.7	30.1767	30.247	30.118	.129	.3253	55.8	47.0	N.W.	6.50	0.5	3	0	93	....	....	....	15
16	69.48	77.8	60.8	17.0	30.0560	30.125	29.993	.132	.3782	52.7	51.0	W.	8.79	0.0	1	0	90	....	....	....	16
17	70.73	81.9	59.0	22.9	30.0052	30.060	29.951	.109	.4383	59.7	55.2	S.	5.66	0.8	5	0	87	....	....	....	17
18	75.43	84.3	66.0	18.3	29.9212	29.994	29.853	.141	.4303	48.8	54.7	S.W.	17.25	1.8	9	0	83	....	....	....	18
19	74.53	86.0	68.2	17.8	29.8282	29.897	29.763	.134	.5787	68.7	62.8	S.W.	12.71	3.5	9	0	60	0.37	....	0.37	19
SUNDAY........20	......	84.6	67.4	17.2	......	......	......	......	......	...	....	N.	8.58	....	..	..	87	....	....	....	20...........SUNDAY
21	75.65	88.8	64.0	24.8	29.7118	29.810	29.623	.187	.5515	65.5	61.5	S.E.	11.00	5.3	10	0	71	0.88	....	0.88	21
22	69.43	77.0	67.5	9.5	29.7702	29.817	29.741	.076	.6580	91.8	66.8	S.	11.75	9.8	10	9	13	0.80	....	0.80	22
23	67.85	72.9	63.9	9.0	29.9440	30.006	29.862	.144	.5743	85.3	62.7	N.	14.00	9.8	10	9	5	0.03	....	0.03	23
24	68.32	76.4	61.6	14.8	29.9690	30.027	29.904	.123	.5810	84.0	63.2	N.	8.50	9.2	10	7	25	0.03	....	0.03	24
25	70.37	79.8	64.5	15.3	29.9560	30.062	29.899	.163	.5873	79.3	63.8	S.	13.62	6.0	10	0	68	0.03	....	0.03	25
26	67.07	75.5	58.7	16.8	30.1475	30.174	30.124	.050	.4438	68.5	55.7	N.	9.33	0.5	2	0	95	....	....	....	26
SUNDAY........27	......	78.8	55.9	22.9	......	......	......	......	......	....	....	N.	6.33	....	..	..	78	....	....	....	27...........SUNDAY
28	70.97	80.7	61.5	19.2	30.2128	30.252	30.194	.058	.5868	78.5	63.5	N.	4.37	1.8	5	0	83	....	....	....	28
29	71.92	82.0	62.7	19.3	30.2092	30.270	30.169	.101	.5378	70.2	61.0	S.	7.79	1.2	7	0	78	....	....	....	29
30	73.63	83.8	62.7	21.1	30.1408	30.236	30.058	.178	.5785	69.8	62.8	S.	12.37	0.5	1	0	86	....	....	....	30
31	73.60	81.5	63.5	18.0	30.0575	30.115	29.997	.118	.6050	72.7	63.8	S.	17.21	5.3	9	0	78	....	....	....	31.
Means......	68.84	77.60	60.96	16.64	29.9518	30.0143	29.9007	.1136	.5013	70.71	58.20	S 38° ¾ W.	11.43	4.45	7.63	1.07	64.32	2.52	....	2.52	...............Sums.
25 Years means for and including this month	66.71	75.03	58.76	16.26	29.9379	......	......	.133	.4829	73.28	....	....	s 12.39	5.71	..	..	¶58.14	3.52	....	3.52	25 Years means for and including this month.

a ANALYSIS OF WIND RECORD.

Direction........	N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.	CALM.
Miles	1374	98	142	1232	1742	2549	318	1052	
Duration in hrs..	140	10	19	95	147	190	38	88	17
Mean velocity....	9.81	9.80	7.47	12.97	11.85	13.42	8.37	11.95	

Greatest mileage in one hour was 26, on the 19th.

Greatest velocity in gusts, 28 miles per hour on the 19th.

Resultant mileage, 2,855.
Resultant direction, S. 38° ¾ W.
Total mileage, 8,507.

a Wind records from noon on the 15th to noon on the 17th are from the City Hall.

* Barometer readings reduced to sea-level and temperature 32° Fahrenheit.

§ Observed.

† Pressure of vapour in inches of mercury.

‡ Humidity relative, saturation being 100.

¶ 18 years only. *s* 13 years only.

The greatest heat was 88°.8 on the 21st; the greatest cold was 51.°2 on the 15th giving a range of temperature of 37.6 degrees.

Warmest day was the 21st. Coldest day was the 8th. Highest barometer reading was 30.270 on the 29th. Lowest barometer was 29.623 on the 21st, giving a range of 0.547 inches. Maximum relative humidity was 98 on the 22nd, 23rd and 23th. Minimum relative humidity was 34 on the 21st.

Rain fell on 11 days.

Lunar coronas on the 19th, 20th and 21st.

Fog on 1 day.

Thunderstorms on the 2nd, 12th, 21st and 22nd.

EMBER, 1899.

l, 187 feet, C. H. McLEOD, *Superintendent.*

DAY	Sky Clouded in Tenths. Mean.	Max.	Min.	Per cent. possible Sunshine.	Rainfall in inches.	Snowfall in inches.	Rain and snow melted.	DAY.
	10.0	10	6	0 0	0.66	....	0.66	1
	7.8	10	0	34	....	...	....	2
SUNDAY.......	...	..	..	27	0.03	...	0.03	3 ....SUNDAY
	6.0	10	0	74	....	....	....	4
	8.3	10	0	6	0.00	....	0.00	5
	1.5	4	0	95	....	....	....	6
	6.2	10	0	30	0.02	....	0 02	7
	7.5	10	3	63	0.02	....	0.02	8
	0	6	0	97	....	....	....	9
SUNDAY.......	....	..	..	77	....	....	...	10...........SUNDAY
	7.8	10	0	5	....	....	....	11
	7.7	10	0	26	1.21	....	1.21	12
	7.7	10	4	56	0.02	....	0.02	13
	3.8	10	0	90	....	....	....	14
	1.3	7	0	89	....	....	....	15
	1 0	4	0	75	....	..	....	16
SUNDAY.......	....	..	..	36	....	....	.. .	17......... .SUNDAY
	6.3	10	0	23	....	....	....	18
	8 3	10	0	0.0	0.56	....	0.56	19
	10 0	10	10	0.0	0.14	....	0.14	20
	8.8	10	0	6	0.02	...	0.02	21
	6.0	10	0	18	0.01	....	0.01	22
	2.0	9	0	81	....	....	....	23
SUNDAY.......	....	..	..	3	0.21	....	0.21	24 ....SUNDAY
	9.7	10	8	34	0.13	....	0.13	25
	9.2	10	5	0.0	1.56	....	1.56	26
	8.0	10	0	11	0.05	....	0.05	27
	0.0	0	0	93	....	....	....	28
	5 0	10	0	65	0.30	....	0.30	29
	6.7	10	0	81	0.14	....	0.14	30
Means...... ..	5.68	8.9	1.4	43.17	5.08	....	5.08	...............Sums.
25 Years mea for and includi this month	5.40	..	..	¶53.71	3.26	....	3.26	25 Years means for and including this month.

Direction....	
Miles	
Duration in hr	
Mean velocity.	

sea-level and

f mercury.

being 100.

the 3rd ; the

giving a range

Greatest m ldest day was 26th. g was 30.425 on

Greatest v 63 on the 12th, on the 26th. aximum rela-

tive humidity was 99 on the 20th and 26th. Minimum relative humidity was 34 on the 16th.

Rain fell on 17 days.

Lunar corona on the 21st.

Fog on 3 days.

Thunderstorm on the 12th, during which hail fell.

ABSTRACT FOR THE MONTH OF SEPTEMBER, 1899.

Meteorological Observations, McGill College Observatory, Montreal, Canada. Height above sea level, 187 feet, C. H. McLEOD, *Superintendent.*

DAY	THERMOMETER.				*BAROMETER.				†Mean pressure of vapor.	‡Mean relative humidity.	Dew Point.	WIND.		SKY CLOUDED IN TENTHS.			Per cent. possible Sunshine.	Rainfall in inches.	Snowfall in inches.	Rain and snow melted.	DAY.
	Mean.	Max.	Min.	Range.	Mean.	§Max.	§Min.	Range.				General direction.	Mean velocity in miles per hour	Mean.	Max.	Min.					
1	57.13	63.5	54.2	9.3	30.1627	30.181	30.115	.066	.3762	80.7	51.0	N.	19.75	10.0	10	6	0 0	0.66	....	0.66	1
2	64.40	73.0	54.4	18.6	30.0492	30.152	29.952	.200	.4940	81.3	58.0	N.	11.83	7.8	10	0	34	....	...	...	2
SUNDAY........ 3	.....	77.6	57.0	20.6	......	......	......	......	......	....	....	S.	17.45	...	..	..	27	0.03	...	0.03	3 ....SUNDAY
4	56.37	63.2	50.6	12.6	30.0373	30.075	29.930	.145	.3040	67.2	45.3	S.	10.70	6 0	10	0	74	....	....	....	4
5	61.17	67.5	54.3	13.2	29.8442	30.067	29.674	.393	4190	76.5	53.7	S.	15.96	8.3	10	0	6	0.00	....	0.00	5
6	56.48	64.5	50.5	14.0	30.0682	30.196	29.678	.518	.2608	56.7	40.8	W.	20.45	1.5	4	0	95	....	....	....	6
7	54.33	59.8	45.9	13.9	30.0860	30.246	29.846	.400	.2710	63.7	41 8	S.	8.84	6.2	10	0	30	0.02	....	0 02	7
8	61.17	71.0	54.5	16.5	29.8448	29.945	29.805	.140	.4033	74 8	52.8	S W.	12.58	7.5	10	3	63	0.02	....	0.02	8
9	57.35	65.7	49.0	16.7	30.0717	30.149	29.945	.204	.2807	61.2	43.7	N.W.	5.84	0	6	0	97	....	....	....	9
SUNDAY........10	.... .	69.2	49.8	19.4	......	......	......	......	......	....	....	S.E.	6.12	....	..	..	77	....	....	...	10..........SUNDAY
11	60.78	65 1	56.8	8.3	29.9358	30.138	29.740	.398	.3560	67 5	58.0	S.E.	16.58	7.8	10	0	5	....	....	....	11
12	58.53	67.6	54.0	13.6	29.5398	29.740	29.463	.277	.4178	86.7	54.7	S.E.	15.84	7.7	10	0	26	1.21	....	1.21	12
13	50.88	57.6	46.5	11.1	29.7782	29.940	29.561	.379	.2868	77.7	43.7	S.W.	16.84	7.7	10	4	56	0.02	....	0.02	13
14	46.87	52.8	40.0	12.8	30.0953	30.182	29.940	.242	.2315	72.5	38.2	S.W.	16.42	3.8	10	0	90	....	....	....	14
15	48.70	55.8	42.0	13.8	30.3007	30.366	30.182	.184	2363	70.3	38 7	S.W.	12.12	1.3	7	0	89	....	....	....	15
16	53.35	64.0	40.4	23.6	30.3237	30.425	30.179	.246	.2592	66.7	40 8	S.E.	10.83	1 0	4	0	75	....	..	....	16
SUNDAY....... 17	.....	76.2	52.0	24.2	......	......	......	......	......	....	....	S.E.	17.75	....	..	..	36	....	....	.. .	17......... .SUNDAY
18	65.27	73.1	59.0	14.1	29.9483	30.025	29.872	.153	.5342	85.8	60.8	S.	8.46	6.3	10	0	23	....	....	....	18
19	55.48	62.3	51.0	11.3	29.9908	30.049	29.872	077	.4178	94 3	53.8	N.	15.96	8 3	10	0	0.0	0.56	....	0.56	19
20	52.43	54.8	49.7	5.1	29.8535	29.967	29 794	.173	.3813	96.7	51.3	N.	12.29	10 0	10	10	0.0	0.14	....	0.14	20
21	55.37	59.8	51.0	8.8	29.8067	29.844	29.777	.067	.3695	84.2	50 5	S.	12.71	8.8	10	0	6	0.02	...	0.02	21
22	48.75	56.9	38.5	18.4	29.9727	30.178	29.844	.334	.2888	81.2	43.0	S.W.	15.58	6.0	10	0	18	0.01	....	0.01	22
23	42.78	48.6	37.4	11.2	30.2785	30.335	30.178	.157	.1797	65.7	31.8	W.	8 50	2.0	9	0	81	....	....	....	23
SUNDAY........24	.....	60.0	37.9	22.1	......	......	......	......	......	....	....	S.E.	20.75	....	..	..	3	0.21	....	0.21	24 ....SUNDAY
25	64.87	72.2	57.8	14.4	29.7898	29.816	29.754	.062	.4913	80.3	58.5	S.E.	20.71	9 7	10	8	34	0.13	....	0.13	25
26	52.78	61.5	45.5	16.0	29.6625	29 790	29.542	.248	.3903	95.8	51.5	S.E.	15.21	9.2	10	5	0.0	1.56	....	1.56	26
27	45.67	49.5	44.0	5.5	29.7955	29.901	29 644	.257	.2545	83.0	40.5	S.W.	20.62	8.0	10	0	11	0.05	....	0.05	27
28	55.35	64.6	44.0	20.6	29.9732	30.031	29 901	.130	.3062	70.5	45.3	S.	17.84	0.0	0	0	93	....	....	....	28
29	54.60	67.5	46.5	21.0	29.9138	29.962	29 832	.130	.3493	82.5	49.2	S.E.	18.10	5 0	10	0	65	0.30	....	0.30	29
30	44.05	49 5	36.1	13.4	29.9567	30.164	29.863	.301	.2173	76.0	36.2	S.	17.49	6.7	10	0	81	0.14	....	0.14	30
Means......	54.80	63.15	48.34	14.80	29.9646	30.0717	29.8455	.2237	.3382	76.92	47.44	s 18° W.	14.67	5.68	8.9	1.4	43.17	5.08	....	5.08	....Sums.
25 Years means for and including this month	58.39	66.47	50.68	15.78	30.0146	......	......	.182	.3752	75.74	....	...	s 12.85	5.40	..	..	¶53.71	3.26	....	3.26	25 Years means for and including this month.

a ANALYSIS OF WIND RECORD.

Direction........	N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.	CALM.
Miles	1364	19	164	2344	2430	2877	849	521	
Duration in hrs..	100	4	16	138	178	176	57	49	2
Mean velocity....	13.64	4.75	10.25	16.98	13.65	16.35	14.39	10.63	

Greatest mileage in one hour was 32, on the 26th.

Greatest velocity in gusts, 36 miles per hour on the 26th.

Resultant mileage, 4,580.
Resultant direction, S. 18° W.
Total mileage, 10,568.

* Barometer readings reduced to sea-level and temperature 32° Fahrenheit.

§ Observed.

† Pressure of vapour in inches of mercury.

‡ Humidity relative, saturation being 100.

¶ 18 years only. s 13 years only.

The greatest heat was 77°.6 on the 3rd; the greatest cold was 36.°1 on the 30th giving a range of temperature of 41.5 degrees.

Warmest day was the 18th. Coldest day was the 23rd. Highest barometer reading was 30.425 on the 16th. Lowest barometer was 29.463 on the 12th, giving a range of 0.962 inches. Maximum relative humidity was 99 on the 20th and 26th. Minimum relative humidity was 34 on the 16th.

Rain fell on 17 days.

Lunar corona on the 21st.

Fog on 3 days.

Thunderstorm on the 12th, during which hail fell.

)BER, 1899.

l, 187 feet, C. H. McLEOD, *Superintendent.*

DAY	Sky Clouded in Tenths. Mean.	Max.	Min.	Per cent. possible Sunshine.	Rainfall in inches.	Snowfall in inches.	Rain and snow melted.	DAY.
SUNDAY.......	....	..	..	33	0.00	0.00	0.00	1..........SUNDAY
	8.0	10	0	18	....	0.00	0.00	2
	6.8	10	0	48	....	....	....	3
	6.0	10	0	31	....	....	....	4
	3.3	10	0	78	....	....	....	5
	4.0	10	0	77	0.00	....	0.00	6
	2.3	6	0	74	....	....	....	7
SUNDAY.......	....	..	..	17	....	....	....	8..........SUNDAY
	10.0	10	10	0 0	0.55	....	0.55	9
	6.7	10	0	34	....	....	....	10
	9.2	10	0	42	0.01	....	0.01	11
	10.0	10	10	2	....	....	....	12
	6.7	10	0	9	....	....	....	13
	5.7	10	0	37	0.00	....	0.00	14
SUNDAY.......	....	..	..	86	....	....	....	15......... .SUNDAY
	5.3	10	0	49	0.01	....	0.01	16
	6.0	10	0	40	....	....	....	17
	8.3	10	0	0.0	0.48	....	0.48	18
	3.0	10	0	79	....	....	....	19
	9.5	10	3	46	....	....	....	20
	0.3	10	0	100	....	...	....	21
SUNDAY......	....	..	..	65	....	....	....	22..........SUNDAY
	10.0	10	10	0.0	....	....	....	23
	5.5	10	0	0.0	....	....	....	24
	1.0	6	0	87	....	....	....	25
	7.0	10	0	26	0.31	....	0.31	26
	10.0	10	10	0.0	0.02	....	0.02	27
	10 0	10	10	0.0	0.85	....	0.85	28
SUNDAY......	....	..	..	39	0.57	....	0.57	29..........SUNDAY
	0.2	1	0	98	...	....	....	30
	8.3	10	0	0.0	0.59	....	0.59	31
Means...... ..	6.27	9.3	2.04	39.74	3.39	0.00	3.39	...............Sums.
25 Years mea for and includi this month	6.32	.	..	¶40.87	3.04	....	3.15	25 Years means for and including this month.

sea-level and

Direction.... f mercury.

Miles ...... eing 100.

Duration in h the 14th; the

Mean velocity d 22nd, giving

s.

Greatest r dest day was

25th. was 30.512 on

Greatest was 29.721 on

on the 25th. ches. Maxi-

mum relative humidity was 99 on the 9th. 10th, 11th, 28th, 29th. Minimum relative humidity was 40 on the 21st.

Rain fell on 12 days.

Snow fell on 2 days.

Rain or snow fell on 13 days.

Hoar frost on 1 day.

Lunar halo on the 19th.

Lunar coronas on the 10th, 14th, 15th, 18th, 19th.

Fog on 6 days.

ABSTRACT FOR THE MONTH OF OCTOBER, 1899.

Meteorological Observations, McGill College Observatory, Montreal, Canada. Height above sea level, 187 feet, C. H. McLEOD, *Superintendent.*

DAY	THERMOMETER. Mean.	Max.	Min.	Range.	*BAROMETER. Mean.	§Max.	§Min.	Range.	†Mean pressure of vapor.	‡Mean relative humidity.	Dew Point.	WIND. General direction.	Mean velocity in miles per hour	SKY CLOUDED IN TENTHS. Mean.	Max.	Min.	Per cent. possible Sunshine.	Rainfall in inches.	Snowfall in inches.	Rain and snow melted.	DAY.
SUNDAY........ 1	.....	41.8	31.5	10.3	......	......	......	......	......	....	....	S.W.	13.53	....	..	..	33	0.00	0.00	0.00	1..........SUNDAY
2	38.35	42.9	32.7	10.2	30.4858	30.512	30.437	.075	.1513	66.2	27.7	W.	10.20	8.0	10	0	18	....	0.00	0.00	2
3	40.87	44.9	35.2	9.7	30.4188	30.512	30.344	.168	.1582	62.0	28.7	N.W.	3.62	6.8	10	0	48	....	....	....	3
4	46.03	50.5	38.6	11.9	30.2202	30.344	30.121	.223	.2122	68.2	36.2	S.W.	6.88	6.0	10	0	31	....	....	....	4
5	49.88	55.9	45.5	10.4	30.0910	30.122	30.049	.073	.2427	68.5	39.3	S.W.	9.59	3.3	10	0	78	....	....	....	5
6	48.00	57.0	41.0	16.0	29.9523	30.049	29.876	.173	.2315	70.8	38.2	N.	6.17	4.0	10	0	77	0.00	....	0.00	6
7	44.57	51.8	39.0	12.8	30.1305	30.200	29.953	.247	.2100	71.7	35.3	N.W.	8.45	2.3	6	0	74	....	....	....	7
SUNDAY........ 8	.....	52.1	36.2	15.9	......	......	......	......	......	....	....	N.	3.34	....	..	..	17	....	....	....	8..........SUNDAY
9	46.52	49.1	42.5	6.6	30.0028	30.028	29.955	.073	.3105	97.7	45.8	N.	2.58	10.0	10	10	0 0	0.55	....	0.55	9
10	54.03	60.8	48.0	12.8	30.1472	30.183	30.028	.155	.3778	90.8	51.2	S.	5.21	6.7	10	0	34	....	....	....	10
11	56.72	68.9	43.7	25.2	30.1380	30.187	30.099	.088	.3865	83.3	51.3	S.W.	13.11	9.2	10	0	42	0.01	....	0.01	11
12	60.02	65.4	56.0	9.4	30.1573	30.211	30.110	.101	.4320	83.2	54.7	S.W.	6.88	10.0	10	10	2	....	....	....	12
13	54.13	59.5	51.5	8.0	30.2100	30.271	30.129	.142	.3262	77.7	47.3	N.	8.58	6.7	10	0	9	....	....	....	13
14	61.05	73.8	48.0	25.8	30.1005	30.190	30.014	.176	.4275	79.2	54.3	S.W.	16.87	5.7	10	0	37	0.00	....	0.00	14
SUNDAY........15	.....	57.5	43.5	14.0	......	......	......	......	......	....	....	N.	10.29	....	..	..	86	....	....	....	15.......... SUNDAY
16	51.03	58.5	43.1	15.4	30.1947	30.329	30.055	.274	.2810	73.2	42.8	N.	11.20	5.3	10	0	49	0.01	....	0.01	16
17	62.92	69.0	55.6	13.4	29.9023	30.055	29.769	.286	.4387	76.0	55.5	S.	16.70	6.0	10	0	40	....	....	....	17
18	56.60	65.0	53.1	11.9	29.8633	29.900	29.769	.131	.4203	91.3	54.0	S.W.	6.04	8.3	10	0	0.0	0.48	....	0.48	18
19	50.60	57.5	45.2	12.3	30.0732	30.163	29.880	.283	.2642	72.0	41.0	S.W.	16.87	3.0	10	0	79	....	....	....	19
20	37.85	45.2	33.5	11.7	30.3000	30.382	30.163	.219	.1340	58.7	24.8	N.W.	11.29	9.5	10	3	46	....	....	....	20
21	36.18	42.9	30.0	12.9	30.4568	30.483	30.382	.101	.1135	53.5	21.0	N.W.	11.79	0.3	10	0	100	....	...	....	21
SUNDAY........22	.....	44.9	30.0	14.9	......	......	......	......	......	....	....	S.W.	2.92	....	..	..	65	....	....	....	22..........SUNDAY
23	45.43	49.8	41.1	8.7	30.2983	30.359	30 269	.090	.2207	72.2	37.0	N.E.	1.54	10.0	10	10	0.0	....	....	....	23
24	50.30	57.7	41.9	15.8	30.2897	30.359	30.240	.119	.2610	69.7	40.2	S.E.	10.87	5.5	10	0	0.0	....	....	....	24
25	59.60	70.9	48.1	22.8	30.1783	30.281	30.079	.202	.3400	68.3	48.3	S.	23.04	1.0	6	0	87	....	....	....	25
26	54.35	62.9	46.9	16.0	30.1160	30.196	30.062	.134	.3290	77.7	47.2	S.W.	19.12	7.0	10	0	26	0.31	....	0.31	26
27	41.72	46.9	40.1	6.8	30.2185	30.248	30.173	.075	.1987	75.0	34.5	N.	17.12	10.0	10	10	0.0	0.02	....	0.02	27
28	43.83	51.9	38.2	13.7	29.9562	30.173	29.721	.452	.2810	96.3	43.0	N.	8.75	10 0	10	10	0.0	0.85	....	0.85	28
SUNDAY........29	.....	53.0	42.5	10.5	......	......	......	......	......	....	....	S.W.	13.37	....	..	..	39	0.57	....	0.57	29..........SUNDAY
30	45.07	52.1	38.0	14.1	30.2028	30.266	30.085	.181	.2187	70.0	36.8	S.W.	15.46	0.2	1	0	98	...	....	....	30
31	42.65	48.1	36.4	11.7	30.1355	30.289	29.902	.387	.2437	88.8	39.2	N.	5.42	8.3	10	0	0.0	0.59	....	0.59	31
Means......	49.17	55.10	41.83	13.28	30.1631	30.2420	30.0717	.1780	.2773	75.46	41.36	W. 28.8° S	10.22	6.27	9.3	2.04	39.74	3.39	0.00	3.39	..............Sums.
25 Years means for and including this month	45.64	52.60	38.77	13.83	30.0081	......	......	.217	.2667	76.60	....	....	♯ 13.26	6.32	.	..	¶40.87	3.04	....	3.15	25 Years means for and including this month.

ANALYSIS OF WIND RECORD.

Direction........	N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.	CALM.
Miles	1798	25	122	230	1853	2380	313	884	
Duration in hrs..	207	7	22	24	139	167	31	89	58
Mean velocity....	8.68	3.57	5.55	9.58	13.33	14.25	10.09	9.93	

Greatest mileage in one hour was 32, on the 25th.

Greatest velocity in gusts, 36 miles per hour on the 25th.

Resultant mileage, 2,645.
Resultant direction, W. 28.8° S.
Total mileage, 7,605.

* Barometer readings reduced to sea-level and temperature 32° Fahrenheit.

§ Observed.

† Pressure of vapour in inches of mercury.

‡ Humidity relative, saturation being 100.

¶ 18 years only. ♯ 13 years only.

The greatest heat was 73°.8 on the 14th; the greatest cold was 30.°0 on the 21st and 22nd, giving a range of temperature of 43.8 degrees.

Warmest day was the 17th. Coldest day was the 21st. Highest barometer reading was 30.512 on the 1st and 2nd. Lowest barometer was 29.721 on the 28th, giving a range of .791 inches. Maximum relative humidity was 99 on the 9th. 10th, 11th, 28th, 29th. Minimum relative humidity was 40 on the 21st.

Rain fell on 12 days.

Snow fell on 2 days.

Rain or snow fell on 13 days.

Hoar frost on 1 day.

Lunar halo on the 19th.

Lunar coronas on the 10th, 14th, 15th, 18th, 19th.

Fog on 6 days.

:MBER, 1899.

], 187 feet, C. H. McLEOD, *Superintendent.*

DAY	Sky Clouded in Tenths. Mean.	Max.	Min.	Per cent. possible Sunshine.	Rainfall in inches.	Snowfall in inches.	Rain and snow melted.	DAY.
	10.0	10	10	0	0.57	....	0.57	1
	0.3	10	0	99	....	....	....	2
	2.8	10	0	98	....	....	....	3
	9.7	10	8	1	0.61	....	0.61	4
SUNDAY.......	....		..	0	....	....	....	5..........SUNDAY
	6.7	10	0	2	....	....	....	6
	2.8	10	0	54	....	....	....	7
	7.5	10	0	34	....	....	....	8
	9.0	10	4	18	0.00	....	0.00	9
	6.8	10	0	5	0.06	....	0.06	10
	8.2	10	0	0	....	1.1	0.11	11
SUNDAY.......	....	..	..	57	....	1.3	0.13	12..........SUNDAY
	2.5	6	0	86	....	..	....	13
	5.5	10	0	0	....	....	....	14
	8.2	10	0	0	0.04	..	0.04	15
	1.8	10	0	90	....	....	....	16
	2.8	8	0	89	....	....	....	17
	8.3	10	0	0	0.06	....	0.06	18
SUNDAY.......	....	..	..	15	0.07	....	0.07	19......... .SUNDAY
	7.3	10	1	56	....	...	....	20
	10.0	10	10	0	0.00	0.00	0.00	21
	7.7	10	2	28	0.19	....	0.19	22
	5.8	10	0	6	....	....	....	23
	3.8	10	0	49	....	....	....	24
	7.0	10	0	10	...	0.00	0.00	25
SUNDAY.......	....	..	..	27	....	0.00	0.00	26..........SUNDAY
	10.0	10	10	0	....	....	....	27
	10.0	10	10	0	0.00	....	0.00	28
	6.0	10	0	36	0.00	0.00	0.00	29
	10.0	10	10	0	0.00	....	0.00	30
Means...... ..	6.56	9.8	2.5	28.7	1.60	2.4	1.84	...............Sums.
25 Years mea[ns] for and includi[ng] this month	7.27	.	..	¶28 9[3]	2.30	12.45	3.57	25 Years means for and including this month.

| sea-level and

Direction.... f mercury.

Miles ...... being 100.

Duration in hr the 19th; the

Mean velocity. iving a range

Greatest m ldest day was
7th.

Greatest w was 30.503 on
on the 7th. was 29.549 on
ches. Maxi-

mum relative humidity was 99 on the 8th, 9th, 14th, 19th. Minimum relative humidity was 43 on the 3rd.

Rain fell on 12 days.

Snow fell on 6 days.

Rain or snow fell on 16 days.

Lunar halos on the 13th, 18th.

Lunar coronas on the 9th, 10th, 13th, 14th, 16th, 17th, 22nd.

Fog on 5 days.

ABSTRACT FOR THE MONTH OF NOVEMBER, 1899.

Meteorological Observations, McGill College Observatory, Montreal, Canada. Height above sea level, 187 feet, C. H. McLEOD, *Superintendent.*

DAY	THERMOMETER. Mean.	Max.	Min.	Range.	*BAROMETER. Mean.	§Max.	§Min.	Range.	†Mean pressure of vapor.	‡Mean relative humidity.	Dew Point.	WIND. General direction.	Mean velocity in miles per hour	SKY CLOUDED IN TENTHS. Mean.	Max.	Min.	Per cent. possible Sunshine.	Rainfall in inches.	Snowfall in inches.	Rain and snow melted	DAY.
1	40.72	44.8	33.6	11.2	29.7572	29.919	29.639	.280	.2313	88.3	37.5	N.W.	22.7	10.0	10	10	0	0.57	....	0.57	1
2	31.72	35.8	26.4	9.4	30.2183	30.362	29.919	.443	.1107	61.2	20.2	W.	16.0	0.3	10	0	99	...	....	....	2
3	34.18	36.9	29.0	9.9	30.3145	30.421	30.131	.290	1213	62.5	22 3	N.E.	6.6	2.8	10	0	98	....	....	....	3
4	37.67	42.9	32.6	10.3	29.8155	30.131	29.713	.418	.1962	87.0	33.8	S.W.	15.0	9.7	10	8	1	0.61	....	0.61	4
SUNDAY 5	.....	39.5	32.0	7.5	......	......	......	......	......	...	...	W.	16.8	....	..	..	0	....	....	....	5..........SUNDAY
6	36.68	39.2	33.8	5.4	30.2517	30.314	30.152	.162	.1655	76.0	30.0	W.	12.2	6.7	10	0	2	....	....	....	6
7	39.90	44.8	32.9	11.9	30.3102	30.336	30.291	.045	.1998	82.7	34.2	S.W.	24.0	2.8	10	0	54	....	....	....	7
8	40.90	48.5	36.6	11.9	30.2202	30.304	30.117	.187	.2383	92.8	39.0	S.W.	11.2	7.5	10	0	34	....	....	....	8
9	38.03	42.9	34.0	8.9	29.8917	30.117	29.687	.430	.2197	95.5	36.8	S.W.	14.3	9.0	10	4	18	0.00	....	0.00	9
10	38.75	46.2	27.4	18.8	29.7828	29.991	29.625	.366	.1928	77.7	32.3	N.W.	15.5	6.8	10	0	5	0.06	....	0.06	10
11	25.37	27.3	21.4	5.9	29.9608	30.028	29.891	.137	.1163	84.5	21.5	N.	15.6	8.2	10	0	0	....	1.1	0.11	11
SUNDAY........12	.....	28.6	21.0	7.6	......	......	......	......	......	....	....	N.W.	16.5	....	..	..	57	....	1.3	0.13	12..........SUNDAY
13	24.02	29.6	16.6	13.0	30.3145	30.355	30 289	.066	.0997	76.2	17.7	W.	15.5	2.5	6	0	86	....	..	....	13
14	27.88	32.9	19.6	13.3	30.2732	30.331	30.211	.120	.1348	87.8	24.7	S.	6.7	5.5	10	0	0	....	....	....	14
15	32.58	36.4	24.3	12.1	29.9495	30.211	29.818	.393	.1633	87.3	28.8	S.	18.4	8.2	10	0	0	0.04	..	0.04	15
16	30.57	36.4	24.8	11.6	30.3622	30.503	29.932	.571	.1177	68.2	21.5	N.W.	16.6	1.8	10	0	90	....	....	....	16
17	24.85	32.1	19.0	13.1	30.3967	30.503	30.226	.277	.1077	79.0	19.2	N.	10.8	2.8	8	0	89	....	....	....	17
18	39.18	43.3	29.2	14.1	29.9942	30.226	29.904	.322	.2160	89.3	36.2	S.	16.8	8.3	10	0	0	0.06	....	0.06	18
SUNDAY........19	.....	48.7	39.0	9.7	......	......	......	......	......	....	....	S.W.	14.3	....	..	..	15	0.07	....	0.07	19......... SUNDAY
20	35.73	39.0	32.5	6.5	29.9880	30 050	29.836	.154	.1567	74.5	28.5	N.W.	13.6	7.3	10	1	56	....	...	....	20
21	32.12	33.5	30.7	2.8	29.9637	30.049	29.820	.229	.1435	78.5	26.2	S.	5.2	10.0	10	10	0	0.00	0.00	0.00	21
22	37.87	43.3	33.2	10.1	29.7388	29.820	29.694	.126	.1940	85.2	33.5	W.	12.6	7.7	10	2	28	0.19	....	0.19	22
23	35.33	38.6	30.6	8.0	29.9763	30.106	29.800	.306	.1555	75.2	28.2	N.W.	10.5	5.8	10	0	6	....	....	....	23
24	31.18	33.8	28.2	5.6	30.0722	30.137	30 007	.130	.1433	81.5	26.3	S.W.	10.2	3.8	10	0	49	....	....	....	24
25	32.23	35.1	29.2	5.9	29.9910	30.030	29.946	.084	.1438	78.8	26.3	S.W.	14.2	7.0	10	0	10	...	0.00	0.00	25
SUNDAY........26	.....	32 5	24.3	8.2	......	......	......	......	......	....	....	S.W.	12.3	....	..	..	27	....	0.00	0.00	26..........SUNDAY
27	35.72	38.5	32.3	6.2	29.8363	29.878	29.805	.073	.1782	84.2	31.5	S.W.	10.8	10.0	10	10	0	....	....	....	27
28	39.10	41.8	35.9	5.9	29.6523	29.810	29.568	.242	.1965	82.5	33.8	S.	12.3	10.0	10	10	0	0.00	....	0.00	28
29	38.55	42.4	34.0	8.4	29.6182	29.691	29.549	.142	.1808	77.2	31.8	S.W.	12.2	6.0	10	0	36	0.00	0.00	0.00	29
30	34.87	36.9	32.0	4.9	29.7290	29.806	29.684	.122	.1793	88.3	31.7	N.	6.2	10.0	10	10	0	0.00	....	0.00	30
Means........	34.45	38.47	29.20	9.27	30 0146	30.1318	29.8967	.2352	.1655	80.84	28.98	....	13 52	6.56	9.8	2.5	28.7	1.60	2.4	1.84	...............Sums.
25 Years means for and including this month	32.59	38.93	26.66	12.27	30.0169	......	......	.267	.1607	80.00	....	S. 79 5° W	s 15.88	7.27	.	..	¶28 9	2.30	12.45	3.57	25 Years means for and including this month.

ANALYSIS OF WIND RECORD.

Direction.......	N.	N.E.	E.	S E.	S.	S.W.	W.	N.W.	CALM.
Miles	1290	23	240	68	1309	2882	2335	1586	
Duration in hrs..	115	5	20	3	110	181	168	104	14
Mean velocity....	11.2	4.6	12.0	22.7	11.9	15.9	13.9	15.2	

Greatest mileage in one hour was 32, on the 7th.

Greatest velocity in gusts, 34 miles per hour on the 7th.

Resultant mileage, 5,270.
Resultant direction, S. 79.5° W.
Total mileage, 9,733

* Barometer readings reduced to sea-level and temperature 32° Fahrenheit.

§ Observed.

† Pressure of vapour in inches of mercury.

‡ Humidity relative, saturation being 100.

¶ 18 years only. s 13 years only.

The greatest heat was 48°.7 on the 19th; the greatest cold was 16°.6 on the 13th, giving a range of temperature of 32.1 degrees.

Warmest day was the 8th Coldest day was the 13th. Highest barometer reading was 30.503 on the 16th and 17th. Lowest barometer was 29.549 on the 29th, giving a range of .954 inches. Maximum relative humidity was 99 on the 8th, 9th, 14th, 19th. Minimum relative humidity was 43 on the 3rd.

Rain fell on 12 days.

Snow fell on 6 days.

Rain or snow fell on 16 days.

Lunar halos on the 13th, 18th.

Lunar coronas on the 9th, 10th, 13th, 14th, 16th, 17th, 22nd.

Fog on 5 days.

ABSTRACT FOR THE MONTH OF DECEMBER, 1899.

Meteorological Observations, McGill College Observatory, Montreal, Canada. Height above sea level, 187 feet. C. H. McLEOD, *Superintendent.*

DAY	THERMOMETER.				*BAROMETER.				†Mean pressure of vapor.	‡Mean relative humidity.	Dew Point.	WIND.		SKY CLOUDED IN TENTHS.			Per cent. possible Sunshine.	Rainfall in inches.	Snowfall in inches.	Rain and snow melted.	DAY.
	Mean.	Max.	Min.	Range.	Mean.	§Max.	§Min.	Range.				General direction.	Mean velocity in miles per hour	Mean.	Max.	Min.					
1	41.27	48.0	33.1	14.9	29.6060	29.835	29.376	.459	.2360	89.7	38.5	S.E.	14.71	8.5	10	1	1	0.23	....	0.23	1
2	40.25	48.0	34.1	13.9	29.4758	29.494	29.376	.118	.2082	83.0	35.2	S.W.	20.62	6.0	10	0	9	0.06	....	0.06	2
SUNDAY........ 3	.....	37.7	31.4	6.3	......	......	......	......	......	...	....	S.W.	13.83	....	..	..	25	0.00	0.0	0.00	3..........SUNDAY
4	24.67	33.8	19.2	14.6	29.5600	29.671	29.458	.213	.1252	92.8	22.8	N.W.	21.25	10.0	10	10	0	....	6.2	0.62	4
5	18.82	22.0	15.0	7.0	29.8243	29.931	29.622	.309	.0845	82.3	14.3	S W.	13.46	8.3	10	0	16	....	0.0	0.00	5
6	18.82	24.5	13.1	11.4	30.1327	30.453	29.910	.543	.0937	90.8	16.8	N.	11.50	5.3	10	0	0	....	3 0	0.30	6
7	18.47	27.1	9.4	17.7	30.3105	30.534	29.926	608	.0953	92.0	16.5	S.E.	10.08	7.3	10	0	0	....	0.0	0.00	7
8	25.02	31.0	18.7	12.3	29.9917	30.218	29.810	.408	.1192	87.2	22.0	S.W.	17.67	9.2	10	5	4	....	3.3	0.33	8
9	12.77	19.0	9.7	9.3	30.4513	30.508	30.218	.290	.0682	88.2	10.0	N.W.	5.47	2.2	7	0	86	....	...	....	9
SUNDAY........10	.....	33.6	6.6	27.0	......	......	......	......	......	....	....	S.E.	10.87	....	..	..	0	0.00	....	0.00	10..........SUNDAY
11	37.17	42.2	33.2	9.0	30.0180	30.159	29.816	.343	.2115	94.5	35.7	S.	15.87	10.0	10	10	0	0.48	....	0.48	11
12	47.03	56.4	41.3	15.1	29.6053	29 816	29.444	.372	.2862	87.0	42.8	S.	22.08	10.0	10	9	0	0.83	....	0.83	12
13	37.12	41.3	31.5	9.8	29.8322	30.037	29.724	.313	.1975	88.8	34.0	S.W.	16.16	10.0	10	7	0	0.06	0.0	0.06	13
14	19.63	31.6	16.4	15.2	30.3318	30.412	30.037	.375	.0953	88.8	16.8	N.W.	11.42	7.5	10	0	0	....	0.5	0.05	14
15	17.23	22.9	7.1	15.8	30.0627	30.381	29.753	.628	.0903	92.3	15.3	W.	21.25	7.8	10	0	35	....	7.8	0.78	15
16	8.83	14.7	0.3	14.4	30.5732	30.634	30.381	.253	.0580	88.5	6.2	W.	11.46	6.2	10	0	25	....	....	....	16
SUNDAY........17	.....	34.4	8.6	25.8	......	......	......	......	......	....	....	S.	7.42	....	..	..	0	....	....	....	17.......... SUNDAY
18	34.17	37.1	30.9	6.2	30.3512	30.428	30.184	.244	.1772	89.3	31.7	S.	11.37	9.8	10	8	20	....	....	....	18
19	35.62	41.2	28.8	12.4	29.9762	30.184	29.854	.330	.1982	93.5	33.8	S.W.	22.17	8.2	10	0	0	0.67	0.1	0.68	19
20	29.60	36.0	22.0	14.0	30.2322	30.311	30.090	.221	.1372	82.3	25.0	S.W.	18.62	7.3	10	0	13	....	....	....	20
21	30.85	36.3	22.4	13.9	30.2553	30.278	30.191	.087	.1573	91.3	28.5	S.	7.67	8.3	10	0	16	....	....	....	21
22	26.57	29.6	22.0	7.6	30.3292	30.360	30.278	.082	.1375	95.2	25.2	N.	0.42	9.2	10	5	0	...	....	...	22
23	30.02	37.2	22.4	14.8	30.0500	30.300	29.820	.480	.1498	89.8	27.2	S.E.	10.12	3.3	10	0	15	....	....	....	23
SUNDAY........24	....	37.0	33.6	3.4	......	......	......	......	......	....	....	E.	19.50	....	..	..	0	0.02	0.1	0.03	24..........SUNDAY
25	24.63	37.0	17.7	19.3	29.3788	29.600	29.088	.512	.1022	76.5	18.7	S.W.	17.25	3.7	8	0	55	....	....	....	25
26	16.12	20.6	11.6	9.0	29.7512	29.882	29.600	.282	.0798	87.3	13.3	S.W.	9.25	0.5	1	0	84	....	...	....	26
27	16.67	21.6	9.7	11.9	29.9803	30.033	29.882	.151	.0782	83.3	12.5	S.	8.38	5.8	10	0	28	....	0.4	0.04	27
28	19.68	24.0	14.5	9.5	30.0420	30.085	29.991	.094	.0862	80.2	14.7	S.W.	5.96	7.2	10	0	21	....	0.5	0.05	28
29	13.85	19.8	3.7	16.1	29.8943	29.991	29.833	.158	.0800	96.0	12.8	S.W.	6.12	10.0	10	8	5	....	2.8	0.28	29
30	-4.88	3.7	-9.1	12.8	29.7310	29.833	29.687	.146	.0323	92.3	-6.7	S.W.	31.17	5.0	10	0	21	....	0.2	0.02	30
SUNDAY........31	... .	0.8	-12.3	13.1	......	......	......	......	......	....	....	S.W.	12.46	....	..	..	60	....	....	....	31..........SUNDAY
Means......	24.65	30.65	17.63	13.02	29.9903	30.129	29.821	308	.1302	88.57	21.7	S. 40° W.	13.73	7.18	9.4	2.4	17.4	2.35	24.9	4.84	...............Sums.
25 Years means for and including this month	19.16	26.27	12.00	14.27	30.0297	......	......	.297	.1013	83.19	....	....	‡16.46	6.89	.	..	¶28.47	1.36	23.48	3.64	25 Years means for and including this month.

ANALYSIS OF WIND RECORD.

Direction.......	N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.	CALM.
Miles	890	238	155	883	2053	4361	1141	493	
Duration in hrs..	93	15	28	66	143	231	67	29	72
Mean velocity....	9.57	15.87	5.54	13.38	14.36	18.88	17.03	17.00	

Greatest mileage in one hour was 40, on the 30th.

Greatest velocity in gusts, 44 miles per hour on the 12th.

Resultant mileage, 5,660.
Resultant direction, S. 40° W.
Total mileage, 10,214

* Barometer readings reduced to sea-level and temperature 32° Fahrenheit.

§ Observed.

† Pressure of vapour in inches of mercury.

‡ Humidity relative, saturation being 100.

¶ 18 years only. ‡ 13 years only.

The greatest heat was 56°.4 on the 12th; the greatest cold was -12°.3 on the 31st, giving a range of temperature of 68.7 degrees.

Warmest day was the 12th. Coldest day was the 30th. Highest barometer reading was 30.634 on the 16th. Lowest barometer was 29.088 on the 25th, giving a range of 1.546 inches. Maximum relative humidity was 99 on the 4th, 11th, 12th, 15th, 21st, 22nd, 23rd. Minimum relative humidity was 65 on the 19th.

Rain fell on 9 days.

Snow fell on 15 days.

Rain or snow fell on 20 days.

Hoar frost on 2 days.

Lunar coronas on the 7th, 12th, 13th, 15th 16th.

Fog on 2 days.

· 1899.

Observationse N. 45° 30′ 17″. Longitude $4^h\ 54^m\ 18{\cdot}67^s$ W.

C. H. McLEOD, *Superintendent.*

MONTH.		Number of days on which rain fell.	Inches of snow.	Number of days on which snow fell.	Inches of rain and melted snow.	No. of days on which rain *and* snow fell.	No. of days on which rain *or* snow fell.	MONTH.
January	1	5	25.1	19	4.62	3	21	January ....
February	1	5	9.1	16	1.63	4	17	February.........
March	2	8	43.7	20	8.53	7	21	March ....
April	4	13	1.9	3	1.63	2	14	April...... .....
May	5	14	....	..	1.59	..	14	May ....
June............	6	16	....	..	2.46	..	16	June.......... ......
July	6	21	....	..	7.72	..	21	July..............
August	6	11	...	..	2.52	..	11	August.........
September	5	17	....	..	5.08	..	17	September.......
October.........	4	12	0.0	2	3.39	1	13	October..........
November	3	12	2.4	6	1.84	2	16	November ....
December	2	9	24.9	15	4.84	4	20	December.... ...
Sums for 1899 ...		143	107.1	81	45.85	23	201	Sums for 1899 ...
Means for 1899 ..	4	....	....	..	3.82	..	..	Means for 1899 ..
Means for 25 years ending Dec. 31, 1899.	4	135	118.7	79	40.17	16	202	Means for 25 years ending Dec. 31, 1899.

* Barometer r dicates that the temperature has been *higher*: "—" that it has been *lower* than the aver tern Standard time. The anemometer and wind vane are on the summit of Mount R

The greatest , therefore 108.°2. Greatest range of thermometer in one day was 45.°4 on January 27 t day was January 10, when the mean temperature was 13.°43 below zero. The lowes t velocity in gusts was at the rate of 66 miles per hour on March 6. The total mileage bserved on 9 nights ; fog on 42 days ; thunder storms on 12 days ; lunar halos on 8 nig l of the autumn was on November 11.

NOTE.—The y

Meteorological Abstract for the Year 1899.

Observations made at McGill College Observatory, Montreal, Canada. — Height above sea level 187 ft. Latitude N. 45° 30′ 17″. Longitude $4^h\ 54^m\ 18{\cdot}67^s$ W.

C. H. McLEOD, *Superintendent.*

Month.	Thermometer. Mean.	¶ Deviation from 25 years, means.	Max.	Min.	Mean daily range.	* Barometer. Mean.	Max.	Min.	Mean daily range.	† Mean pressure of vapour.	‡ Mean relative humidity.	Mean dew point.	Wind. Resultant direction.	Mean velocity in miles per hour.	Sky clouded per cent.	Per cent. possible bright sunshine	Inches of rain.	Number of days on which rain fell.	Inches of snow.	Number of days on which snow fell.	Inches of rain and melted snow.	No. of days on which rain *and* snow fell.	No. of days on which rain *or* snow fell.	Month.
January	14.24	+ 2 10	49.0	- 19.4	18.91	30.0671	30.777	29 219	418	.0835	83.2	10.0	S. 46° W.	17.97	54	39.5	2.03	5	25.1	19	4.62	3	21	January ....
February	16.13	+ 0.47	41.0	— 13.1	12.18	29.9436	30.573	29.274	.318	.0854	79.5	10 7	S. 45½° W.	18.56	53	48.4	0.54	5	9.1	16	1.63	4	17	February........
March	22.16	— 2.34	42 5	— 6.0	13.34	29.9856	30 583	28.998	385	.1035	81.8	17.6	N. 75½° W.	15 66	60	39.2	2.23	8	43.7	20	8.53	7	21	March ....
April	42 85	+ 2.60	82.0	21 5	15.94	30.0372	30.409	29.395	.176	.2042	70.7	33 5	S. 45¼° W.	13.68	40	63.0	1.37	13	1.9	3	1.63	2	14	April..... .....
May	56.58	+ 1.79	78 4	36.0	18.75	29 9706	30 264	29.611	.162	.3041	68.1	45.3	N. 64¼° W.	13.47	47	61.0	1.59	14	....	..	1.59	..	14	May ....
June........	65.97	+ 1.08	87.0	51.0	17.43	29 9175	30.227	29.491	.167	.4426	68.7	54.6	S. 86½° W.	12.79	50	63.7	2.46	16	....	..	2.46	..	16	June..... ......
July	68 31	— 0.57	84.4	51 1	16.55	29 8762	30.163	29.590	.135	.5149	74.2	59.2	S. 45½° W.	13.92	56	63.5	7.72	21	....	..	7.72	..	21	July..............
August	68 81	+ 2.13	88.8	51.2	16.64	29 9518	30.270	29.623	.114	.5013	70.7	58.2	S. 38¾° W.	11 43	44	64.3	2.52	11	...	..	2.52	..	11	August..... .....
September	51.80	— 3.59	77.6	36.1	14.80	29.9646	30.425	29.463	.230	.3382	76.9	47.4	S. 18° W.	14.67	57	43.2	5.08	17	....	..	5.08	..	17	September.......
October	49.17	+ 3.53	73.8	30.0	13.28	30.1631	30.512	29.721	.178	.2773	75.5	41.4	S. 61¼° W.	10.22	63	39.7	3.39	12	0.0	2	3.39	1	13	October..........
November	34.45	+ 1.86	48.7	16 6	9.27	30.0146	30.503	29.549	.235	.1655	80.8	20.0	S. 79½° W.	13.52	66	23.7	1.60	12	2.4	6	1.84	2	16	November ....
December	24.65	+ 5.49	56.4	— 12 3	13.02	29.9903	30.634	29 088	.308	.1302	88.6	21 7	S. 40° W.	13.73	72	17 4	2 35	9	24.9	15	4.84	4	20	December.... ...
Sums for 1899 ...	..	....	....	....	....	....	....	....	....	....	..	....	....	....	....	....	32.88	143	107.1	81	45.85	23	201	Sums for 1899 ...
Means for 1899 ..	43.18	+ 1.20	....	....	15.01	29.9902	....	....	.235	.2625	76.6	35.7	S. 54½° W.	14.09	55	47.6	....	....	....	..	3.82	..	..	Means for 1899 ..
Means for 25 years ending Dec. 31, 1899.	41.98	....	....	....	...	29.9812	....	....	....	.2541	75.2	....	....	*a* 14.97	60	§45.91	28.41	135	118.7	79	40.17	16	202	Means for 25 years ending Dec. 31, 1899.

* Barometer readings reduced to 32° Fah. and to sea level. † Inches of mercury. ‡ Saturation 100. § For 18 years only. *a* For 13 years only. ¶ "+" indicates that the temperature has been *higher*: "—" that it has been *lower* than the average for 25 years inclusive of 1899. The monthly means are derived from readings taken every 4th hour, beginning with 3 h. 0 m. Eastern Standard time. The anemometer and wind vane are on the summit of Mount Royal, 57 feet above the ground and 810 feet above the sea level.

The greatest heat was 88.8° above zero on Aug. 21; the greatest cold was 19.4° below zero on January 10. The extreme range of temperature was, therefore 108.°2. Greatest range of thermometer in one day was 45.°4 on January 27; least range was 2.°8 on November 21. The warmest day was June 13, when the mean temperature was 76.°43 above zero. The coldest day was January 10, when the mean temperature was 13.°43 below zero. The lowest relative humidity was 30 on June 29. The greatest mileage of wind recorded in one hour was 54 miles on January 27, and the greatest velocity in gusts was at the rate of 66 miles per hour on March 6. The total mileage of wind was 123,444. The resultant direction of the wind for the year was S. 54½° W., and the resultant mileage 53,900. Auroras were observed on 9 nights; fog on 42 days; thunder storms on 12 days; lunar halos on 8 nights; lunar coronas on 45 nights; Mock suns on 2 days First sleighing of winter in city on November 12. The first appreciable snowfall of the autumn was on November 11.

NOTE.—The yearly means of the above are the averages of the monthly means, except for the velocity of the wind.

Published quarterly; Price $3.00 the Volume of eight numbers.

VOLUME VIII. NUMBER 4.

THE CANADIAN RECORD OF SCIENCE

INCLUDING THE PROCEEDINGS OF
THE NATURAL HISTORY SOCIETY OF MONTREAL,
AND REPLACING

THE CANADIAN NATURALIST.

CONTENTS.

PAGE

The Rate of Propagation of the Venous Pulse. By Dr. W. S. Morrow 205

A Forest Fire at St. John about 2000 Years ago. By G. F. Matthew, LL.D., F.R.S.C 213

The Rock Formation of the Bermudas. By J. S. Buchan, Q.C., B.C.L 219

Notes on the Glaciation of Mount Orford, P.Q. By J. Dresser 223

On the Height of Orford Mountain. By N. N. Evans and O. E. Leroy 225

Oldhamia. By G. F. Matthew, LL.D., F.R.S.C 228

Progress of Geological Work in Canada during 1899. By H. M. Ami, D.Sc. 232

Proceedings of the Natural History Society 246

Session 1899–1900 258

Duck Hawk on Mount Royal. By Alfred Griffin 265

List of Members of the Natural History Society of Montreal 267

MONTREAL:
PUBLISHED BY THE NATURAL HISTORY SOCIETY.

LONDON, ENGLAND: Collins, 157 Great Portland St.

BOSTON, MASS.: A. A. Waterman & Co., 36 Bromfield St.

1900.

NATURAL HISTORY SOCIETY OF MONTREAL.

[*Incorporated* 1832.]

OFFICERS—SESSION 1900-1901.

Patron:
HIS EXCELLENCY THE GOVERNOR-GENERAL OF CANADA.

Hon. President:
LORD STRATHCONA AND MOUNT ROYAL.

President:
REV. ROBT. CAMPBELL, M.A., D.D.

Vice-Presidents:
FRANK D. ADAMS, Ph.D., F.R.S.C.
B. J. HARRINGTON, Ph.D., F.R.S.C.
HON. J. K. WARD.
PROF. E. W. MACBRIDE, M.A., D.Sc.
C. T. WILLIAMS.
J. H. JOSEPH.
HON. JUSTICE WÜRTELE.
A. HOLDEN.
T. WESLEY MILLS, M.A., M.D.

Hon. Recording Secretary:
CHAS. S. J. PHILLIPS.

Hon. Corresponding Secretary:
J. S. BUCHAN, Q.C., B.C.L.

Honorary Treasurer:
F. W. RICHARDS.

Curator:
ALFRED GRIFFIN.

Members of Council:
ALBERT HOLDEN, *Chairman.*
J. A. U. BEAUDRY, C.E.
E. T. CHAMBERS.
JOSEPH FORTIER.
N. N. EVANS, M.A.Sc.
EDGAR JUDGE.
DR. GIRDWOOD.
H. MCLAREN.
GEO. SUMNER.
JOHN HARPER.

Editing and Exchange Committee:
REV. ROBT. CAMPBELL, M.A., D.D., *Chairman.*
FRANK D. ADAMS, Ph.D., F.R.S.C.
J. S. BUCHAN, Q.C., B.C.L.
PROF. J. T. DONALD.
A. T. DRUMMOND, LL.D., Kingston, Ont.
PROF. E. W. MACBRIDE, M.A., D.Sc.
G. F. MATTHEW, LL.D., F.R.S.C., St. John, N.B.
T. WESLEY MILLS, M.A., M.D.
J. F. WHITEAVES, Ottawa, Ont.

Library Committee:
E. T. CHAMBERS, *Chairman.*
J. A. U. BEAUDRY, C.E.
A. E. NORRIS.
JOSEPH FORTIER,
ALFRED GRIFFIN.
G. M. TOD.
C. T. WILLIAMS.

Museum Committee:
A. E. NORRIS, *Chairman.*
REV. ROBT. CAMPBELL, M.A., D.D.
G. A. DUNLOP.
O. E. LEROY, B.A.
A. B. DUMOUCHEL.
PROF. E. W. MACBRIDE, M.A., D.Sc.
J. B. PICKEN.
H. E. VENNOR.

Field Work Committee:
C. T. WILLIAMS, *Chairman.*
FRANK D. ADAMS, Ph.D., F.R.S.C.
J. S. BUCHAN, Q.C., B.C.L.
REV. ROBT. CAMPBELL, M.A., D.D.
ALBERT HOLDEN.
O. E. LEROY, B.A.
PROF. E. W. MACBRIDE, M.A., D.Sc.
J. B. PICKEN.
F. W. RICHARDS.
REV. G. COLBORNE HEINE, B.A.

Lecture Committee:
REV. G. COLBORNE HEINE, B.A., *Chairman.*
REV. ROBT. CAMPBELL, M.A., D.D.
PROF. JOHN COX, M.A.
J. S. BUCHAN, Q.C., B.C.L.
N. N. EVANS, M.A.Sc.
B. J. HARRINGTON, Ph.D., F.R.S.C.
CHAS. S. J. PHILLIPS.
EDGAR JUDGE.
T. WESLEY MILLS, M.A., M.D.
HON. JUSTICE WÜRTELE.

House Committee:
ALBERT HOLDEN, *Chairman.*
H. MCLAREN.
C. T. WILLIAMS.

Membership Committee:
EDGAR JUDGE, *Chairman.*
J. A. U. BEAUDRY, C.E.
REV. ROBT. CAMPBELL, M.A., D.D.
ALBERT HOLDEN.
HON. J. K. WARD.
H. MCLAREN.
CHAS. S. J. PHILLIPS.
GEO. SUMNER.
C. T. WILLIAMS.

Superintendent:
ALFRED GRIFFIN.

THE

CANADIAN RECORD

OF SCIENCE.

VOL. VIII. JULY, 1900. No. 4.

THE RATE OF PROPAGATION OF THE VENOUS PULSE.[1]

By DR. W. S. MORROW,

Lecturer in Physiology, McGill University.

(From the Physiological Institute of the University of Breslau.)

This research was undertaken at the suggestion of Prof. Karl Hürthle, of Breslau, to determine the rate at which the venous pulse travels. Before I began my experiments Prof. Hürthle had satisfied himself that a venous pulse could frequently be observed in the veins of the neck and extremities of normal dogs.

He had also devised very sensitive apparatus for recording the same (Hürthle's venous manometers). Tracings of the pulse in the veins of the extremities of normal dogs, taken with this apparatus, are shown in Figures 1 and 2. Other investigators had also observed the venous pulse in the extremities of normal animals, and still others (2 and 3) had studied it in normal and pathological human subjects, but no one had undertaken to measure the rate at which it travelled. It seemed probable that this would be found different from that of the arterial pulse, on

[1] This research was reported in German in Pflürger's Archives for March.

account of the differences in pressure in the two kinds of vessels.

My experiments were all performed on dogs, which first received an injection of morphine, and were then thoroughly anæsthetized with a mixture of equal parts of chloroform and ether.

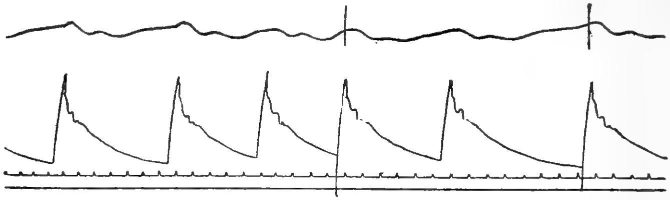


Fig. 1.—Pressure tracing from artery (below) and femoral vein (above). Time $\frac{1}{5}$ seconds. From a dog.

Pulse tracings were taken on a blackened surface simultaneously from two points on the veins. At the same time a chronograph was arranged to mark seconds or fifths of seconds on the recording surface, so as to indicate the rate at which it was moving. By this means it was possible to estimate the time elapsing between the appearance of a certain wave on the tracing taken from a vein at a point near the heart, and on that taken farther away from the heart. Then, in order to estimate the rate at which a given pulse wave travelled, it was only necessary to know, in addition, the distance of the points on the veins from one another measured along the line of blood flow, or more exactly the difference in the distances of the two points from the heart (right auricle).

The recording surface employed was that of Hürthle's large clockwork kymograph.

The pulse waves were recorded by inserting a fine glass canula, with a long drawn out point, into the vein through a side branch. (See Fig. 3.) The canula was then connected by rubber tubing with one of Hürthle's venous manometers, which marked the waves on the surface of the kymograph.

Hürthle's venous manometers which were used in the experiments consist of small metallic tambours, 10 mm. in diameter, covered over with thin rubber tissue slightly stretched. On the centre of this membrane rests a light metal disc of 8 mm. diameter, which supports, and transmits its movements to a lever moving very easily and writing at one end on the kymograph with a suitably shaped quill. The lever magnifies the up and down movements of the disk as 120:5.

On account of the very slight variations in pressure underlying the venous pulse, friction has to be minimized as much as possible. This is accomplished by adjusting the lever against the kymograph by a screw arrangement, so that it exerts the slightest possible pressure upon it. The manometers, the glass canulas, and the rubber tubing connecting them were filled with saturated solution of magnesium sulphate, which prevented the clotting of the blood in the vein over the opening of the canula.

It was possible, by measuring the distance that the lever of the manometer was raised, and comparing this with the effects of known pressures of water at the close of the experiments, to estimate approximately the pressure present in the veins at any point represented on the tracings.

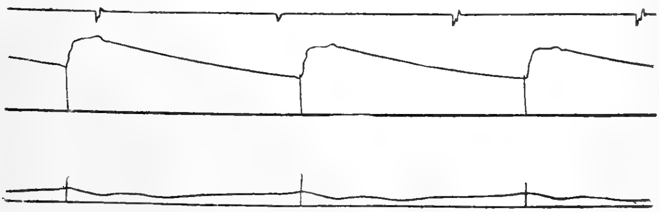


Fig. 2.—Pressure tracing from artery (above) and brachial vein (below). Time in seconds. From a dog.

The rate of propagation was measured in two regions:

1. Through the external jugular vein.

2. Through the inferior vena cava to the femoral vein.

In the first case, pulse tracings were taken simultaneously from the central and peripheral ends of the external jugular, by inserting one canula into it through the posterior scapular vein, and another through the external maxillary.

To measure the rate of propagation through the inferior vena cava, one tracing was taken as above from the central end of the external jugular, and the other from the femoral

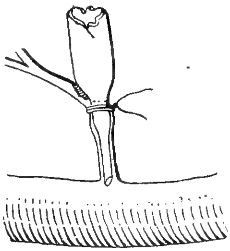


Fig. 3.

vein by introducing a canula into it through the deep femoral. At the end of the experiments the distances of the points on the veins used from the right auricle were measured; if one indicates the distance of the point nearest the heart by $e_{\prime}$, and the distance of the point farthest away by $e_{\prime\prime}$, then the length of vein for which the rate of propagation of the pulse waves is estimated is $e_{\prime\prime} - e_{\prime}$.

Finally, at the end of the experiment the points on the two tracings, corresponding to one another in time, were established by causing both levers to write vertical lines, with the kymograph standing still. The marking of these points was sometimes attended with considerable difficulty, on account of the waves being less sharp than those of the arterial pulse.

In most cases, however, a fair number of satisfactory markings could be made. An example of these markings is seen in Fig. 4. The distance apart of the vertical lines indicates how much later the wave began in the distal part of the vein than in the central, the exact time being estimated by comparison with the horizontal line between the tracings, on which seconds are marked.

If now one indicates with (a) the distance in centimetres between the vertical lines marking the beginning of a given wave in the two tracings, with (s) the rate at which the recording surface travels in centimeters, with ($e_{\prime\prime} - e_{\prime}$) the length of vein being studied, and with (v) the rate of propagation of the pulse in that length of vein, then

$$v = s\,\frac{(e_{\prime\prime} - e_{\prime})}{a}$$

As regards the presence of a pulse in the veins of the animals experimented on, it may be said that one could always be observed and recorded in the central end of the jugular. In most cases it could also be recorded from the distal end of the jugular and from the femoral; but the waves were sometimes not sharp enough for satisfactory marking. The estimations reported below were taken

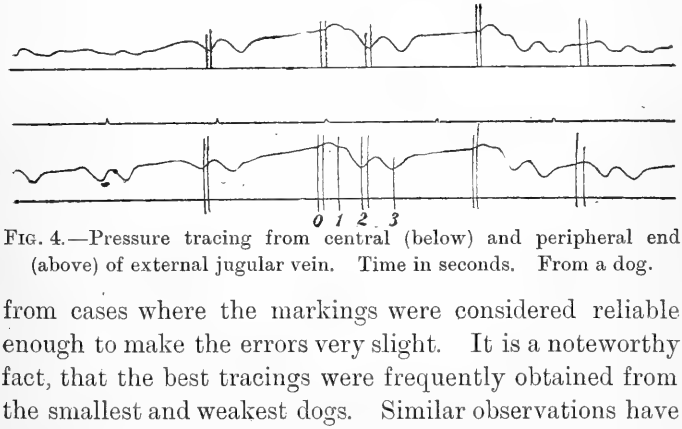


FIG. 4.—Pressure tracing from central (below) and peripheral end (above) of external jugular vein. Time in seconds. From a dog.

from cases where the markings were considered reliable enough to make the errors very slight. It is a noteworthy fact, that the best tracings were frequently obtained from the smallest and weakest dogs. Similar observations have been made by Gottwald (1) on dogs, and Gerhardt (2) on human subjects. Gerhardt claims to have observed the venous pulse most frequently in weak and anæmic girls.

Although a discussion of the form of the venous pulse does not properly find a place in this paper, it is necessary to allude to it briefly in order to have names for the various waves whose rate of propagation was studied. Following Fredericq (4), Gerhardt (2) and others, I distinguish, as may be seen in Fig. 4, a presystolic wave, 0, a systolic wave, 1, a first and second diastolic wave, 2 and 3, Such a typical and complete form, however, cannot always be observed, but one or more of the above mentioned waves is often absent from the tracing.

THE RATE OF PROPAGATION THROUGH THE JUGULAR VEIN.

The results of the measurements made in the different experiments were arranged in tabular form, as given below, and also the rate of propagation and the pressure in the jugular, estimated by the methods described above. The results are set down in order according to the velocity.

TABLE I.

Rate of Propagation of the Presystolic Wave.
(All measurements in centimeters.)

Difference in the distance from the right auricle of the distal and prominal points on the veins.	Distance on recording surface between beginning of wave in the two tracings.		Distance travelled by recording surface per second.		Calculated velocity of pulse.		Pressure in central end of jugular in centimeters water.
$e_{\prime\prime} - e_{\prime}$	a		s		v		p
23·5−12·5=11	·065	....	1·85	....	313	....	5·5
	·060	....	1·70	....	312	....	5·5
	·070	....	1·80	....	283	....	5·4
	·080	....	1·75	....	241	....	3·2
	·100	....	1·83	...	201	....	3·5
				Average	270	....	4·6

In the remaining tables only the calculated results will be given, namely, the rate of propagation in centimeters per second and the pressure in centimeters of water in the central end of the jugular vein.

TABLE II.

Presystolic Wave.

	v		p
	228	....	8·5
	225	...	9·5
	218	....	8·8
	194	...	8·5
	173	....	8·5
	170	....	9·0
Average	201	....	8·8

TABLE III.

Presystolic Wave during Dyspnœa.

	v		p
	257	....	8·9
	254	....	9·1
	235	....	9·3
	235	....	9·4
	231	....	9·2
	221	....	8·5
	208	....	9·3
	205	...	9·2
Average	220	....	9·1

TABLE IV.

Systolic Wave.

v		*p*
364	....	5·5
337	....	4·9
330	....	5·2
291	....	5·8
264	....	5·5
259	....	4·7
248	...	4·2
248	....	3·9
248	....	3·5
228	....	6·0
194	....	4·5
Average 268	....	4·9

TABLE V.

Systolic Wave.

v		*p*
161	...	7·5
147	....	7·7
143	....	6·8
134	....	7·6
130	....	7·3
115	....	6·9
Average 138	....	7·3

TABLE VI.

First Diastolic Wave.

v		*p*
278	....	2·9
264	....	2·7
257	....	2·8
254	....	2·9
252	....	2·7
248	..	2·5
248	...	2·5
241	....	3·0
220	....	3·2
214	...	2·8
205	....	2·4
198	....	3·7
198	....	2·7
198	....	2·0
196	....	2·7
193	....	2·0
180	...	2·0
165	....	2·0
Average 223	....	2·6

TABLE VII.

First Diastolic Wave.

v		*p*
139	....	6·8
130	....	6·3
117	....	6·3
117	....	5·5
116	....	6·0
114	....	6·1
108	....	6·1
103	....	6·0
102	....	5·3
100	....	4·9
99	....	5·3
98	....	5·7
98	....	5·2
95	....	5·5
93	....	5·5
92	....	5·5
92	....	5·5
89	....	4·8
86	....	5·0
85	....	5·2
85	....	5·0
Average 103	....	5·6

RATE OF PROPOGATION OF THE PULSE THROUGH THE INFERIOR VENA CAVA.

TABLE VIII.

Presystolic Wave.

v		*p*
138	....	2·4
128	....	3·1
128	....	3·1
122	....	2·7
106	....	2·0
92	....	2·7
89	....	2·7
Average 115	....	2·7

TABLE IX.

First Diastolic Wave.

v		*p*
117	....	2·0
113	....	2·2
104	....	2·6
104	....	1·5
93	....	2·0
92	....	2·6
Average 104	....	2·1

TABLE X.

First Diastolic Wave.

v		p	
136	....	6·5	
127	....	6·5	
120	..	6·5	
119	..	6·5	
112	....	6·3	
101	....	7·1	
140	....	4·6	Dyspnœa.
136	..	4·2	Dyspnœa.
130	....	4·8	Dyspnœa.
124	....	4·8	Dyspnœa.
114	...	4·5	Dyspnœa.
112	....	3·2	Dyspnœa.
110	...	2·9	Dyspnœa.
106	...	2·8	Dyspnœa.
101	....	2·9	Dyspnœa.
101	....	2·5	Dyspnœa.
Average 118		4·8	

TABLE XI.

Second Diastolic Wave during Dyspnœa.

	v		p
	70	....	–2·5
	69	....	–2·6
	67	....	–2·3
	65	...	–2·5
	64	....	–2·0
	63	....	–2·0
Average	66	....	–2·3

In the following table the average rates and pressures from the preceding tables are brought together:

TABLE XII.

Table.	Average velocity.	Average pressure.	Wave.	
I.	270	4·6	Presystolic	Jugular vein.
II.	201	8·8	"	Jugular vein.
III.	230	9·1	"	Jugular vein.
IV.	268	4·9	Systolic	Jugular vein.
V.	138	7·3	"	Jugular vein.
VI.	223	2·6	I. Diastolic	Jugular vein.
VII.	103	5·6	"	Jugular vein.
VIII.	115	2·7	Presystolic	Through inferior vena cava to femoral.
IX.	104	2·1	I. Diastolic	Through inferior vena cava to femoral.
X.	118	4·8	"	Through inferior vena cava to femoral.
XI.	66	–2·3	II Diastolic	Through inferior vena cava to femoral.

The results of the investigation may be summarized as follows:

1. The changes in the pressure of blood within the right auricle and great veins are propagated through the larger veins of the trunk and extremities, causing a venous pulse.

2. The rate of propagation of this venous pulse varies between one and three meters per second in round numbers. This is much slower than the rate of propagation of the arterial pulse, which is to be explained by the lower pressure within the veins, and the differences in the walls of the two kinds of vessels.

3. A direct proportion between rate of propagation and pressure within the external jugular vein could not be demonstrated.

4. Some of the waves, especially the presystolic and the systolic, travel faster than others.

LITERATURE:

(1) Gottwald, Pflüger's Archiv., Vol. 25, p. 1.
(2) Gerhardt, Archiv. f. exper. Pathologie, Vol. 34, p. 402.
(3) Friedreich, Deutsches Arch. f. klin. Med., Vol. 1, p. 241.
(4) Frédéricq, Travaux du lab. de Léon Frédéricq, Vol. 3, p, 85.

A FOREST FIRE AT ST. JOHN ABOUT 2000 YEARS AGO.

By G. F. MATTHEW, LL.D., F.R.S.C.

The opening up of a bog deposit near St. John has revealed some interesting information about the physical history of the region around the Bay of Fundy in past ages, both antecedent to and contemporaneous with the presence of man on its shores. Not the least notable is the discovery that St. John was swept by a forest fire about the beginning of the Christian era.

Among the objects found in this peat bog are charred twigs, and flakes of wood also charred, that have been found at several points at a definite depth in the bog. These objects are scattered over the surface of a certain layer of the bog, where they are buried among unburned twigs, leaves of grass and other vegetable remains in a partly decayed condition, but so little changed that their brown color contrasts strongly with the jet black of the burned twigs.

From the way in which these light charred fragments are buried among the unburned material it is inferred that they were blown in upon the bog from the surrounding hills. These hills being much drier than the bog, would be liable to be swept by forest fires, while the water-soaked bog would preserve the trees which were growing on it as well as the scorched fragments resting upon its surface. The antiseptic properties of the peat would help to preserve the charred fragments as well as the remains of the vegetation into which they had fallen, and thus bring them down to our time comparatively unchanged.

These burnt twigs are in a layer about two feet below the present surface of the bog. On this layer they are plentiful, but scattered examples are found about half an inch or an inch lower down. If we allow for the possibility of animals traversing the bog, we shall understand that it would be possible for some of the fragments of charcoal to be forced a short way into the yielding moss of its surface by their feet, and thus these fragments that are more deeply buried may have originally belonged to the one principal layer.

We have found this charcoal layer at the three points in the bog where sections of the bog deposit were taken, and always at about the same distance from the surface.

In 1880 and 1881 the author investigated the fresh water deposits of Lawlor's Lake, in the Torryburn valley, five miles N.E. of St. John ; and incidentally in connection therewith, examined two dry basins in the same valley, one at the east and west ends of the lake. In the latter basin the section of the Recent deposit showed fragments of charcoal at a depth of two feet and a half. That this charcoal layer may have been cotemporary with that at the Rockwood bog seems probable, notwithstanding that it is buried to a greater depth, for through the Torryburn basin runs a small brook which, although connected originally with Lawlor's Lake by an underground passage through limestone rock, may be considered to have carried more sediment than could come to the Rockwood bog, which lies in the col of a small valley, from which the water flows in two directions; the Rockwood deposit at this stage (two feet below the surface) was a purely vegetable deposit.

From the fact that both at Torryburn and Rockwood there is a charcoal deposit at about the same horizon in the Recent deposits, it appears reasonable to infer that they had probably a common origin, and that this was a forest fire, which extended over an area of at least some miles in the vicinity of St. John. The question arises—if there was such a fire at the time indicated, how was it set?

It has been suggested that such fires arise from the heat developed by a lightning stroke. But while buildings are often destroyed in this way, it would seem that growing trees, which are often struck, seldom take fire. This may be attributed to the dampness of the trunk and foliage, which rapidly conducts the electricity away; and then if a fire should originate from this cause, it stands a good chance of being extinguished by the rain which usually accompanies a thunder storm.

I have seen it stated that in the South of France forest fires have been known to originate from the drops of balsam which exude from pine trees, these drops forming natural lenses which concentrate the rays of the sun and lead to ignition of the wood through the resinous vapors that escape the balsam or gum.

It appears to the writer that neither of these causes has been active in this region in Recent Geological Time in setting fire to forests. For we have in the Rockwood bog a record of the physical events of this kind for a period reaching back for from 6000 to 9000 years. The Rockwood deposit has been carefully examined inch by inch, and layer by layer, from the summit to the bottom, and this in three different places, but no charcoal fragments have been met with, except at the one level of two feet below the surface. If the fire had been due to physical causes there is good reason to think that such fires would have recurred at intervals, from the time that the country was first forest-clad, after the Champlain Period, until now, but, as we have remarked, only the one layer of scorched twigs and flakes of wood is known, and that at a period about two thousand years back.

Another possible source of such a fire is the agency of man. It is claimed by some archæologists that the earliest men on this continent were unacquainted with the use of fire. To men of this race we will not ascribe the calamity which devastated the neighborhood of St. John; but men who knew not of fire were followed by those who did know, and the carelessness of such a people seems sufficient cause for the phenomenon in the Rockwood bog. We know the care which the savage exercises to prevent the spread of fire from his camping ground; he knows the destruction of game animals that would accompany the sweep of a forest conflagration, which for the sake of himself and his tribe is to be avoided. The savage also is in constant fear of his human enemies, and the smoke of his camp-fire might reveal his presence to a prowling adversary; hence he makes his camp-fire as small as possible, and hovers over it. The fire he makes is thus also easily extinguished. The first users of fire, however, who entered the Acadian forests may not have learned or felt the need of these precautions, and thus have carelessly allowed a fire to spread. From these various considerations we infer the *probability* that the forest fire recorded in the Rockwood bog was due to the agency of man.

Is it possible to fix within a reasonable limit the time when this event occurred?

Only those who have sectioned and examined the trees and shrubs which grow on the margin of what the Danes call a *Skovmose* or Forest Bog can have any conception of the exceedingly slow rate at which trees grow in such situations. In the first place, their roots are constantly buried in the cool, damp moss, and the whole plant is constantly bathed in the moist and chilled air that covers the bog. But further, it is impossible for the roots of such trees to reach a magazine of mineral sustenance, such as the ground affords, but as a recompense they spread out their long slender roots to a surprising distance over the surface of the bog in search of food. The juices of the bog afford them little or no lime and potash, the roots can not pass through the water-soaked subsoil, and so they are literally starved. Spruce trees (*Abies nigra*) that are no better than little shrubs in such situations, will show by the rings of growth that they are 30 or 40 years old. A growth for the same number of years would have enabled their brethren on the upland to reach the size of stalwart trees.

Cedar trees (*Thuja occidentalis*) also have been dwarfed in the same way, but not to the same extent, as some of them have finally struggled up to considerable dimensions. One such tree, the tenacity of whose roots had been weakened by the drainage of the bog, due to the operations of the park commissioners of Rockwood Park, had fallen across the canal they made. The overturning of the tree showed just how far the roots descended into the bog, and it was to a depth no greater than six inches; the boll of the tree had sunk deeper than this, owing to the weight of its trunk, but the lowest layer of roots started out at this level to radiate through the moss of the bog. At the time the tree fell the lower tier of roots had perished (probably many years before), and the life of the tree was sustained by an upper tier of roots that spread out about three inches from the surface of the bog. Many of the roots of even this second tier had perished, for the tree had long passed its prime.

One of the park commissioners was kind enough to have the tree sawed as near to the base as the heart wood remained, and thus exposed the annual layers of growth. On counting these layers it was found that the tree had attained the age of four hundred years. Moss grew up around the base of the tree, and regular layers of peat moss and forest vegetation had accumulated above the roots during the long period of its growth.

During this period of four hundred years it would appear that the bog added only six inches to its depth. As far down as the charcoal layer there is no great difference in the nature of the bog deposit; sometimes an extra amount of forest mould shows that the trees which grew along the borders of the bog were able to throw out colonies into the open sphagnous area; at others a return of a moister climate reversed the conditions, and the bog encroached on the forest; but assuming that the growth was comparatively uniform, twelve hundred years would have elapsed from the time when the charcoal layer was deposited until the seed of this cedar sprouted in the moss of the bog.

But in estimating the age of the charcoal layer, other factors are to be considered; one of these is the condensation of the peat in the lower layers by the weight of the superincumbent mass of vegetable matter. To test this, a sample of the peat above the roots of the cedar tree was weighed and compared with that of the peat a foot down from the surface; the latter was found to be a third heavier, showing a considerable condensation of the mass; at a lower level the weight was still greater. Allowing for the reduction of bulk from this cause in the lower layers, I think it may be assumed that 2,000 years have elapsed since the charcoal layer was deposited, and therefore since the occurrence of the forest conflagration of which it is a witness.

The Rock Formation of the Bermudas.

By J. S. Buchan, Q.C., B.C.L.

A few preliminary remarks concerning the Bermudas generally may be of interest, and will assist in making the special subject before us more clearly understood.

The Bermudas are a cluster of islands about 350 in number, many being, however, mere rocks, situated in the Atlantic Ocean in Lat. 32° 20′ N. and Long. 74° 50′ W., or, to describe their position in other words, a straight line 700 miles long, drawn almost due south from Halifax, would pass through them, while another due west, about 600 miles in length, would almost strike Charleston in South Carolina.

The islands lie to the south of a coral reef or atoll about 24 miles in length by 12 in breadth, of which the part above water is the southern fringe or edge, containing in all only about 19 square miles of land, and said to be, with the exception of St. Helena, the most isolated body of land on the globe.

They form the only coral reef in the Central Atlantic, and almost the only instance in which living, reef-building coral is found so far to the north, the conditions being, however, favorable to it, owing to the temperature of the water being raised by the Gulf stream.

The surface of the islands presents a succession of low, rolling hills, with valleys between them, and scarcely any level ground, the highest point being Gibb's Hill, on which the light-house is situated, 362 feet above sea level. The soil, of a red-brown color, is only a few inches deep, but very fertile.

The islands are altogether of coral formation, which is found in various stages, from the sand thrown up by the waves to the stalagmite which marks the floor of some ancient cave from which the roof and walls, with the hill in which it was formed, have been swept away.

The process by which the final stage, if it may be so called, is reached, is not only of great interest in itself, but particularly so because it is now, as it has doubtless been throughout the whole history of the islands, going on, and can be studied in all stages of progress.

The beginning of this process must be sought for in the reefs which surround the islands, and protect them from the direct force of the sea. Out on the reefs, where the coral is living and growing, fragments are constantly broken off and thrown in towards the shore by the violence of the surf, to be by the same means gradually ground up into a fine sand, which is eventually washed up to form a beach, wide stretches of which are exposed at low water.

From this point the evolution of the rock formation may be said to begin. The sand is blown inland by the wind, forming great ridges, which have the appearance of enormous snowdrifts. The principal "sand-glacier" where this is now to be seen is at Elbow Bay, on the south shore, where the sand has drifted far inland to great depths, completely filling up valleys, and even overwhelming houses in its progress. The whole of the land has been formed in the same manner, as in some of the quarries a stratum of the red surface soil is sometimes seen under 30 or 40 feet of more recent rock, formed by the sand drifting over the land surface, and then becoming consolidated.

The first stage in the formation of the land is thus reached, when the sand has been piled up into a hill, which continues to grow until it has perhaps assumed a form, which prevents it from continuing to drift in the same direction.

When this stage has been reached, the surface soon becomes covered with vegetation, and the process towards the next stage begins. The sand by its own weight becomes more compact, especially where the drift is of great depth, and through the action of the rain water percolating through it, the sandbank gradually changes first into the material shown in the specimen marked No. 1 in the Museum, and in the course of time into the hard crystalline form marked No. 2, which is simply a later, or more advanced form, of the rock under the same process, but appearing more particularly where the pressure has been greatest.

The other specimens, Nos. 3 and 4, are the result of a different action. In many cases, through certain parts of the sand hill being more soluble or less compact than others, cavities are opened, which are enlarged in various ways until caverns are formed, in which the water, percolating through the roof, forms stalactites and stalagmites, in the manner common to all limestone formations, but in the Bermuda caves with great rapidity, owing to the soluble nature of the rocks. For the same reason, whole hills have in some cases been swept away by erosion, or more properly, by the softer parts of the rock becoming disintegrated, and in some cases apparently dissolved by the action of the elements, leaving in places sharp pinnacles, composed of the harder parts of the rock, standing, and in others, the floors of caves covered with stalagmite. The specimen No. 3 was, in fact, taken from such a cave floor on Ireland Island, near the dockyard, and No. 4 from one of these pinnacles, which seem to become cemented together into a quasi-stalactite, and then, when the softer parts disintegrate, it is further hardened by weathering.

This in brief is the process by which the coral rock is formed, which throughout the islands is everywhere the same.

This rock is of the greatest value to the people, particularly in view of the fact that wood is not available for building purposes, owing to its scarcity. The rock, when *in situ,* is soft, and easily cut into any shape with ordinary tools. When a quantity of the material is required for any purpose, the soil is removed from a hillside, a large block cut out of it, which is then sawn into the desired size and shape, and the pieces piled up until they become hardened, which soon occurs when exposed to the action of the sun and the atmosphere.

The blocks and slabs thus obtained form an excellent building material, which is further protected by a white-wash, made from a very strong lime, obtained from the same rock as the building material itself. The islands have excellent roads, which are for the most part cut through the hills so as to leave no gradients, and the surface of which becomes as hard and smooth as ordinary asphalt.

There are no freshwater streams or wells in the Bermudas, and the water supply is obtained altogether from the rains. Every one who erects a dwelling is obliged by law to provide a tank or cistern of a certain capacity, proportionate to the dwelling, the cistern being frequently built in the excavation from which the material for the house was taken, which only required a covering of cement to make it water-tight.

As is frequently the case with coral islands, the Bermudas are steadily sinking, possibly on account of the weight of new material as it is added to them, and this would seem to have been the case throughout their whole existence.

The coral insect appears to be incapable of existing in more than 30, or at most 50 fathoms of water, but even close to the reefs depths of from 12,000 to 15,000 feet are found. From this it would appear that the base of the Bermudas was a great elevation, possibly of volcanic origin, on which the coral insects found a suitable formation to build the reefs from which the islands were formed, and if the Atlantic were drained it would have the appearance of a huge mountain from $2\frac{1}{2}$ to 3 miles in height, rising from an almost level plain.

As the building progressed, the mountain continued to sink, so that what was once dry land is now far beneath the waves. This was shown by the discovery during the excavations at Ireland Island for the floating dock, of trunks of large cedar trees at considerable depths below the present sea bottom, and in dredging the channel leading into Hamilton Harbor the roof of a cave filled with stalactites was broken through, which proves that the place where it was found must have been dry land. Trunks of cedar are also found out in the reefs surrounding the islands, which are now altogether submerged.

No information, so far as I have been able to ascertain, exists as to the depth of the coral formation. A few years ago an attempt was made by an English scientific society to obtain such information by means of a diamond drill in the Island of Funafuti, in the Southern Pacific, but the experiment failed, owing to the sand filling the bore. It was then proposed to make the experiment in the Bermudas, but this as yet does not appear to have been done. It would, however, be a matter of great interest, and might prove of much value in determining the age of this recent formation, as well as settle some other questions, if such a project were carried out.

Note on the Glaciation of Mount Orford, P.Q.

By Principal Dresser, St. Francis College, Richmond, P.Q.

In the recent and very interesting "Report on the Surface Geology and Auriferous Deposits of South-eastern Quebec," by Mr. R. Chalmers (Annual Report Geological Survey of Canada, Volume X., New Series, Part J), it is stated that no evidences of glaciation were observed near the summit of Mount Orford. The extreme height of glacial action, from which the thickness of the greater Laurentide glacier is calculated, is thought to have been

1800 feet. Above this the mountain is said to have stood as a "minatak" or island within the glacier to a height of at least 1000 feet.

From these conclusions it is evident that the observations on which they are based did not include that dome-shaped part of the summit of the mountain, which is apparently its highest point. This, which is separated from the highest of the bare and exposed peaks along the front, or southern face of the mountain, by a deep ravine, shows most undoubted evidence of glaciation. Here, near the point where a flagstaff has stood for the past few years, the rock, a fine-grained and much-altered diabase, is distinctly striated, and the whole eminence has a generally smoothed and rounded appearance.

Fragments of clay-slate and pebbles of other rock foreign to the mountain occur here, and boulders of serpentine, evidently from the western base of the mountain, are to be seen in other places near by. The rock appears to have suffered less from atmospheric erosion than at points of about equal height a few hundred yards to the south, from which it seems reasonable to infer that it has here been protected by a thin mantle of drift, of which the transported rock fragments mentioned above are remnants, which have not been removed by summer rains or forest fires.

The direction of the glacial striæ, as measured at the flagstaff by Mr. A. H. Honeyman, of Knowlton, Que., and the writer, was found to be S. 25° E., magnetic, which fairly accords with the directions given by Mr. Chalmers for striæ caused by the greater Laurentide glacier at the foot of the mountain. These range from S. 25° E. to S. 53° E. on the true meridian.

Reasoning from this limit of the height reached by the ice-sheet, viz., 1800 feet, Mr. Chalmers shows that if it passed over the range of hills along the United States boundary line, some 2000 feet in height, as was probably the case, that those hills must have stood relatively lower than at present. This hypothesis is then applied to the explanation of certain high level terraces near the international boundary line, and the deformation of gravel beds around Lake Memphremagog and along the Coaticook and Salmon rivers. But in view of the evidences of ice action at a much greater altitude than 1800 feet, the hypothesis may be no longer needed. And as Mount Orford is the highest point mentioned in the area under discussion, it is, therefore, apparent that the maximum elevation reached by the ice of this region in glacial times has not yet been ascertained, and is not likely to be from evidence obtainable in the Eastern Townships.

On the Height of Orford Mountain.

N. N. Evans and O. E. Leroy.

A good deal of interest is attached to the height of Orford Mountain, not only because its peak is frequently ascended by excursionists to view the magnificent panorama of lake and river, mountain and valley spread out before them when standing upon its summit, but also because certain geological theories involving a more or less accurate knowledge of the elevation are under discussion at the present time; and the various figures given for the height vary so widely as to be quite unreliable.

The recent excursion of the Natural History Society of Montreal to Orford offering a very favorable opportunity for a barometric determination of its height, the writers made careful observations upon that occasion; and as much interest in the result was expressed by many members of the Society, it was thought advisable to publish the figures thus obtained, as offering probably the most correct of the many widely-divergent numbers given in this connection.

With respect to the determination of altitudes by means of the barometer, a few words may not be out of place, and the following, from Johnson's Theory and Practice of Surveying (Ed. 1887, p. 128), may be quoted:

"It (the aneroid barometer) has a vernier attachment, and is read with a magnifying-glass to single feet of elevation. It must not be supposed, however, that elevations can be determined with anything like this degree of accuracy by any kind of barometer. The barometer simply indicates the pressure at the given time and place, but for the same place the pressure varies greatly from various causes. All barometric changes, therefore, cannot be attributed to a change in elevation, when the barometer is carried about from place to place.

"If two barometers are used simultaneously, which have been duly compared with each other, one at a fixed point of known elevation and the other carried about from point to point in the same locality, as on a reconnoissance, then the two sets of readings will give very close approximations to the differences in elevation. If the difference of elevation between distant points is desired, then long series of readings should be taken to eliminate local changes of pressure. The aneroid barometer is better adapted to surveys than the mercurial, since it may be transported and handled with greater ease and less danger. It is not so absolute a test of pressure, however, and is only used by exploring and reconnoissance parties. For fixed stations, the mercurial barometer is to be preferred."

The observations on the trip were made with two aneroid barometers, one manufactured by Cary, of London, and the other by Usteri-Reinacher, of Zürich. The instruments were carefully compared with the standard mercurial barometer in the Observatory at McGill College, where readings were made throughout the day, and these readings, reduced to sea-level, furnished the corrections necessary to eliminate barometric changes due to varying weather conditions. Observations of temperature were made simultaneously with the barometric observations, and these furnished further corrections in the calculation of the results.

The elevations above sea-level thus obtained were as follows:

Station.	Cary.	Ust.-Rein.
Windsor Station.......	130 feet.	127 feet.
Orford Siding.........	929 "	934 "
Summit of mountain...	2642 "	2683 "

The agreement between the results is quite as close as could be expected, but it would be of much value could a series of such observations be obtained, as the mean of a large number of results naturally carries more conviction with it than that deduced from only two. However, it may be considered certain that the height of Orford Mountain is, in round numbers, two thousand six hundred and fifty feet above the level of the sea.

It might be of interest to add that upon a clear day Montreal Mountain is visible from Orford, as was the case upon the occasion of the excursion above mentioned, and conversely, under favorable conditions, Orford is visible from Montreal Mountain, being seen above and beyond the middle of the Shefford Mountain group. This group, as viewed from Montreal, consists of a long ridge towards the observer's left, rising towards the right into two rounded bosses; Orford is seen over the ridge.

McGill College, June, 1900.

Oldhamia.

By G. F. Matthew, LL.D., F.R.S.C.

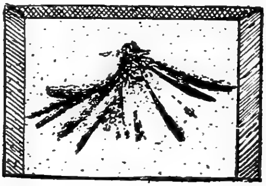


Fig. 1. Fascicle of Oldhamia mag. $\frac{2}{1}$, Cambrian, Div. 1 b, Caton's Island, N.B., Canada.

About twelve years ago (1888) the writer collected from the Cambrian rocks of the St. John Group a fossil which he thought to be a fascicle of Oldhamia.

The object was not described at the time, because he had hopes that in later explorations he might meet with better examples, or others that would throw a better light on the structural details of the fossil. This expectation was not realized, and therefore it seems desirable to put on record the description of this object, hoping that others may be able to supplement the information here given.

Oldhamia is an interesting form, of which the first examples were found in the Wicklow Mountains in Ireland, and were described by Edward Forbes. At first and for a number of years it was regarded as a characteristic fossil of the Lowest Cambrian, but later discoveries have given a wider range to the genus.

Robert Etheridge, Jr., says that Forbes regarded these forms as probably belonging to the Polyzoa or Hydrozoa; but Mr. Busk, a high authority on the Polyzoa, did not recognize them as of that class, and suggested that they might be corallines after the type of Acetabulifera. Rev. Mr. Berkly also suggested this seaweed as a probable ally, because the structure, though jointed, showed no trace of definite cells such as Bryozoa (or Polyzoa) and Hydrozoa have.

Prof. H. A. Nicholson in his Palæontology classes Oldhamia with the Hydrozoa, but stated that its nature was uncertain.

This fossil occurs in the finer layers of the green and purple grits of Lower Cambrian age at Bray Head in Ireland, where the fronds are in great abundance, matted together and spread over the surface of the finer layers. The species which occur here are *O. antiqua* and *O. radiata.* Though Goeppert refers them to different genera, some later observers think they are all of the one species, but in different attitudes of preservation. *Radiata* appears to be the form first described, and so would be the type of the genus. The form figured by Nicholson (after Salter) as *O. antiqua* is not of the same type as that which Zittél figures under the same name. They appear to belong to different species, and perhaps Nicholson's figure represents the type *radiata.*

Mr. Etheridge says that "Oldhamia *must have had a calcareous or semi-calcareous structure to have been preserved at all,*" and when one notices how deeply the mould of this fossil is indented on the surface of the slate, this claim seems well founded. Mr. Etheridge also remarks of Goeppert "that he does not seem to have perceived that the hard filament must needs have been connected by a membrane, not quite destroyed, and that the frond must have been sufficiently hard to impress the sandy deposit in which they are imbedded." We (R. Etheridge) place these singular organisms provisionally in the class Hydrozoa, believing them to have close affinities with the Sertulariidæ, and belong to that group rather than the calcareous corallines. He also adds that *O. antiqua* is rarer than the other, but Prof. Nicholson says that *O. antiqua* is the commoner species.

There seems to be considerable uncertainty still as to the exact horizon in the Cambrian at which the original Oldhamia was found. At first the fossil was referred to the lowest Cambrian, as the slates and grits of Bray Head were correlated with the Llamberis slates on the opposite side of St. George's Channel. But there is really no absolute evidence fixing the age of these grits, as the oldest fossiliferous horizon in this district, with determinable trilobites, is Ordovician.

On the continent of Europe Oldhamia has been found in Cambrian beds from the Trimadœ downward. Prof. C. Malaise has found it in the slates of the middle division of the Cambrian of Belgium; and also at the base of the upper division (Sålmien), which contains the Dictyonema zone, he has found remains singularly like this fossil. Prof. Jules Bergeron, who has studied the Cambrian system in the south of France, found Oldhamia in the upper part of the "Olemus Substagi." It may therefore be looked for in any part of the Cambrian from the base to the Dictyonema zone.

Dr. Chas. Barrois has noted the existence of the genus Oldhamia in the Cambrian rocks of the Pyrenees, but his species (*O. Hovelaquei*) differs from *O. antiqua* by its greater size, by the frond not being jointed appendages, and by the mode of insertion of the appendages, which are not branched. He says that the appendages or leaves were rigid (as with other species of the genus). He considers that the nearest analogy of this form is with certain seaweeds of the family Dasycladeæ, such as Acrogenia of the Devonian and Acetabulifera of the Eocene.

Barrois says that Oldhamia is related to several small forms of Chondrites that appear in the earlier geological epochs, and are characterized by a frond, erect, divided into rounded branches more or less numerous, of which the substance was probably stiff, and of a cartilagenous or gelatinous nature. Such are several palæozoic Chondrites described by Goeppert, the *Chondritis flabellaris* of Saporta of the Upper Lias, and others. The regular branching of the stems and the fan-like arrangement of the appendages forbids us, he says, from comparing this fossil with the tracks of worms.

From the above cited authorities it is clear that there is a wide difference of opinion as to the affinities of Oldhamia, for while the majority of the English palæontologists incline to place it with the Hydrozoa, the German and French writers suppose the genus to belong to the Algæ.

The following brief description is all that can be said about the St. John Group forms:

OLDHAMIA SP.

A detached fascicle, having about eleven visible spreading appendages, of which the outer are horizontal and the others set at a more and more acute angle until the middle ones are vertical. Several of the appendages are branched, with branches standing at a wide angle; the appendages were thick and rigid, sub-lanceolate in form and obtusely pointed; some appendages are wider than others; they spring from a common base, which is somewhat nodose.

The fossil is in the condition of a mould in fine argillaceous sandstone; as the rock shows no clear marks of stratification, it is not known whether the fossil was in a vertical or horizontal position.

It would seem from the quotations in the earlier part of this article that while the writers who have described species of Oldhamia agree in ascribing to it a frond with rigid leaves or appendages, there is a great diversity of opinion as to the substance of which the frond or stem and branches was composed. In the case of the Acadian species, however, there is no trace of the original substance, though the mould is well filled out; it seems most probable, therefore, that the frond was calcareous. Shells of Obolus (Botsfordia) in the same layers of sandstone preserve in most cases the greater part of their calcareo-corneous shells, and their dark color.

Size.—This fascicle is about 7 mm. long (including the nodular base) and 15 mm. in width. The single appendages are about 5 mm. long.

Horizon and Locality.—In olive-gray argillaceous sandstones of Division 1, Band *b*, at Caton's Island, King's County, New Brunswick, Canada, in company with *Botsfordia pulchra.* Rare.

Progress of Geological Work in Canada during 1899.

By H. M. Ami, M.A., D.Sc., F.G.S.,
of the Geological Survey of Canada.

INTRODUCTORY NOTE.

The following synopsis of geological work in Canada for the year 1899 has been prepared with a view of furnishing students of geology in Canada with as complete a list of the writings of those engaged in geological work as possible. It comprises, besides general geological writings bearing upon questions of stratigraphy, and nomenclature, the titles of papers upon other branches of geological work. These include writings on palæontology, on mining and kindred subjects. It is one of the difficulties against which geologists in a young country like Canada have to contend, namely, that there is practically no complete bibliography of Canadian geology available. For a number of years past the writer has attempted to bring together in the form of a card catalogue the writings concerning Canadian geology, published both in Canada and elsewhere. He will be under extreme obligations to the contributors of that science who will kindly forward him such titles of geological writings as are likely to be of value in compiling a catalogue of Canadian geological works.

The present list contains one hundred and nine separate titles of papers bearing on the geology of Canada for 1899, including one or two records for previous years hitherto unnoticed. It has been prepared in the hope that it may serve to fill a want in the direction of bibliographic references, without which it is practically impossible to be in touch with or know what is going on in the scientific world about us.

ADAMS, FRANK D.

Review of "Report on the Geology and Natural Resources on the area included in the Nipissing and Temiscaming map sheet, comprising portions of the District of Nipissing, Ontario, and of the County of Pontiac, Quebec."

Journal of Geology, Vol. 7, No. 7, pp. 713-717, Oct.-Nov., 1899. Chicago.

ADAMS, FRANK D.

Sir William Dawson (Biographical Sketch of).

(Science, n.s., Vol. 10, pp. 905-910, Dec. 22, 1899), N.Y. (with portrait). Also in "McGill Outlook," Montreal, for Dec., 1899.

ADAMS, FRANK D.

Studies in the Geology of the Vicinity of Montreal, which might be undertaken by members of the Natural History Society.

Can. Rec. Sci., Vol. 8, No. 2, pp. 65-70. July, 1899 (issued Dec. 30th, 1899), Montreal, Que.

ADAMS, FRANK D., and BARLOW, A. E.

(Report of Geological Work of, in Central Ontario) .

Sum. Rep. Geol. Surv. Dept. for the year 1898, pp. 106-111, 1899. Govt. Printing Bureau, Ottawa.

AMI, H. M.

On the Geology of Wolfville, and part of the Basin of Minas, Nova Scotia.

The Evangeline Journal, Third edition, Season 1899. Rockwell & Co., Wolfville, Nova Scotia, issued June, 1899.

AMI, H. M.

The Mastodon in Western Ontario.

Abstract. Science,n. s., Vol. 7, p. 80, 1898. (Not previously recorded).

AMI, H. M.

Sir William Dawson (The Scientific Work of) (in French). L'Aurore, 34me Année, No. 50, pp. 4-5. Montreal.

AMI, H. M.

(Notes on general results of a Palaeontological Survey of numerous outcrops in the Counties of Antigonish, Pictou, Colchester, Cumberland, Hants, and Kings, Nova Scotia).

Summary Report, Geol. Surv. Dept., pp. 180-182. Govt. Printing Bureau, Ottawa.

AMI, H. M.

(List of Fossil Organic Remains from the altered grey slates with shaly bands (of the Silurian) from six miles west of Canterbury Station, along the St. Andrews and Woodstock branch of the Canadian Pacific Railway).

Summary Report for 1898, Geol. Surv. Dept., p. 137, issued 1899. Govt. Printing Bureau, Ottawa.

AMI, H. M.

On a new or hitherto unrecognized geological horizon in the Gas and Oil Region of Western Ontario, Canada.

Journal Can. Mining Institute, Vol. 2, pp. 186-191, 2 pl., 1899. Ottawa. (Also issued as separate under cover.)

AMI, H. M.

Palaeontological Notes (Notice of palaeontological writings in Summary Rep. Geol. Surv. Dept. for 1898.

The Ottawa Naturalist, Vol. 13, No. 4, p. 116, July, 1899. Ottawa.

AMI, H. M.

Excursion to Queen's Park, Aylmer. (Geology).

The Ottawa Naturalist, Vol. 13, No. 5, pp. 131-132, Aug. 1899. Ottawa.

AMI, H. M.

Excursion to Cumberland, Ont. Geology.

The Ottawa Naturalist, Vol. 13, No. 5, pp. 133-134, August, 1899. Ottawa.

AMI, H. M.

Report of the Geological Branch for 1898-1899. (Addressed "To the Council of the Ottawa Field-Naturalists' Club," March, 1899.)

The Ottawa Naturalist, Vol. 13, No. 9, pp. 218-223, December, 1899. Ottawa.

AMI, H. M.

Belinurus grandaevus, a new species of palaeozoic crustaceans, recently described by Prof. T. R. Jones and Dr. Henry Woodward, from the Eo-Carboniferous of Riversdale, Nova Scotia.

The Ottawa Naturalist, Vol. 13, No. 9, pp. 207-209, Dec. 1899. Ottawa.

AMI, H. M.

(Silurian Fossils recorded from Burnt Island, Manitoulin Island, the nearest outcrop of fossiliferous limestones to the Duck Islands, Lake Huron).

Summary Rep. Geol. Surv. Dept. for 1898, p. 179. Govt. Printing Bureau, Ottawa.

AMI, H. M.

On some Cambro-Silurian and Silurian fossils from Lake Nipissing, Temiscaming and the Mattawa outliers.

Appendix 2, Pt. I., Annual Rep. Geol. Surv. Can., Vol. 10, pp. 289-302, 1899. Ottawa.

AMI, H. M.

(Note on the Geology of the Duck Islands, Lake Huron.)

Sum. Rep. Geol. Surv. Dept., for the year 1898, pp. 176-180. 1899. Govt. Printing Bureau, Ottawa.

BAIN, J. WATSON.

Notes on Working Mines.

Rep. of the Bureau of Mines, Vol. 8, Pt. 2, 1899, pp./275-279, 1899. Toronto.

BAIN, J. WATSON.

Summer Mining Schools.

Rep. Bureau of Mines, Vol. 8, Pt. 2, pp. 280-282, 1899. Toronto.

BAILEY, L. W.

Triassic ? rocks of Digby Basin, Nova Scotia.

Nova Scot. Instit. Sci., Proc. and Trans., Vol. 9, Pt. 4, pp. 356-360, 1898. Halifax.

BAILEY, L. W.

The Mineral Resources of the Province of New Brunswick.

Ann. Rep. Geol. Surv. Can., Vol. 10, Part M., 128 pp. and addendum, Ottawa.

BAILEY, L. W.

Some typical sections in Southwestern Nova Scotia.

Brit. Assoc. Adv. Sci., Rep. 1897, p. 640, 1898. London, Eng. (Not previously recorded.)

BARLOW, A. E. (and FERRIER, W. F.)

On the relations and structure of certain granites and associated arkose of Lake Temiscaming, Canada.

Brit. Assoc. Adv. Sci., Rep. 1897, pp. 659-660, 1898. London, Eng.

BARLOW, A. E.

Report on the Geology and Natural Resources of the area included in the Nipissing and Temiscaming map-sheets, comprising portions of the district of Nipissing, Ontario, and County of Pontiac, Quebec.

Geol. Surv., Can., Ann. Rep., Vol. 10, pt. I., 302 pp. with 2 appendixes.

BARLOW, A. E. (and ADAMS, FRANK D.)

(Report of the Geological Work of, in Central Ontario.)

Sum. Rep. Geol. Surv. Dept., for the year 1898, pp. 106-111, 1899. Govt. Printing Bureau, Ottawa.

BATHER, F. A.

A record of, and Index to, the literature of Echinoderma published during the year 1898, with a few items from previous years.

Zoological Record for 1898. Zool. Soc., London, 1899, 73 pp.

BELL, ROBERT.

Fossil-like forms on the Sault Ste. Marie sandstone.

Abstract, Science, n.s., Vol. 7, p. 80, 1898.

BELL, ROBERT.

The geological history of Lake Superior. (Advance copy.)

(Read before the Can. Instit. Toronto, Apl. 15, 1899.) Memorial Volume of Trans. Can. Instit. 1899, Toronto.

BELL, ROBERT.

(Report of geological work of, in the Michipicoten gold-mining region of Lake Superior, Canada.

Sum. Rep. Geol. Surv. Dept., for year 1898, pp. 99-106. 1899. Govt. Printing Bureau, Ottawa.

BLUE, ARCHIBALD.
Mineral Industries of Ontario, Statistics of 1898.
Rep. Bureau Mines, Vol. 8, pt. 1, 1899, pp. 9-28. Toronto.

BLUE, ARCHIBALD.
Corundum in Ontario.
Rep. Bureau of Mines, Vol. 8, pt. 2, 1899, pp. 241-249, 1899. Toronto, Ont.

BOYD, DAVID G.
Michipicoten, Mining Division.
Rep. Bureau of Mines (for Ontario), Vol. 8, pt. 1, pp. 100-105, 1899. Toronto.

BONNEY, T. G.
The Parent-rock of the Diamond in South Africa.
Can. Rec. Sci., Vol. 8, No. 2 (July, 1899), (issued Dec. 30, 1899), pp. 95-114. 1899. Montreal.

BOW, JAMES A.
Mines of North-western Ontario.
Rep. Bureau of Mines, Vol. 8, pt. 1, pp. 49-99, 1899. Toronto.

BOW, JAMES A.
Lower Seine Gold Mines.
Rep. Bureau of Mines, Vol. 8, pt. 2, 1899, pp. 263-274. Toronto, Ont.

BROCK, R. W.
(Report of geological work of, in West Kootenay, British Columbia.)
Sum. Rep. Geol. Surv. Dept., for year 1898, pp. 63-71, 1899. Govt. Printing Bureau, Ottawa.

CARLYLE, W. A.
(Mining operations for gold, coal, etc., in the Province of British Columbia.)
Brit. Col. Ann. Rep. of the Minister of Mines for 1897, pp. 453-460, 1898. Victoria, B.C.

CHALMERS, ROBERT.
(Report on the surface geology and auriferous deposits of South-eastern Quebec.)
Sum. Rep. Geol. Surv. Dept. for year 1898, pp. 121-124, 1899. Govt. Printing Bureau, Ottawa.

CHALMERS, ROBERT.
The pre-glacial decay of rocks in Eastern Canada.
Brit. Assoc. Adv. Sci. Rep. 1897, pp. 655-656, 1898, London.

CHALMERS, ROBERT.

The gold-bearing deposits of the Eastern Townships of Quebec.

Federated Can. Min. Instit. Journ., Vol. 2, pp. 13-27, 1897. Ottawa.

CHALMERS, ROBERT.

Report on the Surface Geology and Auriferous Deposits of South-eastern Quebec.

Geol. Surv. Can., Ann. Rep., Vol. 10, pt. T, 160 pp., with map, 1899. Ottawa. (one plate.)

CHALMERS, ROBERT.

(Report on the surface geology of portions of New Brunswick.

Sum. Rep. Geol. Surv. Dept., for year 1898, pp. 133-139, 1899. Ottawa.

CHARLTON, W. A., JR.

Goulais River to Dalton.

Rep. Bureau of Mines, Vol. 8, pt. 2, 1899, pp. 197-204, 1899. Toronto.

COLEMAN, A. P.

Notes on Western Ontario Goldfields.

Fed. Can. Min. Instit. Journ. Vol. 2, pp. 278-282, 1898. Ottawa.

COLEMAN, A. P.

A new Analcite Rock from Lake Superior.

Journ. Geol., Vol. 7, No. 5, July-Aug., 1898, pp. 431-436, 1899. Chicago.

COLEMAN, A. P.

Corundiferous nepheline-syenite from Eastern Ontario.

Journ. Geol., Vol. 7, No. 5, pp. 437-444, July-Aug., 1899. Chicago.

COLEMAN, A. P.

Canadian Pleistocene Flora and Fauna.

Rep. Committee (of Brit. Assoc. Adv. Sci.) to investigate Canadian Pleistocene Flora and Fauna. Section C, 3pp. 1899. (Dover meeting.)

COLEMAN, A. P.

Copper in Parry Sound District.

Rep. Bureau of Mines, Vol. 8, pt. 2, pp. 259-262, 1899. Toronto.

COLEMAN, A. P.
Corundiferous nepheline-syenite.
Rep. Bureau of Mines, Vol. 8, pt. 2, pp. 250-253, 1899. Toronto, Ont.

COLEMAN, A. P.
Copper regions of the Upper Lakes.
Rep. Bureau of Mines, Vol. 8, pt. 2, 1899, pp. 121-174, (with reports by Prof. A. B. Mellincott), pp. 134-141, and 144-146, 1899. Toronto.

COLEMAN, A. P. (and MELLINCOTT, A. S.)
Michipicoten Iron Range.
Rep. Bureau of Mines, Vol. 8, pt. 2, 1899, pp. 254-258. 1899. Toronto.

DAWSON, G. M.
Summary report of the Geological Survey Department for the year 1898, (containing also reports of the several technical officers of the Geological Survey staff, on the geology, etc., of various portions of the Dominion of Canada.)
208 pp. 1899. Govt. Printing Bureau, Ottawa.

DAWSON, G. M.
(On mammoth and musk-ox remains, from the Saskatchewan gold-bearing gravels of the Edmonton district, Alberta.)
Sum. Rep. 1898, Geol. Surv. Dept., pp. 19-20, 1899. Govt. Printing Bureau, Ottawa.

DAWSON, SIR J. WILLIAM.
Note on an Echinoderm collected by Dr. Ami at Besserers, Ottawa River, in the Pleistocene (Leda Clay).
The Ottawa Naturalist, Vol. 13, No. 9, pp. 201-202, Dec., 1899. Ottawa.

(DAWSON, SIR J. WILLIAM.)
Biographical Sketch by Frank D. Adams, Science, n.s., Vol. 10, pp. 905-910, Dec. 22, 1899. Portland.

DE KALB, COURTENAY.
The condition of Ontario mines.
Rep. Bureau of Mines, Vol. 8, pt. 1, pp. 29-48, 1899. Toronto.

DOWLING, D. B.

(Report of Geological Work of, in the Lake Nipigon Region of Ontario.)

Sum. Rep. Geol. Surv. Dept., for year 1898, pp. 94-99. 1899. Govt. Printing Bureau, Ottawa.

DRESSER, J. A.

(Report on the Petrography of Shefford Mountain.)

Sum. Rep. Geol. Surv. Dept., for year 1898, pp. 120-121, 1899. Govt. Printing Bureau, Ottawa.

DRUMMOND, A. T.

The Lake on the Mountain, near Picton, Ont.

Can. Rec. Sci., Vol. 8, No. 2, pp. 90-95, (issued Dec. 30th, 1899.) July, 1899. Montreal.

ELLS, R. W.

Canadian Geological Nomenclature.

Being the presidential address to Section IV., Roy. Soc. Can., May, 1899.

Trans. Roy. Soc. Can., Ser. 2, Vol. 5, Sect. 4, pp. 3-38, 1899. Ottawa.

ELLS, R. W.

The Mineral Resources of the Ottawa District.

The Ottawa Naturalist, Vol. 13, No. 1, pp. 14-21, No. 2, pp. 25-36, 1899. Ottawa. (Issued as separate 20 pp., June, 1899.)

ELLS, R. W.

(Report of the Geological Work of, in Eastern Ontario, and adjacent portions of Quebec.)

Sum. Rep. Geol. Surv. Dept., for year 1898, pp. 112-119. 1899. Govt. Printing Bureau, Ottawa.

FARIBAULT, E. R.

(Report on the Structural Geology of a portion of the gold-bearing rocks of Nova Scotia.)

Sum. Rep. Geol. Surv. Dept., for year 1898, pp. 149-159, 1899. Govt. Printing Bureau, Ottawa.

FLETCHER, HUGH.

(Report of the Geology of the Springhill Coal basin, and of the Iron ore deposits of Whycocomagh, in Nova Scotia.)

Sum. Rep. Geol. Surv. Dept., for year 1898, pp. 139-148. 1899. Govt. Printing Bureau, Ottawa.

FRASER, W. A.

(Report on the actual progress of Boring Operations at Victoria, and near Pelican River, Athabasca River.)

Sum. Rep. Geol. Surv. Dept., for year 1898, pp. 32-36, 1899. Ottawa. Govt. Print. Bureau.

GILPIN, E., JR.

Nova Scotia Gold-fields.

"The Mining Journal," London, England, March 4, 1899, pp. 247-248. Gives results of work done by Mr. Faribault, of the Geological Survey of Canada. (To be continued.)

GOODWIN, DR. W. L.

Summer Mining Classes.

Rep. Bureau of Mines, Vol. 8, pt. 2, 1899, Toronto, pp. 282-283, 1899. Toronto.

HOBBS, W. H.

The Diamond Field of the Great Lakes.

Journ. Geol. Vol. 7, No. 4, May-June, 1899, pp. 375-388, with two glacial maps and 1 table, 1899. Chicago.

INGALL, E. D.

Canada as a producer of the precious metals.

Journ. Can. Banker's Assoc., Toronto, 16 pp., 2 folding plates, 1899. Toronto.

INGALL, E. D (and DENIS, THEO. C. and T. McLEISH.)

Annual Report for 1897.

Section of Mineral Statistics and Mines.

Part S, Ann. Rep., Vol. 10, Geol. Surv. Can., 232 pp. 1899. Ottawa.

JONES, T. RUPERT (and WOODWARD, HENRY.)

Contributions to Fossil Crustacea.

Geol. Mag., Dec. 4, Vol. 6, No. 423, pp. 388-390, pl. 15, Figs. 2 and 3, 1899. London, Eng.

KAIN, S. W. (and MATTHEW, G. F.)

On Artesian and Fissure Wells in New Brunswick.

Bull. Nat. Hist. Soc. N. Br., No. 17, Art. 7, Vol. 4, pt. 2, pp. 143-152, 1899. St. John, N.B.

LAMBE, L. M.

(Notes on the reptilian remains from the Belly River and Laramie formations of the North-west Territories of Canada.)

Sum. Rep. Geol. Surv. Dept., for year 1898, pp. 184-190, 1899. Govt. Printing Bureau, Ottawa.

LAMBE, L. M.

On reptilian remains from the Cretaceous of North-western Canada.

The Ottawa Naturalist, Vol. 13, No. 3, pp. 68-70, June, 1899. Ottawa.

LAMBE, L. M.

Notes on a Stromatoporoid from the Hudson River formation of Ontario.

The Ottawa Naturalist, Vol. 13, No. 7, Oct., 1899, pp. 170-171, 1899. Ottawa.

LOW, A. P.

(Report of Geographical and Geological Work of, on the East coast of Hudson Bay.)

Sum. Rep. Geol. Surv. Dept. for year 1898, pp. 124-133, 1899. Govt. Printing Bureau, Ottawa.

MATTHEW, G. F. (and KAIN, S. W.)

On Artesian and Fissure Wells in New Brunswick.

Bull. Nat. Hist. Soc. N.B., No. 17, Art. 7, Vol. 4, pt. 2, pp. 143-152, 1899. St. John, N.B.

MATTHEW, G. F.

Preliminary Notice of the Etcheminian Fauna of Cape Breton.

Bull. Nat. Hist. Soc. N.B., No. 18, Vol. 4, pp. 198-208, 4 pls. (1-4), 1899. St. John, N.B.

MATTHEW, G. F.

Review of preliminary notice of the Etcheminian Fauna of Newfoundland. From Bull. Nat. Hist. Soc. N.B., June, 1899.

Geol. Mag., No. 422, n.s., Dec. 4, Vol. 6, No. 8, Aug., 1899. London, England.

MATTHEW, G. F.

A new Cambrian Trilobite.

Bull. Nat. Hist. Soc., New Brunswick, No. 17, Article 5, pp. 136-142, March, 1899. St. John, N.B.

MATTHEW, G. F.

Studies on Cambrian Faunas, No. 2.

The Cambrian System in the Kennebecasis Valley.

Part I.—Stratigraphy of the Cambrian in the Valley.

Part II.—Description of the species found.

Trans. Roy. Soc. Canada, Sect. IV., Vol. 4, new series, pp. 123-153, Plates I. and II., issued 1899.

MATTHEW, G. F.

Art. I. Preliminary Notice of the Etcheminian Fauna of Newfoundland.

Bull. Nat. Hist. Soc. N.B., No. 18, Vol. 4, pp. 189-197. 1899. St. John (pls. 1-3).

MATTHEW, G. F.

A Palaeozoic Terrane beneath the Cambrian.

Ann. N.Y. Acad. Sc., Vol. 12, No. 2, pp. 41-56, April, 1899. New York City.

MELLINCOTT, A. B. (and COLEMAN, A. P.)

Michipicoten Iron Range.

Rep. Bureau of Mines, Vol. 8, pt. 2, pp. 254-258, 1899. Toronto.

MILLER, WILLET G.

Notes on the Corundum-bearing rocks of Eastern Ontario, Canada.

Amer. Geol., Vol. 24, pp. 276-282, pl. 13, Nov., 1899. Minneapolis.

MILLER, WILLET G.

Corundum and other minerals.

Rep. Bureau of Mines, Vol. 8, pt. 2, pp. 205-240, 1899. Toronto.

McCONNELL, R. G. (and TYRRELL, J. B.)

Preliminary note of the Gold deposits and Gold mining in the Klondike region, Yukon district.

Sum. Rep. Geol. Surv. Dept. for year 1898, pp. 55-62, 1899. Govt. Printing Bureau, Ottawa.

McEVOY, J.

(Report of Geological Work of, in Northern Alberta and the Rocky Mountains, Canada.)

Sum. Rep. Geol. Surv. Dept. for year 1898, pp. 72-86, 1899. Govt. Printing Bureau, Ottawa.

McINNES, WM.

Report on the Geology of the area covered by the Seine River, and Lake Shebandowan map sheets, comprising portions of Rainy River and Thunder Bay districts, Ontario.

Ann. Rep. (pt. H), Vol. 10, Geol. Surv. Can., 65 pp., 2 maps in case. 1899. Ottawa.

McINNES, WM.

(Geological Work of, in the Seine River and Shebandowan map sheets areas.)

Sum. Rep. Geol. Surv. Dept. for year 1898, pp. 87-94. 1899. Govt. Printing Bureau, Ottawa.

PARKS, WM. ARTHUR.

The Nipissing Algoma Boundary.

Rep. Bureau of Mines, Vol. 8, pt. 2, 1899, pp. 175-196. Toronto.

REED, F. R. COWPER.

Woodwardian Museum Notes, A New Trilobite from Mt. Stephen, Field, B.C.

Geol. Mag., No. 42, n.s., Dec. 4, Vol. 6, No. 8, Aug., 1899, pp. 358-361. London.

ROBERTS, AUSTIN.

Nickel Extraction by the Moud process.

Rep. Bureau of Mines for Ontario, Vol. 8, pt. I., pp. 106-120, 1899. Toronto.

ROBERTSON, WM. FLEET.

Mineral Production, etc., of British Columbia.

Ann. Rep. Minister of Mines for 1898, for B.C., pp. 961-1230, 1899. Victoria, B.C.

SPENCER, J. W.

Mr. Huddleston On the Eastern Margin of the North Atlantic Basin.

Geol. Mag., Dec. 4, No. 426, Vol. 6, No. 12, pp. 559-566, Dec., 1899. London, Eng.

TYRRELL J. B. (and McCONNELL, R. G.)

Preliminary note of the Gold Deposits and Gold mining in the Klondike region, Yukon district.

Sum. Rep. Geol. Surv. Dept. for year 1898, pp. 55-62, 1899. Govt. Printing Bureau, Ottawa.

TYRRELL, J. B.
(Geological Work of, in Yukon district.)
Sum. Rep. Geol. Surv. Dept. for year 1898, pp. 37-55, 1899. Ottawa.

VAUX, GEO. and WM. S., JR.
Some observations on the Illecillewaet and Asulkan Glaciers of British Columbia.
Proc. Acad. Nat. Sc. Philadelphia, pp. 121-124. (1899).

WEEKS, F. B.
Bibliography and Index of North American Geology, Palaeontology, Petrology and Mineralogy.
Bull. U.S. Geol. Surv., No. 162, pp. 163, 1899. Washington.

WELLS, J. WALTER.
"Provincial Assay Office."
Report of the Bureau of Mines, Vol. 8, pt. 2, pp. 284-289, 1899. Toronto.

WESTON, T. C.
Reminiscences among the Rocks in connection with the Geological Survey of Canada.
Printed for the author, 1899. Toronto.

WESTON, T. C.
Notes on a Geological trip over a portion of the Canadian North-west Territories.
The Ottawa Naturalist, Vol. 13, No. 8, pp. 177-187, November, 1899. Ottawa.

WILCOX, WALTER D.
A certain type of Lake Formation in the Canadian Rocky Mountains.
Journ. Geol., Vol. 7, pp. 247-260 (4 types of lake), May, 1899. Chicago.

WHITEAVES, J. F.
Recent Discoveries of Rocks of the age of the Trenton formation at Akpotok Island, Ungava Bay, Ungava.
Amer. Journ. Sci., Vol. 7, pp. 433-434, 1899. New Haven.

WHITEAVES, J. F.
The Devonian System in Canada.
Address by J. F. W., vice-pres. and chairman of Section E, Amer. Assoc. Adv. Sci., Columbus, Ohio, meeting, Aug. 21-26, 1899, 31 pp., 1899. Easton, Pa.

WOODMAN, J. EDMUND.
Studies in the Gold-bearing Slates of Nova Scotia.
Proc. Boston Soc. Nat. History, Vol. 28, No. 15, pp. 375-407, with three plates. Boston, March, 1899.

WOODWARD, HENRY (and JONES, T. RUPERT.)
Contributions to Fossil Crustacea.
Geol. Mag., Dec. 4, Vol. 6, No. 423, pp. 388-390, pl. 15, figs. 2-3, 1899. London.

WOODWARD, HENRY.
Sir William Dawson, C.M.G., LL.D. (Edin.), D.C.L., F.R.S., F.G.S.
Geol. Mag., Vol. 6, Dec. 4, whole No. 426, No. 12, pp. 575-578, 1899. London.

WRIGHT, FREDERICK G.
A new method of estimating the age of Niagara Falls.
Appleton's Pop. Sci. Monthly, June, 1899, 10 pp. and 6 figs., 1899. New York City.

PROCEEDINGS OF THE NATURAL HISTORY SOCIETY.

MONTREAL, November 27th, 1899.

The first monthly meeting of the Society was held this evening.

PRESENT—Walter Drake, in the chair; Dr. Campbell, J. A. U. Beaudry, J. S. Buchan, J. H. Joseph, Canon Ellegood and C. S. J. Phillips and others.

The minutes of the previous meeting were taken as read.

It was then moved by the Rev. Robert Campbell, D.D., and seconded by J. S. Buchan, Q.C., and unanimously resolved, that:—

"The Natural History Society of Montreal place on record its sense of the deep loss it has sustained in the decease of Sir J. William Dawson, its Honorary President. From the date of his entering upon office as Principal of McGill University, he took a deep interest in the Society, recognizing its importance as an agency for extending a knowledge of science in the community and as a centre for rallying scientific workers, the success of which he felt must re-act favorably upon his own work in the University. He was the mainstay of the Society for upwards of forty years, and his communications to its proceedings would fill many volumes.

"He also early perceived how important it was that the Society should have a periodical of its own, through which the researches carried on under its auspices could be communicated to the world; and he loyally supported the CANADIAN NATURALIST, and afterwards the RECORD OF SCIENCE, by publishing first in them a large proportion of his papers on scientific subjects, his articles in the successive series of the periodical numbering in all 168, whilst he was joint author of three additional articles.

"The Society showed its appreciation of his eminence in the scientific world as well as the work he was doing for itself by electing him twenty times to the annual presidency, while for the last ten years he was chosen Honorary President.

"He attended its meetings with unvarying regularity until failing health hindered, and to the last he took the deepest interest in its welfare.

"His memory is warmly cherished by the members of the Society, as his presence at its meetings for so long a period was an inspiration to those who had the privilege of associating with him."

It was unanimously resolved that a copy of the above resolution should be sent to Lady Dawson.

MEMBERS.—Moved by J. A. U. Beaudry, seconded by J. S. Buchan, that the rules be suspended and the following be elected as members:—Ludger Larose, ordinary; Miss J. Cairnie, J. A. Dresser and Miss L. J. Binmore, associate.

It was resolved on motion that the following two papers be taken as read, and be inserted in the CANADIAN RECORD OF SCIENCE :—" Phenological Observations in Canada," by A. H. Mackay, LL.D., F.R.S.C., of Halifax, N.S. ; also the " Lake-on-the-Mountain," near Picton, Ont., by A. T. Drummond, LL.D.

A special communication by Rev. Robert Campbell on " The Plants of the Rocky Mountains " was then listened to with the greatest interest, the pleasure being considerably enhanced by the illustrations from Mr. Van Brunt's colored lantern slides.

DONATIONS.—White Seal; donor, W. Walker, 295 St. Urbain Street. Bald-headed Eagle, shot at Brome Lake, August, 1899 ; donor, Roland C. McGowan. King Rail (or loon), shot at Sabrevois, P.Q., October, 1899. Euthia Olivacea ; donor, B. S. Bowdish, San Juan, Porto Rico.

MONTREAL, January 29th, 1900.

The second monthly meeting of the Society was held this evening, January 29th, 1900, at 8 o'clock.

PRESENT—Prof. Frank D. Adams, Vice-President, in the chair ; Rev. Dr. Campbell, J. A. U. Beaudry, O. E. Leroy, B.A. ; Edgar Judge, Rev. G. Colborne Heine, C. T. Williams, P. S. Ross, H. McLaren, J. S. Buchan, Q.C. ; C. S. J. Phillips and others.

The minutes of the previous meeting were read and confirmed.

COMMUNICATIONS.—A letter was read from Lady Dawson acknowledging receipt of the letter of condolence. A letter was also read from Lachlan Gibb, *re* " Mosquitoes."

COMMITTEES.—Mr. C. S. J. Phillips reported that the programe for the Somerville Course was nearly completed.

The Rev. Dr. Campbell reported in connection with the provincial grant that the application had gone forward, and requested that members would put themselves personally in communication with members of the Legislature.

MEMBERS ELECTED.—Moved by C. T. Williams, seconded by Edgar Judge, that the by-laws be suspended, and that the following persons be elected:—Mr. J. Low, ordinary; Mr. Carey G. Joseph, associate.

PAPER.—O. E. Leroy, B.A, then read a communication on "The Physical Features of Cape Cod," which provoked many questions and an animated discussion.

A vote of thanks was moved by the Rev. Dr. Campbell, seconded by J. A. U. Beaudry, expressing the great obligations of the Society to Mr. Leroy for his very interesting paper.

H. M. Ami, D.Sc., F.G.S., not being present, Dr. Campbell read his paper on the "Subdivisions of the Carboniferous System in Eastern Canada."

A vote of thanks was moved by the Rev. G. Colborne Heine, seconded by J. S. Buchan, Q.C.

The meeting then adjourned.

MONTREAL, February 26th, 1900.

The third monthly meeting of the Society was held this evening at 8 o'clock.

PRESENT—J. A. U. Beaudry, in the chair; J. S. Buchan, Q.C.; E. T. Chambers, Jos. Fortier, Rev. Dr. Campbell, Prof. Donald, C. S. J. Phillips, and many others, including six of Prof. Donald's pupils.

The minutes of the previous meeting were read and confirmed.

The report of the Council was taken as read, all members being present.

VOTE OF CONDOLENCE.—On motion, the Rev. Dr. Campbell, and C. S. J. Phillips, recording secretary, were appointed to draw up a suitable minute regarding the great loss the Natural History Society has sustained in the sudden death of Mr. Walter Drake, one of its vice-presidents and the chairman of one of its important committees, and to communicate the same to the family of the deceased.

The following is the resolution adopted:

"In recording its sorrow at the sudden death of Mr. Walter Drake, one of the Vice-Presidents of the Natural History Society of Montreal, and Chairman of its Membership Committee, the Society would express its appreciation of his high and noble qualities as a citizen. Every good cause found in him an earnest advocate. Himself possessed of a cultured mind and varied stores of information, he was keenly alive to the valuable service which the Natural History Society, through its Museum, its lectures and its library, is rendering to the citizens of Montreal as a means of promoting especially a knowledge of the wonderful works of God, and he was always ready to aid it both by contributions and personal endeavors on its behalf. Among the last of his acts before finally leaving the city was to address a communication to the Quebec Government in its interests. For these reasons the Natural History Society begs to assure his stricken family that it sincerely shares in their sorrow over his decease."

The attention of the Society having been also drawn to the loss which the Hon. Justice Wurtele, one of the Vice-Presidents of the Natural History Society, had sustained in the death of his son, the Society agreed to record its sympathy with him in his bereavement, and the same Committee was appointed to frame a suitable minute and forward it to him in the name of the Society.

MEMBER ELECTED.—The rules having been suspended, the following gentleman was unanimously elected an ordinary member:—Dr. Louis Laberge.

The Rev. Dr. Campbell then read his paper on "Cap-à-l'Aigle Plants not previously reported," which proved very interesting.

A vote of thanks was moved by J. S. Buchan, seconded by E. T. Chambers, and carried unanimously.

Prof. J. T. Donald, M.A., then gave his "Notes on Recent Laboratory Investigations," which imparted some very valuable information respecting Iron Ores, Water Supply, Food Matters, etc., etc.

An interesting discussion ensued, which was earnestly taken up by the members present.

Dr. Campbell moved and J. S. Buchan seconded a vote of thanks to the eminent Professor for his very valuable aud interesting paper.

MONTREAL, March 26th, 1900.

The fourth monthly meeting of the Society was held this evening at 8 o'clock.

PRESENT—Rev. Robert Campbell, Vice-President, in the chair; J. H. Joseph, Joseph Fortier, E. T. Chambers, H. McLaren, J. A. U. Beaudry, Albert Holden, Prof. MacBride, R. C. Adams, Prof. Penhallow, Dr. Jackson, Prof. Donald, the Recording Secretary, and about twenty others.

The minutes of the last meeting were read and confirmed.

MEMBERS ELECTED.—On motion, the rule was suspended and the following members were elected:—Madame Herveiaux, ordinary, proposed by A. Griffin, seconded by C. S. J. Phillips; John Fair, ordinary, proposed by Rev. R. Campbell, seconded by C. S. J. Phillips.

After routine business the following communications were given to the Society: "On Canadian Marine Biological Station," by Dr. F. S. Jackson, Demonstrator of Zoology in McGill College. The subject was treated under two heads—Scientific and Economic. This interesting paper was listened to with more than ordinary attention, as this Society had something to do with its inception.

Prof. Penhallow made a few remarks, stating that the Government had voted $5,000 for construction and $2,000 per annum for five years for its maintenance.

Prof. MacBride, in a few well chosen words, stated that he had spent some time at Naples and also at Plymouth, England, at the stations in those places. At the St. Lawrence station, although the temperature was low, there were lots of food supply for fishes.

Dr. Jackson made replies to several questions put to him.

A vote of thanks was then moved by E. T. Chambers, seconded by F. W. Richards, and carried unanimously.

"The Rock Formation of the Bermudas," by J. S. Buchan, Q.C., B.C.L., was then given, and proved very interesting. It was illustrated by numerous specimens, which drew forth remarks from Prof. MacBride, who spoke of Darwin's opinion on the formation of the Coral islands.

Several other remarks were made by different members.

A vote of thanks was moved by J. H. Joseph, seconded by J. A. U. Beaudry, and unanimously carried.

The meeting then adjourned.

MONTREAL, April 30th, 1900.

The fifth monthly meeting of the Society was held this evening at 8 o'clock.

PRESENT—Rev. Robt. Campbell, D.D., in the chair; F. W. Richards, J. A. U. Beaudry, Edgar Judge, E. T. Chambers, J. S. Buchan, Dr. Jackson and a number of others.

The minutes of last meeting were read and confirmed.

MEMBERS ELECTED.—On motion, the rule was suspended and the following were elected as members:—Oswald H. Duckett, ordinary, moved by A. Griffin, seconded by C. S. J. Phillips; E. S. Phillips, ordinary, moved by A. Griffin, seconded by C. S. J. Phillips; Lieut.-Col.

John Bayne MacLean, ordinary, moved by Dr. Campbell, seconded by Edgar Judge; D. W. Ross, ordinary, moved by Edgar Judge, seconded by Dr. Campbell; W. A. Hastings, ordinary, moved by Edgar Judge, seconded by Dr. Campbell; F. C. Emberson, associate, moved by A. Holden, seconded by Dr. Campbell.

Mr. E. Chambers then announced several additions to the Library, and Mr. Alfred Griffin, the Curator, reported the following list of donations to the Museum :—

A. A. McCulloch, 20 McTavish Street, about 2,000 Shells, a number of Eggs, a number of Mineral Specimens, a small number of Fossil Shells, a Girdle from the Sandwich Islands; Alfred Joyce, Phillips Square, Duck Hawk, shot on mountain, March, 1900; G. Egg, 24 Tupper Street, Garter Snake, 3 feet 4 inches long (abnormally large), taken at Abbotsford, July, 1899; J. A. U. Beaudry, 107 St. James Street, a number of Geological Specimens.

A vote of thanks was then moved and seconded to the various donors and unanimously carried.

The following communications were then given to the Society :—"The Rate of Propagation of the Venous Pulse," by W. S. Morrow, M.D., which was listened to with great interest. Questions were asked by several of the members, and answered by Dr. Morrow, after which a vote of thanks was moved by J. A. U. Beaudry, seconded by Dr. Jackson, and carried unanimously.

"Note on the Glaciation of Mount Orford, P.Q.," by J. A. Dresser, M.A., was then read by Dr. Campbell in the absence of the author.

Dr. Campbell also read a paper by G. F. Matthew, LL.D., F.R.S.C., on "A Forest Fire at St. John about 2,000 Years Ago."

It was then moved by Edgar Judge, seconded by A. Holden, and carried, that the thanks of the Society be tendered Messrs. Dresser and Matthew.

The meeting then adjourned.

MONTREAL, 28th May, 1900.

The sixth monthly meeting of the Society was held this evening at 8.15 o'clock.

PRESENT—J. H. Joseph in the chair; Rev. Robert Campbell, D.D., J. S. Buchan, C. T. Williams, Jos. Fortier, P. S. Ross, E. T. Chambers, Edgar Judge, Ludger Larose, P. Norris, Mr. Ryan, Mr. Patterson and the Recording Secretary.

The minutes of the last meeting were read and confirmed.

After routine business the following papers were read by Rev. R. Campbell, D.D. :—"Oldhamia," by G. F. Matthew, LL.D., F.R.S.C., of St. John, N.B., and "Some Fungi on Staphylea Trifolia," by J. Dearness, of Normal School staff, London, Ont.

On motion of Dr. Campbell, seconded by Edgar Judge, a vote of thanks was tendered to the authors of the above interesting papers. Carried unanimously.

This being the date appointed for the annual meeting, and many of the members being absent, it was moved by C. T. Williams, seconded by Jos. Fortier, "that this meeting be adjourned until Monday, June 4th, for the reception of annual reports and the election of officers for the session of 1900–1901."

The meeting then adjourned.

MONTREAL, June 4th, 1900.

ADJOURNED ANNUAL MEETING.

The adjourned annual meeting was held this evening in the Library.

PRESENT—Rev. Robert Campbell, D.D., in the chair; A. Holden, P. S. Ross, J. H. Joseph, H. McLaren, F. C. Emberson, J. B. Williams, Jos. Fortier, F. W. Richards, John Harper, H. H. Lyman, J. S. Buchan, A. Griffin, Hon.

J. K. Ward, H. Vennor, Rev. G. Colborne Heine, and the Recording Secretary.

MINUTES.—It was moved by J. H. Joseph, seconded by E. T. Chambers, and carried, " That the minutes be taken as read."

The Curator reported the following donations to the Museum:—

Specimens of Mica from Burgess, Ont.; donor, Rev. R. Campbell. Iron Ores and Fossils from Nova Scotia; donor, P. S. Ross.

The Librarian reported that he had received for the Library a copy of Wood's " British Song Birds;" donor, Mrs. Alfred Griffin.

A vote of thanks was unanimously accorded to the above donors.

It was proposed by J. H. Joseph, seconded by J. B. Williams, and carried, " That the general discussion on the reports should be made after the whole of the reports were read."

ANNUAL REPORTS.—The following reports were then read:—Council, A. Holden; Treasurer, F. W. Richards; Curator, A. Griffin; Librarian, E. T. Chambers; Lecture Committee, C. S. J. Phillips; Editing Committee, Dr. Campbell; Field Day Committee, Dr. Campbell and J. S. Buchan.

Moved by F. W. Richards, seconded by Jos. Fortier, that reports be received and adopted.

DISCUSSION ON REPORTS.—John Harper raised the question of the mitoyen wall rights in connection with the work being done in the hall. J. S. Buchan, Q.C., stated that anyone could get them by paying for them.

J. H. Joseph suggested that the incoming Council should take measures to assist the Librarian.

The Rev. Dr. Campbell responded on behalf of the president, Prof. Wesley Mills, who was unavoidably absent in Europe, that he was proud to state that the efforts made and results obtained by the Society were superior to those of any previous year. The fact of the Museum being open free, with daily admission, ought to establish a great claim upon the public. The great success that had attended the excursions of the Field Committee, the Saturday Afternoon Talks with the Juveniles and the increased attendance at the Somerville Lectures were most encouraging. Although regretting that the number of working naturalists was not so numerous as might be wished, yet there was a noticeable increase in the workers, who were evidently taking more interest in the study of nature.

He also referred to the number of museums that had been established in all towns in the United States and were benefited and supported by municipal grants or the gifts of private individuals, and expressed his deep regret that such an important institution as the Natural History Society of Montreal was deprived of any such assistance.

The Treasurer, F. W. Richards, stated that the most rigid economy had been observed during the year, and suggested that a special fund should be organized for the future publication of the RECORD OF SCIENCE.

P. S. Ross expressed his deep regret at the stoppage of the Provincial grant to the Society, and urged the advisability of adding to the "Endowment Fund."

The Hon. J. K. Ward wished that special efforts should be made to increase the number of life members, and intimated that he would be pleased to become one.

A letter was read from the Hon. Mr. Justice Wurtele, regretting that owing to his judicial duties, he was unable to be present, but cordially wishing the Society every success.

ELECTION OF OFFICERS.—It was moved by A. Holden, and seconded by J. S. Buchan, Q.C., and carried unanimously, that Lord Strathcona and Mount Royal be the Hon. President of the Society.

The President then vacated the chair, which was temporarily filled by J. H. Joseph, who proposed, seconded by J. S. Buchan, "that the Rev. Dr. Campbell be the President of the Society for the ensuing year." Carried by acclamation.

Messrs. H. McLaren and Jos. Fortier were then appointed scrutineers, and the following gentlemen were nominated and balloted for to act as Vice-Presidents :—Hon. J. K. Ward, Prof. MacBride, Dr. Adams, Prof. Harrington, Hon. Justice Wurtele, C. T. Williams, J. H. Joseph, A. Holden, Dr. T. Wesley Mills.

It was then moved, seconded and carried, that the following gentlemen be elected to their respective positions :—C. S. J. Phillips, Recording Secretary ; J. S. Buchan, Corresponding Secretary ; F. W. Richards, Treasurer ; Alfred Griffin, Curator.

MEMBERS OF COUNCIL.—Albert Holden, Chairman ; J. A. U. Beaudry, C.E. ; E. T. Chambers, Joseph Fortier, N. N. Evans, Edgar Judge, Dr. Girdwood, H. McLaren, John Harper, Geo. Sumner.

EDITING AND EXCHANGE COMMITTEE.—Rev. Robert Campbell, M.A., D.D., Chairman ; Frank D. Adams, Ph.D., F.R.S.C. ; J. S. Buchan, Q.C. ; Prof. J. T. Donald, A. T. Drummond, LL.D.; Prof. E. W. MacBride, M.A. ; G. W. Matthew, St. John, N.B. ; T. Wesley Mills, M.A., M.D. ; J. T. Whiteaves, Ottawa.

LIBRARY COMMITTEE.—E. T. Chambers, Chairman ; J. A. U. Beaudry, C.E. ; A. E. Norris, Jos. Fortier, Alfred Griffin, G. M. Tod, C. T. Williams.

The meeting then adjourned.

Session 1899–1900.

Report of Council.

The Chairman of Council begs to submit the following report for the year ending May 30th, 1900:

During the year eight meetings of Council have been held, at which reports of the different Committees were received, and all other business of the Society discussed, before being submitted to the regular monthly meetings of the Society.

The regular monthly meetings have been held as usual. The following papers, arranged for by the Lecture Committee, were read at these meetings:

November 27th, 1899.—"The Plants of the Rocky Mountains," by Rev. R. Campbell, D.D.

January 29th, 1900.—"The Physical Features of Cape Cod," by O. E. Leroy, B.A. "The Subdivision of the Carboniferous System in Eastern Canada," by Prof. H. M. Ami, D.Sc., F.G.S.

February 26th.—"Cap-à-l'Aigle Plants not previously reported." Rev. R. Campbell, D.D. "Notes on recent Laboratory Investigations." Prof. J. T. Donald, M.A.

March 26th.—"On Canadian Marine Biological Station." Dr. F. S. Jackson. "The Rock Formation of the Bermudas." J. S. Buchan, Q.C., B.C.L.

April 30th.—"The Rate of Propagation of the Venous Pulse." W. S. Morrow, M.D. "Note on the Glaciation of Mount Orford, P.Q." J. A. Dresser, M.A.

April 30th.—"A Forest Fire at St. John about 2000 years ago," by G. F. Matthews, LL.D., F.R.S.C.

May 28th.—"Oldhamia." G. F. Matthews, LL.D., F.R.S.C. "Some Fungi on Staphylea Trifolia." J. Dearness.

New members elected during the year: 13 ordinary, three associate and two life members.

We regret to have to record the removal by death of the following members:

T. J. Claxton, Sir J. W. Dawson, Walter Drake, E. K. Greene, James Johnston, Hugh McLennan, John Stirling, F. Wolferstan Thomas, J. H. Winn.

The "Somerville Course" of six lectures and the "Half Hour Talks to Young People" on Saturday afternoon of eight lectures, all of which were illustrated by the electric lantern, were most successful, and the Lecture Committee who arranged for these lectures are to be congratulated on the great success of the same.

The Annual Field Day Excursion to Montfort was held on June 10th, and was largely attended, by about 270 members and their friends, and was in every way a success.

An agreement has been made with Mr. Kearney to close up the two windows in the large hall, for the sum of $200, also for the purchase of the mitoyen rights, which are to be paid for at the current value of same. The deeds for this transaction are now being prepared.

A. Holden,
Chairman of Council.

Annual Report of Editing and Exchange Committee.

Your Editing and Exchange Committee beg leave to report that, as instructed a year ago, they have continued the publication of the Record of Science, three numbers of Volume VIII being since issued, and the fourth number being now in the printer's hands. Interesting and valuable material has been furnished by the correspondents of the Society, residing in other parts of the Dominion, as as well as by the local members; and so far there has been sufficient matter always on hand to make up each number, as the time for going to press came round. The three numbers issued during the year have received favorable notice from the press and correspondents, and your Committee trust that the journal's reputation has been fairly well sustained in their hands. A large number of valuable scientific periodicals has been received in exchange, in which there is a record of the progress made in science during the past year. These are valuable for reference, and may be consulted by members of the Society who are interested in one or other of the branches of Natural History.

In name and by authority of the Committee.

ROBERT CAMPBELL,
Chairman.

MONTREAL, June 4th, 1900.

MUSEUM REPORT, SESSION 1899–1900.

GENTLEMEN,—I have devoted considerable time and attention to the requirements of the Museum, but the work has been of a limited character, chiefly owing to the want of space.

Acting on the suggestion of my predecessor, I am cleaning and re-arranging the fossil collection in the same manner as was done with the shells.

Some of the large mammals have been cleaned with benzine and freed from moths. I have also treated some of the birds in the same way.

I am glad to say that the donations during the past year have been of a valuable character. Among the most important were a large collection of shells, numbering 2000 specimens; also a number of geological specimens, fossils, eggs, and a girdle from the Sandwich Islands; the whole donated by A. A. McCulloch, Esq.

We are also indebted to Mr. Alfred Joyce for a fine specimen of the Duck Hawk (*falco peregrinus via* "*anatum*") shot by one of his employees on the mountain during the month of March. This is the first instance on record of its having been observed in Montreal.

A very fine white seal was presented by Mrs. W. Walker, and a number of plants by the Rev. R. Campbell, D.D.

The attendance at the Museum was nearly double that of last year, probably owing to the free admission every day.

The Saturday afternoon lectures were well attended, the electric lantern adding considerably to the interest. Many of the audience also visited the Museum.

When time will permit, I would suggest that a list of our duplicates be printed in the RECORD OF SCIENCE. This would be the means of securing by exchange many specimens of which we are in need.

The Saturday afternoon excursions inaugurated by the Field Work Committee should be the means of adding many specimens to our "Local Collection."

In conclusion, I would again call your attention to the want of space, a fact that prevents us from displaying many hundreds of specimens now unavoidably stowed away.

Respectfully submitted,

ALFRED GRIFFIN,
Curator.

REPORT OF THE LIBRARIAN.

It gives me great pleasure to be able at last to report that a catalogue of the books in the cases in the Library, with the exception of those in the French and German languages, has been completed and the whole re-arranged.

All the works on the shelves are represented by cards, which will be arranged in proper cases according to subjects. The number of books catalogued is 2428. Many of these were presented by their authors to the Society, but by far the greater number have been received as exchanges for the Canadian Naturalist and for the Canadian Record of Science. Other valuable works have been presented by the U. S. Geological Survey, the Canadian Geological Survey, and the Smithsonian Institution.

Besides the books in the Library, some 350 volumes have had to be placed in the committee room on the opposite side of the hall. These cannot be catalogued until some arrangements have been made for providing proper accommodation for them and for books which are continually being received, as well as for the large number of volumes awaiting binding. This want of space will, I trust, be taken into serious consideration by the House Committee.

As regards the binding, does it not seem a pity that the latest works of scientific interest should be really out of reach of members while the matter is fresh and of the greatest use? Above 300 volumes have already been made up, and many more will be ready in a very short time. It is therefore hoped that the Council will see the necessity of furthering the interests of the Society by making a liberal grant for binding 350 volumes.

In going over the contents of the Library I find that the Society is in possession of several very old and valuable works. Among these are the following:

1. Historia Plantarum. 3 vols. Joanni Raio. 1686.
2. History of Four-footed Beasts and Serpents, collected out of the writings of Conradus Gesner and others by Edward Topsel. Many curious engravings. 1608.
3. Historia Muscorum. J. J. Dillenii. 1811. With copper-plate engravings.

4. Harmonicon Cœleste. An Absolute and entire piece of Astronomie. By Vincent Wing. London, 1651.
5. Les Reports des divers special cases argue & adjude en le Court del Bank le Roy. Black letter. 1683.
6. The Herball or Generall Historie of Plantes gathered by John Gerarde. Enlarged and Amended by Thos. Johnson. London, 1636.
7. Hakluyt's Voyages (great part in black letter). London, 1589.
8. Biblia Sacra. A. Theodore Beza. Amstelœdami, 1551.
9. Italian Grammar. 1639.
10. Ovid. Bound in wooden boards. 1531.

Many of these are in poor condition, and it would be to the credit of the society if they could be put in a better state.

I have to acknowledge the receipt of the following donations:

From the late Walter Drake, Esq.:

Pyrenomycetes, by Ellis and Everhart.

Lichenology.

Mosses, by Lesquereux & James.

From Mrs. Griffin.—Wood's British Song-Birds.

From the Leigh Baron Trust.—Biological Experimentation. Dr. Richardson.

From Dr. H. Ami, of Ottawa.—18 pamphlets on scientific subjects, by the donor.

I cannot close this report without acknowledging the great help I have received from Mr. Griffin, who has spent so many hours with me in the Library, and without whose help the work of arranging and cataloguing the Society's works could not have been so nearly completed.

Respectfully submitted,

E. T. Chambers,
Hon. Librarian.

Natural History Society of Montreal

in account with

F. W. Richards, *Hon. Treas.*

Statement.

To cash on hand June 1st, 1899		$162 83	
" Receipts:—			
Rents	$803 50		
Members' Subscriptions	630 00		
Field Day Surplus	53 59		
Donations	27 75		
*Entrance Fees Museum	13 30		
Record of Science	6 65		
Sale of 2 Boxes	50	1535 29	
By Disbursements:—			
A. Griffin, Salary	$552 00		
Record of Science	210 39		
Sundry Expenses	197 92		
Lighting	137 00		
Insurance 3 years	127 50		
Fuel	111 41		
Repairs	95 51		
Printing	72 79		
Lecture	57 50		
†Taxes	49 02		
Commissions on Collections	46 37		
Museum	24 20		
Library	17 85		$1699 46
" Interest on Overdraft			41 88
" Bank Overdraft 1st June, 1899			492 60
" Cash on hand			15 68
To Bank Overdraft 31st May, 1900		551 50	
		$2249 62	$2249 62

*Museum open free after Aug. 1st, 1899.

†Included in this amount is a special assessment $14.10 for opening Inspector Street

CASH ACCOUNT.

To Balance on hand June 1st, 1899	$ 162 83	
" Receipts as per Cash Book	1535 29	
" Loans " Bank "	725 30	
By Deposits " " "		666 40
*" Interest " " "		41 88
" Disbursements as per Cash Book		1699 46
" Cash on hand		15 68
	$2423 42	$2423 42

BANK ACCOUNT.

Due Bank 1st June, 1899		492 60
" " New Loans		725 30
Paid " on account Loans	666 40	
Due " 31st May, 1900	551 50	
	$1217 90	$1217 90

Montreal, May 31st, 1900.

Audited and found correct. JOSEPH FORTIER.
C. T. WILLIAMS.

*$15.68 of this was paid on last year's loans.

DUCK HAWK ON MOUNT ROYAL.

Among the many interesting donations to the Natural History Society's Museum during the past year one of the most unique and rare was a a fine spəcimen of the Duck Hawk (*Falco Peregrinus,* variety *anatum*), presented by Mr. Alfred Joyce, of Montreal. It was shot during the month of March by one of his employees on Mount Royal, and is the first authenticated instance on record of its having been observed in the vicinity of Montreal.

E. D. Wintle in his " Birds of Montreal " refers to it as follows :—" Summer resident," scarce. While out black duck shooting in the first week of October, some years ago on Lake St. Peter, a duck hawk swooped down on the live decoy ducks, breaking the wing bone of one of them, but the ducks evidently saw the hawk coming, as suddenly, uttering loud quacks of alarm, they dived under the water just in time to save themselves from the hawk, which passed so quickly over them that I could not get a shot at this terror of the ducks. The late Mr. Caulfield received a beautiful pair of these hawks to stuff for the Museum of the Natural History Society of Montreal, from Mr. N. C. Fisk, of Abbottsford, which were shot May 7, 1890, on Yamaska Mountain, at Abbottsford, about 40 miles east of Montreal. Mr. Fisk said this pair of duck hawks had a nest on the western side of the mountain, and he has observed this species there every year for forty years past.

He took two eggs of the duck hawk in April, 1891, there, from under a rocky ledge; no material was used for the nest, only a slight hollow scratched out by the hawks under a shelving rock. These eggs were presented to the Museum of the Natural History Society of Montreal by Mr. Fisk, and his son kindly gave me a fine female specimen of the duck hawk which he shot about April 18, 1892, on Yamaska Mountain, and it is now in my collection of birds' skins; so that it appears the locality is a very attractive one for this species for a breeding-place, because when a pair of these hawks are shot there another pair takes their place. Mr. Fisk wrote to me, under date of May 4, 1893, that the hawks were there and had been for some time past, and that he heard them "squeal" to-night for the first time; and writing again, under date of June 10, 1893, he said that his son had shot one of the hawks, but could not obtain the other one. He kindly sent me the one shot, which was a beautiful male specimen, but, unfortunately, by the time it reached me it was too much decomposed to have the skin preserved for my collection.

The specimen above referred to, presented by Mr. Joyce, has been cleverly mounted by A. B. Dumouchel, taxidermist, of this city, and has been placed on view in the Society's collection.

ALFRED GRIFFIN,
Curator.

List of the Members of the Natural History Society of Montreal.

LIFE MEMBERS.

Burland, J. H.
Claxton, F. J.
Drummond, Hon. G. A.
Ferrier, J.
Finley, S.
Hingston, Sir W. H.
Hodgson, Jonathan.
Hague, Geo.
Iles, Geo.
Joseph, J. H.
Latour, Major L. A. H.
Molson, John.
Molson, J. T.
Molson, J. W.
McCulloch, F.
McFarlane, T.
McGibbon, A.
Nivin, W.
Sumner, Geo.
Sutherland, L.
Watt, D. A. P.
Watson, Hugh.

HONORARY MEMBERS.

Baldwin, Bishop, Rt. Rev.............London, Ont.
Beaubien, Hon. Louis.................Montreal, P.Q.
Hall, Prof. J.........................Albany, N.Y.
Lefroy, General J. H.................London, Eng.
Montgomery, T.......................Toronto, Ont.
Rae, D...............................London, Eng.
Rogers, C............................London, Eng.
Selwyn, D. A., R.C...................Ottawa, Ont.
Whiteaves, J. F......................Ottawa, Ont.

CORRESPONDING MEMBERS.

Brown, John.................Hamilton, P.O.
Bailey, L. W.................Fredericton, N.B.
Baylis, Rev. J. G.............Longueuil, P.Q.
Campbell, Dr. A.............
Hubbard, O. P...............Hanover, N.S.
Jowett, A. A.................Sheffield, Eng.
Laberge, C...................St. Johns, P.Q.
Langevin, J..................Rimouski, P.Q.
Latour, Dr. C. H.............Boucherville, P.Q.
Lavallée, Rev. M. C..........St. Vincent de Paul.
Leacroft, J. W...............Quebec.
Lemoine, J. M...............Quebec.
Lee, Dr. J. C................London, Ont.
Macoun, Prof. J.............Ottawa, Ont.

Marsh, Prof. J. W.	Forest Grove, Oregon, U.S.
Matthew, G. F.	St. John, N.B.
Mackay, A. H.	Pictou, N.S.
McDougall, P. L.	Toronto, Ont.
McCantee, Dr. T. B.	Boston, Mass.
Macfarlane, T.	Ottawa, Ont.
Nelson, Dr. Wolfred	
Newcombe, Dr. W.	Troy, N.Y.
Niles, B. F.	Washington, D.C.
Osler, Dr. C. B.	Philadelphia. Pa.
Pilote, Rev. F.	St. Anne de la Pocatière, P.Q.
Packard, A. S.	Providence, R.I.
Robinson, Rev. P.	Abbotsford, P.Q.
Rose, H.	Granby, P.Q.
Sailsbury, D. J. W.	New York.
Saunders, W.	London, Ont.
Sicotte, Judge	St. Hyacinthe, P.Q.
Spencer, J.	Pointe Claire, P.Q.
Taché, J. C.	Quebec, P.Q.
Thieleke, H.	Quebec, P.Q.
Turcot, Dr. M.	St. Hyacinthe, P.Q.
Westwood, Prof. J. O.	Oxford, Eng.
Winslow, Dr. W. C.	Boston, Mass.
Wurtele, Rev. L.	Acton Vale, Eng.
Woodward, A. Smith	London, Eng.

ORDINARY MEMBERS.

Alexander, C.
Allan, Andrew.
Adams, Prof. F. D.
Adami, Dr. J. G.
Beattie, John.
Brainerd, T. C.
Brown, J. Stevenson.
Bemrose, Jos.
Beaudry, J. A. U., C.E.
Bond, E. L.
Browne, Dr. A. A.
Botterell, E. H.
Birkett, Dr. H. S.
Baby, Hon. Mr. Justice.
Boulter, G.
Buchan, J. S.
Brodie, A.
Bovey, Prof. H. J.
Baker, Dr. M. C.
Byarelle, Aug.
Campbell, Rev. R.
Chambers, E. T.
Costigan, W. T.
Craik, Dr. R.
Cassils, C.
Cameron, Dr. J. C.
Cox, Prof. John.
Cushing, H. B.
Cayford, James.
Campbell, Dr. G. G.
Coristine, James.
Drysdale, W.
Donald, Prof. J. T.
Diverall, G. J.

Duff, J. M. M.
Deeks, Dr. W. E.
Drummond, G. E.
Dougall, J. R.
Dunlop, G. C.
Dumouchel, A. B.
Duckett, Oswald H.
Ewing, A. S.
Ewing, S. H.
Ewing, S. H.
Evans, N. N.
Fortier, Jos.
Fyshe, Thos.
Fair, John.
Gardner, James.
Garth, C.
Girdwood, Dr. G. P.
Goode, J. B.
Graham, Hugh.
Gault, A. F.
Greene, G. A.
Gurd, C.
Gibb, Lachlan.
Griffin, Alfred.
Gascoigne, Frank.
Harrington, Dr. B. J.
Henshaw, F. W.
Holden, Albert.
Harvie, R.
Harper, John.
Hodgson, T. E.
Heine, Rev. G. C.
Hooper, Angus W.
Hervieux, Madam.
Hastings, W. A.
Judge, Edgar.
Joyce, Alfred.
Kinloch, W. G.
Lyman, H. H.
Lovejoy, Dr. G. W.
Laing, Peter.
Leroy, O. S., B.A.
Lyman, A. C.
Larose, Ludger.
Low, J.
Laberge, Dr. Louis.
Mathewson, J. A.
Morrice, D.
Mills, Prof. Wesley.
Morgan, Jas.
Morrice, W. J.
Marling, J. W.
Molson, Mrs. J. H. R.
Macfarlane, A. B.
McCallum, Dr.
McDonald, Sir W. C.
McEachran, Dr. D.
McKenzie, H.
McGregor, Jas.
McLaren, H.
MacBride, Prof. E. W.
McLachlan, R. W.
McLean, Lt.-Col. J. B,
Norris, A. E.
Oughtred, A. R.
Penhallow, Prof. D. P.
Prowse, G. R.
Phillips, C. S. J,
Paton, Hugh.
Paton, Jas.
Prefontaine, Mayor.
Picken, J. B.
Phillips, E. S.
Roddick, Dr. T.
Ruttan, Dr. R. F.
Robertson, Alex.
Richards, F. W.
Rolland, Hon. J. D.
Robertson, David.
Ross, Capt. W.
Rexford, Rev. E. I.
Ross, P. S.
Roy, W. Ormiston.
Ross, D. W.
Shearer, Jas.
Silverman, S.
Strathcona, Lord.
Slessor, J.

Stirling, Dr. J. W.
Small, E. A.
Stewart, Dr. J.
Scott, W. A.
Shepherd, Dr. F. J.
Springle, Dr. J. A.
Smith, R. Wilson.
Thomas, H. W.
Thibodeau, A. A.
Tiffin, H. J.
Ussher, C. E. E.
Van Horne, Sir W. C.
Vasey, T. E.
Williamson, J.
White, R.
Wurtele, Hon. Mr. Justice.
Ward, Hon. J. K.
Williams, J. B.
Williams, C. T.
Yates, Dr. H. B.

ASSOCIATE MEMBERS.

Austin, Mrs. H. H.
Bickley, Miss.
Binmore, Miss L. J.
Corley, Miss M.
Cameron, Miss.
Cairnie, Miss J.
Dunlop, G. A.
Drummond, Mrs. A. P.
Davis, M. Waring.
Dresser, Prof. J. A.
Emberson, F. C.
Fisher, Arthur.
Fairley, Miss.
Hausen, J. F.
Holden, A. E.
Hamilton, Mrs. S.
Iles, Miss G.
Joseph, Carey J.
Laing, Miss.
Leclair, J. H.
Moore, G.
McBratney, Miss I. G.
O'Keeffe, Miss Howard.
Phillips, Miss.
Ryan, Mrs. P.
Sonne, C. N.
Stevenson, Dr. G. H. A.
Sinclair, Miss L. A.
Tod, G. M.
Vennor, H. E.

ARY, 1900.

187 feet. C. H. McLEOD, *Superintendent.*

DAY	Per cent. possible Sunshine.	Rainfall in inches.	Snowfall in inches.	Rain and snow melted.	DAY.
	00	....	0.2	0.02	1
	57	....	0.2	0.02	2
	80	....	....	....	3
	00	....	0.1	0.01	4
	00	....	....	...	5
	85	....	....	....	6
SUNDAY.	00	....	....	....	7..........SUNDAY
	82	....	....	....	8
	33	...	..	....	9
1	51	0.01	2 0	0.21	10
	62	....	6.0	0.70	11
1	16	....	4.5	0.60	12
1	43	...	0.0	0.00	13
SUNDAY........1	21	....	0.8	0.08	14..........SUNDAY
	00	....	.	....	15
1	51	....	1.2	0.12	16
1	70	....	....	....	17
1	00	....	0.8	0.08	18
1	00	0.00	....	0.00	19
2	00	1.16	....	1.16	20
SUNDAY....... 2	95	....	....	....	21......... .SUNDAY
2	33	....	...	....	22
2	32	0.00	....	0.00	23
2	24	....	....	....	24
2	00	0.29	1.3	0.42	25
2	00	..	17.3	1.73	26
2	86	....	0.0	0.00	27
SUNDAY........2	00	....	0.2	0.02	28..........SUNDAY
2	00	....	1.9	0.19	29
3	15	...	0.0	0.00	30
3	00	....	0 1	0.01	31
Means......	30.2	1.46	36.6	5 37	.... Sums.
26 Years means or and including his month	¶34.97	0.861	30.14	3.738	26 Years means for and including this month.

	ea-level and
Direction..	taken from
Miles	observations
Duration in hrs..	
Mean velocity...	e 23rd; the ving a range

Greatest mildest day was 21st and 23rd was 30.73 on

Greatest velo on the 20th, on the 25th.

Minimum relative humidity observed was 64, on the 31st.

Rain fell on 5 days.

Snow fell on 17 days.

Rain or snow fell on 20 days.

Lunar halo on 9th.

Lunar coronas on the 6th, 9th, 13th, 15th, 16th and 17th.

Fog on 4 days.

ABSTRACT FOR THE MONTH OF JANUARY, 1900.

Meteorological Observations, McGill College Observatory, Montreal, Canada. Height above sea level, 187 feet. C. H. McLEOD, *Superintendent.*

DAY	THERMOMETER. † Mean.	Max.	Min	Range.	*BAROMETER. † Mean.	Max.	Min.	Range.	‡Mean relative humidity.	WIND. General direction.	Mean velocity in miles per hour	Per cent. possible Sunshine.	Rainfall in inches.	Snowfall in inches.	Rain and snow melted.	DAY.
1	1 9	6.8	—3.2	10 0	29.69	29.85	29.55	.30	95	N.	6.9	00	....	0.2	0.02	1
2	7.0	12.0	2.8	9.2	29.56	29.73	29.49	.24	88	S.W.	12.5	57	....	0.2	0.02	2
3	4 9	8.8	—0.2	9.0	30 07	30.34	29.74	.60	85	S.W.	16.2	80	....	....	....	3
4	14 5	22.8	4.8	18.0	30 38	30 46	30.34	.12	89	S.	10.7	00	....	0.1	0 01	4
5	31.0	36.7	21.4	15.3	30.15	30.30	30 09	.21	77	S.W.	21.8	00	....	....	.	5
6	23.1	34.8	18 5	16.3	30.36	30.44	30.15	.29	80	S.W.	15.1	85	....	.. .	....	6
SUNDAY 7	29.7	39.2	19.8	19 4	29.99	30.39	29 67	.72	87	S.E.	22.1	00	....	....	....	7 .... SUNDAY
8	17.2	39.8	4.0	35.8	30.23	30.57	29.67	.90	80	W.	18.4	82	....	....	....	8
9	12.3	20.7	3.0	17.7	30.34	30 58	29 95	.63	79	E.	9.8	33	...	..	....	9
10	19 8	36.2	2.8	33.4	29 92	30.30	29.68	.62	84	S.W.	22.6	51	0.01	2 0	0.21	10
11	1 6	10.5	—2.8	13.3	30 20	30.41	29 81	.60	92	N.	11.0	62	....	6.0	0.70	11
12	17.0	21 5	10.5	11.0	29.71	29 91	29.59	.32	93	S.W.	9.1	16	....	4.5	0.60	12
13	9.4	16 0	7.0	9.0	30.09	30.15	29.92	.23	94	S.	0.4	43	...	0.0	0.00	13
SUNDAY........14	14.5	20 0	9.5	10.5	30.00	30.09	29 92	.17	94	N.	3.0	21	....	0.8	0.08	14 .... SUNDAY
15	21.9	26.2	8.8	17.4	30.24	30.32	30 06	.26	94	S.	3.9	00	....	.	....	15
16	24.0	30.5	18.0	12.5	30.11	30.34	30.04	.30	87	S.W.	11.1	51	....	1.2	0.12	16
17	—0.7	17.7	—4.8	22.5	30.63	30.73	30.35	.38	92	N.	14.1	70	....	....	....	17
18	14.8	26.2	—4.0	30.2	30.29	30.58	30 15	.43	98	N.E.	5.3	00	....	0.8	0.08	18
19	34.9	39.2	24.2	15.0	29.94	30.13	29.86	.27	98	S.W.	22.0	00	0.00	....	0.00	19
20	36.0	38.7	34.0	4.7	29.49	29.86	29.26	.60	99	N.W.	14.4	00	1.16	...	1.16	20
SUNDAY...... 21	7.8	33.5	—1.5	35.0	29.96	30 12	29.40	.72	84	W.	14.6	95	....	....	....	21 .... SUNDAY
22	31.1	38.5	12.5	26 0	29 96	30.01	29 86	.15	85	S W.	18.1	33	....	...	....	22
23	26.5	42.0	2.3	39 7	29.81	30.22	29.59	.63	71	S.W.	26.8	32	0.00	....	0.00	23
24	—2.1	5.5	—7.8	13.3	30.31	30.48	30.01	.47	85	N.	15.0	24	....	....	....	24
25	20 3	33.8	5.5	28.3	29.64	29 99	29.41	.58	90	S.E.	17.9	00	0.29	1.3	0.42	25
26	7.5	31.2	—1 5	32.7	29.40	29.47	29.34	.13	91	S.W.	19.7	00	..	17.3	1.73	26
27	3.1	8.8	—2.0	10.8	29.91	30.17	29.48	.69	84	W.	25.4	86	....	0.0	0.00	27
SUNDAY........28	21 3	32.0	4.5	27.5	30.05	30.16	29.91	.25	89	S.E.	12.9	00	....	0.2	0.02	28 .... SUNDAY
29	15 3	34.8	7.8	25.0	29.72	29.91	29.60	31	86	S.W.	22.0	00	....	1.9	0.19	29
30	13.3	18 3	5.6	12.7	29.70	29 75	29.62	.13	81	S.	11.3	15	...	0.0	0.00	30
31	13.7	20.5	3.5	17.0	29 60	29 67	29 50	.17	73	S.W.	11.0	00	....	0 1	0.01	31
Means......	16.28	25.85	6.55	19 29	29 983	30.175	29 775	.401	87.4	S. 47.5° W.	14 36	30.2	1.46	36.6	5 37	.... Sums.
26 Years means for and including this month	12 30	20 72	4.39	16.32	30.053	...	......	.331	82.3	....	§ 16 57	¶ 34.97	0.861	30.14	3.738	26 Years means for and including this month.

ANALYSIS OF WIND RECORD.

Direction..	N	N. E	E.	S E.	S.	S.W.	W.	N W	CALM
Miles	908	251	316	1454	978	4399	1480	900	
Duration in hrs..	88	28	26	93	80	231	83	55	60
Mean velocity....	10.3	9.0	12 2	15.6	12.2	19.0	17.8	16.4	

Greatest mileage in one hour was 36, on the 21st and 23rd

Greatest velocity in gusts, 38 miles per hour on the 25th.

Resultant mileage, 5,600.
Resultant direction, S. 47 5° W.
Total mileage, 10,686

* Barometer readings reduced to sea-level and temperature 32° Fahrenheit.

† Mean of bi hourly readings taken from self recording instruments.

‡ Humidity relative ; mean from observations at 8, 15, and 21 hours.

¶ 19 years only. § 14 years only.

The greatest heat was 42°.0 on the 23rd; the greatest cold was –7°.8 on the 24th, giving a range of temperature of 49.8 degrees.

Warmest day was the 20th. Coldest day was the 24th. Highest barometer reading was 30.73 on the 17th. Lowest barometer was 29.26 on the 20th, giving a range of 1.47 inches.

Minimum relative humidity observed was 64, on the 31st.

Rain fell on 5 days.

Snow fell on 17 days.

Rain or snow fell on 20 days.

Lunar halo on 9th.

Lunar coronas on the 6th, 9th, 13th, 15th, 16th and 17th.

Fog on 4 days.

RUARY, 1900.

M 187 feet. C. H. McLEOD, *Superintendent.*

DAY	Per cent. possible Sunshine.	Rainfall in inches.	Snowfall in inches.	Rain and snow melted.	DAY.
1	75	....	....	....	1
2	83	....	....	....	2
3	61	....	0.2	0.02	3
SUNDAY........ 4	69	....	6.5	0.68	4..........SUNDAY
5	00	....	0.0	0.00	5
6	01	....	1.9	0.12	6
7	48	...	0.1	0.01	7
8	00	0.32	0.0	0.32	8
9	36	0.54	....	0.54	9
10	80	....	....	....	10
SUNDAY........11	81	....	....	....	11...........SUNDAY
12	57	0.07	..	0.07	12
13	00	2.05	...	2.05	13
14	99	....	....	...	14
15	09	....	0.9	0.09	15
16	96	....	....	....	16
17	79	....	....	....	17
SUNDAY........18	00	....	0.1	0.01	18......... .SUNDAY
19	45	....	2.0	0.20	19
20	99	....	....	....	20
21	28	....	...	....	21
22	00	....	3.8	0.38	22
23	15	....	5.0	0.67	23
24	00	0.00	0.0	0.00	24
SUNDAY........25	00	....	9.4	1.03	25...........SUNDAY
26	64	....	0.3	0.03	26
27	99	....	....	....	27
28	00	....	1.3	0.13	28
Means......	43.7	2.98	31.5	6.35	................Sums.
26 Years means for and including this month	¶42.0	.838	23.13	3.112	26 Years means for and including this month.

sea-level and

Direction........	taken from
Miles	15, and 20
Duration in hrs..	
Mean velocity....	he 13th: the

iving a range

Resultant mil

Greatest milea lest day was 13th. was 30.70 on

Greatest veloc 2 on the 25th, on the 13th.

Minimum relative humidity observed was 54, on the 14th.

Rain fell on 5 days.

Snow fell on 15 days.

Rain or snow fell on 18 days.

Hoar frost on 3 days.

Lunar halos, on 11th, 17th.

Lunar coronas on the 6th, 7th, 10th, 11th.

Fog on 5 days.

ABSTRACT FOR THE MONTH OF FEBRUARY, 1900.

Meteorological Observations, McGill College Observatory, Montreal, Canada. Height above sea level, 187 feet. C. H. McLEOD, *Superintendent.*

DAY	THERMOMETER. † Mean.	Max.	Min.	Range.	*BAROMETER. † Mean.	Max.	Min.	Range.	‡Mean relative humidity.	a WIND. General direction.	Mean velocity in miles per hour	Per cent. possible Sunshine.	Rainfall in inches.	Snowfall in inches.	Rain and snow melted.	DAY.
1	—4.5	3.5	—9.2	12.7	29.60	29.86	29.43	.43	84	S.W.	23.4	75	....	....	....	1
2	—3.8	2.5	—11.2	13.7	29.91	29.96	29.86	.10	90	S.W.	7.9	83	....	...	....	2
3	11.0	18.5	2.0	16.5	30.00	30.14	29.88	.26	80	S.W.	14.8	61	....	0.2	0.02	3
SUNDAY........ 4	15.7	19.0	9.5	9.5	29.95	30.14	29.72	.42	94	E.	12.6	69	....	6.5	0.68	4......... SUNDAY
5	17.3	22.2	10.0	12.2	29.85	30.04	29.72	.32	83	S.W.	21.8	00	....	0.0	0.00	5
6	10.5	15.0	7.0	8.0	30.02	30.18	29.89	.29	96	S.	6.1	01	....	1.9	0.12	6
7	9.2	14.8	1.8	13.0	30.31	30.36	30.18	.18	93	N.E.	5.3	48	...	0.1	0.01	7
8	23.5	38.8	10.0	28.8	30.08	30.30	29.87	.43	93	N.E.	10.7	00	0.32	0.0	0.32	8
9	33.5	40.8	24.5	16.3	30.07	30.43	29.74	.69	85	S.	28.2	36	0.54	....	0.54	9
10	22.1	26.0	19.0	7.0	30.45	30.52	30.34	.18	77	W.	8.2	80	....	....	....	10
SUNDAY........11	23.1	31.2	14.5	16.7	30.35	30.34	30.22	.12	86	N.E.	5.3	81	....	....	....	11...........SUNDAY
12	31.4	39.0	20.3	18.7	30.24	30.30	30.12	.18	83	S.E.	8.2	57	0.07	..	0.07	12
13	37.4	44.2	28.7	15.5	29.54	30.12	29.24	.88	92	S.W.	15.9	00	2.05	...	2.05	13
14	19.2	28.7	15.2	13.5	29.94	30.06	29.51	.55	77	S.W.	35.7	99	....	....	...	14
15	17.8	21.2	14.5	6.7	29.92	30.05	29.79	.26	88	S.W.	19.8	09	....	0.9	0.09	15
16	13.9	17.8	10.0	7.8	30.00	30.09	29.85	.24	84	S.W.	25.3	96	....	....	....	16
17	13.0	18.2	7.8	10.4	30.06	30.12	29.95	.17	85	N.E.	3.9	79	....	....	....	17
SUNDAY........18	13.8	19.6	9.6	10.0	29.73	29.95	29.62	.33	82	N.	18.3	00	....	0.1	0.01	18......... SUNDAY
19	16.1	21.2	12.0	9.2	29.80	30.02	29.64	.38	86	W.	24.2	45	....	2.0	0.20	19
20	19.2	24.0	13.0	11.0	30.23	30.31	30.02	.29	84	S.W.	21.5	99	....	....	....	20
21	23.0	28.5	17.0	11.5	30.23	30.31	30.15	.16	85	N.E.	11.5	28	....	...	....	21
22	25.1	29.2	22.7	6.5	29.77	30.15	29.43	.72	96	N.E	29.7	00	....	3.8	0.38	22
23	25.3	29.6	20.5	9.1	29.39	29.51	29.33	.18	83	S.W.	19.1	15	....	5.0	0.67	23
24	32.8	38.8	28.2	10.6	29.44	29.60	29.18	.42	89	S.	18.4	00	0.00	0.0	0.00	24
SUNDAY........25	10.5	35.2	—5.0	40.2	29.05	29.22	28.92	30	94	S.W.	40.1	00	....	9.4	1.03	25...........SUNDAY
26	—9.5	—5.0	—11.5	6.5	29.80	30.23	29.22	1.01	86	S.W.	31.8	64	....	0.3	0.03	26
27	—4.3	4.5	—13.5	18.0	30.54	30.70	30.23	.47	77	S.	21.8	99	....	....	....	27
28	6.5	16.5	—1.8	18.3	30.55	30.68	30.41	.27	93	S.E.	13.6	00	....	1.3	0.13	28
Means...........	16.03	22.99	9.49	13.50	29.958	30.132	29.767	.365	86.6	S. 44¾° W.	18.19	43.7	2.98	31.5	6.35	................Sums.
26 Years means for and including this month	15.67	23.61	7.48	16.13	30.024	......	......	.311	80.5	....	§18.17	¶42.0	.838	23.13	3.112	26 Years means for and including this month.

a ANALYSIS OF WIND RECORD.

Direction....	N	N.E.	E.	S.E.	S.	S.W.	W.	N.W.	CALM.
Miles ...	1338	715	645	576	1259	6402	1149	143	
Duration in hrs..	106	38	74	41	76	240	61	7	29
Mean velocity....	12.6	18.8	8.7	14.1	16.5	26.7	18.8	20.4	

Resultant mileage, 5,950.

Greatest mileage in one hour was 62, on the 13th.

Greatest velocity in gusts, 72 miles per hour on the 13th.

Resultant direction, S. 44¾° W.

Total mileage, 12,227

a Wind velocities from the 10th to the 20th are from the City Hall, and are corrected to Mountain Anemometer.

* Barometer readings reduced to sea-level and temperature 32° Fahrenheit.

† Mean of bi-hourly readings taken from self recording instruments.

‡ Mean from observations at 8, 15, and 20 hours. Percentage of Saturation.

¶ 19 years only. § 14 years only.

The greatest heat was 44.2 on the 13th; the greatest cold was —13.5 on the 27th, giving a range of temperature of 57.7 degrees.

Warmest day was the 13th. Coldest day was the 26th. Highest barometer reading was 30.70 on the 27th. Lowest barometer was 28.92 on the 25th, giving a range of 1.78 inches.

Minimum relative humidity observed was 54, on the 14th.

Rain fell on 5 days.

Snow fell on 15 days.

Rain or snow fell on 18 days.

Hoar frost on 3 days.

Lunar halos, on 11th, 17th.

Lunar coronas on the 6th, 7th, 10th, 11th.

Fog on 5 days.

.RCH, 1900.

187 feet. C. H. McLEOD, *Superintendent.*

DAY	Per cent. possible Sunshine.	Rainfall in inches.	Snowfall in inches.	Rain and snow melted.	DAY.
	00	....	18.2	1.82	1
	00	....	3.6	0.36	2
	68	....	0.3	0.03	3
SUNDAY......	18	....	1.5	0.15	4..........SUNDAY
	88	....	....	....	5
	91	0.00	6.0	1.10	6
	98	....	0.1	0.01	7
	47	....	....	....	8
	00	....	0.0	0.00	9
	00	....	5.0	0.50	10
SUNDAY......	97	....	....	....	11..........SUNDAY
	99	....	....	....	12
	05	....	0.0	0.00	13
	50	....	0.2	0.02	14
	00	....	..	....	15
	11	....	6.8	0.75	16
	62	....	0.2	0.02	17
SUNDAY......	91	....	...	....	18......... .SUNDAY
	22	0.10	3.8	0.44	19
	72	0.03	0.0	0.03	20
	92	....	0.1	0.01	21
	36	....	0.3	0.03	22
	94	....	0.2	0.02	23
	96	....	....	....	24
SUNDAY......	95	....	....	....	25..........SUNDAY
	62	....	0.0	0.00	26
	45	....	0.1	0.01	27
	39	....	0.0	0.00	28
	97	....	....	....	29
	86	....	...	....	30
	85	.. .	....	....	31
Means...... .	50.6	0.13	46.4	5.30	...............Sums.
26 Years mea for and includi this month	¶ 47.38	1.103	24.37	3.651	26 Years means for and including this month.

ea-level and

taken from

Direction....

bservations

Miles ....

Duration in hı

Mean velocity

e 19th; the

ing a range

Greatest m

1st.

est day was

Greatest was 30.67 on

on the 7th. on the 2nd,

Resultant

Minimum relative humidity observed was 73, on the 28th.

Rain fell on 3 days.

Snow fell on 20 days.

Rain or snow fell on 20 days.

An aurora was observed on the 12th.

A lunar halo on 1 night.

Lunar coronas on 2 nights.

Fog on 2 days.

ABSTRACT FOR THE MONTH OF MARCH, 1900.

Meteorological Observations, McGill College Observatory, Montreal, Canada. Height above sea level, 187 feet. C. H. McLEOD, *Superintendent.*

DAY	THERMOMETER. † Mean.	Max.	Min.	Range.	*BAROMETER. † Mean.	Max.	Min.	Range.	‡Mean relative humidity.	α WIND. General direction.	Mean velocity in miles per hour	Per cent. possible Sunshine.	Rainfall in inches.	Snowfall in inches.	Rain and snow melted.	DAY.
1	15.0	19.8	10.0	9.8	29.97	30 41	29.42	.99	98	E.	35.5	00	....	18.2	1.82	1
2	22.5	26.4	20.0	6.4	29.34	29.53	29.23	.30	96	N.W.	27.1	00	....	3.6	0.36	2
3	18.4	22.8	15.0	7.8	29.92	30.17	29.53	.64	87	N.W.	26.6	68	....	0.3	0.03	3
SUNDAY........ 4	12.2	20.5	3.0	17.5	30.23	30.35	30.10	.25	80	S.	13.2	18	....	1.5	0.15	4..........SUNDAY
5	1.0	5.2	—4.0	9.2	30.58	30.67	30.35	.32	82	E.	11.2	88	....	....	....	5
6	13.6	35.2	—3.3	38.5	30.06	30.64	29.60	1.04	96	S.E.	24.9	91	0.00	6.0	1.10	6
7	21.6	35.2	16.0	19.2	30.05	30.44	29.64	.80	81	S.W.	41.8	98	....	0.1	0.01	7
8	20.2	26.8	12.1	14.7	30.48	30.57	30.40	.17	82	S.W.	16.3	47	....	....	....	8
9	27.6	36.7	15.5	21.2	30.07	30.40	29.87	.53	82	S.	16.2	00	....	0.0	0.00	9
10	23.3	34.0	9.2	24.8	29.83	29.97	29.75	.22	85	W.	16.1	00	....	5.0	0.50	10
SUNDAY........11	2.7	9.3	—4.0	13.3	30.07	30.15	29.97	.18	75	N.W.	21.6	97	....	....	....	11..........SUNDAY
12	1.2	7.5	—5.8	13.3	30.23	30.30	30.15	.15	79	W.	20.3	99	....	....	....	12
13	11.2	25.5	—2.2	27.7	29.97	30.18	29.87	.31	81	S.E.	16.6	05	....	0.0	0.00	13
14	16.0	22.8	5.5	17.3	29.95	30.05	29.89	.16	90	S.W.	25.7	50	....	0.2	0.02	14
15	4.5	9.2	—1.0	10.2	30.14	30.21	30.05	.16	84	W.	13.6	00	....	..	....	15
16	12.7	21 0	4.5	16.5	29.68	30.11	29.47	.64	88	S.W.	21.0	11	....	6.8	0.75	16
17	11.6	17.8	7.0	10.8	29.92	30.05	29.72	.33	82	S.W.	26.0	62	....	0.2	0.02	17
SUNDAY....... 18	9.8	15.7	0.5	15.2	30.07	30.18	29.98	.20	89	S.	18.7	91	....	...	....	18......... .SUNDAY
19	29.8	39.2	16.0	23.2	29.67	29.98	29.39	.59	93	S.	18.9	22	0.10	3.8	0.44	19
20	32.9	38.8	26.0	12.8	29.58	29.69	29.38	.31	82	S.W.	31.0	72	0.03	0.0	0.03	20
21	22.6	25.3	16.3	9.0	29.90	29.99	29.70	.29	81	S.W.	26.7	92	....	0.1	0.01	21
22	28.3	35.5	18.0	17.5	29.91	30.04	29.77	.27	89	S.	19.7	36	....	0.3	0.03	22
23	31.7	38.0	19.7	18.3	29.82	29.99	29.73	.26	94	S.W.	23.3	94	....	0.2	0.02	23
24	13.6	19.7	6.5	13.2	30.03	30.10	29.99	.11	90	S.W.	21.6	96	....	....	....	24
SUNDAY........25	20.0	26.8	9.8	17.0	30.02	30.12	29.94	.18	97	S.W.	17.2	95	....	....	....	25..........SUNDAY
26	27.1	33.7	15.3	18.4	29.75	29.94	29.64	.30	95	S.E.	12.5	62	....	0.0	0.00	26
27	32.3	36.7	29.3	7.4	29.66	29.73	29.58	.15	97	S.W.	13.1	45	....	0.1	0.01	27
28	32.4	38.5	26.1	12.4	29.81	29.85	29.73	.12	73	W.	20.4	39	....	0.0	0.00	28
29	32.6	38.2	25.8	12.4	29.93	30.01	29.85	.16	96	W.	21.0	97	....	....	....	29
30	30.3	35.4	25.5	9.9	30.03	30.07	29 99	.08	92	N.W.	10.0	86	....	...	....	30
31	30.8	36.3	23.5	12.8	29.91	30.00	29.85	.15	92	N.W.	18.6	85	... .	....	....	31
Means......	19.66	26.89	8.25	15.41	29.954	30.13	29 79	.334	87.4	S. 47.5° W.	20.82	50 6	0.13	46.4	5.30	...............Sums.
26 Years means for and including this month	24 31	31 46	16.76	14.59	29.975	......	......	.272	77.06	....	§ 13.18	¶ 47.38	1.103	24.37	3.651	26 Years means for and including this month.

α ANALYSIS OF WIND RECORD.

Direction......	N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.	CALM.
Miles	337	842	697	1593	1290	7048	2005	1699	
Duration in hrs..	36	38	40	77	86	274	112	81	
Mean velocity....	9 36	22.16	17 42	20.69	15 00	25.72	17.90	20.98	

Greatest mileage in one hour was 54, on the 1st.

Greatest velocity in gusts, 56 miles per hour on the 7th.

Resultant mileage, 7,705.

Resultant direction, S. 47.5° W.
Total mileage, 15,511
Average velocity, 20.85 miles per hour.

* Barometer readings reduced to sea-level and temperature 32° Fahrenheit.

† Mean of bi-hourly readings taken from self recording instruments.

‡ Humidity relative. Mean from observations at 8, 15, and 20 hours.

¶ 19 years only. § 14 years only.

The greatest heat was 39.2 on the 19th; the greatest cold was —5.8 on the 12th, giving a range of temperature of 45.0 degrees.

Warmest day was the 20th. Coldest day was the 5th. Highest barometer reading was 30.67 on the 5th. Lowest barometer was 29.23 on the 2nd, giving a range of 1.44 inches.

Minimum relative humidity observed was 73, on the 28th.

Rain fell on 3 days.

Snow fell on 20 days.

Rain or snow fell on 20 days.

An aurora was observed on the 12th.

A lunar halo on 1 night.

Lunar coronas on 2 nights.

Fog on 2 days.

RIL, 1900.

87 feet. C. H. McLEOD, *Superintendent.*

DAY	Per cent. possible Sunshine.	Rainfall in inches.	Snowfall in inches.	Rain and snow melted.	DAY.
SUNDAY........	60	....	....	....	1..........SUNDAY
	36	0.00	....	0.00	2
	00	0.06	...	0.06	3
	48	....	0.2	0.02	4
	61	0.00	....	0.00	5
	87	....	....	....	6
	90	....	.. .	....	7
SUNDAY........	78	...	....	....	8..........SUNDAY
	00	....	0.4	0.04	9
	28	0.00	0.1	0.01	10
	85	....	....	....	11
	03	0.04	....	0.04	12
	00	0.16	0.0	0.16	13
	09	0.06	0.0	0.06	14
SUNDAY........	98	....	..	....	15......... .SUNDAY
	82	....	....	....	16
	66	0.02	....	0.02	17
	18	0.66	..	0.66	18
	07	0.07	....	0.07	19
	96	....	....	.	20
	80	....	....	....	21
SUNDAY........	00	0.01	....	0.01	22 ....SUNDAY
	12	0.30	....	0.30	23
	98	...	....	....	24
	99	....	....	....	25
	99	....	....	....	26
	09	0.00	....	0.00	27
	45	0.00	....	0.00	28
SUNDAY..	97	....	....	....	29...........SUNDAY
	35	0.01	...	0.01	30
Means......	51.0	1.39	0.7	1.46	....Sums.
26 Years means for and including this month	¶52.09	1.623	5.29	2.161	26 Years means for and including this month.

ea-level and

being 100.

Direction....... 20 hours.

Miles ..... . he 21st; the

Duration in hrs. ying a range

Mean velocity... lest day was

was 30.48 on

Greatest mile on the 30th,
30th.

Greatest velc
on the 30th. rved was 34,

Resultant mi

Rain fell on 15 days.

Snow fell on 5 days.

Rain or snow fell on 17 days.

Lunar halo on the 16th.

Lunar corona on the 9th.

Fog on the 2nd, 3rd, 12th, 16th, 17th, 23rd, and 29th.

ABSTRACT FOR THE MONTH OF APRIL, 1900.

Meteorological Observations, McGill College Observatory, Montreal, Canada. Height above sea level, 187 feet. C. H. McLEOD, *Superintendent.*

DAY	THERMOMETER. † Mean.	Max.	Min.	Range.	*BAROMETER. † Mean.	Max.	Min.	Range.	‡Mean relative humidity.	*a* WIND. General direction.	Mean velocity in miles per hour	Per cent. possible Sunshine.	Rainfall in inches.	Snowfall in inches.	Rain and snow melted.	DAY.
SUNDAY........ 1	35.09	40 3	29.4	10.9	29.86	29.90	29.83	.07	84	N.W.	22 4	60	....	....	....	1 ... .SUNDAY
2	37.87	42.3	31.6	10.7	29.94	30.00	29.87	.13	96	S.	10.6	36	0.00	....	0.00	2
3	35.85	39.5	33.1	6.4	29.79	29.91	29.73	.18	93	S.W.	11.6	00	0.06	...	0.06	3
4	34.49	38.8	29.5	9.3	29.99	30.14	29.76	.38	90	W.	17.2	48	....	0.2	0.02	4
5	36.90	43.0	30.3	12.7	30.00	30.14	29.83	.31	89	S W.	29.1	61	0.00	....	0.00	5
6	42.33	47.7	36.4	11.3	29.80	29.85	29.76	.09	77	W.	18.2	87	....	....	....	6
7	40.99	48.9	33.0	15.9	29.68	29.78	29.61	.17	70	N.W.	15.5	90	....	.. .	....	7
SUNDAY........ 8	32.43	37.7	24.5	13.2	29.74	29.84	29.66	.18	89	N.W.	22.0	78	...	....	....	8..........SUNDAY
9	26.03	30.3	21.9	8.4	29.90	30.00	29.85	.15	92	W.	17.2	00	....	0.4	0.04	9
10	30.65	37.6	22.7	14.9	30.12	30.30	29.98	.32	77	S.W.	13.3	28	0.00	0.1	0.01	10
11	40.55	48.5	34.3	14.2	30.33	30.38	30.27	.11	69	S.W.	6.6	85	....	....	....	11
12	37.09	41.1	32.8	8.3	30.17	30.27	30.06	.21	88	E.	9.7	03	0.04	....	0.04	12
13	36.29	41.1	33.8	7.3	29.89	30.06	29.79	.27	96	S.W.	13.5	00	0.16	0.0	0.16	13
14	35.94	40.0	32.5	7.5	29.80	29.94	29.76	.18	90	S.W.	24.7	09	0.06	0.0	0.06	14
SUNDAY........15	41.62	49.1	33.6	15.5	30.19	30.31	29 94	.37	65	S.W.	19.1	98	....	..	....	15......... .SUNDAY
16	44.20	52.5	35.9	16.6	30.41	30.48	30.31	.17	65	S.	9.2	82	....	....	....	16
17	44.95	57.0	32.5	24.5	30.30	30.42	30.12	.30	78	S.E.	13.4	66	0.02	....	0.02	17
18	54.79	63.7	44.9	18.8	29.85	30.12	29.77	.35	89	S.E.	20.1	18	0.66	.	0.66	18
19	50.37	56.2	44.7	11.5	29.80	29 97	29.72	.25	84	W.	25.3	07	0.07	....	0.07	19
20	52.49	61.3	43.0	18.3	30.13	30.20	29.97	.23	69	S.W.	16.5	96	....	....	.	20
21	61.01	72.7	48.8	23.9	30.04	30.14	29.94	.20	70	S.	14.7	80	....	....	....	21
SUNDAY........22	53.47	60.8	44.6	16.2	29.94	29.97	29 91	.06	76	S.E.	8.4	00	0 01	....	0.01	22 ....SUNDAY
23	54.06	62.2	43.9	18.3	29.90	29 96	29.86	.10	87	N.E.	8.1	12	0.30	....	0.30	23
24	40.46	54.0	37 8	16.2	30 06	30.15	29.97	.18	55	N	18.0	98	...	....	....	24
25	48.72	59.1	37 9	21.2	30.11	30.18	30.04	.14	42	N.W.	20.0	99	....	....	....	25
26	48.27	56.6	39.8	16.8	29.92	30.07	29.81	.26	46	N.W.	25 4	99	....	....	....	26
27	44.50	49.0	40.0	9.0	29.88	29.92	29.85	.07	63	N.W.	14.9	09	0.00	....	0.00	27
28	47.63	53.1	40.3	12.8	30.03	30.11	29 92	.19	65	N.	11.7	45	0.00	....	0.00	28
SUNDAY.. 29	54.22	66.6	36.2	30.4	29.94	30.11	29.81	.30	61	S.W.	14.0	97	....	....	....	29..........SUNDAY
30	55.15	71.7	40.6	31.1	29.61	29.81	29 40	41	65	S.W.	24 4	35	0.01	...	0.01	30
Means	43.48	50.75	35.68	15 07	29 971	30.081	29 870	.211	76.0	S. 68.5° W.	16.52	51.0	1.39	0.7	1.46	....Sums.
26 Years means for and including this month	47 47	48.95	32.67	16.27	29 964	....	......	201	66.50	....	§16.26	¶52.09	1.623	5.29	2.161	26 Years means for and including this month.

a ANALYSIS OF WIND RECORD.

Direction.. ..	N	N. E	E.	S E.	S.	S.W.	W.	N W	CALM.
Miles	907	350	420	1157	510	4324	1307	2502	
Duration in hrs..	73	46	46	81	38	211	78	147	
Mean velocity....	1.24	7.61	9.13	1.43	1.34	2.05	1.75	1.95	

Greatest mileage in one hour was 41, on the 30th.

Greatest velocity in gusts, 48 miles per hour on the 30th.

Resultant mileage, 3,295.

Resultant direction, S. 68.5° W.

Total mileage, 11,897.

* Barometer readings reduced to sea-level and temperature 32° Fahrenheit.

‡ Humidity relative, saturation being 100.

† Mean from observations at 8, 15, and 21 hours.

¶ 19 years only. § 14 years only.

The greatest heat was 72.7 on the 21st; the greatest cold was 21.9 on the 9th, giving a range of temperature of 50.8 degrees.

Warmest day was the 21st. Coldest day was the 9th. Highest barometer reading was 30.48 on the 16th. Lowest barometer was 29.40 on the 30th, giving a range of 1.08 inches.

Minimum relative humidity observed was 34, on the 26th.

Rain fell on 15 days.

Snow fell on 5 days.

Rain or snow fell on 17 days.

Lunar halo on the 16th.

Lunar corona on the 9th.

Fog on the 2nd, 3rd, 12th, 16th, 17th, 23rd, and 29th.

AY, 1900.

Met 87 feet. C. H. McLEOD, *Superintendent.*

DAY	Per cent. possible Sunshine.	Rainfall in inches.	Snowfall in inches.	Rain and snow melted.	DAY.
1	38	....	....	....	1
2	83	....	....	....	2
3	00	0.03	....	0.03	3
4	60	...	0.0	0.00	4
5	77	....	0.0	0.00	5
SUNDAY........ 6	55	....	...	....	6...........SUNDAY
7	93	....	..	....	7
8	00	0.59	....	0.59	8
9	14	0.25	....	0.25	9
10	20	....	0.0	0.00	10
11	93	....	....	....	11
12	96	....	....	....	12
SUNDAY........13	22	....	....	....	13...........SUNDAY
14	41	0.10	....	0.10	14
15	17	0.48	....	0.48	15
16	92	....	.. .	...	16
17	00	0.92	....	0.92	17
18	00	0.16	....	0.16	18
19	34	...	....	....	19
SUNDAY........20	24	....	....	....	20......... .SUNDAY
21	00	0.26	....	0.26	21
22	100	0.00	....	0.00	22
23	89	....	....	....	23
24	78	...	....	....	24
25	95	....	....	.	25
26	96	....	....	....	26
SUNDAY........27	46	....	....	....	27...........SUNDAY
28	69	....	....	....	28
29	94	....	...	....	29
30	60	0.04	....	0.04	30
31	81	0.28	....	0.28	31
Means......	54.0	3.11	0.0	3.11	................Sums.
26 Years means for and including this month	¶51.04	29.16	....	2.969	26 Years means for and including this month.

Direction.......	
Miles	
Duration in hrs..	
Mean velocity....	

a-level and

aken from

being 100.

ours.

e 31st; the

ng a range

Greatest mile st day was the 15th.

yas 30.39 on

Greatest velo on the 3rd, hour on the 14th

Resultant mi

Minimum relative humidity observed was 40, on the 4th.

Rain fell on 11 days.

Snow fell on 3 days.

Rain or snow fell on 14 days.

An aurora was observed on the 5th.

Fog on the 3rd.

ABSTRACT FOR THE MONTH OF MAY, 1900.

Meteorological Observations, McGill College Observatory, Montreal, Canada. Height above sea level, 187 feet. C. H. McLEOD, *Superintendent.*

DAY	THERMOMETER. † Mean.	Max.	Min.	Range.	*BAROMETER. † Mean.	Max.	Min.	Range.	‡Mean relative humidity.	a WIND. General direction.	Mean velocity in miles per hour	Per cent. possible Sunshine.	Rainfall in inches.	Snowfall in inches.	Rain and snow melted.	DAY.
1	40.84	48.7	34.7	14.0	29.81	29.95	29.71	.24	62	W.	15.7	38	....	....	....	1
2	51.42	65.2	34.2	31.0	29.75	29.94	29.61	.33	58	S.E.	20.1	83	....	....	....	2
3	54.02	67.4	41.0	26.4	29.54	29.62	29.44	.18	75	S.W.	19.0	00	0.03	....	0.03	3
4	41.51	51.6	36.7	14.9	29.69	29.77	29.63	.14	61	S.W.	19.6	60	...	0.0	0.00	4
5	40.88	49.0	32.7	16.3	29.86	29.92	29.77	.15	64	S.	19.2	77	....	0.0	0.00	5
SUNDAY........ 6	42.03	53.4	35.0	18.4	29.94	30.15	29.87	.28	61	S.W.	18.8	55	....	...	....	6..........SUNDAY
7	41.39	50.4	31.2	19.2	30.18	30.27	30.10	.17	52	S.W.	15.1	93	....	..	....	7
8	44.27	47.8	36.8	11.0	29.77	30.10	29.55	.55	91	E.	16.0	00	0.59	....	0.59	8
9	38.67	44.2	33.8	10.4	29.70	29.98	29.55	.43	70	N.W.	21.8	14	0.25	....	0.25	9
10	34.54	42.0	28.0	14.0	30.00	30.04	29.96	.08	65	W.	18.9	20	....	0.0	0.00	10
11	41.45	51.2	30.7	20.5	29.97	30.05	29.90	.15	60	W.	11.0	93	....	....	....	11
12	47.24	57.3	34.0	23.3	29.98	30.07	29.91	.16	62	S.	14.9	96	....	....	....	12
SUNDAY 13	58.24	68.7	50.9	17.8	29.91	29 93	29.87	.06	55	S.W.	16.4	22	....	....	....	13..........SUNDAY
14	59.14	74 1	45.1	29.0	29 75	29.92	29 62	.30	81	S.W.	15.0	41	0.10	....	0.10	14
15	61.71	78.7	51.5	27.2	29.80	30.05	29.64	.41	89	S.W.	23.2	17	0.48	....	0.48	15
16	55 12	63.4	45.3	18.1	30.14	30.18	30.05	.13	72	N.W.	7.9	92	....	....	...	16
17	46.62	55 3	43.0	12.3	30.06	30.17	29.90	.27	87	N	16.3	00	0.92	....	0.92	17
18	45.09	48.2	42.2	6.0	29.75	29.90	29.83	.07	92	N.	16.1	00	0.16	....	0.16	18
19	49.56	57.6	42.0	15.6	29.73	29.83	29.68	.15	70	N..	19.6	34	...	....	....	19
SUNDAY........20	50.00	59.2	41.7	17.5	29.69	29.71	29.66	.05	70	N.	13 7	24	...	....	....	20.......... SUNDAY
21	47.16	53.4	42.7	10.7	29.73	29.79	29.70	.09	90	N.W.	9.7	00	0.26	....	0.26	21
22	54 82	68.8	41.6	27.2	29.80	29.89	29.77	.12	60	W.	19.1	100	0.00	....	0.00	22
23	58.60	69.7	43.1	26.6	29.92	29 99	29.86	.13	60	S.W.	12.2	89	....	....	....	23
24	52.86	73.4	49.6	23.8	29.97	30.03	29.89	.14	65	N.	17.0	78	...	....	....	24
25	61.45	73.2	46.5	26.7	30.15	30.19	30 03	.16	63	S.E.	11.8	95	....	....	.	25
26	60.99	76 1	49.0	27.1	30.13	30.23	30.00	.23	61	S.	15.7	96	....	....	....	26
SUNDAY........27	64.14	75.8	52.7	23.1	29.93	30.08	29.93	.15	72	N.	17.1	46	....	....	....	27..........SUNDAY
28	57.44	67.3	48.7	18.6	30.22	30.30	30.08	.22	61	N.	18.9	69	....	....	....	28
29	59.29	72.4	44.3	28.1	30.31	30.39	30.24	.15	59	N.	8.0	04	....	...	....	29
30	62.59	76 0	48.0	28.0	30.09	30.24	29 94	.30	74	S.	11.2	60	0.04	....	0.04	30
31	67.89	80.0	60.1	19.9	29.89	29.94	29 84	.10	73	S.W.	16.6	81	0.28	....	0.28	31
Means............	51.32	61.92	41.83	20 09	29.880	30.020	29 824	.196	68.9	W. 6.5° N.	15.99	54.0	3.11	0.0	3.11	..............Sums.
26 Years means for and including this month	64.66	64 01	45.74	18.28	29.931	......	......	.169	66.47	....	§ 14 32	¶51.04	29.16	....	2.969	26 Years means for and including this month.

a ANALYSIS OF WIND RECORD.

Direction......	N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.	CALM.
Miles	3124	472	409	1248	902	2853	1808	1082	
Duration in hrs..	193	42	28	84	68	152	105	72	
Mean velocity....	16 19	11.24	14 25	14.86	13 26	18.77	17.22	15.03	

Greatest mileage in one hour was 34 S.W. on the 15th.

Greatest velocity in gusts, 36 S.W. miles per hour on the 14th.

Resultant mileage, 2900.

Resultant direction, W. 6 5° N.
Total mileage, 11,898
Average velocity 15.99 *m.p.h.*

* Barometer readings reduced to sea-level and temperature 32° Fahrenheit.

† Mean of bi-hourly readings taken from self-recording instruments.

‡ Humidity relative, saturation being 100. Mean of observations at 8, 15, and 20 hours.

¶ 19 years only. § 14 years only.

The greatest heat was 80.0 on the 31st; the greatest cold was 28.0 on the 10th, giving a range of temperature of 52.0 degrees.

Warmest day was the 31st. Coldest day was the 10th. Highest barometer reading was 30.39 on the 29th. Lowest barometer was 29.44 on the 3rd, giving a range of .95 inches.

Minimum relative humidity observed was 40, on the 4th.

Rain fell on 11 days.

Snow fell on 3 days.

Rain or snow fell on 14 days.

An aurora was observed on the 5th.

Fog on the 3rd.

NE, 1900.

7 feet. C. H. McLEOD, *Superintendent.*

DAY	Per cent. possible Sunshine.	Rainfall in inches.	Snowfall in inches.	Rain and snow melted.	DAY.
	85	0.00	....	0.00	1
	02	1.96	....	1.96	2
SUNDAY........	30	....	....	....	3 .... SUNDAY
	98	...	....	....	4
	99	....	....	....	5
	92	....	.	....	6
	00	0.18	..	0.18	7
	51	0.00	....	0.00	8
	98	....	....	....	9
SUNDAY........	99	....	....	....	10........... SUNDAY
	46	0.03	....	0.03	11
	98	....	....	....	12
	87	....	....	....	13
	48	0.49	....	0.49	14
	99	....	.. .	....	15
	82	0.01	....	0.01	16
SUNDAY........	99	....	....	....	17.......... SUNDAY
	99	....	....		18
	99	....	....	....	19
	9[illegible]	....	....	....	20
	93	....	....	....	21
	34	0.09	....	0.09	22
	99	...	....	....	23
SUNDAY........	46	0.05	....	0.05	24 .... SUNDAY
	99	0.05	....	0.05	25
	31	0.02	...	0.02	26
	33	1.32	....	1.32	27
	65	....	....	....	28
	46	0.04	....	0.04	29
	00	0.09	....	0.09	30
Means......	63.5	4.33	....	4.33	.... Sums.
26 Years means for and including this month	¶54.63	3.587	....	3.587	26 Years means for and including this month.

a-level and

aken from

Direction.......

Miles ....

being 100.
ours.

Duration in hrs..

Mean velocity....

e 27th; the
ing a range

Greatest mile est day was
southwest on the was 30.19 on
Resultant mi on the 29th,
Resultant dir

Minimum relative humidity observed was 44, on the 19th.

Rain fell on 14 days.

Fog on 3 days.

ABSTRACT FOR THE MONTH OF JUNE, 1900.

Meteorological Observations, McGill College Observatory, Montreal, Canada. Height above sea level, 187 feet. C. H. McLEOD, *Superintendent.*

DAY	THERMOMETER. † Mean.	Max.	Min.	Range.	*BAROMETER. † Mean.	Max.	Min.	Range.	‡Mean relative humidity.	WIND. General direction.	Mean velocity in miles per hour	Per cent. possible Sunshine.	Rainfall in inches.	Snowfall in inches.	Rain and snow melted	DAY.
1	71.12	79 2	60 2	19.0	29.97	30.05	29.90	.15	61	N	9 0	85	0.00	....	0.00	1
2	60.31	67.4	57.6	9.8	29.80	29.94	29.72	.22	92	N.E.	19.0	02	1.96	....	1.96	2
Sunday........ 3	59.40	68.0	53.5	14.5	30.04	30.15	29.83	.32	59	N.	20.8	30	....	....	....	3 .... .Sunday
4	62.73	74.5	49.0	25.5	30.13	30.21	30.04	.17	72	S.	9.2	98	...	....	....	4
5	68.41	76.6	58.0	18.6	30.00	30.04	29.96	.08	74	S.W.	16.9	99	....	....	....	5
6	69.37	81.3	58.0	23 3	29 96	30.05	29.84	.21	70	S.	8.8	92	....	.	....	6
7	67.72	74.5	62.5	12.0	29.74	29.84	29.64	.20	89	S.E.	16.6	00	0.18	..	0.18	7
8	70.82	80.6	65.3	15.3	29.66	29.69	29.64	.05	81	S.	11.5	51	0.00	....	0.00	8
9	62 43	69.8	55.6	14.2	29.87	30.08	29.67	.41	71	W.	12.5	98	....	....	....	9
Sunday........10	59 61	68.4	47.6	20.8	30 04	30.17	29.88	.29	62	S.E.	11.0	99	....	....	....	10..........Sunday
11	68.15	79.3	59.9	19.4	29.84	29.88	29.80	.08	74	S.	18.4	46	0.03	....	0.03	11
12	61.57	68.3	54.2	14.1	30.12	30.18	29.88	.30	65	N.W.	11.4	98	....	....	....	12
13	65.02	77.5	50.0	27.5	30.08	30.18	29.96	.22	68	S.E.	12 6	87	....	...	....	13
14	64.71	75.0	54.6	20.4	29.86	29 96	29.81	.15	81	S.	20.6	48	0.49	...	0.49	14
15	63.94	72.7	53.2	19.5	30.02	30.08	29.93	.15	63	S.W.	21.2	99	....	...	....	15
16	66.42	76.0	56.3	19.7	29.97	30.02	29.92	.10	68	S.W.	13.0	82	0.01	....	0.01	16
Sunday....... 17	59 85	67.2	49.4	17.8	30.04	30.07	29.97	.10	65	N.	8.2	99	....	....	....	17......... .Sunday
18	62.34	72.0	49.3	22.7	30.12	30.15	30.06	.09	68	N.	14.0	99	....	....		18
19	68.99	78.8	54.8	24.0	30.13	30.19	30.07	.12	60	N	8.6	99	....	....	....	19
20	73 07	83.9	60.0	23.9	29.93	30.07	29 80	.27	58	S.W.	19.6	99	....	....	....	20
21	70.39	80.0	60.0	20.0	29.74	29.81	29.67	.14	68	S.W.	23.5	93	....	....	....	21
22	60.65	67.9	52.6	15.3	29.81	29 91	29.69	.22	82	S.W.	11.1	34	0.09	....	0.09	22
23	62 11	72.0	49.9	22.1	29.93	29.99	29.87	.12	71	S.	11.1	99	...	....	....	23
Sunday........24	69 53	78.4	61.5	16.9	29.74	29.87	29.62	.25	70	S.W.	21.9	46	0.05	....	0.05	24 ....Sunday
25	67 97	74.7	63.0	11.7	29.78	29 89	29 62	.27	62	W.	14.7	99	0.05	....	0.05	25
26	63.97	74.0	53.3	20.7	29.80	29.89	29.65	.24	81	S E.	7.5	31	0.02	...	0.02	26
27	69.13	86.0	56.0	30.0	29.55	29.67	29.48	.19	97	S.W.	19.9	33	1.32	....	1.32	27
28	71.60	77.3	66.0	11.3	29.55	29.60	29.50	.10	68	S.W.	12.2	05	....	....	....	28
29	62 00	74.0	51.0	23.0	29.49	29 59	29.37	.22	76	S.W.	20.2	46	0 04	....	0.04	29
30	51.49	56.6	47.5	9.1	29.60	29.76	29.46	.30	84	S.W.	39 5	00	0.09	....	0.09	30
Means............	65.16	74.40	55.66	18.74	29.877	29.966	29 775	.191	75.3	S. 48.8° W.	15.49	63.5	4.33	....	4.33	................Sums.
26 Years means for and including this month	64.90	73.66	56.34	17.55	29.905	......	......	.154	70.18	....	§ 13 20	¶54.63	3.587	....	3 587	26 Years means for and including this month.

ANALYSIS OF WIND RECORD.

Direction......	N.	N.E.	E.	S E.	S.	S.W.	W.	N.W.	Calm.
Miles	1876	376	145	1374	893	5144	835	503	
Duration in hrs..	148	31	16	98	75	244	60	48	
Mean velocity....	12.7	12.1	9.0	14 0	11 9	21.1	13.9	10.5	

Greatest mileage in one hour was 49 from the southwest on the 30th.

Resultant mileage, 4590.

Resultant direction, S. 48.8° W.

Total mileage, 11,156.

Mean velocity—, 15 49 miles per hour.

* Barometer readings reduced to sea-level and temperature 32° Fahrenheit.

† Mean of bi-hourly readings taken from self-recording instruments.

‡ Humidity relative, saturation being 100. Mean of observations at 8, 15, and 20 hours.

¶ 19 years only. § 14 years only.

The greatest heat was 86.0 on the 27th; the greatest cold was 47.5 on the 30th, giving a range of temperature of 38.5 degrees.

Warmest day was the 20th. Coldest day was the 30th. Highest barometer reading was 30.19 on the 19th. Lowest barometer was 29.37 on the 29th, giving a range of .82 inches.

Minimum relative humidity observed was 44, on the 19th.

Rain fell on 14 days.

Fog on 3 days.

Published quarterly; Price $3.00 the Volume of eight numbers.

VOLUME VIII. NUMBER 5.

THE CANADIAN RECORD OF SCIENCE

INCLUDING THE PROCEEDINGS OF
THE NATURAL HISTORY SOCIETY OF MONTREAL,
AND REPLACING

THE CANADIAN NATURALIST.

CONTENTS.

PAGE

Some Palæobotanical Aspects of the Upper Palæozoic in Nova Scotia. By PROF. DAVID WHITE, U.S. National Museum, Washington, D.C. 271

Additional Notes on the Flora of Cap-à-l'Aigle. By ROBERT CAMPBELL, M.A., D.D. 281

On a New or hitherto Unrecognized Geological Formation in the Devonian System of Canada. By H. M. AMI, D.Sc 296

An Hour's Botanizing on the Mountain Side. By JOHN DEARNESS 306

The Canadian Marine Biological Station. By F. SLATER JACKSON, M.D. 308

A Hornblende Lamprophyre Dyke at Richmond, P.Q. By JOHN A. DRESSER 315

Was Mount Royal an Active Volcano? By J. S. BUCHAN, K.C., B.C.L. 321

Addenda and Corrigendum to "Progress of Geological Work in Canada during 1899." By H. M. AMI, D.Sc. 329

Palæontological Note. By H. M. AMI, D.Sc 331

Book Notices 333

MONTREAL:
PUBLISHED BY THE NATURAL HISTORY SOCIETY.

LONDON, ENGLAND: COLLINS, 157 Great Portland St.

BOSTON, MASS.: A. A. WATERMAN & Co., 36 Bromfield St.

1901.

NATURAL HISTORY SOCIETY OF MONTREAL

[*Incorporated* 1832.]

OFFICERS—SESSION 1900-1901.

Patron:

HIS EXCELLENCY THE GOVERNOR-GENERAL OF CANADA.

Hon. President:

LORD STRATHCONA AND MOUNT ROYAL.

President:

REV. ROBT. CAMPBELL, M.A., D.D.

Vice-Presidents:

FRANK D. ADAMS, Ph.D., F.R.S.C.
B. J. HARRINGTON, Ph.D., F.R.S.C.
HON. J. K. WARD.
PROF. E. W. MACBRIDE, M.A., D.Sc.
C. T. WILLIAMS.
J. H. JOSEPH.
HON. JUSTICE WÜRTELE.
A. HOLDEN.
T. WESLEY MILLS, M.A., M.D.

Hon. Recording Secretary:

CHAS. S. J. PHILLIPS.

Hon. Corresponding Secretary:

J. S. BUCHAN, Q.C., B.C.L.

Honorary Treasurer:

F. W. RICHARDS.

Curator:

ALFRED GRIFFIN.

Members of Council:

ALBERT HOLDEN, *Chairman.*

J. A. U. BEAUDRY, C.E.
E. T. CHAMBERS.
JOSEPH FORTIER.
N. N. EVANS, M.A.Sc.
EDGAR JUDGE.
DR. GIRDWOOD.
H. MCLAREN.
GEO. SUMNER.
JOHN HARPER.

Editing and Exchange Committee:

REV. ROBT. CAMPBELL, M.A., D.D., *Chairman.*

FRANK D. ADAMS, Ph.D., F.R.S.C.
J. S. BUCHAN, Q.C., B.C.L.
PROF. J. T. DONALD.
A. T. DRUMMOND, LL.D., Kingston, Ont.
PROF. E. W. MACBRIDE, M.A., D.Sc.
G. F. MATTHEW, LL.D., F.R.S.C., St. John, N.B.
T. WESLEY MILLS, M.A., M.D.
J. F. WHITEAVES, Ottawa, Ont.

Library Committee:

E. T. CHAMBERS, *Chairman.*

J. A. U. BEAUDRY, C.E.
A. E. NORRIS.
JOSEPH FORTIER,
ALFRED GRIFFIN.
G. M. TOD.
C. T. WILLIAMS.

Museum Committee:

A. E. NORRIS, *Chairman.*

REV. ROBT. CAMPBELL, M.A., D.D.
G. A. DUNLOP.
O. E. LEROY, B.A.
A. B. DUMOUCHEL.
PROF. E. W. MACBRIDE, M.A., D.Sc.
J. B. PICKEN.
H. E. VENNOR.

Field Work Committee:

C. T. WILLIAMS, *Chairman.*

FRANK D. ADAMS, Ph.D., F.R.S.C.
J. S. BUCHAN, Q.C., B.C.L.
REV. ROBT. CAMPBELL, M.A., D.D.
ALBERT HOLDEN.
O. E. LEROY, B.A.
PROF. E. W. MACBRIDE, M.A., D.Sc.
J. B. PICKEN.
F. W. RICHARDS.
REV. G. COLBORNE HEINE, B.A.

Lecture Committee:

REV. G. COLBORNE HEINE, B.A., *Chairman.*

REV. ROBT. CAMPBELL, M.A., D.D.
PROF. JOHN COX, M.A.
J. S. BUCHAN, Q.C., B.C.L.
N. N. EVANS, M.A.Sc.
B. J. HARRINGTON, Ph.D., F.R.S.C.
CHAS. S. J. PHILLIPS.
EDGAR JUDGE.
T. WESLEY MILLS, M.A., M.D.
HON. JUSTICE WÜRTELE.

House Committee:

ALBERT HOLDEN, *Chairman.*

H. MCLAREN.
C. T. WILLIAMS.

Membership Committee:

EDGAR JUDGE, *Chairman.*

J. A. U. BEAUDRY, C.E.
REV. ROBT. CAMPBELL, M.A., D.D.
ALBERT HOLDEN.
HON. J. K. WARD.
H. MCLAREN.
CHAS. S. J. PHILLIPS.
GEO. SUMNER.
C. T. WILLIAMS.

Superintendent:

ALFRED GRIFFIN.

THE

CANADIAN RECORD

OF SCIENCE.

VOL. VIII. JANUARY, 1901. No. 5.

Some Palæobotanical Aspects of the Upper Palæozoic in Nova Scotia.

By David White.

Introduction.

In a recent issue of the Transactions of the Nova Scotia Institute of Science[1] Mr. Hugh Fletcher, geologist of the Canadian Survey, presents correlations of the Upper Palæozoic formations by palæontologists in marked contradiction with stratigraphic determinations by himself and other geologists in Nova Scotia. Confident of the validity of identification on stratigraphic evidence only, he rejects the palæontological correlations, which he finds incompatible with the supposed order of succession of the strata, as well as totally erroneous as to the age of the terranes. The difference of statement involves broad questions, such as the reference of formations to one great period or another, to middle Carboniferous or middle Devonian.

[1] Vol. X., 1899-1900, pp. 235-244. Geological Nomenclature in Nova Scotia.

Since the palæontological correlations that Mr. Fletcher finds so misleading are largely based on the evidence of fossil plants; and since he does me the honor to mention my opinions regarding the equivalents of several of the Upper Palæozoic formations, I herein present somewhat more definitely the palæontological evidence as seen from my own standpoint. At the same time a seeming discrepancy between one of my correlations and that of the same flora by Mr. Kidston, whom Mr. Fletcher also quotes, will be explained.

From the outset it must be borne in mind that I personally have not visited the region in question, and the views expressed regarding the ages of several of the Nova Scotia plant beds are based exclusively on palæontological evidence, interpreted in accordance with our knowledge of the fossil floras of the Appalachian province or of Europe. Reasoning from the observed vertical and horizontal distribution both of identical and of related genera and species, and especially from the stratigraphical occurrence of identical or essentially identical floras, I shall state (1) what, in my judgment, are the approximate positions of the respective plant beds as naturally indicated by the floras, and (2) the maximum of time latitude within which the floras should fall. The correlations are theoretical, and may be slightly modified by local stratigraphical conditions. Such a method is liable to error, but the errors, if the conclusions are based on ample fossil material, should fall within reasonable limits of proximity to the truth. Surely the coefficient of error should not be so great as to permit an entire geological period to intervene between its palæontologically theoretical position and its actual place.

Only those portions of the formations actually furnishing the plant material are included in this discussion. It is conceived that the time interval represented by one or more of the enormously thick subdivisions of the Nova

Scotia Carboniferous may include more than one flora, and that when such cases occur, both floras may not be referable to the same stage.

The sequence and correlations of the rocks in question as worked out by Dr. Ells and Mr. Fletcher on the stratigraphic basis is shown in the following table extracted from the correlation chart in Mr. Fletcher's paper. The correlations by Mr. Kidston and myself are also quoted from the same chart. It will be understood that in adjusting palæontological correlations to the diagrammatic classification of such a chart it is sometimes necessary to restrict them to narrower limits than the author originally intended, while at the same time the conception both of proportion and of emphasis is lost. Thus a tentative or suggested correlation that is limited in its geological range is often quoted instead of the correlation that is positive but of greater latitude. Usually no distinction is made between definite correlations, opinions as to probable age, and mere suggestions. Neither does such a chart indicate the sufficiency or meagreness of the material on which the correlation is based.

Canadian Geological Survey.	Ells & Fletcher in Nova Scotia.	R. Kidston.	David White.	
Permian.	Permian or Upper Carboniferous.	Union ?	....	Carboniferous.
Coal Measures.	Coal Measures.	Riversdale, Harrington River and Cordaite Shales (St. John Devonian).	Union ?	
Millstone Grit.	Millstone Grit.	....	Riversdale and Cordaite Shales (Devonian of St. John, N.B.)	
Carboniferous Limestone.	Carboniferous Limestone.	....	....	
Carboniferous Conglomerate.	Carboniferous Conglomerate.	Horton (Lower Carboniferous of England).	Horton (Pocono of Pennsylvania, Waverly. Newer than Kiltorcan).	

Canadian Geological Survey.	Ells & Fletcher in Nova Scotia.	R. Kidston.	David White.	
Catskill. Chemung.	Union, including rocks of MacAra Brook, Lochaber and Economy.	....	....	Devonian.
Hamilton.	Riversdale, Harrington River (4000 ft.) MacKay Head and Horton.	....	....	
Corniferous.	Basal Conglomerate.	....	....	

The Horton Plant Beds.

The Horton Bluff terrane, as recognized by Sir William Dawson (1843) and Sir Charles Lyell (1847), is referred by Dr. Ells and Mr. Fletcher to the Hamilton, it being apparently included in the Riversdale series. The Horton plant beds are characterized by a very peculiar flora containing an abundance of both *Aneimites Acadicus* and *Lepidodendron corrugatum* with its numerous decorticated phases, together with one or more higher types of *Lepidodendron* and a singular form of *Sphenopteris*. *Aneimites* appears to be an exclusively Carboniferous genus. The Lepidodendra are larger and more advanced, with larger bolsters than any known Devonian type. Biologically the flora is distinctly younger than any yet found in undisputed Devonian rocks, and it appears to be even more modern than the Ursa[1] flora.

Essentially the same flora is everywhere characteristic of the Pennsylvania and Virginia Pocono, with which the Horton flora was correctly correlated by Sir William Dawson as long ago as 1873. Not only is the Pocono similarly marked by an abundance of *Lepidodendron corrugatum*, but by the hardly less abundant *Aneimites*, some

[1] The Ursa stage, typical in Bear Island and Spitzbergen, is generally included within the lower limit of the Carboniferous, though by some geologists it is regarded as transitional from Devonian to Carboniferous.

of whose forms are hardly separable from the Acadian type. The Nova Scotian flora appears also to correspond to the Calciferous Sandstone series of Scotland, as has also been indicated by Mr. Kidston, who so ably elaborated the latter flora. The Horton plant terrane should, on purely palæobotanical grounds, lie below the typical Carboniferous Limestone; but I believe it should go hardly so low as the Ursa stage, or below the boundary generally accepted for the Lower Carboniferous. While granting that certain of the rocks included by the Nova Scotia geologists under the Hamilton rubric may be Hamilton in age, I do not hesitate to insist that the Horton plant beds are not earlier, at most, than the Ursa stage.

The Riversdale and Harrington River Plant Beds.

The plant beds near Riversdale and Harrington River also are assigned to the Middle Devonian by the Nova Scotia geologists. The Riversdale plants were, in 1873, correlated by Sir William Dawson with the Millstone Grit. Although but a small quantity of plant material from these beds has come under my personal observation, even this, which includes typical representatives of *Neuropteris, Alethopteris, Annularia, Cordaites* and *Cardiocarpon*, is unequivocally Carboniferous.[1] Whether interpreted by the specimens in hand or the lists submitted by Mr. Kidston (who reached nearly the same conclusion), it is clear that the Riversdale-Harrington River plants are most closely allied to the flora of the Canadian Millstone Grit, or, more explicitly, to the plants of the Pottsville formation in the Appalachian trough. Taking into account the small amount of plant material, and the limited number of fern species, it appears unwise to insist on

1 Recently Dr. H. M. Ami, of the Geological Survey of Canada, has announced the discovery, in the Harrington River beds, of specimens of *Whittleseya*, an American genus as yet unknown below the Pottsville formation. See the Ottawa *Naturalist*, Vol. XIV., Aug., 1900.

an absolute correlation with the Pottsville, to whose flora nearly all of the species from the beds in question are common. On the other hand the plants from the Riversdale beds are practically totally different from, as well as assuredly younger than, the Horton flora.

From the palæobotanical standpoint there appears to be little room for the belief that the Riversdale-Harrington River plant beds may in any case be lower than the St. Louis, while on the other hand the plants seem strongly to indicate a level at or above the top of the Lower Carboniferous. At the present stage of our knowledge of the fossil floras these beds can not, without disregarding palæobotany, be correlated with beds below the Carboniferous Limestone (Windsor) unless it be understood that the Limestone is no older than the upper portion of the Lower Carboniferous. The Mississippian equivalents of the Carboniferous limestone (Windsor) and the time interval which it covers are not yet definitely ascertained; but, if it represents one or more stages in the lower portion of the Lower Carboniferous, my observations of the plants of the Devonian, Pocono, Mauch Chunk and Pottsville formations in the Allegheny region, and my faith in the validity of their evidence, lead me to urge that the Riversdale and Harrington River plant beds are probably above the Carboniferous Limestone, though, if the latter extends without unconformity up to the Millstone Grit, they may lie within it. They can not be Middle Devonian. If the extrusions of eruptive rock cut the Riversdale plant formation, as is stated by the Nova Scotia geologists, the metamorphic action is certainly Carboniferous, and it appears probable that it can not very long antedate the close of the Lower Carboniferous.

Possibly Dr. Ells and Mr. Fletcher were influenced in referring the Riversdale beds to the Middle Devonian through first correlating them with the "fern ledges" at St. John, N.B. It would be a singular incident in palæontology if the Riversdale plants, whose correlation by Sir William Dawson with the Millstone Grit is not likely to prove far from correct, were now to be pronounced Devonian on account of their palæontological identity with the fern ledges whose erroneous reference to the Devonian was earlier forced upon Sir William by the findings of the stratigraphers. The study of the plants collected at several hundred localities in the Pottsville formation along the Appalachian trough proves conclusively that the St. John flora is from nearly the same stage, while, as I have elsewhere pointed out,[1] it is probable that a portion of the section at the "fern ledges"[2] is contemporaneous with the upper portion of the Pottsville.

THE MACKAY'S HEAD PLANT BEDS.

MacKay's Head, another of the sections now placed in the Hamilton, furnished a number of the species described in 1873 by Sir William Dawson and referred by him to the Millstone Grit. Dawson's list includes alternate-ribbed species of *Calamites,* a large Carboniferous type of *Lepidodendron* identified by him as *L. aculeatum,* a fern figured as "*Odontopteris?*", and other ferns identified as *Alethopteris lonchitica* and *Sphenopteris obtusiloba.* These species, though few in number, are recognized by palæobotanists as distinctly Carboniferous. The material is hardly sufficient for a definite correlation, but it seems probable that the flora, especially the *Lepidodendron* and the *Alethopteris,* will eventually be found to lie above the Carboniferous Limestone. The small amount of published plant evidence points towards the Pottsville or Millstone Grit, to which the MacKay's Head beds were referred by Sir William Dawson.

1 20th Ann. Rept. U.S. Geol. Surv., pt. 2, 1900, pp. 913, 917.

2 Dr. G. F. Matthew suggests the reference of a portion of the St. John fern ledges to the Silurian.

Discussion of the Problem.

From the foregoing it will be seen that the reference by Mr. Fletcher and Dr. Ells of the Riversdale-Harrington River and MacKay's Head plant beds to the Hamilton would necessitate the existence of essentially Middle Carboniferous floras in the Middle Devonian. This could be admitted only on absolutely indisputable stratigraphical evidence, such as their occurrence in a continuous normal section, with abundant characteristic Middle Devonian marine fossils in close association or appropriate sequence. Evidence of this character appears to be wholly absent or quite inconclusive. It does not appear that the testimony of the animal fossils from the plant beds differs widely from that of the plants. The contradictions between the correlations by stratigraphy and those of palæozoologists[1] are perhaps less striking only because the evidence of invertebrate fossils is less abundant or is of a class of animals (*e.g.* Phyllopoda and Anthracomyæ) of somewhat uncertain stratigraphical value.

The grounds for confidence in the palæobotanical evidence are strong. The plant remains on either side of the Lower Carboniferous—*i. e.* in the Devonian and in the Upper Carboniferous—exhibit the same succession of essentially identical contemporaneous floras in New Brunswick and in other regions of Nova Scotia as well as in the United States. This presumptive evidence in favor of the contemporaneity or approximate contemporaneity of the floras of the Lower Carboniferous and Pottsville (Millstone Grit) of the United States and Europe on the one hand with the corresponding floras of the Horton and Riversdale beds of Nova Scotia on the other hand is supported by the geographical relations as well as the conditions of migration. A land stretch of no very great extent, and at times reduced to a lowland, between the Nova Scotia and

1 Dr. Ami places the Riversdale beds within the Carboniferous period, but at the base of the Lower Carboniferous. (See Trans. Nova Scotia Inst. Science, Vol. X., p. 171.)

the Appalachian basins, must have been clothed throughout by the general flora characteristic of the particular geological time; and on the occasions of the great floral changes of the earth it should, with the important aid of air and water currents, have carried migrating species so rapidly from shore to shore that the period of each successive flora would be essentially contemporaneous in either basin. In view of these relations only undeniable stratigraphic evidence can prove that the identical floras do not belong to the same great period, and that we have in Nova Scotia the unique phenomenon of a typical middle Carboniferous flora in rocks of the middle Devonian. Such an occurrence, as yet unknown elsewhere in North America or Europe, and in direct contradiction of all biopalæobotanical data, would scarcely be harder to explain for one district than would it be to account for its absence in other regions of the Northern hemisphere.

The existence of the wide gulf between the correlations by stratigraphy and those by palæontology does not admit of the conclusion that the verdict of the stratigraphers is final. With all respect for their ability and the conscientious character of their work in a field offering great difficulties of surface concealment, it is still proper to enquire of the Nova Scotia geologists if there is not a further stratigraphical explanation; whether, for instance, certain plant beds at different points may not have been wrongly correlated in carrying the stratigraphical identifications across to the type (reference) sections; or whether the Carboniferous Limestone of their sections is not much younger than is generally supposed; or whether certain of the superpositions are not possibly due to overthrust faulting.

Note of Explanation.

A seeming discrepancy between Mr. Kidston's and my own correlations of the Riversdale-Harrington River plants appears in Mr. Fletcher's table,[1] where Mr. Kidston is recorded as referring these beds to the Coal Measures, while I am quoted as correlating them with the Pottsville (Millstone Grit). This difference represents only a variation in the nomenclature of the Coal Measures in Great Britain and in America. The upper portion of the Pennsylvanian Pottsville appears, as I have elsewhere indicated,[2] to be contemporaneous with the Lower Coal Measures of Europe, while the succeeding beds in the northern Appalachian area of this country represent the Middle Coal Measures, etc., of the Old World. Accordingly my correlation of the fern beds at St. John with the upper Pottsville nearly corresponds to Mr. Kidston's correlation with the Lower Coal Measures. I do not insist that the Riversdale plants are necessarily so late as the Pottsville, though I believe they belong close to, if not in, the Pottsville stage. It is interesting to note that the conclusions reached by Mr. Kidston and myself, each independently and without the knowledge of the other, as to the age of the plant beds under discussion, are nearly identical. Not less interesting is it that our conclusions, with the exception of those relating to the St. John fern ledges, tend in general to sustain the correlations made by Sir William Dawson thirty years or more ago.

So far as I can recollect, I have never seen a fossil from the Union, or expressed an opinion as to the age of that formation, which in Mr. Fletcher's table I am credited as doubtfully referring to the Coal Measures. The terranes referred by Mr. Fletcher to this formation, which from the descriptions seems to have some features in common with the Catskill, do not appear to have yet yielded plant remains of stratigraphical value.

1 Op. cit., p. 243. See p. 3 of this paper.

2 Bull. Geol. Soc. America, Vol. XI., pp. 166, 173; 20th Ann. Rept. U.S. Geol. Surv., pt. 2, pp. 912, 917.

ADDITIONAL NOTES ON THE FLORA OF CAP-À-L'AIGLE.

By REV. ROBERT CAMPBELL, M.A., D.D.,

In the RECORD OF SCIENCE, Vol. IV., No. 1, pp. 54–68, and Vol. V., No. 1, pp. 38–40, appeared lists of plants collected at Cap-à-l'Aigle, County of Charlevoix, up to that date. The work of noting the plants of that region has gone on from year to year, during the latter part of July and the first three weeks of August. The Laurentian Mountains form not only the background of the landscape but also the backbone of the Flora, if I may be allowed a free metaphor. If the rocks that face those mountains are the oldest on the earth's crust, as is generally held, then the plant-life developed on them may be regarded as also the oldest that exists in the world, since the geological evidence indicates that the north-eastern portion of the continent was the earliest to emerge from the primeval waters. On this ground a special interest attaches to the flora of the Saguenay basin and the heights of Labrador beyond. It will be observed that the district is specially fruitful in sedges, rushes, grasses and other endogenous plants. The following catalogue embraces all the additional species that I have noted up to date :

OSMUNDACEÆ R. BR.

OSMUNDA REGALIS L.—*Royal Fern.*—Loutre Marsh. July.

POLYPODIACEÆ R. BR.

WOODSIA ILVENSIS (L.) R. BR.—*Rusty Woodsia.*—Cap-à-l'Aigle rocks. August.

CYSTOPTERIS BULBIFERA (L.) BERNH.—*Bulblet Cystopteris.*—Banks of St. Lawrence. August.

CYSTOPTERIS FRAGILIS (L.) BERNH.—*Brittle Fern.*—In many places. July.

DRYOPTERIS FRAGRANS (L.) SCHOTT.—*Fragrant Shield-fern.*—One clump found on top of a mountain. August.

PHEGOPTERIS PHEGOPTERIS (L.) UNDERW.—*Long Beech-fern.*—In high woods at Cap-à-l'Aigle.—August.

PHEGOPTERIS HEXAGONOPTERA (MICHX.) FEE.—*Broad Beech-fern.*—In same localities as the last. August.

CRYPTOGAMMA ACROSTICHOIDES R. BR.—*American Rock-brake.*—On rocks on banks of St. Lawrence. August.

PELLÆA STELLERI (S. G. GMEL.) WATT.—*Slender Cliff-brake.*—On cliffs at Pointe-à-Pic. August.

LYCOPODIACEÆ MICHX.

LYCOPODIUM SELAGO L.—*Fir Club-moss.*—In moist woods. August.

LYCOPODIUM LUCIDULUM MICHX.—*Shining Club-moss.*—In similar localities. August.

LYCOPODIUM ANNOTINUM L.—*Stiff Club-moss.*—In the same district.

LYCOPODIUM CLAVATUM L.—*Running Pine.*—Dry woods. August.

LYCOPODIUM COMPLANATUM L.—*Trailing Christmas Green.*—Also in dry woods. August.

PINACEÆ LINDL.

PINUS DIVARICATA (AIT.) LUDW.—*Labrador Pine.*—Abundant on the heights. August.

JUNIPERUS NANA WILLD.—*Low Juniper.*—In former list called *Juniperus communis.*

TAXUS MINOR (MICHX.) BRITTON.—*American Yew.*—Not rare. August.

TYPHACEÆ J. ST. HIL.

SPARGANIUM EURYCARPUM ENGELM.—*Broad-fruited Bur-reed.*—Common. August.

ALISMACEÆ D.C.

Sagittaria latifolia Willd.—*Broad-leaved Arrow-head.*—Common. August.

Sagittaria arifolia Nutt.—*Arum-leaved Arrow-head.* Common. August.

Sagittaria cuneata Sheldon.—*Floating Arrow-head.* —Rarer. August.

Sagittaria gramineæ Michx.—*Grass-leaved Arrow-head.* —Common. August.

GRAMINEÆ Juss.

Ixophorus viridis (L.) Nash.—*Green Fox-tail.*—Common, August.

Phleum alpinum (L.)—*Mountain Phleum.*—On Cap-à-l'Aigle Mts. August.

Cinna latifolia (Trev.) Griseb.—*Slender Wood Reed-grass.*—Common in high woods. August.

Agrostis rupestris Allioni.—*Rock Bent-grass.*—Port-à-Persil. August.

Agrostis perennans (Walt.) Tuckerm.—*Thin-grass.* —Common on hills. August.

Agrostis hyemalis (Walt.) B.S.P.—*Rough Hair-grass.* —Common on dry hills. August.

Calamagrostis Canadensis (Michx.) Beauv.—*Blue-joint grass.*—In wet places. Common. August.

Calamagrostis Langsdorfii (Link.) Trin.—*Langsdorf's Reed-grass.*—In less moist localities than the last. August.

Ammophila arenaria (L.) Link.—*Sea Sand-reed.*—Very common on sea-shore. August.

Trisetum subspicatum (L.) Beauv.—*Narrow False Oat.* —On rocks near Cap-à-l'Aigle wharf. Rare. August.

Danthonia spicata (L.) Beauv.—*Common Wild-oat Grass.*—Common. July.

Spartina cynosuroides (L.) Willd.—*Tall Marsh-grass.* —Moist places near the shore. August.

CATABROSA AQUATICA (L.) BEAUV.—*Water Whorl-grass.* —Near mill on Salmon River. July.

DACTYLIS GLOMERATA L.—*Orchard Grass.*—Common. July.

POA ANNUA L.—*Low Spear-grass.*—Common. July.

POA COMPRESSA L.—*Wire-grass.*—Common. July.

POA ALPINA L.—*Alpine Spear-grass.*—Common. August.

POA NEMORALIS L.—*Wood Meadow-grass.*—In high woods. August.

POA FLAVA L.—*False Red-top.*—In swamps. August.

POA DEBILIS TORR.—*Weak Spear-grass.*—In woods. August.

POA ALSODES A. GRAY.—*Grove Meadow-grass.*—In woods. August.

PANICULARIA CANADENSIS (MICHX.) KUNTZE.—*Rattle-snake grass.*—Marshy ground. August.

PANICULARIA ELONGATA (TORR.) KUNTZE.—*Long Manna-grass.*—In wet woods. August.

PANICULARIA NERVATA (WILLD.) KUNTZE. — *Nerved Manna-grass.*—In damp ground. August.

PANICULARIA AMERICANA (TORR.) MACM.—*Reed Meadow-grass.*—Common in damp places. July.

PANICULARIA FLUITANS (L.) KUNTZE.—*Floating Manna-grass.*—In wet ground. August.

FESTUCA RUBRA L.—*Red Fescue-grass.*—On the hill-tops. August.

FESTUCA OVINA L.—*Sheep's Fescue-grass.*—In pasture fields. July.

BROMUS CILIATUS L.—*Fringed Brome-grass.*—In woods. August.

BROMUS KALMII A. GRAY.—*Kalm's Chess.*—In woods near the St. Lawrence. August.

BROMUS SECALINUS L.—*Chess.*—In grain fields. July.

LOLIUM PERENNE L.—*Rye-grass.*—Common. July.

AGROPYRON REPENS (L.) BEAUV.—*Couch-grass.*—Common. July.

AGROPYRON VIOLACEUM (HORNEM.) VASEY.—*Purplish Wheat-grass.*—Occasionally met with. August.

HORDEUM JUBATUM L.—*Squirrel-tail Grass.*—On road-side. August.

ELYMUS ARENARIUS L.—*Downy Lyme-grass.*—On the shore. August.

CYPERACEÆ J. ST. HIL.

CYPERUS ESCULENTUS L.—*Yellow Nut-grass.*—In moist fields. August.

ELEOCHARIS PALUSTRIS (L.) R. & S.—*Creeping Spike-rush.*—In marshes. August.

ELEOCHARIS ACICULARIS (L.) R. & S.—*Needle Spike-rush.* In wet ground. July.

ELEOCHARIS ACUMINATA (MUHL.) NEES.—*Flat-stemmed Spike-rush.*—In moist places. August.

SCIRPUS LACUSTRIS L.—*Great Bulrush.*—In shallow ponds. July.

SCIRPUS FLUVIATILIS (TORR.) A. GRAY.—*River Bulrush.* —Near l'Outre River. August.

SCIRPUS ATROVIRENS MUHL.—*Dark Green Bulrush.*—Common in swamps. July.

SCIRPUS MICROCARPUS PRESL.—*Small-fruited Bulrush.*—In wet woods. August.

SCIRPUS CYPERINUS (L.) KUNTH.—*Wool-grass.*—In wet places. August.

CAREX LUPULINA MUHL.—*Hop Sedge.*—Common in swamps. July.

CAREX UTRICULATA BOOTT.—*Bottle Sedge.*—Banks of Salmon River. July.

CAREX RETRORSA SCHWEIN.—*Retrorse Sedge.*—In low ground. August.

CAREX LURIDA PARVULA (PAINE) BAILEY.—*Small Sallow Sedge.*—Iu springy ground. July.

CAREX HYSTRICINA MUHL.—*Porcupine Sedge.*—In low meadows. August.

CAREX PSEUDO-CYPERUS L.—*Cyperus-like Sedge.*—In bogs. August.

CAREX COMOSA BOOTT.—*Bristly Sedge.*—On border of ponds. July.

CAREX TRICHOCARPA MUHL.—*Hairy-fruited Sedge.*—In moist fields. August.

CAREX RIPARIA CURTIS.—*River-bank Sedge.*—Bank of l'Outre River. July.

CAREX HOUGHTONII TORR.—*Houghton's Sedge.*—Abundant on sandy fields. July.

CAREX FUSCA ALL.—*Brown Sedge.*—Bog near St. Lawrence. July.

CAREX STRICTA LAM.—*Tussock Sedge.*—Same places as the last. August.

CAREX HAYDENI DEWEY.—*Hayden's Sedge.*—In swamps. July.

CAREX MAGELLANICA LAM.—*Magellan Sedge.*—Marsh near St. Lawrence. August.

CAREX MARITIMA MULLER.—*Seaside Sedge.*—On banks of St. Lawrence. August.

CAREX CRINITA LAM.—*Fringed Sedge.*—Hillside swamps. July.

CAREX GRACILLIMA SCHWEIN.—*Graceful Sedge.*—In moist woods. July.

CAREX ARCTATA BOOTT.—*Drooping Wood Sedge.*—In dry woods. July.

CAREX TENUIS RUDGE.—*Slender-stalked Sedge.*—In same localities as above. July.

CAREX GRANULARIS MUHL.—*Meadow Sedge.*—In wet fields. July.

CAREX LAXIFLORA LAM.—*Loose-flowered Sedge.*—In dry woods. July.

CAREX AUREA NUTT.—*Golden-fruited Sedge.* — Near mountain springs. July.

CAREX PEDUNCULATA MUHL.—*Long-stalked Sedge.*—In dry woods. July.

Carex pedicellata (Dewey) Britton.—*Fibrous-rooted Sedge.*—In dry woods. July.

Carex Pennsylvanica Lam.—*Pennsylvania Sedge.*—On hills. July.

Carex varia Muhl.—*Emmons' Sedge.*—Common. On high ground. July.

Carex leptalea Wahl.—*Bristle-stalked Sedge.* — In bogs. July.

Carex stipata Muhl.—*Awl-fruited Sedge.*—In moist ground. July.

Carex vulpinoidea Michx.—*Fox Sedge.*—Common. July.

Carex rosea Schk.—Stellate Sedge.—In dry woods. July.

Carex tenella Schk.—*Soft-leaved Sedge.*—In bogs. July.

Carex sterilis Willd.—*Little Prickly Sedge.*—Common. July.

Carex canescens L.—*Silvery Sedge.*—Common. July.

Carex arcta Boott.—*Northern Clustered Sedge.*—In mountain swamp. Rare. July.

Carex trisperma Dewey.—*Three-fruited Sedge.*—In swamp. August.

Carex Deweyana Schwein.—*Dewey's Sedge.*—Common. July.

Carex tribuloides Wahl.—*Blunt Broom Sedge.*—Very common. August.

Carex Scoparia Schk.—*Pointed Broom Sedge.*—Very common. July.

Carex cristatella Britton.—*Crested Sedge.*—Common. August.

Carex adusta Boott.—*Browned Sedge.* — On hills. July.

Carex festucacea Willd.—*Fescue Sedge.*—In meadows. July.

ARACEÆ Neck.

Arisæma triphyllum (L.) Torr.—*Indian Turnip.*—In moist woods. July.

Calla palustris L.—*Water Arum.*—In bogs. August.

JUNCACEÆ Vent.

Juncus effusus L.—*Common Rush.*—Very common. August.

Juncus filiformis L.—*Thread Rush.*—In marshes. July.

Juncus Balticus Willd.—*Baltic Rush.*—Abundant by the shore. August.

Juncus tenuis Willd.—*Slender Rush.*—Very common. July.

Juncus articulatus L.—*Jointed Rush.*—On springy ground. August.

Juncus Richardsonianus Schult.—*Richardson's Rush.* Common. July.

Juncus nodosus L.—*Knotted Rush.*—Common. July.

Juncus Canadensis J. Gay.—*Canada Rush.*—Rare. August.

Juncus Canadensis brevicaudatus Engelm.—*Short-tailed Canada Rush.*—Common. August.

Juncoides parviflorum (Ehrh.) Coville.—*Small-flowered Wood-rush.*—In mountain woods. August.

Juncoides spicatum (L.) Kuntze.—*Spiked Wood-rush.* In woods on hillsides. August.

CONVALLARIACEÆ Link.

Streptopus amplexifolius (L.) DC.—*Clasping-leaved Twisted-stalk.*—In moist woods. July.

Polygonatum biflorum (Walt.) Ell.—*Hairy Solomon's Seal.*—In dry woods. July.

ORCHIDACEÆ Lindl.

Cypripedium reginæ Walt.—*Showy Lady's Slipper.*—Rare. July.

Cypripedium parviflorum Salisb.—*Small Yellow Lady's Slipper.*—Rare. July.

Orchis rotundifolia Pursh.—*Small Round-leaved Orchis.*—Common. In damp woods. July.

Habenaria orbiculata (Pursh.) Torr.—*Large Round-leaved Orchis.*—In black mould in woods. July.

Habenaria Hookeriana A. Gray.—*Hooker's Orchis.*—In similar situations to the above. August.

Habenaria bracteata (Willd.) R. Br.—*Long-bracted Orchis.*—In moist woods. August.

Gyrostachys cernua (L.) Kuntze.—*Nodding Lady's Tresses.*—Common. August.

Listera convallarioides (Sw.) Torr.—*Broad-lipped Tway blade.*—In moist woods. Rare. August.

Peramium repens (L.) Salisb.—*Lesser Rattlesnake Plantain.*—In moist woods on mountain side. August.

Achroanthes unifolia (Michx.) Raf.—*Green Adder's Mouth.*—Common. July.

Leptorchis Loeselii (L.) MacM.—*Fen Orchis.*—Common. July.

Corallorhiza Corallorhiza (L.) Karst.—*Early Coral-root.*—Rare. July.

Corallorhiza multiflora Nutt.—*Large Coral-root.*—Common. August.

MYRICACEÆ Dumort.

Myrica Gale L.—*Sweet Gale.*—Near l'Outre River. July.

SALICACEÆ Lindl.

Salix alba vitellina (L.) Koch.—*Golden Osier.*—Near Cap-à-l'Aigle wharf. July.

SALIX CORDATA MUHL.—*Heart-leaved Willow.*—Ste. Fidèle. August.

URTICACEÆ REICHENB.

URTICA URENS L.—*Small Nettle.*—Common. August.

ADICEA PUMILA (L.) RAF.—*Clearweed.*—In swampy woods. July.

SANTALACEÆ NUTT.

COMANDRA LIVIDA RICHARDS.—*Northern Comandra.*—Rare. In woods near Cap-à-l'Aigle wharf. July.

POLYGONACEÆ LINDL.

RUMEX ACETOSA L.—*Sour Dock.*—In one place by roadside. July.

POLYGONUM PENNSYLVANICUM L.—*Pennsylvania Persicaria.*—Common. August.

POLYGONUM CILINODE MICHX.—*Fringed Black Bindweed.*—Common. July.

CHENOPODIACEÆ DUMORT.

CHENOPODIUM GLAUCUM L.—*Oak-leaved Goosefoot.*—Common. July.

ATRIPLEX PATULA L.—*Spreading Orache.*—About old ruins. July.

ATRIPLEX HASTATA L.—*Halberd-leaved Orache.*—Common on the shore. August.

AMARANTHACEÆ J. ST. HIL.

AMARANTHUS RETROFLEXUS L.—*Rough Pigweed.*—Common. August.

CARYOPHYLLACEÆ REICHENB.

ALSINEA GRAMINEA (L.) BRITTON.—*Lesser Stitchwort.*—Common. July.

Cerastium alpinum L.—*Alpine Chickweed.*—Woods near Salmon River. August.

Arenaria Grœnlandica (Retz.) Spreng.—*Mountain Sandwort.*—Formerly reported as *Arenaria stricta.*

RANUNCULACEÆ Juss.

Caltha palustris L.—*Marsh Marigold.*— Common. Fruited in July.

Anemone Canadensis L.—*Canada Anemone.*—In one place near Cap-à-l'Aigle wharf. July.

Ranunculus abortivus L.—*Kidney-leaved Crowfoot.*—Fruited in July.

PAPAVERACEÆ B. Juss.

Capnoides sempervirens (L.) Borck.—*Pink Corydalis.*—Common on tops of rocks. August.

CRUCIFERÆ B. Juss.

Lepidium Virginicum L.— *Wild Pepper-grass.*—Getting common. August.

Thlaspi arvense L.—*Field Penny-cress.* — Common. July.

Roripa palustris (L.) Bess.—*Marsh Water-cress.*—Getting common. August.

Arabis brachycarpa (T. & G.) Britton.—*Purple Rock-cress.*—Common. July.

CRASSULACEÆ DC.

Sedum Telephium L.—*Live-forever.*—Along roadsides. August.

SAXIFRAGACEÆ Dumort.

Saxifraga Aizoon Jacq.—*Livelong Saxifrage.*—Rocks near Pointe-à-Pic wharf. Fruited in July.

Chrysoplenium Americanum Schwein.—*Golden Saxifrage.*—In swamps. July.

GROSSULARIACEÆ Dumort.

Ribes prostratum L'Her.—*Fetid Currant.*—In cold wet places. Fruited in July.

ROSACEÆ B. Juss.

Rubus chamæmorus L.—*Cloudberry.*—Peat bog. July.

Rubus occidentalis L.—*Black Raspberry.*—Fruited in July.

Potentilla littoralis Rydberg.—*Coast Cinquefoil.*—On high ground near the coast. July.

Comarum palustre L.—*Purple Marsh-locks.* — In swamps. August.

Geum rivale L.—*Purple Avens.*—In low ground. July.

Geum macrophyllum Willd.—*Large-leaved Avens.*—Rare. July.

Agrimonia Brittoniana Bicknell.—*Britton's Agrimony.*—Along roadside. August.

POMACEÆ L.

Amelanchier rotundifolia (Michx.)—*Round-leaved June Berry.*—On rocks near Cap-à-l'Aigle wharf. Fruited in July.

PAPILIONACEÆ L.

Astragalus elegans (Hook.) Britton.—*Pretty Milk Vetch.*—Hillside near Murray Bay Bridge. July.

GERANIACEÆ J. St. Hil.

Geranium Bicknellii Britton.—*Bicknell's Crane's-bill.* —On rocks near Point-à-Pic wharf. August.

EMPETRACEÆ Dumort.

Empetrum nigrum L.—*Black Crowberry.*—On rocks near Cap-à-l'Aigle wharf. Fruited in August.

ANACARDIACEÆ LINDL.

RHUS HIRTA (L.) SUDW.—*Staghorn Sumach.*—Formerly reported as *Rhus glabra.*

ILACACEÆ LOWE.

ILEX GLABRA (L.) A. GRAY.—*Inkberry.*—On mountain side. July.

ILICIOIDES MUCRONATA (L.) BRITTON.—*Wild Holly.*—Swamp on mountain top. Fruited in August.

HYPERICACEÆ LINDL.

HYPERICUM PERFORATUM L.—*Common St. John's Wort.*—Rare. July.

HYPERICUM BOREALE (BRITTON) BICKNELL.—*Northern St. John's Wort.*—In wet places. August.

ONAGRACEÆ DUMORT.

EPILOBIUM ANAGALLIDIFOLIUM LAM.—*Pimpernel Willow-herb.*—On high mountain. August.

EPILOBIUM PALUSTRE L.—*Marsh Willow-herb.*—Formerly reported as *Epilobium coloratum.*

EPILOBIUM LINEARE MUHL.—*Linear-leaved Willow-herb.*—In marshy places. August.

ONAGRA OAKESIANA (A. GRAY) BRITTON.—*Oakes' Evening Primrose.*—Formerly reported as *Onagra biennis.*

KNEIFFIA PUMILA (L.) SPACH.—*Small Sundrops.*—In dry places. July.

UMBELLIFERÆ B. JUSS.

SANICULA MARYLANDICA L.—*Black Snake-root.*—Common. July.

PYROLACEÆ L.

PYROLA CHLORANTHA SW.—*Greenish-flowered Wintergreen.*—In dry woods. July.

PYROLA ASARIFOLIA MICHX.—*Liver-leaf Wintergreen.*—In wet woods. July.

Pyrola minor L.—*Lesser Wintergreen.*—In dry woods. August.

Pyrola secunda L.—*One-sided Wintergreen.*—In dry woods. July.

VACCINIACEÆ Lindl.

Vaccinium Vitis-Idæa L.—*Mountain Cranberry.*—Common on high rocky places. July.

MENYANTHACEÆ G. Don.

Menyanthes trifoliata L.—*Buckbean.*—Near mouth of Murray river. Fruited in August.

SCROPHULARIACEÆ Lindl.

Chelone glabra L.—*Turtle-head.*—Common in wet places. July.

Veronica Americana Schwein.—*American Brooklime.*—In creeks. August.

Veronica scutellata L.—*Marsh Speedwell.* — In swamps. August.

RUBIACEÆ B. Juss.

Galium tinctorium L.—*Stiff Marsh Bedstraw.*—In bogs. July.

CAPRIFOLIACÆ Vent.

Viburnum acerifolium L.—*Maple-leaved Arrow-wood.*—In woods near Salmon River. Fruited in July.

Viburnum cassinoides L.—*Withe-rod.*—In wet woods. July.

CICHORIACEÆ Reichenb.

Lactuca Canadensis L.—*Wild Lettuce.*— Common. August.

LACTUCA SPICATA (LAM.) HITCH.—*Tall Blue Lettuce.*—In moist places. August.

NABALUS NANUS (BIGEL.) D.C.—*Lion'sfoot.*—Rocks near Salmon River. August.

COMPOSITÆ ADANS.

EUPATORIUM MACULATUM L.—*Spotted Joe-Pye-Weed*—In moist places. August.

SOLIDAGO HISPIDA MUHL.—*Hairy Golden-rod.*—Abundant on the dry banks of the St. Lawrence. August.

SOLIDAGO MACROPHYLLA PURSH.—*Large-leaved Golden-rod.*—On rocky sides of the mountains. August.

SOLIDAGO SEMPERVIRENS L.—*Seaside Golden-rod.*—On rocks near mouth of Salmon River. August.

SOLIDAGO RUGOSA MILL.—*Wrinkle-leaved Golden-rod.*—In dry places. August.

ASTER LINDLEYANUS T. & G.—*Lindley's Aster.*—On banks of Murray River. August.

ASTER TARDIFLORUS L.—*North-eastern Aster.*—Port-à-Persil. August.

ASTER PRENANTHOIDES MUHL.—*Crooked-stem Aster.*—Port-à-Persil. Augnst.

ASTER NOVI-BELGII L.—*New York Aster.*—Port-à-Persil. August.

ASTER ACUMINATUS MICHX.—*Whorled Aster.*—In moist woods. July.

ERIGERON PULCHELLUS MICHX.—*Robin's Plantain.*—On dry hills. July.

ERIGERON PHILADELPHICUS L.—*Philadelphia Fleabane.*—In dry fields. July.

ERIGERON ACRIS L.—*Blue Fleabane.*—In dry woods. August.

On a New or hitherto Unrecognized Geological Formation in the Devonian System of Canada.

By H. M. Ami,
of the Geological Survey of Canada.

The paper describes an outcrop of what appears to be the base of the Old Red Sandstone of Britain and that phase of it, such as occurs in the red Cornstone of Herefordshire, England. It is met with in the red shales and sandstones of McArras Brook in Antigonish County, Nova Scotia, from which a most interesting and important fish fauna has recently been obtained, referable to a Lower Devonian horizon.

The presence of Pteraspidians, Cephalaspidians and Acanthodians, as well as Pterygotus, as determined by Mr. A. Smith Woodward and Dr. Henry Woodward, London, would seem to indicate clearly the presence of a fauna precisely similar in parts to the Hereford beds referable to the Lower Devonian or Old Red Sandstone.

The *Pteraspis* found in a calcareous matrix in the series of strata is one which Mr. Woodward refers to as very closely allied if not actually identical with *P. Crouchii.*

The horizon indicated is low down in the Devonian, not far from the summit of the Silurian. From the nature of the sediments, their composition, origin and general characters, they appear to be much more closely related to European Devonian or Old Red Sandstone strata than to the usual type of North American Devonian such as is met with in the Peninsula of Gaspé, or in Ontario and Manitoba and the United States.

The term *Knoydart* formation is assigned to this series of strata in order to be able to designate and separate it from other palæozoic formations in that portion of Eastern

Canada where the sedimentation has a wonderfully close resemblance to European types. This was long ago pointed out by Sir William Dawson, J. W. Salter and E. Billings.

The following species of fossils are provisionally recorded as characteristic of this Knoydart formation. Similar or identical species will no doubt be found sooner or later in other parts of Antigonish and other counties of Eastern Nova Scotia.

FOSSIL ORGANIC REMAINS FROM KNOYDART FORMATION, NOVA SCOTIA.

1. Pteraspis, sp. *cf.* P. Crouchii.
2. Cephalaspis sp.
3. Onchus Murchisoni, Agassiz.
4. Psammosteus, sp., cf. P. Anglicus, Traquair.

Mr. Woodward writes: The McArras Brook specimens "represent the base of the lower Old Red Sandstone of Britain."

Ann. Rep. new ser. vol. 2, 1886 (1887, Montreal), p. 49P, under the head of "F. Devonian," Mr. Hugh Fletcher describes three distinct groups of Devonian strata corresponding closely with those of New Brunswick," and gives the following table of equivalencies:—

NEW BRUNSWICK.	NOVA SCOTIA.
3. Mispeck group.	3. Upper Red Slate and Sandstone group.
2. Dadoxylon Sandstone and Cordaite shale.	2. Middle Gray Sandstone and Slate group.
1. Bloomsbury Conglomerate.	1. Lower Conglomerate group.

After giving the distribution of the above in Nova Scotia, in general, the first reference to the age of the McArras Brook strata is then given on page 49P, which reads as follows: "The Upper rocks," (*i. e.*, the Upper Red Slate and Sandstone group) "are found again near Union Railway Station, and also at McArras Brook."

On page 67P, Mr. Fletcher quotes Dr. Honeyman's views on the age of these rocks:[1] "They are certainly not Lower Helderberg, and may therefore be Devonian," and on p. 68P, the same writer quotes Sir William Dawson,[2] in which he regards them as "Pre-Carboniferous although not separated from the Silurian."

Mr. Fletcher there describes strata on McArras Brook as follows: "Good exposures are also cut by McArras Brook behind the mass of amygdaloid at the shore, consisting of red, flinty, micaceous, jointed sandstone and slate, often concretionary, interstratified with greenish thick bedded and flaggy sandstone, containing traces of carbonate of copper and iron pyrites; the brook being rocky up to the shore road. From the latter, a collection of fossils made by Mr. Weston, comprising fragments of plants and fish teeth, not certainly determinable, together with certain interesting footprints *Protichnites carbonarius.*

In his "Geology, Chemical, Physical and Stratigraphical," Sir Joseph Prestwich[3] makes the following statement regarding the "Old Red Sandstone" of Herefordshire, which enables geologists to correlate and recognize similar strata with a marked degree of proximity to certainty wherever they occur.

"The Old Red Sandstone of Herefordshire was long thought to be non-fossiliferous, a few fragmentary specimens only have been found, when in the railway cuttings near Ledbury, the Rev. W. S. Symonds (see Quart. Journ. Geol. Soc., Vol. 16, p. 193, and Vol. 17, p. 152) discovered in the lowest beds (the Ledbury shales) of that formation remains of *Pterygotus, Onchus, Pteraspis* and *Cephalaspis,*

1 Trans. Nov. Scot. Inst. Sc. Vol. 3, p. 13.

2 Acadian Geology, p. 316, line 4, and Supplement, p. 49, line 15.

3 In chap. VI., "The Devonian System: 'The Old Red Sandstone,'" p. 82.

together with large numbers of the head shields of *Auchenaspis.*"

It is impossible to read over the association of forms in the above Ledbury shales of Herefordshire without recognizing in them the fauna and horizon met with at McArras Brook in Antigonish County, Nova Scotia.

In 1843 Dr. Abraham Gesner [1] describes an "Old Red Sandstone, or Devonian group," which he recognizes above Silurian beds . . . in several parts of the Province" . . . consisting of . . . "a bright red micaceous sandstone or conglomerate, accompanied by thin beds of red shale and marly clay, and in some places containing seams of fibrous gypsum." He adds : "Hitherto no organic remains have been found in it." He recognizes it at Advocate Harbor and on the Moose River, where it is "seen lying unconformably beneath the Coal Measures."

In his report Mr. H. Fletcher classifies these rocks of Advocate Harbor as Devonian. The "Old Red Sandstone or Devonian Group" of Gesner are therefore linked with the rocks of Union and Riversdale, "but, from the fauna and flora found in them, are referable to Carboniferous times, and from their position in the stratigraphical succession appear to belong to the Eo-Carboniferous.

In November, 1899, in a communication on a number of fossil fishes sent him by the writer from various localities in which the geological horizon and precise affinities of the species sent were doubtful, Mr. A. Smith Woodward, the eminent authority on Palæozoic fishes, gives the following notes on the specimens which he had previously submitted to Dr. R. Traquair of Edinburgh :—

"The specimens from McArras Brook are extremely interesting and represent the base of the Lower Old Red Sandstone of Britain. The Pteraspidian remains are sufficient to prove that they belong to the genus *Pteraspis.*

1 Proc. Geol. Soc. London, Vol. 4, part 1, No. 95, p. 187, 1843.

Both dorsal and ventral shields are so much like those of *P. Crouchi* that if these Nova Scotian fossils had been found in West England we should have referred them to the latter species. Perhaps the rostral plate may prove to distinguish your form when it is completely known. One piece of dorsal shield, in counterpart, shows the impressions of the supposed branchial pouches on one side.

"The pointed fragments may be Cephalaspidian cornua, but are uncertain.

"There is the typical *Onchus Murchisoni, Ag.*

"Most interesting is one small fragment of *Psammosteus*, with ornament identical with that of *P. anglicus.* (See Traquair, Ann. Mag. Nat. Hist., Ser. 7, Vol. 11, 1898, p. 67, pl. i., figs. 1, 2.) In this fossil the chambers of the middle layer are larger than in our unique plate.

"On the whole, I should place the McArras Brook beds on the same horizon as the Lower Old Red Cornstones of the Hereford District of England, above the passage beds."

In order to give a comprehensive view of the succession of strata in this Knoydart formation, the following section, carefully measured and prepared by Mr. Hugh Fletcher, of the Geological Survey of Canada, in the year 1897, is here given :—

"From the mass of trap near the mouth of McAra Brook the following is the section in ascending order :

Amygdaloidal trap, probably Lower Carboniforous as described in Report P. for 1886.

		ft.	in.
	Measures concealed. On the left bank of the brook trap is in the cliff, while on the right bank there are indications of red stratified Devonian rocks.	30	0
1.	Red, argillaceous shale, more or less slaty, with coherent underclay full of rootlets. Dip 230°/32° (Magnetic)	3	0
2.	Red, argillaceous slaty rock, not well seen . .	4	9

	ft.	in.
3. Red, broken, argillaceous shale, with greenish and gray blotches................	6	0
4. Red shale, nearly all concealed...........	6	0
5. Red, very coherent, concretionary, calcareous rock at the mouth of a little brook from the eastward........................	1	6
6. Red, argillaceous shale..................	7	6
7. More coherent, flaggy rocks, which may be called sandstone.....................	1	0
8. Red, argillaceous shale..................	8	0
9. Red, coherent, somewhat sandy flags, in two layers.............................	3	0
10. Red, argillaceous shale, in part blotched with green.........................	46	0
11. Greenish and reddish, coherent micaceous sandstone and flags, with fossils. (No. 1)	4	0
12. Red, argillaceous shale, with coherent layers	22	0
13. Red, somewhat coherent, massive argillaceous rock........................	6	0
14. Red, coherent flags, containing fish remains..	11	6
15. Red, argillaceous shale..................	5	0
16. Greenish, calcareous flags, from which Dr. Ami collected many fossil fish remains in 1897. The upper part contains broken carbonized plants, seeds, etc. (No. 2)...	2	0
17. Red and green, somewhat massive, mottled, calcareous rocks, with nodular, rounded and oval spots and fish remains. Dip 230°/25° on fine long faces............	7	0
18. Red, argillaceous shale, with layers of more coherent, concretionary flags...........	5	0
19. Red, micaceous flags....................	1	6
20. Red, somewhat crumbly, argillaceous shale, forming fine ledges in the brook........	2	0
21. Red, argillaceous shale, with layers of fine, more coherent flags..................	14	6

	ft.	in.
22. Greenish, flinty, argillaceous and siliceous flags, micaceous, and sometimes spotted with red, containing much carbonaceous matter, and cut by veins of quartz. (No. 3)	3	0
23. Greenish, coherent, massive, fine sandstone, in two layers........................	4	0
24. Red and greenish mottled shale, in regular layers, more massive towards the top, for the most part red..................	8	0
25. Reddish, coherent flags and argillaceous shale	32	0
26. Red, crumbly, argillaceous shale, not well seen................................	11	0
27. Red, crumbly, argillaceous shale, with harder bands, not well seen..................	10	9
28. Red, argillaceous shale, with flaggy layers..	17	6
29. Red, argillaceous shale, not well seen......	25	0
30. Red, coherent, thick bedded sandstone, in two layers, at a small waterfall.........	6	0
31. Red, coherent, argillaceous shale, with green layers and blotches..................	5	0
32. Measures not well seen, but evidently chiefly red..................................	6	0
33. Greenish, argillaceous shale, at the mouth of a little brook from the westward. (No. 4.) From this, the seeds and plants[1] were obtained by Dr. Ami in 1896. One coarse, rusty layer is full of pyrites and plant remains......................	2	6
34. Measures concealed, probably greenish shales cut by quartz veins and containing plants	3	0
35. Greenish quartzite or fine sandstone, over which the little brook from the westward falls into the main stream at water level	3	0

1 From a microscopic examination recently made of the peculiar objects in question, referred to in No. 33 of the section as "seeds and plants," the writer is of the opinion that there is no evidence of the presence of such organisms.

	ft.	in.
36. Grey and greenish and red coherent, argillaceous rock in three layers..	3	0
37. Red, argillaceous shale, with coherent layers. The top comes to the foot of the falls in a gorge from which Mr. Weston is supposed to have obtained his fish remains. (No. 5)	12	0
38. Red, coherent, argillaceous shale, forming a little fall..........................	15	0
39. Red, coherent shales, forming a higher fall..	14	0
40. Red, argillaceous shale, containing greenish blotches, harder layers and small nodules. To the water level of the lower side of the culvert at the shore road..........	31	0
41. Red, argillaceous rock, with green layers and blotches, in cliffs at the road, dipping 235°/32°	30	0
42. Red and green mottled, argillaceous shale, principally red.....................	15	0
43. More coherent, red, siliceous and argillaceous rock, with a few fish remains..........	10	0
44. Greenish and mottled lenticular limestone, from which Dr. Ami obtained the fish remains, *Pteraspis*, etc., first sent to Dr. Woodward (No. 6)..................	0	6
45. Red, argillaceous and siliceous rock, with green bands and blotches..............	30	0
46. Reddish, altered rock, at the level of the road under the schoolhouse, not well seen....	20	0
47. Greenish, argillaceous flags and shales (No. 7)	4	0
48. Red, argillaceous shale..................	3	0
49. Red and greenish sandstone, in two layers..	4	0
50. Red, argillaceous shales, with layers of more coherent rock, some of which contain rootlets..........................	17	0
51. Measures concealed....................	13	6

	ft.	in.
52. Bright red, soft, argillaceous shale. To the first bridge where the brook crosses to the eastward........................	4	0
53. Red, argillaceous shale, with a few more coherent layers........................	31	0
54. Greenish, somewhat massive, argillaceous and arenaceous rock (No. 8). At the second bridge where the brook runs to the westward, the dip now changes to 80°, and this layer is concealed for some distance, but again appears to return to the road further south. Assuming that this is the case, the section is continued beyond as follows :—		
55. Red, argillaceous shale, with coherent layers	18	0
56. Greenish and dark gray crumbly argillaceous rock..............................	3	0
57. Greenish and gray argillaceous rock, the upper part greatly altered............	4	0
58. Trap..............................	4	0
59. Red, argillaceous shale, greatly altered.....	6	0
60. Measures concealed. Dip 250°/23°. To a little brook from the eastward.........	5	0
61. Red, argillaceous shale, and thin flags in which fish remains were found (No. 9)...	14	0
62. Red, argillaceous shale and flags..........	43	0
63. Trap, thickness undefined ; perhaps.......	120	0
This trap begins about 550 yards above the main road. In the brook west of the road there is a green, flinty shale, which yielded no fossils.		
Total thickness of the stratified rocks in the section..........................		

NOTE.

This section is only approximate. It represents only a small portion of measures apparently as thick as at Union, seen also in Knoydart Brook and other streams of the vicinity. It is not supposed that either the base or the summit of the series is here given."

The above series of strata (exclusive of the "trap") constitute part of the succession to which the term *Knoydart* formation is applied, in order to separate it from the various members of the Silurian system to the east of and in close relation to the Devonian series. The local divisions of the Silurian fall naturally (and provisionally) into four formations, in descending order as follows:—

THE STONEHOUSE FORMATION.

THE MOYDART FORMATION.

THE MCADAM FORMATION.

THE ARISAIG FORMATION (LIMITED).

For a definition of these formations by the writer, *see* the January number of the Supplement (No. 1307) to *The Scientific American*, New York City, p. 20949, in Dr. E. O. Honey's article on the Albany Meeting of the Geological Society of America and the discussion of the papers read.

AN HOUR'S BOTANIZING ON THE MOUNTAIN SIDE.

By JOHN DEARNESS.

On the 8th and 9th November, 1898, the Ontario Entomological Society, at the invitation of the Montreal Branch, held its annual meeting in the Royal city, the date being the twenty-fifth anniversary of the foundation of the Branch just named. On the morning of the 9th, the mountain side afforded an advantageous position to watch the sun rise. The weather was delightful, the air comparatively clear, and not too cool to be pleasant,—a dry, clear, bracing morning.

If there were any insects on the wing, they were not conspicuous enough to divert attention from the rich fungal flora in the humid rearward slopes of the wooded terraces. The bareness of the trees and shrubs rendered the cryptogamic forms more noticeable.

On the right of the path entering under the inclined railway there were a few dilapidated shrubs, including bladder-nut (*Staphylea trifolia*). On some of the stems of these shrubs, in a brush heap and on dead erect branches, there was a vigorous growth of three or four species of fungus. One of them is related to the black-knot of the plum (*Otthia* or *Plowrightia morbosa*) at least so far as a similar method of fruiting establishes relationship among these forms. Whether the fungus on *Staphylea* like that on plum has a parasitic stage I cannot say, but in the stage of complete maturity both develop a stromatic layer which becomes thickly covered with fruit-balls, technically called perithecia. Each little shining, papillate globe contains a large number of sacs standing among infertile branches called paraphyses. Each sac or ascus contains eight semi-transparent, centrally constricted spores. The species on *Staphylea* is illustrated in Plate 41 of Ellis and

Everhart's Pyrenomycetes, from material collected near London, Ont.

A still more interesting species obtained on the same host is a *Fenestella*, probably *F. princeps*. It was not, at the time of collection, mature enough to be sure of the species. It, too, is a pyrenomycete; microscopically less attractive than *Otthia*, but when sectioned and prepared for study under the microscope much more beautiful. For study and identification freehand sections of these forms are easily made and are quite satisfactory, if mounted in water or dilute glycerine.

Another imperfect but interesting form, found on the same host, proved a new species. It was described and figured in the current volume of *Proceedings of the Canadian Institute*, under the name *Haplosporella Staphylina*. The perithecia are grouped in small round stromata with their apices projecting. The relatively large brownish spores appear sessile on the hymenial lining of the perithecia.

Another sphæreloid ascomycete on the twigs, I have not yet identified. It is not very far from Prof. Peck's *Metasphæria* on the same host. Besides the foregoing, all on bladder-nut, two or three cosmopolitan species were observed but not recorded.

The more conspicuous hypoxylons and valseæ were found in variety and in fine fruiting condition, on decaying birch, hawthorn and sumach, a few rods nearer the ascent. Coriaceous hymenomycetes—stereum, dædalea and other polyporei were in fair profusion, but the season was too far advanced to find any of the fleshy species except *Collybia velutipes*, the gregarious velvet-footed collybe which is usually given a place in lists of edible toadstools. Its favorite situation is on partially decayed elm, but it grows on other kinds of wood.

The Canadian Marine Biological Station.

By F. Slater Jackson, M.D.

The history of Acadian Zoology may be said to date from the time of Champlain, for Lescarbot's " Histoire de la nouvelle France," published in 1609, contains accounts of the more common Mollusca of that region. In Champlain's own work, " Les Voyages du Sieur de Champlain," published a few years later (viz., in 1613) mention is made of the various shell-fish which appear to have been employed by him for food. Similarly Denys' " Description Géographique et Historique des costes de l'Amerique Septentrionale " and his " Histoire Naturelle," published in 1672, contain in addition, references to many forms apparently overlooked by previous observers: thus he mentions the Razor-fish (Ensatella Americana) and various Cephalopoda, of which latter his accounts are singularly interesting and accurate. These observations, however interesting historically, contain little of scientific value. It was not until 1852 that a systematic scientific study of the marine organisms of Acadia was commenced. In this year Stimpson spent three months in investigating the Invertebrata of Grand Manan, and his results, published two years later, constitute the first important contribution to our knowledge of this subject. In 1870 Gould's " Invertebrata of Massachusetts " (which first appeared in 1841) was rëedited, and made to include many species common to that State and to New Brunswick and Nova Scotia.

The Reports of the United States Fish Commission also contain much valuable information relative to the species inhabiting the Bay of Fundy, particularly in the vicinity of Eastport, Me., and Grand Manan. More recently the entire subject has been carefully reviewed and studied by Prof. Ganong, of Harvard, whose name is associated with the Zoology of Nova Scotia and New Brunswick as that of Dr. G. F. Matthew is with the Geology and Palæontology of that region. To us in 1899 was offered the opportunity of corroborating and extending the observations of these writers, for in that year the Canadian Government granted an appropriation of $7000 for the erection, equipment and maintenance of a Marine Biological Station, largely through the influence of Sir Louis Davies, Minister of Marine and Fisheries.

The objects of such an institution may be considered under two aspects, Scientific and Economic. From a Scientific point of view may be mentioned :—

(1) The collection and identification of the various organisms indigenous to the region.

(2) The study of their abundance, food, habits, mode of propagation, and the circumstances favorable or inimical to their life and propagation.

(3) Their parasites.

(4) Their variation under natural and artificial conditions.

(5) Their development and life history.

(6) The depth and temperature of the water inhabited by the various forms.

(7) The investigation of such forms and phases of organic life as cannot be satisfactorily preserved for subsequent study.

The Economic aspect presents itself under such headings as the following:—

(1) The investigation of such organisms as are of commercial value; more especially the fishes and edible Mollusca.

(2) Problems concerning their natural and artificial propagation.

(3) The study of the food, habits and development of Fishes, and their relative abundance under varying conditions.

(4) A consideration of organisms injurious to timber.

To meet these objects and to facilitate the elucidation of these problems the present Laboratory was built and equipped.

The Laboratory itself (the construction of which was commenced in June, 1899) is a one-storey building, well lighted from above and from the sides. In the centre is a large room where ten or twelve investigators may comfortably work. It is provided with tables and shelves, basins, fresh and salt water, etc.

At either end are two smaller rooms for the use of the Director, storage of glassware and reagents, and for the tanks supplying the fresh and salt water. These last are replenished by means of pumps, of which there are two, one operated by hand, the other by hot air. While the present equipment of the Laboratory leaves much to be desired, much has already been done in this direction. A boat, dredges, tow-nets, etc., have been provided, and the Laboratory contains, in addition, the nucleus of a reference library of no small value, including a complete set of the "Challenger" Reports, a gift from the British Government.

The Laboratory was designed as a floating station, and with this object a barge has been constructed, upon which it may be placed and towed from one locality to another.

Its present situation has been well chosen, viz., St. Andrews, N.B., on the shore of Passamaquoddy Bay.

In speaking of Passamaquoddy Bay Prof. Ganong says:

"Lying in the south-western corner of Charlotte County, with a length of fifteen and a breadth of seven miles, it receives the waters of four rivers and many smaller streams, and is filled by the tide twice each day through four narrow channels. The degree of hardness of the surrounding rocks is favorable to the existence of a great variety of life; for they consist largely of soft, easily eroded conglomerates and sandstones, which are carried away by the strong tides and deposited among the islands, forming pebble, sand, and mud bottoms, while numerous trap dykes afford rugged reefs and ledges."

Under these favorable conditions the investigator seeks the desired information by all means in his power. Collecting at low tide the numerous littoral forms so abundant in the tide-pools, under the rocks, and in the mud and sand exposed by the receding water, securing by means of the tow-net the smaller drifting and swimming organisms —the plankton and nekton—on or near the surface, dredging at various depths the more stationary and inaccessible forms, examining the haul of the fisherman, and the contents of the fishes' stomachs—such are the more important methods of ascertaining the habitat and mode of life of the organisms, and of securing material for future identification and investigation.

With regard to the fauna of this region, a correct conception may perhaps best be gained by a comparison with that of Vineyard Sound and the vicinity of Cape Cod, so thoroughly worked out by Gould and by Verrill and Smith.

It may be said in general that the New Brunswick fauna is less rich and more Arctic and Boreal in character, being intermediate in these respects between those of the Massachusetts Coast and the Gulf of St. Lawrence.

This is obviously due to the lower temperature of the water and the diminished influence of the Gulf Stream, to which the waters of Vineyard Sound owe not only their increased temperature but also many of their characteristic types—more especially numerous pelagic animals, which are directly transported by its currents.

Other factors, as noted by Dr. Stimpson, are the great depth of the water on the Maine and New Brunswick coasts, and the thick fogs so prevalent in this region. He states that "the surface temperature of the sea is 15°—20° lower than in Massachusetts Bay at the same time," which latter, according to Verrill, varies in August from 66° to 72° F.

Stimpson further says :—

"It is interesting to notice a great similarity of the Fauna of this region and that of Greenland, as described by O. Fabricius and others. The correspondence is very great, especially among the Tunicata and Echinodermata, of which the species are nearly the same."

Another interesting point of comparison is that between the existing Acadian Fauna and that of the Canadian Pleistocene period. Many of the Invertebrata (particularly the Mollusca) are common to both, and the Capelin (*Mallotus Villosus*) described by Cox as "never ranging further south than the shores of New Brunswick" occurs, as is well known, in the clay concretions of the Pleistocene at Green's Creek, near Ottawa.

While it is not my intention to enumerate a list of the species collected in this vicinity, a brief reference to some of the commoner and more important forms may be of interest.

Of Cœlenterata may be mentioned various Hydroids, of which *Plumularia* and *Sertularia* are the most common. The large "Jelly-fish" (*Aurelia Flavidula*) is abundant, and another closely related form (*Ptychogena Lactea*)—conspicuous by the prominent white cross on its disc—is occasionally found. The common Sea-anemone (*Metridium Marginatum*) is frequently met with, but of Ctenophores, such as *Idyia* and *Pleurobrachia*, so abundant at Halifax, I saw but few.

The class of animals popularly grouped together as "Worms" is well represented. Conspicuous among these are the large Carnivorous sea-worms of the genus *Nereis*, observed at low tide, partially extruded from their holes.

On turning over the stones at low tide, almost every one is seen to harbor various Nemerteans—those interesting organisms with eversible proboscis and supposed Vertebrate affinities, and a multitude of other interesting forms may be obtained by digging in the mud and sand.

The Echinodermata are well represented. Prof. Ganong, in his paper on "The Echinodermata of New Brunswick," mentions twenty-eight species. The common Star-fish (*Asterias Vulgaris*), the Sea Urchin (*Strongylocentrotus Drobachiensis*), the "Sand-Dollar" (*Echinarachnius Parma*), the Sea-Cucumber (*Cucumaria Frondosa*), together with several Brittle-stars, and the delicate and transparent *Synapta*, are among the more common.

Of Crustacea the most abundant and conspicuous are the Barnacles (*Balanus Balanoides*), which are so numerous along the littoral zone as to give the rocks in many places a marked white appearance.

Crabs and lobsters, although not very abundant, are met with, and little Amphipod Crustacea of the genus *Gammarus* are found in swarms in the tide pools and in the shallow water. In many places beautiful Isopoda are found swimming on the surface, and the Hermit-crab (*Bernhardus Pubescens*) is frequently seen occupying the shells of whelks and other Gastropods.

A list of even the more common Mollusca would, I fear, prove tedious, but Prof. Ganong's delightful little book on "The Economic Mollusca of Acadia" will be read with pleasure by all interested in the subject. Among Lamellibranchs clams of the genus *Mya*, Mussels (*Mytilus*) and Horse-mussels (*Modiola*) are abundant; the former buried in the sand with nothing but the siphons visible, and the latter attached to the rocks by means of their byssus, or forming large beds, where the star-fish congregate to feed upon them. The Scallop (*Pecten Islandicus*) is also found in fair quantity, and by means of the dredge numerous and interesting forms are to be obtained.

Another Lamellibranch of economic as well as of scientific interest is the Teredo, or ship-worm, so injurious to timber.

Of Gastropoda, whelks (*Buccinum*) and Limpets (*Acmæa*), together with the so-called round-whelks (*Lunatia*) and the widely distributed *Littorina*, are among the forms more commonly met with.

Squid, of the genera *Loliago* and *Ommastrephes*, are frequently taken in the nets of the fisherman, and occasionally found along the shore.

A consideration of the fish and fisheries of this region, while of the highest scientific and economic interest, cannot be entered into here.

Since the publication in 1852 of Perley's Report of the Fisheries of New Brunswick, and of the "Descriptive Catalogue of the Fishes of Nova Scotia" by J. F. Knight (1866) much has been done upon this important subject, and the annual Report of the Commissioner of Fisheries contains much interesting and important information.

The good work done by the United States Fish Commission is a sufficient indication that money and energy expended on the scientific investigation of economic problems produce far-reaching and satisfactory results.

During the past summer investigations were undertaken at the Biological Station by a number of workers, representing the various Canadian Universities. Among them were:

The Director, Prof. Prince, Commissioner of Fisheries; Prof. Macallum, Prof. MacBride, Prof. Fowler, Dr. Knight; Dr. Stafford, Miss Ganong and Dr. Scott.

Among the problems which received the attention of these workers were: the anatomy, variation and parasites of fishes, the question of water contamination as affecting the fisheries, the chemistry and physiology of some Medusæ, together with observations on the flora of the vicinity.

That the scientific and industrial communities of Canada will profit by the establishment of the Marine Biological Station is beyond doubt, and we trust that another summer will see us well advanced in the pleasant and profitable work of investigation.

McGill Zoological Laboratory,
Jan. 10th, 1901.

A Hornblende Lamprophyre Dyke at Richmond, P.Q.

By John A. Dresser, M.A.

A trap dyke of considerable interest was lately discovered by Mr. G. H. Pierce, C.E., in the lower Trenton limestones on the southern outskirts of the town of Richmond, P.Q. It can be seen near the highways a few yards south of the residence of Mr. Mills Wilcocks, having been brought to view somewhat recently by the erosive action of a small stream in the bed, or bank, of which it can be traced for some twenty rods.

It has a width of about three feet, and stands nearly vertically, running in a southeast-northwesterly course at an angle of 30° to 40° with the strike of the enclosing sedimentary rock. This, which is a dark, nearly black, graphitic limestone, belonging to what is known as the Farnham Black Slates (Ann. Rept. Geol. Survey of Canada, 1894, Part J, Dr. R. W. Ells) is not altered in any noteworthy manner at the contact; and while it has been folded and contorted to a remarkable degree, being within the folded belt of the Appalachian mountain system, the dyke shows no evidence of having been subjected to the same disturbing agencies. It has thus apparently been intruded not only later than the deposition of the lower Trenton sediments but after they had passed through the crumpling, folding and tilting which has given them their present altered character and position.

The dyke is a fine-grained holocrystalline rock, having a dark iron-gray color and weathering readily on exposure to a rusty brown. It is quite strongly magnetic, fragments as large as grains of rice adhering readily to a pocket horse-shoe magnet.

By the aid of the microscope the constituents of the rock are seen to be as follows:

I. Essential.—1. Primary—Hornblende.
Feldspar.
2. Secondary—Calcite.
Chlorite.
Serpentine (?)

II. Accessory.—1. Primary—{Magnetite.
Apatite.
2. Secondary—Leucoxene.

Hornblende is in very distinct idiomorphic crystals, often having a slender columnar form, and is the most prominent constituent of the rock. It is brown in color and pleochroic with $\mathfrak{b}$ nearly $=\mathfrak{c}$, the scheme of absorption being $\mathfrak{c}>\mathfrak{b}>\mathfrak{a}$. $\mathfrak{c}$ and $\mathfrak{b}$ = dark brown, and $\mathfrak{a}$, yellowish brown. The greatest angle of extinction that was measured, $c \wedge \mathfrak{c}, = 17°$. A number of smaller crystals are also present, but it is not definitely ascertained whether they represent a separate generation, *i.e.*, that they crystallized at a different period of the solidification of the rock from the larger hornblendes, or not.

Feldspar appears usually in lath-shaped or slender sections, which are generally unstriated by the polysynthetic twinning of plagioclase, though many are twinned once. Some extinguish nearly or quite parallel to the longer axes, others at angles as high as 80°. The feldspars often show an approach to a radial arrangement, and are less distinctly idiomorphic as well as less abundant than the hornblende.

Calcite, either alone or more frequently associated with other secondary minerals, forms numerous irregular masses in which crystals of feldspar are sometimes imbedded. After hornblende and feldspar it is the most abundant constituent. While presumably of secondary origin, no remnants of any mineral from which it has probably been derived have been found in it.

A greenish substance, nearly or quite isotropic, which is associated with calcite in places, and commonly forms pseudomorphs after hornblende, is regarded as chlorite. In association with calcite it occasionally shows aggregate polarization and sometimes has a more serpentine-like appearance, where it probably consists in part of that mineral.

The iron ore is in black angular grains, which have a metallic lustre and are all thought to be primary. Its general characters are those of magnetite, some of the larger grains containing cores of leucoxene, thus indicating its titaniferous nature.

Needles of apatite penetrate both feldspar and hornblende.

The rock thus belongs to the dark-colored trap dykes, or lamprophyres, and agrees most closely with the characters of Camptonite, of which it is a fairly typical specimen.

The known occurrences of Camptonite in eastern North America include Montreal and the shores of Lake Memphremagog in Canada, as well as several localities in the states of New Hampshire and Vermont, southern Maine and eastern New York.[1] The nearest of these, that at Lake Memphremagog, is about fifty miles south of the present occurrence.

Camptonite is commonly, though not invariably,[2] an accompaniment of highly alkaline rocks, such as nepheline syenites, no occurrence of which is known, however, nearer than Brome and Yamaska mountains, some fifty miles to the westward. From the presence of such dykes

1 "The Trap Dykes of the Lake Champlain Region," by J. F. Kemp and V. F. Marsters. Bull. U.S.G.S., No. 107. "Camptonites and other Intrusives at Lake Memphremagog," by V. F. Marsters. *Amer. Geologist*, July, 1895.

2 "Geology of the Castle Mountain Mining District." Weed and Pirsson. Bulletin U.S. Geol. Survey, No. 139, p. 111. The authors here cite Brögger's opinion, deduced from the study of the basic rocks of Gran, Norway (Q. J. G. Soc. London, Feb., 1894), that Camptonite is "not necessarily indicative of the presence of a definite type of granular plutonic rock as formerly supposed."

along the shores of Lake Champlain Prof. Kemp has pointed out the probable occurrence of an area of nepheline syenite in that region, which has not yet, however, been discovered, though amongst the many igneous rocks of these localities even a series of such a character may yet be found perhaps running along the western border of the Appalachian folding.

The other rocks of igneous origin in this vicinity are the well-known serpentines of the Eastern Townships, three miles to the south, which contain irruptive masses of hornblende granite, and are bordered on the south by a volcanic agglomerate, the matrix of which is an altered porphyrite. Both the first and second of these have been fully described by Dr. F. D. Adams.[1] Of the former, Dr. Adams says, "the alteration to serpentine was found to be complete, with the exception of a few irregular-shaped remnants which occur in one of them. . . . They are probably bastite or some allied mineral derived from the alteration of a rhombic pyroxene, which was a constituent of the rock from which the serpentine was derived."

The hornblende granite is described as "composed essentially of quartz, orthoclase, plagioclase and hornblende, with a little titanic iron ore. The hornblende, as is usual in granites, seldom has a good crystalline form. It is light green in color, strongly pleochroic, shows in many places the characteristic cleavage and often occurs twinned. It sometimes contains little pleochroic 'hofe' surrounding minute doubly refracting crystals. Its angle of extinction, as is often the case with the hornblende in granites, is large. The greatest angle measured was 24°, and this was in a section in the zone of the orthopinacoid and clinopinacoid, nearly but not quite coinciding with the latter plane. Many of these hornblende grains assume a fibrous form at their edge, but this is especially the case at the extremi-

1 "Notes on the Microscopic Structure of some Rocks of the Quebec Group," by F. D. Adams. Rep. Geol. Surv. Can., 1880-1-2, part A.

ties of the elongated patches in which it often occurs. The rock is no longer fresh. The feldspar, of which a very considerable portion is plagioclase, is a good deal decomposed, and the hornblende is altered in a very peculiar and hitherto unobserved manner. . . ."

It is a very frequent associate of the serpentines throughout the Eastern Townships, and is commonly believed by miners to be a necessary condition of the occurrence of the better class of asbestos deposits. It is enclosed in the serpentine, and from this fact, as well as its finer crystallization near the contact, is presumably intrusive through it, although the actual contact is generally concealed.

The porphyrite consists of a fine feldspathic base, containing phenocrysts of plagioclase and a few large individuals of epidote and chlorite, possibly representing primary hornblende. It, too, is considerably decomposed, and it contains veins and secondary aggregates of quartz, chlorite and epidote. No quartz, that is certainly primary, could be distinguished. The relations of this rock are not so easily determined as the last, yet are tolerably certain. It appears to have reached about the same degree of decomposition as the granite, but has suffered less dynamic metamorphism, and although the difference in the susceptibility of various rocks to metamorphic agencies prevents this fact from furnishing a safe clue to their relative ages, yet it cannot be entirely overlooked. The porphyrite also contains fragments of Cambrian slate which probably elsewhere overlies the serpentine, but this fact, again, is not yet clearly established. But a block, apparently of the same agglomerate which is found in Lot 13, Range XIII. of the township of Cleveland, nearly two miles north of the serpentine belt, contains fragments which are macroscopically indistinguishable from the hornblende granite just described. This evidence, which appears conclusive, is substantiated by the fact that the course of local glaciation has here been such as to convey a large number of serpentine boulders, whose character is unmistakable, for a distance of three or four miles north of the occurrence of that rock.[1] Accordingly the porphyrite may be regarded as the latest intrusion along the serpentine belt.

At a distance of a mile and a half north of the locality of the lamprophyre dyke described above, there is an interbedded sheet of amygdaloidal trap rock,[2] probably diabase. This is also highly altered in character, and, like the other rocks that have been mentioned, is apparently much older than the dyke. Whether it has any genetic connection either with the dyke or the igneous rocks to the south of it, it is impossible at present to say. The following order of age can, however, be ascertained for the other rocks of igneous origin:

1. The parent rock of the serpentine.
2. Hornblende granite, intrusive through the serpentine.
3. Porphyrite, which was intruded generally along the southern contact of the serpentine with the sedimentary slates, and with the fragments thus included forms an agglomerate.
4. The Camptonite dyke, which is much later in age, and, being a common associate of rocks of a different character, is only doubtfully connected with the others in origin.

1 Dr. R. W. Ells. Ann. Rept. Geol. Survey of Canada, 1894, p. 86 J.
2 *Ottawa Naturalist*, Jan., 1901.

Was Mount Royal an Active Volcano?

By J. S. Buchan, K.C.

Mount Royal is commonly described as the root or remnant of an old volcano, which has been worn down through long ages by the action of the elements, and its peak shorn by ice fields carried over it during the great subsidence of the Glacial Period, until it was reduced to its present comparatively small proportions.

Doubtless many have pictured in their own minds the Mountain in all its glory, in the far distant time when the struggling forces burst through the barriers which restrained them, and seem to see again a great mountain peak piercing the sky, with volumes of smoke and clouds of ashes thrown out and scattered over the surrounding country, while rivers of lava ran down its almost perpendicular sides. It may even be supposed that some have contemplated this picture with a sigh of regret, when they think what a magnificent advertisement the Volcano would be for Montreal, provided, of course, it was removed to a safe distance from the City.

Be that as it may, the question as to what was the height and magnitude of Mount Royal when it had reached its greatest proportions, and the conditions which then prevailed, possesses an intense interest, which the difficulties in the way of its solution only tend to increase.

At the outset, it must be admitted that the records containing the story of the Mountain have for the most part been swept away, and any conclusions based on those which remain are largely conjectural. It will, however, also be admitted that any attempt, however humble, to bring together the facts which bear on the subject, and to state such conclusions as may appear to flow from them, may have some value, even although it falls far short of meetiag the whole question.

In approaching the subject, there is great difficulty in arriving at a just appreciation of the conditions which prevailed in that immensely distant age before the mountain arose from the depths below. If we attempt to reason from the conditions of the present, we will find but little to assist, and much to mislead, and it is only when all the facts relating to the different conditions which have prevailed, and the changes and vicissitudes through which the earth has passed are brought together, and their relation to and bearing on each other are given due weight, that any correct idea of these things can be formed, and the possible history of the mountain in some measure understood.

Mount Royal is an intruded mass of trap, which has been forced upward through an opening or fracture in the lower Silurian strata by which the whole country in the neighborhood of Montreal was overlaid.

The first point to be noticed is that the limestone strata being pierced by the trap, it necessarily follows that the eruption must have occurred after it was laid down. This affords a means of approximately fixing the period at which the eruption occurred, or, at least, of knowing it could not have occurred until after a certain period had elapsed.

On the other hand, as we shall see, it must have taken place before the time of the Lower Helderberg group, which is the highest member of the Upper Silurian formation.

At various places, almost to the top of the mountain, fragments of the Lower Silurian strata are found, apparently in place, where they have been protected from erosion by the harder trap rock.

From this it would appear that the overlying strata have, to a great extent, been removed by denudation, that the general surface of the country is now much lower than it was at some former period, and its relation to the height of the mountain very different from what it is at present.

Since the earth became cooled and hardened, there has been a constant succession of changes in the position and location of the materials which formed its surface.

These have been disintegrated by the effect of the atmosphere, rain, frost, and other influences, and redistributed by the action of water, forming in this way beds and banks which eventually hardened into rocks, which enclose and preserve the various forms of life existing at the time they were deposited, the total mean thickness of the accessible part of these fossiliferous rocks in Europe being estimated by Geikie at 75,000 feet or about 14 miles, while single beds of limestone over 1,000 feet in thickness are described by Logan as occurring in the Laurentians, and the total thickness of the latter formation has been placed at 30,000 feet, or over 5½ miles.

Bearing in mind the tremendous scale on which these operations of nature have been carried on, the fact will be easily realized that there might have been a thickness of several hundred feet of strata above that of the present level, and that it might even have stood much higher than the summit of the mountain as it appears to-day.

The facts which have so far been ascertained would seem to justify the opinion that this was the case. Logan estimates the thickness of the Trenton with the Black River and Birdseye formations at Montreal at 650 or 700 feet, and the Chazy at 150 feet, while the total thickness of the Hudson River formation, the highest member of the Lower Silurian, is placed at 2,000 feet, of which the Utica formation would amount to about 300 feet, although in places the thickness of the latter was much greater, a boring at Laprairie showing a depth of over 1,000 feet.

It is needless to say that no absolutely certain measurements of the highest level of the Silurian strata can be based on these estimates, but they at least show the possibility of its being much higher than the 744 feet above the level of the St. Lawrence, which is the present highest point of the mountain.

There is, however, corroborative evidence in the nature of the trap of Mount Royal itself, and in this respect the same rule is found to apply, to some extent at least, to the other intrusive masses belonging to the same series, namely, Yamaska, Rougemont, Belœil, Montarville and Rigaud. The structure of the mass in all these cases is highly compact, and crystalline, which would indicate that they were ejected and consolidated under great pressure. Some of them reach a height of more than 1,000 feet above the plain, and their summits appear equally solid and crystalline with their bases. Reasoning from these facts, it would appear that the level of the Lower Silurian strata must in all probability have reached a point far above the present summit of Mount Royal.

If this assumption is correct, there would be at the close of the period in which the Hudson River formation, including the Utica and Trenton, was laid down, a great plain, with few inequalities, and covered with solid rock, extending from the Laurentian to the Adirondack Mountains.

An interesting question arises here as to the date or distance of time when the eruption took place. Any estimate which may be made of this date must of necessity be largely a mere deduction from certain supposed premises, both of which may be altogether mistaken. Various attempts, however, for the most part widely divergent, have been made to fix the date, some of which have been placed at over 100,000,000 years. Among others, Lord Kelvin, better known as Sir William Thomson, whose opinion is perhaps of as much value as that of any one, has estimated the whole duration of the earth at 20,000,000 years.

Of this he apportions 5,000,000 for the Azoic or Archæan, the same period to the Eozoic, and 6,000,000 to the Palæozoic, including the carboniferous or coal period.

If the Hudson River formation was completed about the middle of this period of 6,000,000 years, which other circumstances would render probable, it would place the eruption as having occurred about 7,000,000 years ago, but, as already stated, this, as well as any other date which might be named, is altogether conjectural, and may be very far from the fact.

What were the conditions under which the various formations up to the Hudson River were deposited? Probably a shallow sea, with a slow but quiet and continuous subsidence of the land, followed at the end of this period by a contrary movement, which was continued until it stood at possibly a higher level than at present.

As a possible consequence of this movement of elevation, the great fracture or line of disturbance, which, according to Sir William Logan, has been traced for a distance of 180 miles, from the Hills of Brome and Shefford to the Lac des Chats, on the Ottawa River, and which is marked by the Mountains of Brome, Shefford, Yamaska, Rougemont, Belœil, Montarville, Mount Royal and Rigaud, while Mount Johnson or Monnoir, situated to the south of Belœil, apparently belongs to the same series, although out of the range of those first mentioned.

Along the line of this fracture or disturbance, at various places where the overlying strata had been weakened or forced apart, liquid or viscid matter was forced upwards until the cavity in the strata was completely filled, in some places, as in the quarry on Côte des Neiges Hill, tilting up and curving the limestone strata and leaving it lying at an angle against the intruded mass. Where the fracture reached the surface, the lava, if the eruption was without violence, would flow out over the surrounding country, forming sheets or floors, as in the Indian Deccan, where an extent of country estimated at 200,000 square miles is covered with nearly horizontal sheets of lava to a depth of 4,000 or 5,000 feet. If accompanied by explosions or great force, the molten matter, with ashes and stones, would be thrown out, and a cone built up out of the ejected materials.

If, on the contrary, the fracture did not extend to the surface, the molten matter would be forced upwards as into a mould, where it would be cooled and consolidated into a mass, the shape of the cavity which contained it. If, then, in course of time, the overlying crust under which it cooled should be removed, the intrusive mass, being harder than the surrounding rock, would remain and stand out as a hill or "Boss" of trap.

There is reason for the opinion that Mount Royal belongs to the latter class. Had the ordinary volcanic phenomena been present, the resulting cone or sheets of lava might have protected the softer limestone strata from erosion, as is the case at various points on the mountain where the limestone was overlaid by the trap, and thus preserved the mountain from it, to some extent at least; but the strongest reason for this opinion is found in the fact that the trap of which the mountain is composed presents, as already noticed, the compact and highly crystalline structure, which it could scarcely have shown had it not been consolidated under great pressure.

Assuming this view to be correct, the eruption or ejection of the trap which now constitutes the mountain might have been accompanied by no external phenomena, unless it were by earthquakes of a more or less violent character, according to the nature of the disturbances, which were probably of frequent occurrence, since the principal mass of the mountain is composed of two distinct and different materials ejected at different periods, while a succession of trap dykes and floors extending for great distances from the mountain, and, in the case of the dykes, frequently cutting each other, show that the activity was successive and long continued, although proceeding far below the surface of the country.

But while the mountain was thus being formed in the depths beneath, a different process was going on at the surface. The comparatively soft sedimentary rock was being dissolved and eroded by the action of the elements, until in course of time the limestone had been removed to nearly its present level, and the great mass of lava, being hard enough to resist the action which dissolved the limestone, stood out as a mountain possibly of much greater height than at present.

This process of denudation must have continued for a long period to have removed the great thickness of strata which probably existed, and it might possibly have begun about the middle of the period of 6,000,000 years already referred to.

Following this erosion came a subsidence of the land, during which the conglomerate of the Lower Helderberg group was laid down, of which St. Helen's Island and Round Island, with the exception of a few scattered outlying patches, present the only examples in the neighborhood of Montreal.

This formation, according to Logan, "Geology of Canada," pp. 669, 358, rests unconformably on the Lower Silurian strata, and is cut by dykes of dolorite, which show that the volcanic activity had not ceased even at that period. This formation found on St. Helen's and Round Islands presents a most difficult question for solution. The conglomerate is composed of fragments, sometimes rounded, but for the most part angular, of Laurentian gneiss, white sandstone, Trenton limestone, black and red shales, and red sandstone, besides fragments of igneous rocks, the whole cemented together by a paste of gray dolomite, covering the island, and rising into a hill, the greatest height of which is about 125 feet above the river.

How such a mass of different materials became collected together, whether it is in the nature of a Moraine formation or fragments carried by fields of ice from different localities and deposited in an eddy of the glacial sea of some possible Silurian Ice Age, is a question of the greatest difficulty, and perhaps somewhat beyond the scope of the present enquiry; but as it is the opinion of some observers that the dolomite paste which binds the conglomerate together contains volcanic ash, if this view is correct, it is not impossible that there may have been at this point something more of volcanic activity than on the mountain itself, which, at the time the conglomerate was deposited, was, as the land subsided, a small island, then completely covered with water, and afterwards, doubtless during the Pleistocene period, worn down to its present height by the great icefields floating on the surface of the glacial ocean. Then, as the elevation of the land continued, at the close of this period it would again become an island, its cliffs broken and worn by the waves, which piled up beaches of pebble and shingle around its sides until at length the land arose above the water, and the mountain stood out, presenting much the same appearance as it does at the present time.

Such in outline is the possible history of Mount Royal, if this view is well founded; but while the weight of evidence appears to support it, the fact must always remain that, with our limited information, the opposite view, which holds that the mountain has at some period been an active volcano, may be the true one.

There may, however, be in the former opinion something reassuring to timid citizens, who are perhaps disturbed by the ancient prophecy which declared that the old volcano would yet awaken from its sleep and destroy the city, since, if it never has been an active volcano, there should be less probability of its becoming one in the future.

Addenda and Corrigendum to "Progress of Geological Work in Canada during 1899."[1]

By H. M. Ami, M.A., D.Sc., F.G.S.,
(Of the Geological Survey of Canada, Ottawa).

BROCK, R. W.
West Kootenay Ore Bodies.
The Journ. Can. Min. Inst., Vol. 2, pp. 72-86, 1899, Ottawa, Canada.

COLQUHOUN, A. J.
Notes on the occurrence of quicksilver in Canada.
The Journal of the Canadian Mining Institute, Vol. 2, pp. 13-16, illustrated, 1899. Ottawa, Canada.

DONALD, J. T.
A Notable Canadian Deposit of Chromite.
The Journ. Can. Min. Inst., Vol. 2, pp. 25-27, illustrated, 1899. Ottawa, Canada.

DOUGLAS, JAMES.
Swedish Iron Metallurgy and its Application to Canada.
The Journ. Can. Min. Inst., Vol. 2, pp. 38-53, illustrated, 1899. Ottawa, Canada.

EVANS, J. W.
The Gold Bearing Sands of the Vermillion River.
The Journ. Can. Min. Inst., Vol. 2, pp. 105-107, 1899. Ottawa, Canada.

FARIBAULT, E. R.
On the Gold Measures of Nova Scotia and Deep Mining.
The Journ. Can. Min. Inst., Vol. 2, pp. 119-128, 1899. Ottawa, Canada.

FERRIER, WALTER F. (and A. E. BARLOW).
On the Relations and Structure of certain Granites and Associated Arkose of Lake Temiscaming, Canada.
Brit. Assoc. Adv. Sc. Report, 1897 (Toronto meeting) pp. 659-660, 1898. London, England.

1 Published July, 1900, in Canadian Record of Science, Vol. VIII., No. 4. 15 pp. Montreal.

GANONG, W. F.

Notes on the Natural History and Physiography of New Brunswick.

Bull. Nat. Hist. Soc., N. Br., Vol. 4, pp. 227-257, 1899. St. John, New Brunswick.

GRANT, C. C.

Geological Notes. (Read at the opening meeting of the Geological Section.)

Journ. and Proc., Hamilton Assoc. for Session 1898-9, No. 15, pp. 48-66, 1899. Hamilton, Canada.

MEISSNER, C. A.

Prospecting for Iron Ore in Newfoundland and Cape Breton.

The Journ. Can. Min. Inst., Vol. 2, pp. 66-71, illustrated, 1899. Ottawa, Canada.

MERRITT, WM. HAMILTON.

An Occurrence of Free Milling Gold Veins in British Columbia.

The Journ. Can. Min. Inst., Vol. 2, pp. 143-148, 1899. Ottawa, Canada.

NEIL, A. T. (& A. E. WALKER).

Rep. of the Geol. Section for the Term Ending 1899.

Journ. and Proc. Hamilton Assoc. for Session 1898-99, No. 15, pp. 46-47, (illustrated), Hamilton, Canada.

ROBERTS-AUSTEN, SIR WILLIAM C.

Nickel Extraction by the Mond Process.

Rep. Bureau of Mines for Ontario, Vol. 8, pt. 1, pp. 106-120, 1899. Toronto, Canada.

SELWYN, A. R. C.

Gold Mining in Nova Scotia from 1860-1899.

The Journ. Can. Min. Inst., pp. 162-165, 1899. Ottawa, Canada.

(SELWYN, A. R. C.)

Eminent Living Geologists : Alfred Richard Cecil Selwyn.

Geol. Mag., New Ser., Dec. 4, Vol. 6, pp. 49-55, pl. 2, Feb. 1899. London, England.

SMITH, J. BURLEY.

Description of the Sultana Quartz Lode, and the Sinking of the Burley Shaft in Bald Indian Bay, Lake of the Woods,

The Journ. Can. Min. Inst., Vol. 2, pp. 87-101, illustrated, 1899. Ottawa, Canada.

TYRRELL, J. B.
The Geology of the Klondike Region.
Engin. and Min. Journ., Vol. 67, p. 116. Jan. 28th, 1899.

WALCOTT, CHARLES DOOLITTLE.
Random : A Pre-Cambrian Upper Algonkian Terrane.
Bull. Geol. Soc. Amer., Vol. II., pp. 3-5, 1899. Rochester, N.Y.

WALKER, A. E. (& A. T. NEIL).
Report of the Geological Section for the Term Ending 1899.
Journ. and Proc. Hamilton Assoc. for Session 1898-1899. No. 15, pp. 46-47, (with illustration), Hamilton, Canada.

WALKER, B. E.
Presidential Address. (Read 12th November, 1898). Issued May, 1899.
Proceedings of the Canadian Institute, p. 10. (Place of publication and date not indicated.)

WHITESIDE, O. E. S.
Across the Pitch *versus* Up the Pitch.
The Journ. of the Can. Min. Inst., Vol. 2, pp. 17-20, 1899. Ottawa, Canada.

WILLMOTT, A. B. (and A. P. COLEMAN).
Michipicoten Iron Range.
Rep. Bureau of Mines, Vol. 8, Part 2, pp. 254-258. Toronto, Ontario, 1899.
(Printed by order of the Legislative Assembly of Ontario.)

WOODMAN, J. E.
Shore Developments of the Bras d'Or Lakes.
Amer. Geol., Vol. 24, pp. 329-342, 2 figs. Minneapolis, Minn., U.S.A., 1899.

Palæontological Note.

"On Cyphornis, an Extinct Genus of Birds." By E. D. Cope. *Journal Academy Natural Sciences*, Philadelphia, Vol. IX., pp. 449-452, Pl. XXI., figs. 11–16 ; 1894.

Among the recent additions to our knowledge of the extinct vertebrata of Canada, Prof. E. D. Cope contributes an interesting article in the *Journal of the Academy of Natural Sciences*, Philadelphia. The paper is based on a specimen collected by Dr. George M. Dawson from the Tertiary shales of the west coast of Vancouver Island, and belongs to the Geological Survey of Canada. The bone was sent by Capt. Jacques, of Victoria, B.C., to Dr. G. M. Dawson, and was obtained at Carmanagh Point, Vancouver Island. The specimen is carefully described by Prof. Cope on pages 449 *et seq.*, and consists of the "superior part of a tarsometatarse" belonging to a new genus of bird. It was a singular but rather fortunate occurrence that this portion of the skeleton was preserved, inasmuch as the "tarsometatarse is perhaps the most characteristic part of the skeleton of a bird." Prof. Cope finds that this extinct species of birds, which used to inhabit our western coast in Tertiary times, and to which he has given the generic designation of *Cyphornis,* bears greater resemblance to the Steganopodes or Pelicans than to any other family. "The anterior aspect of the bone," Cope says (*loc. sit.*, p. 451), "is almost exactly like that of *Pelecanus*," but the "posterior aspect resembles that of none of the order, in the absence of the tendinous grooves." When compared with Cretaceous birds, Cope finds but *one* "point of resemblance," and that to the extinct form *Hesperornis*, in "the ridge-like elevation of the anterior part of the external tibial facet, which is in both genera connected with the intercondylar tuberosity." The affinities of this bird, Prof. Cope holds, are more clearly with the "*Steganopodes*," but they have combined with these certain affinities to "more primitive birds with a simple hypotarsal structure." CYPHORNIS MAGNUS, Cope, is the name ascribed to this extinct bird from Canada, which inhabited our western shores in Tertiary times. "As regards its habits, it may be said that the pneumatic character of its foot bone renders it improbable that it depended on this member for habitual locomotion on land. In all the birds of terrestrial habit which I have examined, and of which I can give information, the tarsometatarse is either filled with cancellous tissue, dense or open, or the walls of the shaft are thick, as in the Emeu. The presumed affinity with the Steganopodes indicates natatory habits and probable capacity for flight. Should this power have been developed in *Cyphornis magnus*, it will have been much the largest bird of flight thus far known." On plate XX. of this *livraison* Cope figures six views of the tarsometatarse in question, and in the text expresses the hope that new and additional material will be forthcoming from which to describe more fully the present imperfectly known but interesting species.

Regarding the precise geological horizon to which to refer the species, Prof. Cope writes :—"The characters of *Cyphornis* indicate that the bed from which it was obtained is not older than Eocene nor later than Oligocene."

H. M. AMI.

Book Notices.

The increasing interest taken in the study of Astronomy has induced the proprietors of *Knowledge* to issue an annual for students and workers in that science specially devoted to their requirements. It is entitled "Knowledge Diary and Scientific Handbook, 1901," and will contain, amongst other things, useful tables, original articles, calendar of scientific events, and a blank diary portion.

Botany: An Elementary Text-Book, by L. H. Bailey. 12mo. Half leather. 500 illustrations. Pages xiv + 355. The MacMillan Company. New York. Price $1.10.

The amount of literature relating to the study of plants which has appeared during the last five years is truly astonishing. For a quarter of a century or more Gray's Lessons with plants was the standard, in fact the dominant class-room botany. About the time his "New Manual" was published in 1887, other books presenting the study of botany in quite a different manner appeared. Since that time, each year has marked divergences of opinion among botanists regarding teaching methods.

Gray's Lessons did not take up the subject from the present-day view point of botanical science. It is a question with many whether the botanical science standpoint is best for the pupil—the average pupil. There are many text-books for the student of botany. The admirable works of Coulter, Barnes, Atkinson and Ganong are written for the college student. There are few text-books for the pupil. In the present-day botany, individuals of the plant kingdom illustrating its lowest and simplest forms are studied first. More complete forms are examined in natural order and regular sequence. This is the logical; it is the scientific method, the one approved by those versed in pedagogy.

Bailey's botany "is made for the pupil"—so its author announces. "There are four general subjects in the book: The nature of the plant itself; the relation of the plant to its surroundings; histological studies; determination of the kinds of plants." The author's position on the teaching of botany in the secondary school has no doubt been much influenced by his intimate association with the nature study movement in New York, which in itself has been a great training school. It is as follows: "In the secondary schools, botany should be taught for the purpose of bringing the pupil closer to the things with which he lives, of widening his horizon, of intensifying his hold on life. It should begin with familiar plant forms and phenomena. It should be related to the experiences of the daily life. It should not be taught for the purpose of making the pupil a specialist; that effort should be retained for the few who develop a taste for special knowledge. It is often said that the high-school pupil should begin the study of botany with the lowest and simplest forms of life. This is wrong. The microscope is not an introduction to nature. It is said that the physiology of plants can be best understood by beginning with the lower forms. This may be true ; but technical plant physiology is not a subject for the beginner. Other subjects are more important. . . Good botanical teaching for the young is replete with human interest. It is connected with the common associations. . . When beginning to teach plants, think more of the pupil than of botany. The pupil's mind and sympathies are to be expanded: the science of botany is not to be extended. The teacher who thinks first of his subject teaches science ; he who thinks first of his pupil teaches nature-study. . . The old way of teaching botany was to teach the forms and the names of plants. It is now proposed that only function be taught. But one cannot study function intelligently without some knowledge of plant forms and names. He must know the language of the subject. The study of form and function should go together. Correlate what a plant is with what it does. What is this plant ? What is its office, or how did it come to be ? It were a pity to teach phyllotaxy without teaching light-relation : it were an equal pity to teach light-relation without teaching phyllotaxy."

Of the book itself there is little need to speak. The subject-matter is excellently edited ; the illustrations are elaborately profuse—perhaps unnecessarily so—mostly half-tones ; the paper and binding are of the best. It is an exceedingly attractive volume ; not a dull page between its handsome covers.

We shall watch the success of this book, which in a measure is a reversion to former botanical teaching ideals, with a great deal of interest. There is unquestionably a tendency on the part of the advanced teacher of botany to cater to the specialist in scientific botany rather than the student who wishes to study plants. I think this book has a distinct mission and will find a large constituency awaiting it.

JOHN CRAIG.

Ithaca, N.Y.

LY, 1900.

Me87 feet. C. H. McLEOD, *Superintendent.*

DAY	Per cent. possible Sunshine.	Rainfall in inches.	Snowfall in inches.	Rain and snow melted.	DAY.
SUNDAY........ 1	76	....	....	....	1 ....SUNDAY
2	93	...	....	....	2
3	00	0.42	....	0.42	3
4	63	....	....	....	4
5	21	....	....	....	5
6	00	0.39	...	0.39	6
7	80	0.11	....	0.11	7
SUNDAY........ 8	25	0.77	....	0.77	8..........SUNDAY
9	04	0.03	....	0.03	9
10	74	....	....	....	10
11	21	0.86	....	0.86	11
12	54	0.00	....	0.00	12
13	41	0.03	...	0.03	13
14	84	0.05	....	0.05	14
SUNDAY....... 15	59	...	....	....	15......... .SUNDAY
16	18	1.00	....	1.00	16
17	32	1.76	....	1.76	17
18	68	0.00	....	0.00	18
19	99	....	....	....	19
20	37	0.07	....	0.07	20
21	42	0.00	....	0.00	21
SUNDAY........22	98	....	....	....	22 ....SUNDAY
23	96	....	....	....	23
24	25	0.20	...	0.20	24
25	00	1.34	....	1.34	25
26	90	....	....	....	26
27	95	....	....	....	27
28	90	....	....	....	28
SUNDAY....... 29	91	0.06	....	0.06	29..........SUNDAY
30	05	0.25	....	0.25	30
31	46	0.07	....	0.07	31
Means......	52.4	7.41	....	7.41	..............Sums.
26 Years means for and including this month	¶59.21	4.252	....	4.252	26 Years means for and including this month.

Direction.......	
Miles	
Duration in hrs.	
Mean velocity...	

h, 16th, 17th
nometer.
ea-level and

taken from

being 100.
ours.

Greatest mil e 7th; the
southwest on the ng a range
Greatest vel
hour on the 11th est day was
was 30.16 on

the 22nd. Lowest barometer was 29.34 on the 8th, giving range of .82 inches.

Minimum relative humidity observed was 43 on the 14th.

Rain fell on 19 days.

Fog on 2 days.

Thunderstorms on 5 days—the 8th, 11th, 24th 25th and 29th.

ABSTRACT FOR THE MONTH OF JULY, 1900.

Meteorological Observations, McGill College Observatory, Montreal, Canada. Height above sea level, 187 feet. C. H. McLEOD, *Superintendent.*

DAY	THERMOMETER. † Mean.	Max.	Min.	Range.	*BAROMETER. † Mean.	Max.	Min.	Range.	‡Mean relative humidity.	a WIND. General direction.	Mean velocity in miles per hour	Per cent. possible Sunshine.	Rainfall in inches.	Snowfall in inches.	Rain and snow melted.	DAY.
SUNDAY........ 1	57.19	66 7	48.8	17.9	29.93	30.04	29.76	.28	74	W.	27.0	76	....	....	....	1 ... . .SUNDAY
2	63.22	72.9	51.0	21.9	30.10	30.14	30.02	.12	74	S W.	14 6	93	...	....	....	2
3	61.27	64.7	52.8	11.9	29.89	30.11	29.70	.41	92	S.E.	13.7	00	0.42	....	0.42	3
4	69.87	78.5	63.5	15.9	29.91	29.99	29.78	.21	79	W.	13.5	63	....	....	....	4
5	62.55	68.6	56.3	12.3	30.02	30.09	29.94	.15	76	W.	9.3	21	....	....	....	5
6	60.45	62.4	58.2	4.2	29.83	29.94	29.73	.21	96	E.	7.4	00	0.39	...	0.39	6
7	73.65	87.0	57.2	29.8	29.60	29.73	29.52	.21	74	S.W.	17.6	80	0.11	....	0.11	7
SUNDAY........ 8	69.96	78.7	65.3	13.4	29.41	29 52	29.34	.18	94	S.W.	19.6	25	0 77	....	0.77	8...........SUNDAY
9	62.07	66.4	60 7	5.7	29.53	29.61	29.39	.22	91	S.W.	18.2	04	0.03	....	0.03	9
10	65.40	72.8	59.5	13.3	29.79	29.92	29.61	.31	75	S.W.	18.0	74	....	....	....	10
11	65.66	74 8	59.9	14.9	29.93	30.01	29.84	.17	86	S.	15.0	21	0.86	....	0.86	11
12	60.18	71 3	60.8	10.5	29.84	29.90	29.80	.10	70	S.W.	18.4	54	0.00	....	0.00	12
13	65.80	74.8	61.2	13 6	29.75	29 81	29.71	.10	83	S.W.	16.5	41	0.03	.. .	0.03	13
14	69.19	80.0	60.0	20.0	29.85	29.89	29.78	.11	60	W.	16.7	84	0.05	....	0.05	14
SUNDAY....... 15	71.87	80.3	66.0	14 3	29.86	29.89	29.83	.06	78	S.W.	18.0	59	...	....	....	15......... .SUNDAY
16	73.27	78.5	69.2	9.3	29.84	29.88	29.80	.08	91	S.W.	16.4	18	1.00	....	1.00	16
17	68.67	75.4	65.7	9.7	29.82	29.84	29.81	.03	94	N.	15 7	32	1.76	....	1.76	17
18	70.74	75.5	66.4	9.1	29.83	29.94	29.76	.18	73	S.W.	21.4	68	0 00	....	0.00	18
19	71.05	79.6	62.5	17.1	29.96	29 99	29.92	.07	67	W.	15.0	99	....	....	....	19
20	69.44	80.0	59.5	20.5	29.93	29.99	29.86	.13	79	S.	9.6	37	0.07	....	0.07	20
21	71.62	81.0	66.0	15.0	29.89	30.06	29.81	.25	80	S.W.	18.4	42	0.00	....	0.00	21
SUNDAY........22	71 82	80.7	60.0	20.7	30.12	30.16	30.06	.10	69	S.W.	13.4	98	....	....	....	22 ....SUNDAY
23	73.20	81.3	63.4	18.9	30.05	30.09	29.99	.10	70	S.W.	16.6	96	....	....	....	23
24	72.77	80.2	67.8	12.4	29.91	29 91	29 82	.17	80	S.W.	14 8	25	0.20	...	0.20	24
25	67.15	70.6	64.8	5.8	29 77	29.83	29.72	.11	93	N.W.	5.9	00	1.34	....	1.34	25
26	66.98	74.1	59.2	14.9	29.90	29.96	29.82	.14	68	N.W.	9.8	90	....	....	....	26
27	65.53	72.9	58.4	14.5	30.04	30.08	29.96	.12	65	W.	11.7	95	....	....	....	27
28	68.84	77.0	59.2	17.8	30.05	30.09	30.02	07	73	S.W.	18 0	90	....	....	....	28
SUNDAY....... 29	73 29	84.4	60.0	24.4	29 94	30.03	29.84	.19	72	S.	11.2	91	0 06	....	0.06	29 ....SUNDAY
30	68 41	73.8	62.3	11.5	29.87	29.92	29.84	.08	86	S.	14.3	05	0.25	....	0.25	30
31	69 53	79.0	60.1	18.9	29.82	29 92	29.75	.15	77	S.W.	15.0	46	0.07	....	0.07	31
Means............	67 76	75.64	60 83	14.81	29 870	29.946	29 791	155	78.7	W. 39.7° S.	15 19	52 4	7.41	....	7.41	...............Sums.
26 Years means for and including this month......	68.84	77.31	60.76	16.55	29 897	......	......	.142	71.84	....	§ 13 06	¶59.21	4.252	....	4.252	26 Years means for and including this month.

a ANALYSIS OF WIND RECORD.

Direction......	N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.	CALM.
Miles	301	148	113	515	1743	5139	2943	380	
Duration in hrs..	27	17	15	43	136	290	183	33	
Mean velocity....	11.1	8.7	7.3	12.4	12.8	17.7	16.1	11.5	

Greatest mileage in one hour was 32 from the southwest on the 18th.

Greatest velocity in gusts was 52 miles per hour on the 11th from the southwest.

Resultant mileage, 8320.

Resultant direction, W. 39.7° S.

Total mileage, 11,298.

Average velocity—, 15.19 miles per hour.

a Wind velocity on the 2nd, 3rd, 13th, 16th, 17th and 19th, reduced from City Hall Anemometer.

* Barometer readings reduced to sea-level and temperature 32° Fahrenheit.

† Mean of bi-hourly readings taken from self-recording instruments.

‡ Humidity relative, saturation being 100. Mean of observations at 8, 15, and 20 hours.

¶ 19 years only. § 14 years only.

The greatest heat was 87.0 on the 7th; the greatest cold was 48.8 on the 1st, giving a range of temperature of 38.2 degrees.

Warmest day was the 7th. Coldest day was the 1st. Highest barometer reading was 30.16 on the 22nd. Lowest barometer was 29.34 on the 8th, giving range of .82 inches.

Minimum relative humidity observed was 43 on the 14th.

Rain fell on 19 days.

Fog on 2 days.

Thunderstorms on 5 days—the 8th, 11th, 24th 25th and 29th.

UST, 1900.

M37 feet. C. H. McLEOD, *Superintendent.*

DAY	Per cent. possible Sunshine.	Rainfall in inches.	Snowfall in inches.	Rain and snow melted.	DAY.
	92	0.00	....	0.00	1
	53	0.42	....	0.42	2
	13	....	....	....	3
	76	....	....	....	4
SUNDAY.... ..	38	0.04	....	0.04	5..........SUNDAY
	00	0.60	....	0.60	6
	23	0.34	....	0.34	7
	15	0.75	....	0.75	8
	86	....	....	....	9
	26	0.45	....	0.45	10
	53	0.12	....	0.12	11
SUNDAY........	83	....	....	....	12.... ....SUNDAY
	39	0.29	.. .	0.29	13
	00	0.01	....	0.01	14
	79	00.3	....	0.03	15
	64	....	....	....	16
	89	....	....	....	17
	59	0.02	....	0.02	18
SUNDAY........	79	....	....	....	19..........SUNDAY
	71	....	....	....	20
	88	....	....	....	21
	54	0.07	....	0.07	22
	81	....	....	....	23
	58	....	..	....	24
	64	....	....	....	25
SUNDAY.......	87	....	....	....	26..........SUNDAY
	80	....	....	....	27
	86	....	....	....	28
	84	....	....	....	29
	87	....	....	....	30
	73	....	....	....	31
Means...... ...	60.4	3.14	....	1.14	...............Sums.
26 Years means for and including this month	¶58.26	3.50	....	3.50	26 Years means for and including this month.

a-level and

aken from

Direction......

Miles ....

being 100.

ours.

Duration in hrs.

Mean velocity...

e 26th; the

ing a range

Greatest mil
west on the 11th.
Greatest vel
hour from the w

est day was
was 30.29 on
on the 11th,

Minimum relative humidity observed was 46 on the 17th.

Rain fell on 13 days.

Lunar halo on the 12th.

ABSTRACT FOR THE MONTH OF AUGUST, 1900.

Meteorological Observations, McGill College Observatory, Montreal, Canada. Height above sea level, 187 feet. C. H. McLEOD, *Superintendent.*

DAY	THERMOMETER. † Mean.	Max.	Min.	Range.	*BAROMETER. † Mean.	Max.	Min.	Range.	‡Mean relative humidity.	a WIND. General direction.	Mean velocity in miles per hour	Per cent. possible Sunshine.	Rainfall in inches.	Snowfall in inches.	Rain and snow melted.	DAY.
1	62.75	69.2	55.0	14.2	30.01	30.04	29.85	.19	70	N.W.	11.2	92	0.00	....	0.00	1
2	61.31	75.5	55.0	20.5	29.94	30.04	29.87	.17	81	S W.	14.6	53	0.42	....	0.42	2
3	56.90	63.5	50 0	13.5	30.10	30.20	29.93	.27	76	W.	10.9	13	....	....	....	3
4	62.48	70.4	53.9	16.5	30.25	30.29	30.20	.09	75	N.W.	6.9	76	....	....	....	4
SUNDAY.... .. 5	66.01	78.0	53.7	24.3	30.16	30 25	30.04	.21	85	S.	10.7	38	0.04	....	0.04	5..........SUNDAY
6	69.63	79.4	63.9	15.5	30.04	30.07	29.98	.09	91	N.	6.0	00	0.60	....	0.60	6
7	65 75	67.9	63.9	4.0	30.08	30.12	30.05	.07	94	N.	7.9	23	0.34	....	0.34	7
8	73.06	81 0	66.0	15.0	29 93	30.05	29.84	21	92	S.W.	9.9	15	0.75	....	0.75	8
9	77.58	85.5	72 0	13.5	29.93	29 97	29.88	.09	81	W.	12.6	86	....	....	....	9
10	75.40	82 0	69.8	12.2	29 81	29.91	29.74	.17	89	W.	15.0	26	0.45	....	0.45	10
11	74.67	83.7	59.2	24.5	29.74	29 91	29.70	.21	82	W.	20.3	53	0.12	....	0.12	11
SUNDAY........12	59.32	66.8	49.5	17.3	30.04	30.08	29.91	.17	60	N.W.	12.7	83	....	....	....	12..... .....SUNDAY
13	59.62	68.2	53.0	15.2	30.01	30 07	29.94	.13	86	N.E.	13.0	39	0.29	.. .	0.29	13
14	60 58	66.5	56 4	10.1	29.97	30.00	29.93	.07	88	S.E.	7.0	00	0.01	....	0.01	14
15	69.28	79.1	60.0	19.1	29.96	29.98	29 93	.05	80	S.	12.6	79	00.3	....	0.03	15
16	73.22	82.3	65.9	16.4	29.89	29.93	29.84	.09	73	S.W.	13.2	64	....	....	....	16
17	69.27	76.0	63.7	12.3	30 01	30 05	29.91	.14	55	W.	14 1	89	....	....	....	17
18	66.43	76.5	58 1	18.4	30.03	30.06	29.98	.08	75	N.W.	8.9	59	0.02	....	0.02	18
SUNDAY........19	61.74	69.7	54.0	15.7	30.10	30.12	30.04	.08	70	N.W.	9.8	79	....	....	....	19..........SUNDAY
20	61.32	67.0	53.0	14.0	30.06	30.11	30.01	.10	75	N.	11.0	71	....	....	....	20
21	59.60	68.3	49.7	18.6	29.98	30.04	29.91	.13	71	N.	8.6	88	....	....	....	21
22	65.75	74.0	60.2	13.8	29.93	29.97	29.90	.07	81	W.	9.8	54	0.07	....	0.07	22
23	65.06	74.0	55.9	18.1	29 98	30.03	29.93	.10	73	S.E.	8.1	81	....	....	....	23
24	71.26	80.4	61.7	18.7	29.86	29.93	29 82	.11	79	S.E.	12.7	58	....	...	....	24
25	76 85	86.1	68.9	17.2	29.91	29.96	29.85	.11	75	S.	13.0	64	....	....	....	25
SUNDAY....... 26	79.32	87 9	73.0	14.9	29.93	29.97	29 90	.07	71	S.W.	16.1	87	....	....	....	26..........SUNDAY
27	78.05	84.4	72.5	11.9	29.94	30.00	29.89	.11	64	W.	10.0	80	....	....	....	27
28	70.60	79.5	62.7	16.8	29.97	30.00	29.93	.07	72	N.	7.5	86	....	....	....	28
29	73 28	84.6	61.5	23.1	29.95	29.99	29.92	.07	69	S.	11.1	84	....	....	....	29
30	70.72	78.8	65 0	13.8	30.06	30.13	29.94	.19	66	N.W.	9.2	87	....	....	....	30
31	65 37	71.8	60.1	11.7	30.22	30.28	30.13	.15	69	N.	10.0	73	....	....	....	31
Means..............	67.81	76.06	60.23	15.83	29 993	30.050	29 925	.125	76.4	West.	11.10	60.4	3.14	....	1.14	...............Sums.
26 Years means for and including this month	66.76	75.07	58.82	16.25	29.940	....	......	.133	73.40	....	§ 12.29	¶ 58.26	3.50	....	3.50	26 Years means for and including this month.

ANALYSIS OF WIND RECORD.

Direction......	N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.	CALM.
Miles	1205	422	307	457	1449	786	2458	1177	
Duration in hrs..	123	53	37	39	135	61	187	109	
Mean velocity....	9 8	7.9	8 3	11 7	10.7	12.9	13.2	10.7	

Greatest mileage in one hour was 31 from the west on the 11th.

Greatest velocity in gusts was 32 miles per hour from the west on the 11th.

Resultant mileage, 2,924.

Resultant direction, West.

Total mileage, 8,261.

* Barometer readings reduced to sea-level and temperature 32° Fahrenheit.

† Mean of bi-hourly readings taken from self-recording instruments.

‡ Humidity relative, saturation being 100. Mean of observations at 8, 15, and 20 hours.

¶ 19 years only. § 14 years only.

The greatest heat was 87.9 on the 26th; the greatest cold was 49.5 on the 12th, giving a range of temperature of 38.4 degrees.

Warmest day was the 26th. Coldest day was the 3rd. Highest barometer reading was 30.29 on the 3rd. Lowest barometer was 29.70 on the 11th, giving range of .59 inches.

Minimum relative humidity observed was 46 on the 17th.

Rain fell on 13 days.

Lunar halo on the 12th.

MBER, 1900.

37 feet. C. H. McLEOD, *Superintendent.*

DA	Per cent. possible Sunshine.	Rainfall in inches.	Snowfall in inches.	Rain and snow melted.	DAY.
	89	...	....	....	1
SUNDAY..	87	....	....	....	2..........SUNDAY
	79	0.01	....	0.01	3
	91	....	....	....	4
	73	....	....	....	5
	43	0.41	...	0.41	6
	96	....	....	....	7
	50	....	....	....	8
SUNDAY..	78	....	....	....	9..... .....SUNDAY
	17	0.00	....	0.00	10
	00	0.31	....	0.31	11
	10	0.47	....	0.47	12
	32	....	....	....	13
	94	....	....	....	14
	88	...	....	....	15
SUNDAY...	00	0.68	....	0.68	16..........SUNDAY
	14	0.07	....	0.07	17
	96	....	....	....	18
	87	....	....	....	19
	co	0.17	....	0.17	20
	40	0.09	....	0.09	21
	39	0.18	....	0.18	22
SUNDAY...	38	....	....	....	23 ....SUNDAY
	88	...	...	....	24
	54	....	....	....	25
	61	....	....	....	26
	06	....	....	....	27
	73	....	....		28
	00	1.23	....	1.23	29
UNDAY...	00	....	....	....	30... ....SUNDAY
Means.....	51.0	3.62	....	3.62	..............Sums.
26 Years for and incl this month	¶53.57	3.27	....	3.27	26 Years means for and including this month.

ea-level and

taken from

Direction..

Miles ..... being 100.

hours.

Duration i

Mean veloc he 3rd; the ying a range

Greate west on the lest day was

Greate was 30.37 on

hour from was 29.05 on

Minimum relative humidity observed was 57 on the 1st.

Rain fell on 11 days.

Lunar halos on the 10th and 11th.

Fog on 3 days.

Thunder on the 3rd, 6th and 16th.

ABSTRACT FOR THE MONTH OF SEPTEMBER, 1900.

Meteorological Observations, McGill College Observatory, Montreal, Canada. Height above sea level, 187 feet. C. H. McLEOD, *Superintendent.*

DAY	THERMOMETER. † Mean.	Max.	Min.	Range.	*BAROMETER. † Mean.	Max.	Min.	Range.	‡Mean relative humidity.	WIND. General direction.	Mean velocity in miles per hour	Per cent. possible Sunshine.	Rainfall in inches.	Snowfall in inches.	Rain and snow melted.	DAY.
1	64.77	75.0	54.0	21.0	30.31	30.37	30.26	.11	71	E.	9.4	89	...	....	....	1
SUNDAY...... 2	72.09	83 9	58.5	25.4	30.17	30.27	30.03	.24	77	S.E.	13.6	87	....	....	....	2...........SUNDAY
3	75.51	89.0	68 5	20.5	29.95	30.03	29.87	.16	71	S.	20.4	79	0.01	....	0.01	3
4	70.26	76.7	63.0	13.7	30.15	30.20	29.96	.24	78	S.W.	11.7	91	....	....	....	4
5	70.25	78.0	62.5	15.5	30.08	30.20	29.92	.28	87	S W.	15.7	73	....	....	....	5
6	69.92	82.0	63.0	19.0	29.79	29.92	29.71	.21	93	S.W.	19.7	43	0.41	...	0.41	6
7	56.18	62.1	48.3	13.8	30.15	30.22	29.92	.30	79	N.W.	11.6	96	....	....	....	7
8	59 77	70.0	47.5	22.5	30.12	30.21	30.05	.16	85	S.W.	11.7	50	....	....	....	8
SUNDAY........ 9	62.94	68.1	59.0	9.1	30.12	30.18	30.06	.12	81	N.	12.4	78	....	....	....	9..........SUNDAY
10	55.26	62.2	48.6	13.6	30.20	30.26	30.15	.11	89	N.	6.7	17	0.00	....	0.00	10
11	54.46	56.3	51.8	4.5	29.86	30.15	29.54	.61	99	N.E.	7.1	00	0.31	....	0.31	11
12	60.74	68.1	54.0	14.1	29.42	29.80	29.05	.75	91	W.	25.0	10	0.47	....	0.47	12
13	54.65	59.2	51.5	7.7	29.87	29 93	29.80	.13	91	S.	11.4	32	....	....	....	13
14	58.83	66.1	53 7	12.4	29.99	30.16	29.85	.31	82	W.	18.3	94	....	....	....	14
15	53.30	59.3	46.1	13.2	30.13	30.25	29.94	.31	86	N.	10.2	88	...	....	....	15
SUNDAY........16	57.63	61.5	52.9	8.6	29.70	29.94	29.58	.36	98	E.	15.7	00	0.68	....	0.68	16...........SUNDAY
17	57.26	62.5	51.4	11.1	29.69	29.77	29.59	.18	94	W.	18.5	14	0.07	....	0.07	17
18	51.73	57.9	46.1	11.8	30.03	30.23	29.77	.46	85	N.W.	17.4	96	....	....	....	18
19	49.31	57.8	39.8	18.0	30.29	30.37	30.23	.14	88	S.E.	7.1	87	....	....	....	19
20	52.95	57.8	46.1	11.7	30.07	30.25	29.97	.28	95	S.E.	17.3	00	0.17	....	0.17	20
21	60.52	68.0	55.9	12.1	29.88	29.97	29.83	.14	95	S.E.	11.0	40	0.09	....	0.09	21
22	57.30	64.6	54.2	10.4	29.88	29.90	29.87	.03	91	W.	11.9	39	0.18	....	0.18	22
SUNDAY....... 23	58.08	63.5	53.6	9.9	29.91	29.95	29.88	.07	91	N.W.	9.0	38	....	....	....	23 ....SUNDAY
24	62.11	71.2	54.1	17.1	30.09	30.21	29.95	.26	81	N.W.	14.0	88	....	...	....	24
25	57.70	66.2	49.1	17.1	30.24	30.30	30.20	.10	87	N.E.	10.5	54	....	....	....	25
26	67.73	76.7	58.3	18.4	30.07	30.20	29.95	.25	91	S.E.	12.3	61	....	....	....	26
27	63.91	72.9	54.5	18.4	30.04	30.16	29.92	.24	93	N E.	10.5	06	....	....	....	27
28	53.43	58.7	48.4	10.3	30.25	30.30	30.16	.14	87	N.	13.2	73	....	....		28
29	54.86	61.2	46.0	15.2	30.02	30.25	29.89	.36	96	S.E.	11.1	00	1.23	....	1.23	29
UNDAY........30	54.65	58.7	50.5	8.2	30.16	30.26	29.95	.31	91	W.	4.3	00	....	....	....	30..........SUNDAY
Means............	59 94	67.17	53.03	14.14	30.021	30.140	29.895	.245	87.4	W. 35 .4° S.	12 97	51.0	3.62	....	3.62	..............Sums.
26 Years means for and including this month	58.46	66.50	50 78	15.72	30.015	....	......	.184	76.19	....	§ 12.88	¶53.57	3.27	....	3.27	26 Years means for and including this month.

ANALYSIS OF WIND RECORD.

Direction.......	N	N.E.	E.	S E.	S.	S.W.	W.	N W	CALM.
Miles	1227	160	757	1626	1015	1579	1636	1335	
Duration in hrs..	135	22	72	118	65	97	120	89	
Mean velocity....	9.1	7.3	10 5	13.8	15 6	16.3	13.6	15.0	

Greatest mileage in one hour was 43 from the west on the 12th.

Greatest velocity in gusts was 48 miles per hour from the west, at 3.30 p.m. on the 3rd, and 11.40 a.m. on the 12th.

Resultant mileage, 2460.

Resultant direction, W. 35 .4° S.

Total mileage, 9,335.

* Barometer readings reduced to sea-level and temperature 32° Fahrenheit.

† Mean of bi-hourly readings taken from self-recording instruments.

‡ Humidity relative, saturation being 100. Mean of observations at 8, 15, and 20 hours.

¶ 19 years only. § 14 years only.

The greatest heat was 89.0 on the 3rd; the greatest cold was 46.0 on the 29th, giving a range of temperature of 43.0 degrees.

Warmest day was the 3rd Coldest day was the 19th. Highest barometer reading was 30.37 on the 1st and 19th. Lowest barometer was 29.05 on the 12th, giving range of 1.32 inches.

Minimum relative humidity observed was 57 on the 1st.

Rain fell on 11 days.

Lunar halos on the 10th and 11th.

Fog on 3 days.

Thunder on the 3rd, 6th and 16th.

›BER, 1900.

]87 feet. C. H. McLEOD, *Superintendent.*

DAY	Per cent. possible Sunshine.	Rainfall in inches.	Snowfall in inches.	Rain and snow melted.	DAY.
	66	....	....	....	1
	69	....	....	....	2
	29	....	....	....	3
	33	0.00	....	0.00	4
	38	0.02	....	0.02	5
	00	0.02	...	0.02	6
SUNDAY.... ..	64	....	....	....	7..........SUNDAY
	00	0.98	....	0.98	8
	28	....	....	....	9
	37	....	....	....	10
	91	....	....	....	11
	95	....	....	....	12
	67	....	....	....	13
SUNDAY........	00	....	....	....	14.... .....SUNDAY
	97	....	....	....	15
	26	0.23	0.0	0.23	16
	88	....	....	....	17
	55	0.00	....	0.00	18
	87	....	....	....	19
	88	....	....	....	20
SUNDAY........	46	....	....	....	21.... .....SUNDAY
	65	....	....	....	22
	35	0.84	....	0.84	23
	55	0.00	...	0.00	24
	93	....	....	....	25
	66	....	....	....	26
	62	....	....	....	27
SUNDAY........	32	....	....	...	28..........SUNDAY
	00	0.13	....	0.13	29
	96	0.03	....	0.03	30
	37	....	....	....	31
Means...... ..	52.9	2.25	0.0	2.25	..............Sums.
26 Years mear for and includin this month	¶41.60	3.01	0.0	3.11	26 Years means for and including this month.

ea-level and

taken from

Direction......
Miles ....
Duration in hrs
Mean velocity.

being 100.
ours.

he 4th; the
ing a range

Greatest m
est day was
18th.
Greatest v
was 30.59 on
hour on the 18t
9.61 on the

Minimum relative humidity observed was 59 on the 17th.

Rain fell on 10 days.

Snow fell on 1 day.

Rain or snow fell on 10 days.

Hoar frost on 2 days..

Fog on 5 days.

Thunder on the 5th.

ABSTRACT FOR THE MONTH OF NOVEMBER, 1900.

Meteorological Observations, McGill College Observatory, Montreal, Canada. Height above sea level, 187 feet. C. H. McLEOD, *Superintendent.*

DAY	THERMOMETER.				*BAROMETER.				‡Mean relative humidity.	WIND.		Per cent. possible Sunshine.	Rainfall in inches.	Snowfall in inches.	Rain and snow melted.	DAY.
	† Mean.	Max.	Min.	Range.	† Mean.	Max.	Min.	Range.		General direction.	Mean velocity in miles per hour					
1	52.49	58.2	46.5	11.7	30.12	30.31	29.95	.36	91	S.E.	18.6	57	0.00	....	0.00	1
2	53.36	59.0	46.6	12.4	30.10	30.27	29 95	.32	88	S.W.	25.8	48	0.00	....	0.00	2
3	41.67	46.8	37 2	9.6	30.23	30.35	30.19	.16	92	S.W.	7.8	16	....	....	....	3
SUNDAY.... .. 4	46.82	58.5	37.0	21.5	29.94	30.19	29.82	.37	83	S.	19.4	87	....	....	....	4...........SUNDAY
5	43.07	48.0	38.2	9.8	29.73	29.82	29.68	.14	97	S.W.	8.2	00	0.36	....	0.36	5
6	39.80	43.5	35.0	8.5	29 91	30.02	29.70	.32	84	S.W.	16.3	84	....	...	....	6
7	41.78	44.2	38.0	6.2	29.92	30.02	29.85	.17	95	S.E.	11.4	00	0.57	....	0.57	7
8	43 42	45.1	40.2	4.9	29.77	29 85	29.66	.19	93	S.	9.2	00	0.50	....	0.50	8
9	36.24	39 5	28.4	11.1	29.36	29.66	29.19	.47	92	N.W.	33.8	00	0.16	8.5	1.01	9
10	32.94	34.0	28.4	5.6	29.70	30.02	29.34	.68	93	S.W.	28.8	00	....	0.3	0.03	10
SUNDAY........11	31.81	35 2	28.6	6.6	30.07	30.11	30.01	.10	93	S.W.	7.3	00	....	0.0	0.00	11..... .....SUNDAY
12	35.68	37.3	31.7	5.6	29.71	30.01	29.46	.55	88	S.	19.9	00	0.07	.. .	0.07	12
13	27.34	38.5	22.0	16.5	29.57	29 69	29.39	.30	88	S.W.	17.7	36	0.03	1.9	0.22	13
14	20 30	25.3	16 5	8.8	29.79	29.96	29.39	.57	90	S.W.	19.1	75	....	1.1	0.11	14
15	25.08	29.8	21.2	8.6	29.96	30.12	29.90	.22	95	S W.	19.4	19	....	1.8	0.18	15
16	16.17	20.7	11 0	9.7	30.48	30.62	30.12	.50	86	W.	17.3	86	....	0.8	0.08	16
17	22.95	32.6	9.9	22.7	30.45	30.63	30.19	.44	85	S.	13.2	81	....	....	....	17
SUNDAY 18	33.74	37.1	30 0	7.1	29 98	30.19	29.86	.33	97	S.	18.6	00	0.12	1.2	0.24	18...........SUNDAY
19	25.92	33.0	20.6	12.4	30.26	30.40	30.04	.36	93	N.E.	22.2	00	0.56	....	0.56	19
20	35.45	37.5	33.0	4.5	29.96	30.04	29.85	.19	95	S.W.	10.3	00	0.96	....	0.96	20
21	44.09	56.9	35.0	21.9	29.45	29.85	29.16	.69	87	S.W.	33.5	00	0.73	....	0.73	21
22	33 71	39.0	31.4	7.6	29 85	29.99	29.32	.67	83	W.	26.4	38	....	0.6	0.06	22
23	36.94	43.5	29.5	14.0	29 91	30.26	29.59	.67	72	W.	27.6	91	0.05	....	0.05	23
24	25.56	29.5	22.0	7.5	30.42	30.49	30.26	.23	83	N.E.	10.6	59	....	....	....	24
SUNDAY....... 25	26.27	28.0	23.5	4.5	30.23	30.33	30.17	.21	95	N.E.	17.4	00	....	5.8	0.58	25...........SUNDAY
26	27.73	28.7	26.0	2.7	29.87	30.18	29.66	.52	96	N.E.	30.0	00	0.06	11 5	1.21	26
27	28.95	32.7	22.1	10.6	29.91	30.12	29.67	.45	86	N.E.	25.3	44	....	0.2	0.02	27
28	16.15	22.1	11.7	10 4	30.24	30.29	30.12	.17	88	N.E.	13 0	58	....	....	....	28
29	20 47	24.0	15.0	9.0	30.12	30.22	30.07	.15	95	N.E.	8.4	00	....	1.1	0.11	29
30	28.05	31.5	24 0	7.5	30.11	30.16	30.09	.07	90	N.	2.6	00	....	....	....	30
Means......	33.13	37.99	28.01	9 98	29.972	30.141	29 788	.352	89.9	W. 26° 8′ S.	17.98	29.4	4.17	34.8	7.65	.............Sums.
26 Years means for and including this month	32.61	38.90	26 71	12.19	30.015	....	......	.270	80.39	....	§16.03	¶28.95	2.37	13.31	3.73	26 Years means for and including this month .

ANALYSIS OF WIND RECORD.

Direction......	N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.	CALM.
Miles	767	2434	250	1026	1365	4045	1917	1083	
Duration in hrs..	57	131	25	67	99	201	80	56	4
Mean velocity....	13.5	18.6	10.0	16.2	13 8	20.0	24.0	19.4	

Greatest mileage in one hour was 72 on the 21st.

Greatest velocity in gusts was 72 miles per hour on the 21st.

Resultant mileage, 2395.
Resultant direction, W. 26° 8′ S.
Total mileage, 12,917.

* Barometer readings reduced to sea-level and temperature 32° Fahrenheit.

† Mean of bi-hourly readings taken from self-recording instruments.

‡ Humidity relative, saturation being 100.

¶ 19 years only. § 14 years only.

The greatest heat was 59.0 on the 1st; the greatest cold was 9.9 on the 17th, giving a range of temperature of 49.1 degrees.

Warmest day was the 2nd. Coldest day was the 16th. Highest barometer reading was 30.63 on the 17th. Lowest barometer was 29.16 on the 21st, giving a range of 1.47 inches.

Minimum relative humidity observed was 68 on the 23rd.

Rain fell on 14 days.
Snow fell on 13 days.
Rain or snow fell on 23 days.
Lunar Halos on 3 nights.
Fog on 2 days.

MBER, 1900.

M37 feet. C. H. McLEOD, *Superintendent.*

DAY	Per cent. possible Sunshine.	Rainfall in inches.	Snowfall in inches.	Rain and snow melted.	DAY.
	57	0.00	....	0.00	1
	48	0.00	....	0.00	2
	16	....	....	....	3
SUNDAY.... ..	87	....	....	....	4..........SUNDAY
	00	0.36	....	0.36	5
	84	....	...	....	6
	00	0.57	....	0.57	7
	00	0.50	....	0.50	8
	00	0.16	8.5	1.01	9
1	00	....	0.3	0.03	10
SUNDAY........1	00	....	0.0	0.00	11..... .....SUNDAY
1	00	0.07	...	0.07	12
1	36	0.03	1.9	0.22	13
1	75	....	1.1	0.11	14
1	19	....	1.8	0.18	15
1	86	....	0.8	0.08	16
1	81	....	....	....	17
SUNDAY 1	00	0.12	1.2	0.24	18..........SUNDAY
1	00	0.56	....	0.56	19
2	00	0.96	....	0.96	20
2	00	0.73	....	0.73	21
2	38	....	0.6	0.06	22
2	91	0.05	....	0.05	23
2	59	....	....	....	24
SUNDAY....... 2	00	....	5.8	0.58	25..........SUNDAY
2	00	0.06	11 5	1.21	26
2	44	....	0.2	0.02	27
2	58	....	....	....	28
2	00	....	1.1	0.11	29
3	00	....	....	....	30
Means......	29.4	4.17	34.8	7.65	..............Sums.
26 Years means for and including his month	¶28.95	2.37	13.31	3.73	26 Years means for and including this month .

	ea-level and
	taken from
Direction......	
Miles	being 100.
Duration in hrs.	he 1st; the
Mean velocity...	ving a range

llest day was

Greatest mi was 30.63 on

21st. 9.16 on the

Greatest ve

hour on the 21st.

Minimum relative humidity observed was 68 on the 23rd.

Rain fell on 14 days.

Snow fell on 13 days.

Rain or snow fell on 23 days.

Lunar Halos on 3 nights.

Fog on 2 days.

ABSTRACT FOR THE MONTH OF NOVEMBER, 1900.

Meteorological Observations, McGill College Observatory, Montreal, Canada. Height above sea level, 187 feet. C. H. McLEOD, *Superintendent.*

DAY	THERMOMETER. † Mean.	THERMOMETER. Max.	THERMOMETER. Min.	THERMOMETER. Range.	*BAROMETER. † Mean.	*BAROMETER. Max.	*BAROMETER. Min.	*BAROMETER. Range.	‡Mean relative humidity.	WIND. General direction.	WIND. Mean velocity in miles per hour	Per cent. possible Sunshine.	Rainfall in inches.	Snowfall in inches.	Rain and snow melted.	DAY.
1	52.49	58.2	46.5	11.7	30.12	30.31	29.95	.36	91	S.E.	18.6	57	0.00	....	0.00	1
2	53.36	59.0	46.6	12.4	30.10	30.27	29 95	.32	88	S.W.	25.8	48	0.00	....	0.00	2
3	41.67	46.8	37 2	9.6	30.23	30.35	30.19	.16	92	S.W.	7.8	16	....	....	....	3
SUNDAY....... 4	46.82	58.5	37.0	21.5	29.94	30.19	29.82	.37	88	S.	19.4	87	....	....	....	4..........SUNDAY
5	43.07	48.0	38.2	9.8	29.73	29.82	29.68	.14	97	S.W.	8.2	00	0.36	....	0.36	5
6	39.80	43.5	35.0	8.5	29 91	30.02	29.70	.32	84	S.W.	16.3	84	....	...	....	6
7	41.78	44.2	38.0	6.2	29.92	30.02	29.85	.17	95	S.E.	11.4	00	0.57	....	0.57	7
8	43 42	45.1	40.2	4.9	29.77	29 85	29.66	.19	93	S.	9.2	00	0.50	....	0.50	8
9	36.24	39 5	28.4	11.1	29.36	29.66	29.19	.47	92	N.W.	33.8	00	0.16	8.5	1.01	9
10	32.94	34.0	28.4	5.6	29.70	30.02	29.34	.68	93	S.W.	28.8	00	....	0.3	0.03	10
SUNDAY........11	31.81	35 2	28.6	6.6	30.07	30.11	30.01	.10	93	S.W.	7.3	00	....	0.0	0.00	11..........SUNDAY
12	35.68	37.3	31.7	5.6	29.71	30.01	29.46	.55	88	S.	19.9	00	0.07	....	0.07	12
13	27.34	38.5	21.0	16.5	29.57	29 69	29.39	.30	88	S.W.	17.7	36	0.03	1.9	0.22	13
14	20 30	25.3	16 5	8.8	29.79	29.96	29.39	.57	90	S.W.	19.1	75	....	1.1	0.11	14
15	25.08	29.8	21.2	8.6	29.96	30.12	29.90	.22	95	S W.	19.4	19	....	1.8	0.18	15
16	16.17	20.7	11 0	9.7	30.48	30.62	30.12	.50	86	W.	17.3	86	....	0.8	0.08	16
17	22.95	32.6	9.9	22.7	30.45	30.63	30.19	.44	85	S.	13.2	81	....	....	....	17
SUNDAY........18	33.74	37.1	30 0	7.1	29 98	30.19	29.86	.33	97	S.	18.6	00	0.12	1.2	0.24	18..........SUNDAY
19	25.92	33.0	20.6	12.4	30.26	30.40	30.04	.36	93	N.E.	22.2	00	0.56	....	0.56	19
20	35.45	37.5	33.0	4.5	29.96	30.04	29.85	.19	95	S.W.	10.3	00	0.96	....	0.96	20
21	44.09	56.9	35.0	21.9	29.45	29.85	29.16	.69	87	S.W.	33.5	00	0.73	....	0.73	21
22	33 71	39.0	31.4	7.6	29 85	29.99	29.32	.67	83	W.	26.4	38	....	0.6	0.06	22
23	36.94	43.5	29.5	14.0	29.91	30.26	29.59	.67	72	W.	27.6	91	0.05	....	0.05	23
24	25.56	29.5	22.0	7.5	30.42	30.49	30.26	.23	83	N.E.	10.6	59	....	...	....	24
SUNDAY....... 25	26.27	28.0	23.5	4.5	30.23	30.38	30.17	.21	95	N.E.	17.4	00	....	5.8	0.58	25..........SUNDAY
26	27.73	28.7	26.0	2.7	29.87	30.18	29.66	.52	96	N.E.	30.0	00	0.06	11 5	1.21	26
27	28.95	32.7	22.1	10.6	29.91	30.12	29.67	.45	86	N.E.	25.3	44	....	0.2	0.02	27
28	16.15	22.1	11.7	10 4	30.24	30.29	30.12	.17	88	N.E.	13 0	58	....	....	....	28
29	20 47	24.0	15.0	9.0	30.12	30.22	30.07	.15	95	N.E.	8.4	00	....	1.1	0.11	29
30	28.05	31.5	24 0	7.5	30.11	30.16	30.09	.07	90	N.	2.6	00	....	....	....	30
Means............	33.13	37 99	28.01	9 98	29 972	30.141	29 788	.352	89.9	W. 20° 8′ S.	17.98	29.4	4.17	34.8	7.65	..............Sums.
26 Years means for and including this month	32.61	38.90	26 71	12.19	30.015	....	......	.270	80.39	....	§ 16.03	¶28.95	2.37	13.31	3.73	26 Years means for and including this month .

ANALYSIS OF WIND RECORD.

Direction.......	N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.	CALM.
Miles	767	2434	230	1086	1365	4045	1917	1083	
Duration in hrs..	57	131	25	67	99	201	80	56	4
Mean velocity....	13.5	18.6	10.0	16.2	13 8	20.0	24.0	19.4	

Greatest mileage in one hour was 72 on the 21st.

Greatest velocity in gusts was 72 miles per hour on the 21st.

Resultant mileage, 2395.
Resultant direction, W. 26° 8′ S.
Total mileage, 12,947.

* Barometer readings reduced to sea-level and temperature 32° Fahrenheit.

† Mean of bi-hourly readings taken from self-recording instruments.

‡ Humidity relative, saturation being 100.

¶ 19 years only. § 14 years only.

The greatest heat was 59.0 on the 1st; the greatest cold was 9.9 on the 17th, giving a range of temperature of 49.1 degrees.

Warmest day was the 2nd. Coldest day was the 16th. Highest barometer reading was 30.63 on the 17th. Lowest barometer was 29.16 on the 21st, giving a range of 1.47 inches.

Minimum relative humidity observed was 68 on the 23rd.

Rain fell on 14 days.

Snow fell on 13 days.

Rain or snow fell on 23 days.

Lunar Halos on 3 nights.

Fog on 2 days.

MBER, 1900.

M87 feet. C. H. McLEOD, *Superintendent.*

DAY	Per cent. possible Sunshine.	Rainfall in inches.	Snowfall in inches.	Rain and snow melted.	DAY.
1	00	0.05	0.7	0.12	1
SUNDAY.... .. 2	00	....	0.0	0.00	2...........SUNDAY
3	00	0.07	0.6	0.13	3
4	00	....	3.4	0.34	4
5	00	...	3.2	0.32	5
6	00	....	0.5	0.05	6
7	00	....	2.0	0.20	7
8	00	...	....	....	8
SUNDAY........ 9	84	0.00	2.2	0.22	9.... .....SUNDAY
10	88	....	.. .	....	10
11	04	....	0.3	0.03	11
12	72	....	0.6	0.06	12
13	00	....	5.8	0.58	13
14	16	....	....	....	14
15	00	....	0.0	0.00	15
SUNDAY........16	00	....	0.0	0.00	16..... .....SUNDAY
17	00	....	0.5	0.05	17
18	00	....	0.0	0.00	18
19	00	0.06	0.5	0.11	19
20	00	0.01	0.3	0.04	20
21	85	....	....	....	21
22	24	....	....	....	22
SUNDAY........23	00	0.05	....	0.05	23...........SUNDAY
24	28	....	...	....	24
25	21	....	0.0	0.00	25
26	27	....	1.6	0.16	26
27	63	....	0.0	0.00	27
28	21	....	2.3	0.23	28
29	00	....	0.0	0.00	29
SUNDAY........30	49	....	0.5	0.05	30...........SUNDAY
31	00	....	0.2	0.02	31
Means......	18.8	0.24	25.2	2.76	.............Sums.
26 Years means for and including this month	¶27.96	1.32	23.55	3.61	26 Years means for and including this month.

Direction.......	
Miles	
Duration in hrs.	
Mean velocity...	

a-level and

aken from

being 100.

hours.

e 24th; the n the 10th, degrees.

Greatest mi est day was 9th.

was 30.61 on

Greatest ve 9.30 on the hour on the 9th.

Minimum relative humidity observed was 71 on the 23rd.

Rain fell on 6 days.

Snow fell on 24 days.

Rain or snow fell on 25 days.

Hoar frost on the 16th, 17th and 18th.

Lunar Halo on the 22nd.

Fog on 1 day.

ABSTRACT FOR THE MONTH OF DECEMBER, 1900.

Meteorological Observations, McGill College Observatory, Montreal, Canada. Height above sea level, 187 feet. C. H. McLEOD, *Superintendent.*

DAY	THERMOMETER. † Mean.	Max.	Min.	Range.	*BAROMETER. † Mean.	Max.	Min.	Range.	‡Mean relative humidity.	a WIND. General direction.	Mean velocity in miles per hour	Per cent. possible Sunshine.	Rainfall in inches.	Snowfall in inches.	Rain and snow melted.	DAY.
1	32.92	34.0	31.0	3.0	30.03	30.09	29.99	.10	88	W.	5.0	00	0.05	0.7	0.12	1
SUNDAY.... 2	33.92	35.5	31.6	3.9	30.20	30.23	30.08	.15	90	W.	5.7	00	....	0.0	0.00	2..........SUNDAY
3	33.57	34.2	33.0	1.2	30.18	30.24	30.11	.13	95	S.W.	5.5	00	0.07	0.6	0.13	3
4	31.13	34.0	27.2	6.8	29.88	30.11	29.53	.58	98	N.E.	12.1	00	....	3.4	0.34	4
5	23.57	27.2	21.1	6.1	29.67	29.88	29.52	.36	89	N.E.	13.0	00	...	3.2	0.32	5
6	24.66	27.0	21.7	5.3	30.08	30.20	29.88	.32	90	E	6.8	00	....	0.5	0.05	6
7	23.23	26.7	19.0	7.7	30.15	30.22	30.08	.14	94	S.	6.7	00	....	2.0	0.20	7
8	16.83	21.2	8.7	12.5	30.06	30.22	29.68	.54	89	N.E.	13.0	00	...	....	....	8
SUNDAY........ 9	13.17	33.9	−5.5	39.4	29.66	30.07	29.30	.77	83	W.	28.8	84	0.00	2.2	0.22	9..........SUNDAY
10	−5.48	−1.4	−12.4	11.0	30.25	30.33	30.07	.26	85	W.	20.8	88	....	...	....	10
11	1.78	4.6	−4.7	9.3	30.06	30.21	29.97	.24	95	S.	8.7	04	....	0.3	0.03	11
12	0.95	5.2	−3.6	8.8	30.15	30.23	30.04	.19	90	W.	11.7	72	....	0.6	0.06	12
13	7.68	12.1	2.1	10.0	29.73	30.05	29.58	.47	91	W.	18.3	00	....	5.8	0.58	13
14	2.37	9.5	−4.8	14.3	30.30	30.53	29.83	.70	89	W.	17.7	16	....	....	....	14
15	6.59	8.5	4.2	4.3	30.57	30.60	30.52	.08	95	W.	2.7	00	....	0.0	0.00	15
SUNDAY........16	5.74	8.2	1.4	6.8	30.58	30.61	30.57	.04	92	S.	4.3	00	....	0.0	0.00	16..........SUNDAY
17	1.83	3.3	−0.6	3.9	30.46	30.57	30.34	.23	90	S.	2.7	00	....	0.5	0.05	17
18	3.67	11.2	−2.5	13.7	30.19	30.34	29.98	.30	91	E.	1.8	00	....	0.0	0.00	18
19	25.46	35.1	10.1	25.0	29.90	29.98	29.86	.12	91	S.W.	20.0	00	0.06	0.5	0.11	19
20	31.72	35.8	22.3	13.5	29.91	30.05	29.85	.20	88	W.	18.4	00	0.01	0.3	0.04	20
21	16.79	22.3	12.4	9.9	30.05	30.12	30.01	.11	92	N.W.	7.5	85	....	....	....	21
22	14.94	22.8	7.5	15.3	30.00	30.05	29.98	.07	84	E.	11.3	24	....	....	....	22
SUNDAY 23	22.00	36.9	11.0	25.9	29.93	30.00	29.81	.19	85	S.	16.1	00	0.05	....	0.05	23..........SUNDAY
24	35.37	39.0	30.6	8.4	29.77	29.81	29.71	.10	80	W.	21.0	28	....	...	....	24
25	32.04	34.3	29.2	5.1	29.71	29.79	29.67	.12	80	S.W.	19.3	21	....	0.0	0.00	25
26	20.37	30.0	10.6	19.4	29.84	30.10	29.69	.41	90	W.	20.3	27	....	1.6	0.16	26
27	11.67	25.1	0.6	24.5	30.18	30.25	30.09	.16	88	W.	19.4	63	....	0.0	0.00	27
28	23.79	30.8	12.0	18.8	29.89	30.09	29.78	.31	87	W.	19.3	21	....	2.3	0.23	28
29	22.37	28.3	9.5	18.8	29.83	29.80	29.73	.07	82	W.	27.2	00	....	0.0	0.00	29
SUNDAY........30	29.69	34.1	22.6	11.5	29.73	29.77	29.68	.09	89	S.W.	25.3	49	....	0.5	0.05	30..........SUNDAY
31	33.50	36.0	29.6	6.4	29.74	29.84	29.69	.15	93	W.	16.1	00	....	0.2	0.02	31
Means............	18.64	24.05	12.09	11.95	30.022	30.141	29.891	.250	89.1	W. 16.7° S	13.78	18.8	0.24	25.2	2.76	.... Sums.
26 Years means for and including this month	19.14	26.19	12.00	14.19	30.029	....	......	.295	83.42	....	§ 16.27	¶27.96	1.32	23.55	3.61	26 Years means for and including this month.

ANALYSIS OF WIND RECORD.

Direction........	N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.	CALM.
Miles	330	864	412	47	1048	2326	5140	77	
Duration in hrs..	52	63	51	7	98	130	307	6	30
Mean velocity....	6.3	13.7	8.1	6.7	10.7	17.9	16.7	12.8	

Greatest mileage in one hour was 40 on the 9th.

Greatest velocity in gusts was 44 miles per hour on the 9th.

Resultant mileage, 6035.

Resultant direction, W. 16.7° S.

Total mileage, 10,241.

a—Wind on the 10th, 17th and 18th from City Hall Anemometer.

* Barometer readings reduced to sea-level and temperature 32° Fahrenheit.

† Mean of bi-hourly readings taken from self-recording instruments.

‡ Humidity relative, saturation being 100. Mean of observations at 8, 15 and 20 hours.

¶ 19 years only. § 14 years only.

The greatest heat was 39.0 on the 24th; the greatest cold was 12.4 below zero on the 10th, giving a range of temperature of 51.4 degrees.

Warmest day was the 24th. Coldest day was the 10th. Highest barometer reading was 30.61 on the 16th. Lowest barometer was 29.30 on the 9th, giving a range of 1.31 inches.

Minimum relative humidity observed was 71 on the 23rd.

Rain fell on 6 days.

Snow fell on 24 days.

Rain or snow fell on 25 days.

Hoar frost on the 16th, 17th and 18th.

Lunar Halo on the 22nd.

Fog on 1 day.

Price $3.00 the Volume of eight numbers.

VOLUME VIII. NUMBER 6.

THE CANADIAN RECORD OF SCIENCE

INCLUDING THE PROCEEDINGS OF
THE NATURAL HISTORY SOCIETY OF MONTREAL,
AND REPLACING
THE CANADIAN NATURALIST.

CONTENTS.

PAGE

The Devonian of the Acadian Provinces. By R. W. ELLS, LL.D., F.R.S.C. .. 335
Letter on D. White's article in last issue. By G. F. MATTHEW, LL.D., F.R.S.C. 344
Life History of the Camberwell Beauty Butterfly. By A. E. NORRIS 345
The Flora of Montreal Island. By ROBERT CAMPBELL, M.A., D.D. 349
List of the Published Writings of Elkanah Billings, F.R.S., Palæontologist to the Geological Survey of Canada, 1856-1876. By B. E. WALKER, F.G.S. 366
Proceedings of Natural History Society of Montreal 388
Book Notices 411

MONTREAL:
PUBLISHED BY THE NATURAL HISTORY SOCIETY.

LONDON, ENGLAND: COLLINS, 157 Great Portland St.
BOSTON, MASS.: A. A. WATERMAN & Co., 36 Bromfield St.

1901.

THE

CANADIAN RECORD

OF SCIENCE.

VOL. VIII. JULY, 1901. No. 6.

The Devonian of the Acadian Provinces.

R. W. Ells, LL.D., F.R.S.C.

The publication in a recent number of this journal of a paper by Mr. David White on "Certain Palæobotanic Aspects of the Upper Palæozoic in Nova Scotia"[1] appears to call for some comment in regard to certain statements therein made. The paper seems, as a whole, to be written in an apologetic spirit rather than from the argumentative standpoint, and does not add greatly to our knowledge regarding a somewhat complicated problem presented in certain rock formations which occur both in Nova Scotia and New Brunswick.

Several other papers bearing upon this question have recently appeared in the transactions of the Nova Scotia Institute of Science[2] and elsewhere, and it is to be deplored that a controversy should have arisen on what, in the natural order of geological investigation, should be a comparatively simple question.

1 Can. Rec. Sci., Vol. VIII., No. 5, Jan., 1901.

2 Trans. N. S. Inst. Sci., Vol. X., pp. 162 and 235, Amer. Assoc., Aug., 1899. Ottawa Nat., Vol. XIII., pp. 207, 256, Vol. XIV., pp. 1 and 99.

The study of certain rock formations in Southern New Brunswick, which have long been known under the head of Devonian, was undertaken by several local geologists, notably Hartt, Matthew and Bailey, nearly forty years ago, and a statement of the results then obtained will be found in a report by Professor Bailey entitled "Observations on the Geology of Southern New Brunswick" and published in 1865. The details of the Devonian formations were at that time but little worked out, a large part of what has since been recognized as pre-Cambrian in the south-eastern portion of the province being included. The stratigraphical relations of certain divisions of the Devonian rocks, both to the underlying upper Silurian and the overlying lower Carboniferous, were, however, early recognized, and the finding of a rich flora in the strata at a number of points added greatly to the interest of the investigation. To the late Sir William Dawson, then presumably the ablest Palæobotanist on this side of the Atlantic, was assigned the task of deciphering the correct horizon of the plant remains thus discovered.

That Sir William was especially fitted for this work cannot be denied. He had just completed a series of investigations on the flora and fauna found in the Devonian of Eastern Gaspé, and his work was facilitated by the study of collections of fossil plants from Ohio, New York and Great Britain. Elaborate sections of the Gaspé Devonian had already been made by Sir William Logan[1] and the true position of the rocks in this area was ascertained beyond a doubt, since the lower portion of the section passes downward into the upper part of the Silurian. The thickness of the Devonian rocks as determined by the Gaspé section was found to be somewhat over 7,000 feet.

Fresh from the study of the Gaspé fossils, Sir William Dawson began his study of the plant remains from the

1 Rep. Geol. Sur. Can., 1844.

vicinity of St. John, New Brunswick. From these he evolved a long list of species which to his mind at least conclusively established their horizon as Devonian also.[1] It is unnecessary to go into the details of this study since they are fully stated in the several reports of the Geological Survey on the fossil plants of the Silurian and Devonian extending from 1871 to 1882.[2] The results of his work were also summed up in a report to that Department in 1870–71 by Messrs. Bailey and Matthew.

The remark by Mr. White, on page 6 of his pamphlet, that "the determinations of Sir William in regard to the St. John plant remains were forced upon him by the finding of the stratigraphers" can therefore be assumed to be without foundation and to be misleading. More especially since the details of the stratigraphical sequence of these rocks in Southern New Brunswick were worked out carefully some years subsequent to his determination of the plant remains; and it may be stated that the conclusions arrived at by the stratigraphers abundantly confirmed the decision which had been reached by him some years previously. The great series of beds known in the southern part of the province as Devonian, and divided into Mispec, Cordaite shales and Dadoxylon sandstone, were conclusively found to be beneath the lower Carboniferous limestones as also beneath a considerable thickness of shales, sandstones and conglomerates which also underlie these.

Not only so, but they are known to underlie in great part a series of sandstones and shales, known as the Perry sandstone group,[3] concerning the age of which, as representing the upper member of the Devonian, Sir William apparently never had any doubt to the last of his investigations in this field.

1 Acadian Geology, 1869, and Supplements 1878 and 1891.

2 Fossil plants of the Erian (Dev.) and Up. Sil. of Can., 1882.

3 Fossil plants, discovered at Perry, Me. Proc. Port. Soc. Nat. His., Vol. I., pt. 2, 1862.

It has been suggested in Mr. White's paper on page 9 that "possibly the limestones of New Brunswick and Nova Scotia which are regarded as Lower Carboniferous, should be assigned to a higher position." In this connection it may be stated that the stratigraphical sequence of the Carboniferous rocks proper has within the last twenty-five years been so thoroughly worked out that this assumption is scarcely tenable. Not only in the celebrated Joggins section in Nova Scotia, but in many other places both in that province and in New Brunswick is their true position beneath the rocks which are regarded as Millstone-grit well established. If we admit the proposition of Mr. White, therefore, that the limestones regarded as Lower Carboniferous may be assigned to a higher position, the curious anomaly will result that our Carboniferous rocks proper, representing many thousands of feet of strata, must occupy the place now assigned to the upper or Permo-Carboniferous or possibly to the horizon of the Cretaceous. This would open an entirely new field of investigation, and is a proposition not likely to be favorably entertained, at least in the present state of our knowledge on this subject.

The age of the Lower Carboniferous limestones is, however, held to be abundantly established from their contained fossils which are well defined at many points.

Much has been said in the several papers already published on this question, as to the correlation of the several formations known as Devonian and Carboniferous, and this correlation has recently been apparently based entirely upon a supposed similarity of plant remains found over a wide area. The first correlation on the subject, however, was that made by Sir William Dawson, in which he made the St. John Devonian the equivalent of much of the Gaspé Devonian series.[1] Until further evi-

1 Acad. Geol. Suppl., 1878, page 70; Suppl. 1891, page 19.

dence is, therefore, presented on this subject, this correlation will presumably stand in the opinion of those who have most closely studied the question. Certainly Sir William, to the date of his last work, found no occasion to change his views as to their originally assumed position, and every one familiar with the large amount of careful work which he accomplished on these rocks and on his Devonian flora, a work which may be truly regarded as among the most important which he accomplished in his several lines of geological investigation, will regard his determination in this field as neither hasty nor superficial.

The assumption made by Mr. White, on page 6 of his paper, that "possibly Dr. Ells and Mr. Fletcher were influenced in referring the Riversdale beds to the middle Devonian through first correlating them with the 'Fern ledges' of St. John, N.B.", is practically correct. As regards the writer's share in this work it may be briefly stated. For some years his work had lain, in connection with Messrs. Bailey and Matthew, in the study of the folded rocks of southern New Brunswick, and the principal geological formations there found had been carefully mapped out. Later several years were spent in the study of the Devonian of the Gaspé peninsula over a very considerable area. In 1884 he was assigned to the Cumberland and Colchester district. There the great similarity of certain groups of rock along the south side of the Cobequid mountains to those so recently studied in New Brunswick was so marked that the writer had but little hesitation in assigning them to a similar horizon. Not only were they alike in their physical aspects, but they presented the same stratigraphical unconformity beneath the marine Carboniferous limestones and associated strata, while the fossil contents were also largely identical. Under such circumstances the correlation of the two series was a simple matter, and this has been abundantly confirmed by later investigators, notably by Mr. White himself from an examination of the plant remains from the two areas, and also by Mr. Kidston.

Mr. Fletcher, working independently in the eastern portion of Nova Scotia, had in the meantime encountered precisely similar rocks and reached a similar conclusion as to their age. While therefore the inference was plain that these formations in the two provinces were similar in age, Sir William Dawson, from an examination of a few plants found in the beds near Riversdale, some years previously, had found what he supposed to be a Millstone-grit horizon at that place. The collection on which this determination was based was, however, but small and lacked the completeness of material found in the St. John beds. Moreover, these strata, near Arichat, at the Strait of Canso, East River of St. Mary's, Middle River of Pictou, the mouth of Shubenacadie River, Brookfield and the Cobequid hills, were assigned to the Devonian and lower horizons by Sir William Dawson.

In his report on the Fossil Plants of the Devonian and Silurian, 1871, page 70, Sir William calls attention to the great similarity existing between the floras of the Devonian and Carboniferous systems in many particulars. The presence of some forms, therefore, poorly preserved and presenting a Millstone-grit facies, should not be taken as conclusively overturning the conclusions which he had arrived at from the systematic study of the great collections from the similar sediments in New Brunswick which he had previously assigned to the Devonian. Certain it is that the plants which he found at Riversdale did not in any way affect his own opinion as to the age of the latter.

The question of lithological resemblance between rocks of similar formations over wide areas is also entitled to some consideration in discussing such a problem. Thus the strata of the Carboniferous proper are distinctly much less altered both in New Brunswick and in Nova Scotia than those which we have regarded as of Devonian age.

Among these conditions may be mentioned the hard and quartzose character of many of the Devonian sandstones, a feature rarely found in those of the Carboniferous proper; as also the slaty character of much of the underlying or older series as opposed to the comparatively unaltered shales of the Lower Carboniferous formation. The rocks of the Devonian series are also frequently affected by intrusives which are rarely found in the overlying series, while there is also the further evidence of a marked break or unconformity between the Devonian rocks and those which are styled Lower Carboniferous.

In regard to the peculiar group of the Albert shales found in Albert and Westmoreland counties, New Brunswick, and supposed to be the equivalents of the Horton series of Nova Scotia, it is stated in the Geological Survey Report for 1876-77 by Professor Bailey and the writer, that these distinctly and unconformably underlie the lowest known Lower Carboniferous sediments of New Brunswick, and this feature is clearly indicated in the several sections that are given in the report alluded to. They were, however, at that time styled Lower Carboniferous from the presence of fish remains which were held to be of that age. Certain small areas of bituminous shales are, however, found in apparent association with strata of Lower Carboniferous age elsewhere in the southern part of the province, but these appear to be distinct from the "Albert shale" formation proper.

It is presumed that the present discussion will come to an end when those who now advocate the new theory as to the age of these rocks have made a careful study of their relations in the field. It is to be regretted that simply [1] upon the evidence of a few fossil plants of known wide range such a clash of opinion should have arisen, and that the credit due to Sir William Dawson for his long and careful work in this field should be so seriously

[1] G. S. C. Summary Report for 1898, page 11A, line 6.

threatened. The writer firmly believes, from a somewhat long and careful study of the conditions affecting these rocks, both in Nova Scotia and in New Brunswick, that these conclusions will not be so easily set aside. While no one has greater respect for the work of the conscientious palæontologist than the write , and appreciation for the assistance which has thus been rendered in working out intricate stratigraphical details, it must be admitted that occasionally confusion has arisen from the attempt to work out geological problems in the office or the laboratory only. These difficult problems can be solved largely by careful field work, and instances are not wanting even in the history of Canadian geological investigation, where apparently conflicting testimony between the rocks and their contained fossils has been readily harmonized so soon as the true stratigraphic relations were understood.

In connection with this question, it may not be out of place to refer to some of Sir William Dawson's writings relating to this subject.

1856. Remarks on a Specimen of Fossil Wood from the Devonian Rocks of Gaspé. Amer. Assoc. Sci , 1856, Pt. 2, pp. 174-176.

1858. A Week in Gaspé. Can. Nat. and Geol., Vol. 3, pp. 320-331.

1859. Fossil Plants from the Devonian Rocks of Canada. Quar. Jour. Geol. Soc., Lon., Vol. 15, pp. 477-488.

1859. Recent Researches in the Devonian and Carboniferous Flora of British America. Can. Nat. and Geol., Vol. 4, pp. 297-298.

1860. The Fossil Plants of the Devonian Rocks of Canada. Can. Nat. and Geol., Vol. 5, pp. 1-14.

1861. The Pre-Carb. Flora of New Brunswick, Maine and Eastern Canada. Can. Nat. and Geol., Vol. 6, pp. 161-180.

1862. The Flora of the Devonian Period in North-Eastern America. Quar. Jour. Geol. Soc., Vol. 18, pp. 296-330.

1862. Fossil Plants discovered at Perry, Maine. Portland Soc. Nat. Hist., Vol. 1, Pt. 2, pp. 99-100.

1863. Further Observations on the Devonian Plants of Maine, Gaspé and New York. Quar. Jour. Geol. Soc., pp. 458-469.

1865. The Palæozoic Floras of North-Eastern America. Brit. Assoc. Rep., Vol. 35, pp. 50-51.

1868. Acadian Geology.

1869. Some new Fossil Plants from Gaspé. Can. Nat. and Geol., Vol. 4, pp. 464-465.

1870. Pre-Carb. Floras of North-Eastern America with special reference to the Erian Period. Trans. Roy. Soc., Vol. 18, pp. 333-335.

1871. The Fossil Plants of the Devonian and Upper Silurian Formations of Canada. Geol. Sur. Can., p. 92.

1873. Fossil Plants of Lower Carboniferous and Millstone Grit Formations of Canada. Geol. Sur. Can., p. 47.

1877. Notes on some Scottish Devonian Plants. Can. Nat., Vol. 18, pp. 379-389.

1878. Supplement to Second edition Acadian Geology, pp. 102.

1880. Notes on Fossil Insects from Devonian of New Brunswick. Bos. Soc. Nat. Hist. Ann. Memoirs, pp. 31-34.

1882. Recent Discoveries in the Erian (Dev.) Floras of the United States. Amer. Jour. Sci., Vol. 24, pp. 338-345.

1882. Comparative View of the Successive Floras of Canada. Pro. Amer. Ass. Adv. Sci., Vol. 31, pp. 415-416.

1882. Fossil Plants of the Erian (Dev.) and Upper Silurian Formations of Canada. Geol. Sur. Can., Pt. 2, pp. 91-142.

1883. The Successive Palæozoic Floras of Canada. Can. Nat., pp. 371-379. The more ancient floras of the old and the new world. Abst. Brit. Assoc. Report, Montreal, 1884.

1883. Rhizocarps of the Erian (Dev.) Period in America. Bull. Chicago Acad. Sci., Vol. 1, No. 9, pp. 105-118.

1888. The Geological History of Plants. Int. Sci. Series, pp. 294.

1889. A new Erian Plant allied to Cordaites. Amer. Jour. Sci., Vol. 38.

1890. Note on the Geological Relations of the Fossil Plants from the Devonian of New Brunswick.

1890. New Plants from the Erian and Carboniferous and on the Characters and Affinities of Palæozoic Gymnosperms. Can. Rec. Sci., pp. 28, Vol. 4, No. 1.

1891. Supplementary note to Fourth edition Acadian Geology, 1891.

1891. The Age of the Catskill Flora. Amer. Geologist, Vol. 7, p. 363.

A careful summing up of the work on the Devonian of Eastern Canada will also be found in the valuable correlation papers on the "Devonian and Carboniferous" by H. S. Williams, of the U. S. Geol. Survey, Washington, published in 1891.

Editor CANADIAN RECORD OF SCIENCE :

DEAR SIR,—I am quite aware that you disclaim responsibility for the utterances of authors who write for the RECORD, and this seems only reasonable, but as the antidote should go with the bane, I would ask you to publish the following remarks relative to the statement of Mr. David White, at page 227 of Vol. VIII. of the RECORD.

As to the "erroneous" reference of the flora of the fern ledges near St. John to the Devonian by Sir William Dawson, that is a matter of opinion, but to say that this was forced upon Sir William by the findings of the stratigraphers is distinctly wrong. The young geologist, who showed these rocks and their contents to Sir William, would not have presumed to express an opinion at that day contrary to the one which he held.

But Sir William's opinion was not based on the work of youthful "stratigraphers," for he traversed the sections around St. John carefully himself, about the time that these plants were discovered. Hence, the opinion Sir William held was "forced" upon him not only by the composition of the flora, but by the stratigraphy itself.

I mentioned this matter to Mr. White in a letter which I wrote to him some time ago, but he seems to have overlooked my statement, since he makes no reference to it in his paper in the RECORD.

Geology is not made up of Palæobotany alone, or the Laramie beds would still remain Tertiary; and if we can have modern genera of plants coming down to us from the Cretaceous, the lately elaborated Pottsville flora may have an earlier root than Mr. White suspects.

However, I have no intention to go into the discussion of these points further at present, but simply to assert what Mr. White seems not to have known, that Sir William Dawson went over the sections at St. John containing the very ancient flora of the "fern ledges" himself, and did not trust to the "findings of the stratigraphers."

Thanking you, in anticipation for kindly inserting this note,

I remain yours sincerely,

G. F. MATTHEW.

LIFE HISTORY OF THE CAMBERWELL BEAUTY BUTTERFLY.

(*Vanessa Antiopa.*)

The subject of this paper is one of the commonest butterflies. Its geographic distribution comprises the whole of temperate North America, temperate Europe and England periodically. Dr. A. S. Packard says that it has probably been imported from Europe. In the streets of Montreal it may often be seen. The perfect insect hibernates, selecting for its long winter sleep an old hollow tree and sometimes a place under some loose stones.

On the advent of a warm sunny day, while the snow is on the ground, these lovely creatures may be seen disporting themselves in the birch woods. They are really looking for a good square meal. The sap of the maple or birch trees constitutes their entire food at this time of year; at other times they are fond of over-ripe pears and plums.

About the middle of May they have other business to attend to besides gorging themselves with sap. Their thoughts turn seriously to love. The males, carefully brushed up, playfully pursue their mates, the lady antiopa, as usual, seemingly doing her best to get away from them, a fact of which the reader will readily recall many similar cases in the higher studies of natural history.

The female generally selects a forked twig of willow or poplar and oviposits about 400 beautiful pale yellow eggs, resembling minute musk melons. These eggs hatch about June 6th into little dull orange caterpillars sparsely covered with brown hairs; in the later moults these hairs change into black branched spines.

These caterpillars are very irritable little creatures, throwing up their heads in a threatening manner when one approaches too near them. They spin a line of silk behind them as they walk in search of a fresh leaf, these strands probably serving as life lines in preserving them from injury from a fall, or it may be these form a system of telegraphic wires.

After feeding for four or five days the old skin gets too small and requires to be shed. One can easily tell the time of moulting by their sullen, dissatisfied attitude; this period continues for a day or two, when they manage by a lot of wriggling to get rid of the worn-out skin. After the first moult the caterpillars present a little improved appearance. The head is black, with two rows of interrupted brown lines down the back and several black hairs on each segment, each tipped with a white hair. The description of the four succeeding moults is so similar that it will only be necessary to describe the last one.

Fifth moult.—Length two inches, with four branched spines, innumerable white hairs in between, and a reddish irregular-shaped spot on each segment down the back. The six front legs are black, prolegs Indian red, and anal ones black. These caterpillars do considerable damage sometimes to elm and various other trees, including poplar, willow and hop.

The next stage requires unusual gymnastic accomplishments which would drive a modern acrobat green with envy. The first thing it does is to spin a button of silk (under a ledge of a fence or a branch), tuck its two anal legs into it and hang head downward. Soon afterwards the first two or three segments next to the head swell, the skin splits, showing the newly forming chrysalis inside. The rent increases, and the chrysalis, acting as a wedge, succeeds in opening up the skin and pushing it down towards the anal legs.

By alternate contractions and expansions the head becomes wholly disengaged, and the caterpillar skin, now dry and shrivelled, is pressed together into a small bundle, which is its only means of support, and the difficult task which remains for the chrysalis to perform is to extricate itself from this skin and attach its cremaster to the silk above it. In order to accomplish this (which seems to require an effort beyond the power of a creature unprovided with arms or legs) the cremaster is pushed through the skin and held by it, while it searches for the button of silk. After several apparently futile attempts it finally jumps up a distance of about one-eighth of an inch and hooks its beak into it. All this time the reader will remember that the chrysalis is as soft and weak as a newly hatched bird. A comparison may here be made between a human being, which in its infancy is the most helpless of all creatures, and insects which perform such wonderful feats in their young state. The once soft chrysalis hardens and assumes the well-known grotesque shape. Perhaps these changes can be more plainly brought before the reader by supposing a fat boy, wearing a pair of sharp-pointed boots (so dear to some of our city exquisites), dressed in a worn-out but tightly-fitting sack, with his feet pushed through the sack into a loop of rope attached to the ceiling. He would require to burst the sack, wriggle it down towards his legs, having his whole weight supported by it, get his feet out of his boots and hook his toes into the same loop of rope. I do not think many athletes would care to go through a like series of feats, but practically speaking this is what the weak chrysalis has to do.

After about twelve days in warm weather the butterfly is formed inside, the skin is rent, and the Camberwell Beauty crawls out with diminutive wings, only a quarter of an inch in length, but if you watch it half an hour you will see the wings grow to their natural size, about two or three inches from tip to tip.

It is not generally known that a butterfly attains its full size in the short space of about one hour. In about two hours it is ready to fly. After the courtship and marriage festivities are over another batch of eggs is laid and the butterflies resulting from these secure a snug retreat and hibernate until spring.

The enormous increase of these insects is prevented by ichneumons, tiny wasp-like creatures belonging to the Hymenoptera order.

The special ichneumon which attacks the Camberwell Beauty larva is called *Ptermalus Puparum*, a small metallic green fly; extreme length of body $\frac{3}{32}$ in., wings expanded $\frac{1}{4}$ in. It lays about 130 eggs in the mature larva. These hatch and feed inside, avoiding the vital organs; but the astonishing part is how the larva turns into a chrysalis with 130 ichneumon maggots inside of it, each $\frac{1}{16}$ in. long. I propounded this question to Mr. A. F. Winn, an entomologist of considerable note, and he explained the mystery by informing the writer that the eggs are probably laid while the larva is hung up just before it changes into the chrysalis state; thus it is only incommoded by the ichneumon eggs and not by the large maggots.

When the caterpillar has undergone all the hard work of changing into a pupa, the ichneumon eggs are probably just hatched, and then commence to eat up everything inside the antiopa chrysalis, leaving nothing except the skin. When full fed the maggots are nearly $\frac{1}{8}$ in. long and stout in proportion. The length of the chrysalis (antiopa) is only $1\frac{1}{8}$ in. and diameter at thickest part $\frac{3}{8}$ in., so one can easily imagine how crowded 130 maggots would be in such a small space. A Montreal street car at 6 in the evening will give the reader an idea how tightly these grubs are packed together.

The maggots change into chrysalides and the flies soon emerge by piercing one or two holes, and are just in time to destroy the larvæ of the common white butterfly, while some hibernate.

A. E. Norris.

2753 St. Catherine Street,
Montreal, March 1, 1901.

The Flora of Montreal Island.[1]

(Continued from Vol. VIII., Number 1, p. 24.)

By Rev. Robert Campbell, M.A., D.D.

Now for the first time an attempt is made to collect and classify the mosses of the district. Doubtless the local species were noted by Mr. D. A. P. Watt and others who catalogued the Acrogens of Canada forty years ago, but no distinction was made between those found near the city and those collected elsewhere. The following mosses were obtained during the summer and autumn of 1900:

SPHAGNACEÆ—Peat Mosses.

SPHAGNUM Dill.

Sphagnum acutifolium Ehrh.—*Peat Moss.*—Savanne, St. Michel. August.

1 Being the substance of two papers read before the Natural History Society of Montreal, session 1900-1901.

SPHAGNUM CYMBIFOLIUM HEDW.—*Peat Moss.*—Savanne, St. Michel. August.

SPHAGNUM RIGIDUM COMPACTUM SCHIMP.—*Peat Moss.*—Savanne, St. Michel. August.

BRYACEÆ—TRUE MOSSES.

TREMATODON MICHX.

TREMATODON AMBIGUUM HORNSCH.—Petite Cote woods. June.

DICRANELLA SCHIMP.

DICRANELLA VARIA SCHIMP.—Petite Cote woods. August.

DICRANELLA RUFESCENS SCHIMP.—Base of Mount Royal. June.

DICRANUM HEDW.

DICRANUM FUSCESCENS (TURN.) LONGIROSTRE SCHIMP.—On decayed tree, St. Michel. August.

DICRANUM DRUMMONDII MUELL.—Mount Royal. July.

DICRANUM UNDULATUM TURN.—Foot of Mount Royal.—September.

DICRANODONTIUM BRUCH AND SCHIMP.

DICRANODONTIUM LONGIROSTRE BRUCH AND SCHIMP.—Petite Cote. July.

CERATODON BRID.

CERATODON PURPUREUS BRID.—Common. May to November.

LEPTOTRICHUM HAMPE.

LEPTOTRICHUM TORTILE MUELL.—Westmount. August.

LEPTOTRICHUM VAGINANS SULLIV.—Westmount. September.

BARBULA HEDWIG.

BARBULA RECURVIFOLIA SCHIMP.—Mount Royal. July.

ORTHOTRICHUM Hedw.

Orthotrichum anomalum Hedw.—Rocks, Westmount. May.

FUNARIA Schreb.

Funaria hygrometrica Sibth.—Common all through the season.

BARTRAMIA Hedwig.

Bartramia pomiformis Hedw.—Mount Royal. July.

CONOSTOMUM Swartz.

Conostomum boreale Swartz.—Westmount. June.

BRYUM Dill.

Bryum cæspiticium Linn.—Very common throughout season.

Bryum capillare Linn.—St. Michel woods. June.

MNIUM Linn.

Mnium serratum Laich.—Westmount. June.

AULACOMNIUM Schwægr.

Aulacomnium palustre Schwægr.—Common throughout season.

Aulacomnium palustre imbricatum Bruch and Schimp.—Savanne, St. Michel. August.

TIMMIA Hedw.

Timmia megapolitana Hedw.—Mount Royal. September.

POGONATUM Beauv.

Pogonatum alpinum Rœhl.—Mount Royal. August.

POLYTRICHUM Linn.

Polytrichum gracile Menz.—Mount Royal. August.

POLYTRICHUM FORMOSUM HEDW.—Mount Royal. July.

POLYTRICHUM FORMOSUM PALLIDISETUM BRUCH AND SCHIMP.—Petite Cote woods. June.

POLYTRICHUM OHIOENSE REN. AND CARD.—Mount Royal. August.

POLYTRICHUM PILIFERUM SCHREB.—Westmount. September.

POLYTRICHUM JUNIPERINUM WILLD.—Mount Royal. June.

POLYTRICHUM JUNIPERINUM ALPINUM SCHIMP.—Westmount. July.

POLYTRICHUM STRICTUM BANKS.—Mount Royal. August.

POLYTRICHUM COMMUNE LINN.—Savanne. July.

POLYTRICHUM COMMUNE PERIGONIALE BRUCH AND SCHIMP.—Mount Royal. June.

POLYTRICHUM COMMUNE CANADENSE KINDB.—Mount Royal. August.

PTERIGONIUM SWARTZ.

PTERIGONIUM GRACILE SWARTZ.—Common on Mount Royal all the season.

HYPNEÆ.

BRACHYTHECIUM SCHIMP.

BRACHYTHECIUM ACUMINATUM SETOSUM C. M. AND KINDB.—Common throughout the season.

HYPNUM PROPER.

HYPNUM CURVIFOLIUM HEDW.—Petite Cote woods. June.

HYLOCHOMIUM SCHIMP.

HYLOCHOMIUM SPLENDENS LINN.—Mount Royal. August.

HYLOCHOMIUM TRIQUETRUM LINN.—Bagg's Woods. June.

OPHIOGLOSSACEÆ Presl.

BOTRYCHIUM Sw.

Botrychium simplex E. Hitchcock.—*Little grape-fern.* —Found by Dr. H. B. Cushing at north base of Mount Royal. June.

POLYPODIACEÆ R. Br.

WOODSIA R. Br.

Woodsia Ilvensis (L.) R. Br.—*Rusty Woodsia.*— Below the steep crag, near the top of Mount Royal, above Ravenscrag. September.

CYSTOPTERIS Bern.

Cystopteris fragilis (L.) Bern.—*Brittle fern.*—Crevices of rocks, north end of Mount Royal. August.

ASPLENIUM L.

Asplenium Trichomanes L.—*Maiden-hair Spleenwort.* —Found by Dr. H. B. Cushing on rock at north-east end of Mount Royal. August.

Asplenium angustifolium Michx. — *Narrow-leaved Spleenwort.*—Abundant in Bagg's Woods. August.

Asplenium acrostichoides Sw.—*Silvery Spleenwort.*— In Bagg's woods, and on Mount Royal above Ravenscrag. August.

PELLÆA Link.

Pellæa Stelleri (S.G. Gmel.) Watt.—*Slender Cliff Brake.*—On face of rocks, north-east end of Mount Royal. August.

GRAMINEÆ Juss.

ALOPECURUS L.

Alopecurus pratensis L.—*Meadow Foxtail.*—Fletcher's Field. June.

SIEGLINGIA Bern.

Sieglingia seslerioides (Michx.) Scribn.—*Tall Red-top.*—Bagg's Woods. August.

ELYMUS L.

Elymus robustus Scrib. and Sm.—*Stout Wild Rye.*—Back River. September.

CYPERACEÆ J. St. Hil.

CAREX L.

Carex Ræana Boot.—*Rae's Sedge.*—Savanne, St. Michel. August.

Carex Hartii Dewey.—*Hart Wright's Sedge.*—Beaconsfield. June.

Carex viridula Michx.—*Green Sedge.*—Near Water Works, St. Henri. August.

JUNCACEÆ Vent.

JUNCUS L.

Juncus filiformis L.—*Thread Rush.*—Lachine. August.

ORCHIDACEÆ Lindl.

CYPRIPEDIUM L.

Cypripedium reginæ Watt.—*Showy Ladies' Slipper.*—Savanne, St. Michel. July. (Reported by Dr. Holmes from Mount Royal.)

LEPTORCHIS Thouars.

Leptorchis Loeselii (L.) MacM.—*Fen orchis.*—Abundant in Savanne, St. Michel. July.

CORALLORHIZA R. Br.

Corallorhiza multiflora Nutt.—*Large Coral Root.* —Petite Cote woods. August. (Reported by Dr. Holmes as *odontorhiza.*)

MYRICACEÆ Dumort.

MYRICA L.

Myrica Gale L.—*Sweet Gale.*—Banks Riviere des Prairies. September.

SALICACEÆ Lindl.

SALIX L.

Salix fluviatilis Nutt.—*Sandbar Willow.*—Longue Pointe and Pointe aux Trembles. June.

Salix Bebbiana Sarg.—*Bebb's Willow.*—Savanne, St. Michel. May.

Salix Brownii Bebb. — *Robert Brown's Willow.*— Savanne, St. Michel. June.

Salix candida Fluegge.—*Hoary Willow.*—Savanne, St. Michel. May.

FAGACEÆ Drude.

QUERCUS L.

Quercus velutina Lam.—*Black Oak.*—Mount Royal Cemetery. June.

Quercus alba L.—*White Oak.*—St. Anne's. June.

URTICACEÆ Reichenb.

ADICEA Raf.

Adicea pumila (L.) Raf.—*Clearweed.* — St. Michel woods. August.

CHENOPODIACEÆ Dumort.

CHENOPODIUM L.

Chenopodium glaucum L. — *Oak-leaved Goosefoot.*— Common. August.

AMARANTHACEÆ J. St. Hil.

AMARANTHUS L.

Amaranthus hybridus L.—*Slender Pigweed.*—Common. September.

Amaranthus blitoides S. Wats.—*Prostrate amaranth.* —Railway grounds, Point St. Charles. August.

Amaranthus græcizans L.—*Tumbleweed.*—Alongside railway tracks. September.

ACNIDA L.

Acnida tamariscina tuberculata (Moq.) Uline and Bray.—*Tall Western Water-hemp.*—On banks of St. Lawrence. Common. August.

CARYOPHYLLACEÆ Reichenb.

VACCARIA Medic.

Vaccaria Vaccaria (L.) Britton.—*Cow herb.*—Refuse heap, Cote St. Paul. July.

NYMPHÆACEÆ D.C.

BRASENIA Schreb.

Brasenia purpurea (Michx.) Casp.—*Water-shield.*— Found by Dr. Girdwood at St. Anne's.—(Reported by Dr. Holmes in 1821 from Point St. Charles.)

BERBERIDACEÆ T. and G.

BERBERIS L.

Berberis vulgaris L.—*European Barberry.*—East of reservoir, spread from McGill College grounds. June.

CRUCIFERÆ B. Juss.

ARABIS L.

Arabis glabra (L.) Bernh.—*Tower Mustard.* Mount Royal Park. July.

BRASSICA L.

Brassica campestris L.—*Wild Navew.* — Lachine. August.

BARBAREA R. Br.

Barbarea Barbarea (L.) MacM.—*Yellow Rocket.*—Montreal.

SARRACENIACEÆ La Pyl.

SARRACENIA L.

Sarracenia purpurea L.—*Pitcher Plant.*—Savanne, St. Michel. July. (Reported by Dr. Holmes.)

HAMAMELIDACEÆ Lindl.

HAMAMELIS L.

Hamamelis Virginiana L.—*Witch-Hazel.*—Found by Dr. Girdwood at St. Anne's. September.

ROSACEÆ B. Juss.

GEUM L.

Geum macrophyllum Willd.—*Large-leaved avens.*—Savanne, St. Michel. June.

ROSACEÆ L.

CRATÆGUS L.

Cratægus macracantha Lodd.—*Longspined Thorn.*—St. Michel. May.

CÆSALPINACEÆ Kl. and Garcke.

GYMNOCLADUS Lam.

Gymnocladus dioica (L.) Koch.—*Kentucky Coffee-tree.*—On Parthenais Street, Dorchester Street, near Fort Street, and in Cemetery—introduced. June.

OXALIDACEÆ Lindl.

OXALIS L.

Oxalis cymosa Small.—*Tall Yellow Wood Sorrel.*—On trolley track, Longue Pointe. September.

POLYGALACEÆ Reichenb.

POLYGALA L.

Polygala Senega L.—*Seneca Snakeroot.*—St. Anne's. June.

EUPHORBIACEÆ J. St. Hil.

Euphorbia Peplus L.—*Petty Spurge.*—Pine Avenue. August.

Euphorbia hirsuta (Torr.) Wiegand.—*Hairy Spurge.*—Mount Royal Park. July.

CALLITRICHACEÆ Lindl.

CALLITRICHE L.

Callitriche palustris L.—*Vernal Water Starwort.*—Near Back River. August.

STAPHYLEACEÆ D.C.

STAPHYLEA L.

Staphylea trifolia L.—*American Bladder-nut.*—Roadside, near Cartierville. June. (Reported by Dr. Holmes from St. Martin's, in 1821.)

ACERACEÆ St. Hil.

ACER L.

Acer Saccharum Marsh.—*Rock Maple.*—Mount Royal Park. May.

Acer negundo L.—*Ash-leaved Maple.*—Common. May.

Acer platanoides L.—*Norway Maple.*—McGill College Grounds. April.

HYPERICACEÆ Lindl.

HYPERICUM L.

Hypericum boreale (Britton) Bicknell.—*Northern St. John's Wort.*—Savanne, St. Michel. August.

TRIADENUM Raf.

Triadenum Virginicum (L.) Raf.—*Marsh St. John's Wort.*—Lachine. September.

ELATINACEÆ Lindl.

ELATINE L.

Elatine Americana (Pursh.) Arn.—*Mud Purslane.*—Back River. August.

LYTHRACEÆ Lindl.

LYTHRUM L.

Lythrum alatum Pursh.—*Wing-angled Loosestrife.*—Riviere des Prairies. September.

Lythrum salicaria L.—*Purple Loosestrife.*—Longue Pointe and Pointe aux Trembles. July.

UMBELLIFERÆ B. Juss.

ZIZIA Koch.

Zizia aurea (L.) Koch.—*Early Golden Meadow Parsnip.*—Common. May.

DERINGA Adans.

Deringa Canadensis (L.) Kuntze.—*Honewort.*—Bagg's Wood. July.

HYDROCOTYLE L.

Hydrocotyle Americana L.—*American Marsh—Pennywort.*—Mountain Marsh, Mount Royal Park. August.

ERICACEÆ D.C.

LEDUM L.

Ledum Grœnlandicum Oeder. — *Labrador Tea.*—Savanne, St. Michel. June. (Reported by Dr. Holmes as *Ledum palustre.*)

GAULTHERIA L.

GAULTHERIA PROCUMBENS L.—*Creeping Wintergreen.*—Savanne, St. Michel. June. (Reported by Dr. Holmes in 1822.)

PRIMULACEÆ VENT.

ANAGALLIS L.

ANAGALLIS ARVENSIS L.—*Poor Man's Weather Glass.*—Found occasionally in gardens. July.

APOCYNACEÆ LINDL.

APOCYNUM L.

APOCYNUM HYPERICIFOLIUM AIT.—*Clasping-leaved dog-bane.*—St. Anne's. June.

CONVOLVULACEÆ VENT.

CONVOLVULUS L.

CONVOLVULUS ARVENSIS L.—*Small Bindweed.*—Westmount. July.

BORAGINACEÆ LINDL.

LAPPULA MOENCH.

LAPPULA VIRGINIANA (L.) GREENE.—*Virginia Stickseed.*—Bagg's Wood. August.

LABIATÆ B. JUSS.

HEDEOMA PERS.

HEDEOMA PULEGIOIDES (L.)—PERS.—*American Penny-royal.*—St. Anne's. June.

KOELLIA Moench.

Koellia Virginiana (L.) MacM.—*Virginia Mountain Mint.*—Riviere des Prairies and Westmount. August.

SCROPHULARIACEÆ Lindl.

ILYSANTHES Raf.

Ilysanthes attenuata (Muhl.) Small.—*Shortstalked false pimpernel.*—Savanne, St. Michel. June.

GRATIOLA L.

Gratiola Virginiana L.—*Clammy Hedge-Hyssop.*—Dixie. September.

VERONICA L.

Veronica arvensis L.—*Corn Speedwell.* — Roadside, Cote des Neiges. July.

LEPTANDRA Nutt.

Leptandra Virginica (L.) Nutt. — *Culver's-root.*—Roadside, St. Michel. August.

LENTIBULARIACEÆ Lindl.

UTRICULARIA L.

Utricularia Vulgaris L.—*Greater Bladderwort.*—Pond, Lachine. June.

ACANTHACEÆ J. St. Hil.

DIANTHERA L.

Dianthera Americana L. — *Dense-flowered Water-Willow.*—Shore of St. Lawrence, Point St. Charles. July.

RUBIACEÆ B. Juss.

Galium mollugo L.—*Wild Madder.* — Westmount. July.

Galium spurium L.—*Lesser-Goosegrass.*—St. Anne's. June.

Galium lanceolatum Torr.—*Torrey's Wild Liquorice.* —Westmount. July.

Galium tinctorium L.—*Stiff Marsh Bedstraw.*—Back River. July.

Galium palustre L.—*Marsh Bedstraw.*—St. Anne's. June.

CAMPANULACEÆ Juss.

Campanula rapunculoides L.—*Creeping Bellflower.*—Roadsides, escaped from cultivation (wrongly named *Americana* in former list.)

Campanula aparanoides Pursh.—*Marsh Bellflower.*—Back River. September.

CICHORIACEÆ Reichenb.

LEONTODON L.

Leontodon autumnale L.—*Fall Dandelion.*—Pointe aux Trembles. September.

LACTUCA L.

Lactuca Scariola L.—*Prickly Lettuce.*—Logan's Park. August.

Lactuca hirsuta Muhl.—*Hairy Wood Lettuce.*—Mount Royal Park. August.

Lactuca sagittifolia Ell.—*Arrow-leaved Lettuce.*—Westmount. August.

HIERACIUM L.

Hieracium aurantiacum L.—*Orange Hawkweed.*—Westmount. July.

AMBROSIACEÆ Reichenb.

AMBROSIA L.

Ambrosia psilostachya D.C.—*Western Ragweed.*—Common about Point St. Charles. August.

COMPOSITÆ Adans.

EUPATORIUM L.

Eupatorium maculatum L.—*Spotted Joe-Pye-weed.*—Lachine and Savanne, St. Michel. August.

SOLIDAGO L.

Solidago hispida Muhl.—*Hairy Golden-rod.*—Mount Royal Park. August.

Solidago puberula Nutt.—*Downy Golden-rod.*—Petite Cote. August.

Solidago Virgaurea L. — *European Golden-rod.*—Mount Royal Park. September.

Solidago uliginosa Nutt.—*Bog Golden-rod.*—Savanne, St. Michel. September.

Solidago Canadensis glabrata Porter. — *Smooth Canada Golden-rod.*—Mount Royal Park, at base of mountain. August.

ASTER L.

Aster macrophyllus biformis Burgess.—*Large-leaved Aster.*—Lachine. September.

Aster macrophyllus excelsior Burgess.—*Fine large-leaved Aster.*—Park Road. September.

Aster cordifolius pedicellatus Burgess.—*Blue Wood Aster.*—Mount Royal Park. September.

Aster Lindleyanus T. & G.—*Lindley's Aster.*—Savanne, St. Michel. September.

Aster puniceus firmus (Nees) T. & G.—*Smooth Red-stalked Aster.*—St. Michel. August.

Aster puniceus lucidulus A. Gray.—*Shining Red-stalked Aster.*—St. Michel. August.

Aster paniculatus Bellidifolius (Willd.) Burgess.—*Fair White Aster.*—Common. August.

ERIGERON L.

Erigeron acris Droebachianus (O. F. Mueller) Blytt.—*Blue Fleabane.*—Cote St. Michel. August.

Erigeron acris debilis A. Gray.—*Slender Blue Fleabane.*—Lachine. September.

RUDBECKIA L.

Rudbeckia laciniata L.—*Green-headed Cone-flower.*—August.

HELIANTHUS L.

Helianthus decapetalus L.—*Thin-leaved Wild Sunflower.*—Mount Royal Park. August.

HELENIUM L.

Helenium autumnale L.—*Swamp Sunflower.*—Shore Riviere des Prairies. September.

ARCTIUM L.

Arctium minus Schk.—*Common Burdock.*— Longue Pointe. September.

List of the Published Writings of Elkanah Billings, F.G.S., Palæontologist to the Geological Survey of Canada, 1856-1876.

Prepared by B. E. Walker, F.G.S., Toronto, Canada.

Previous to 1854, the date of his first serious contribution to science, Mr. Billings was the editor of one of the newspapers, the *Citizen*, in Ottawa (Bytown), Canada, and it is stated that he contributed to its columns articles on geology of a more or less popular character. No record of these articles is made here. In 1856 he published the first volume of the *Canadian Naturalist and Geologist.* The title page of this particular volume bears his name, and he is supposed to have written all the articles not specially indicated as from other contributors. Only one paper contains an original description of a fossil, and in the majority of cases they are articles about the wild animals and the geology of Canada, such as might have been contributed to a text book. The second volume was edited by a committee, and does not bear Mr. Billings' name. He apparently contributed at least twelve articles, some over his initials and some not, of which only eight appear in the index. Other articles, not indexed or bearing name or initials, may, of course, be by him. In any event, no article by him in the second volume contains an original description of a fossil or other natural object.

In 1856 he was appointed Palæontologist to the Geological Survey of Canada, and from 1857 to the end of his life his published works are almost entirely devoted to the description of the great number of new genera and species with which his name is associated.

In this list of his published writings the titles in almost every case are given literally as originally printed. In the series of articles devoted to natural history in Canada, the generic and specific name of the animal described is often part of the title. Sometimes this name is in brackets, sometimes not; the specific name may begin with a capital or not, without reference to any system of nomenclature. In the early volumes of the *Canadian Naturalist and Geologist* the entire title is always in italics. Words which in this list appear in brackets thus [ ] are part of the title. Words in brackets thus ( ) are not part of the title, but are notes by the compiler. Attention is particularly directed to this, because the notes of the compiler frequently intentionally contradict statements conveyed by the title. In the compiler's notes references are as a rule not made to illustrations unless they accompany descriptions of new fossils.

A biographical sketch of Mr. Billings by his successor, Mr. Whiteaves, will be found in Vol. VIII., new series, of the *Canadian Naturalist.*

LIST OF PUBLICATIONS IN WHICH WRITINGS BY MR. BILLINGS HAVE APPEARED, WITH THE ABBREVIATIONS USED IN THE BIBLIOGRAPHY.

Publications.	Abbreviations.
Geological Survey of Canada	G.S.C.
The Canadian Journal—Proceedings of Canadian Institute, Toronto, Canada	Can. Journ.
The Canadian Naturalist and Geologist—Proceedings of the Natural Historical Society, Montreal, Canada	Can. Nat.
The American Journal of Science and Arts, New Haven, U.S.	A.J.S.
Proceedings American Association for Advancement of Science	P.A.A.A.S.
Report of the Geology of Vermont	Geol. Verm.
Portland Society of Natural History, Portland, Maine, U.S.	P.S.N.H.
Annals and Magazine of Natural History, London, Eng.	A.M.N.H.
Geological Magazine, London, Eng	Geol. Mag.
Quarterly Journal of the Geological Society, London, Eng.	Q.J.G.S.

BIBLIOGRAPHY.

Year.	Month	Title.	Publication.	Volume.	Page.
1854	April and May	On some New Genera and Species of Cystidea from the Trenton Limestone. Read before the Canadian Institute, February 11th, 1854. (Describes and illustrates the new genera, *Glyptocystites* and *Pleurocystites*)	Can. Journ.	Ser. 1, V. 2	215-218 250-253
"	June	On some new Genera and Species of Cystidea from the Trenton Limestone. Second paper. Read before the Canadian Institute, April 8th, 1854. (Describes and illustrates the new genera, *Comarocystites* and *Amygdalocystites*)	"	"	268-274
1856	February	Elevation and subsidence of Land—Various Theories of the Earth—Origin of Stratified Rocks—European and American Formations—Geographical Distribution of the latter in Canada	Can. Nat.	1	1-25
"	"	On the Nomenclature and Classification of the Animal Kingdom	"	1	26-31
"	"	Fossils of the Potsdam Sandstone; Sea-weeds, Shells and footprints on the rock at Beauharnois	"	1	32-39
"	"	On some of the characteristic fossils of the Lower Silurian Rocks of Canada	"	1	39-47
"	"	On the Crinoidea or Stone Lilies of the Trenton Limestone, with a description of a new species. (Describes and illustrates *Glyptocrinus ramulosus*)	"	1	48-57
"	"	Fossils of the Upper Silurian Rocks, Niagara and Clinton Groups	"	1	57-60
"	"	Natural History of the Moose Deer, Alces Americana	"	1	60-70

BIBLIOGRAPHY—*Continued.*

Year.	Month.	Title.	Publication.	Volume.	Page.
1856	February	The Northern Reindeer, or Barren Ground Caribou [Tarandus arcticus]	Can. Nat	1	71-76
"	"	The Woodland Caribou [Tarandus hastalis]	"	1	77-80
"	April	On the Wapite, or Canadian Stag [Elaphus Canadensis]	"	1	81-87
"	"	On the Common Deer [Cervus Virginianus]	"	1	87-92
"	"	On the Mule Deer [Cervus Macrotis]	"	1	92-100
"	"	On the American or Black Bear [Ursus Americanus]	"	1	100-104
"	"	On the Grizzly Bear [Ursus Ferox]	"	1	104-109
"	"	On the White or Polar Bear [Ursus maritimus]	"	1	109-113
"	"	On the Cinnamon Bear [Ursus cinnamomum]	"	1	114-115
"	"	On the Fossil Corals of the Lower Silurian Rocks of Canada	"	1	115-128
"	"	On some of the technical terms used in the description of Fossil Shells	"	1	128-131
"	"	On some of the Fossil Shells of the Niagara and Clinton Formations	"	1	131-139
"	"	Ornithology; Technical terms	"	1	139-142
"	"	On the Robin, or Migratory Thrush [Turdus migratorious]	"	1	142-146
"	"	On Black Duck [Anas obscura]	"	1	146-149
"	"	On the Wood Duck [Anas sponsa]	"	1	149-152
"	"	On the Green-winged Teal [Anas Carolinensis]	"	1	153-154
"	"	On the Blue-winged Teal [Anas discors]	"	1	154-156
"	"	On the Mallard [Anas boschas]	"	1	156-159
"	"	On a Sea-Gull shot at Ottawa	"	1	159-160
"	June	On the Pigeon [Ectopistes Migratoria]	"	1	168-176

Bibliography—*Continued.*

Year.	Month.	Title.	Publication.	Volume.	Page.
1856	June	On the Species of Woodpeckers observed in the vicinity of the City of Ottawa	Can. Nat	1	176-189
"	"	A Chapter on Earthquakes	"	1	189 195
"	"	On some of the Common Rocks of the British Provinces	"	1	196-202
"	"	On some of the Lower Silurian Fossils of Canada	"	1	203-208
"	"	Natural History of the Wolf [Canis Lupus] and its varieties	"	1	209-215
"	"	On the Foxes of British North America	"	1	216-228
"	"	On the Canadian Otter [Lutra Canadensis]	"	1	228 232
"	"	On the Bob-link or Rice-bird [Dolichonyx orzivora]	"	1	233-237
"	September	Natural History of the Wolverene or Carcajou [Gulo Luscus]	"	1	241-246
"	"	On the Loup Cervier, or Canadian Lynx [Lynx Canadensis] and the Bay Lynx or Wild Cat of the United States [Lynx Rufus]	"	1	247-252
"	"	Natural History of the Raccoon [Procyon Lotor]	"	1	253-260
"	"	On some of the Game Birds of Canada	"	1	284-305
"	"	On the Insects injurious to the Wheat crop	"	1	306-312
"	"	Description of Fossils occurring in the Silurian Rocks of Canada	"	1	312-320
"	December	On the Tertiary Rocks of Canada, with some account of their Fossils	"	1	321-346
"	"	On the American Buffalo [Bison Americanus]	"	1	346-353
"	"	On the Musk Ox [Ovibos moschatus]	"	1	353-357
"	"	The Rocky Mountain Sheep [Ovis montana]	"	1	357-360

BIBLIOGRAPHY—*Continued.*

Year.	Month.	Title.	Publication.	Volume.	Page.
1856	December	On the Skunk [Mephitis chinga]	Can. Nat	1	360-364
"	"	On the Canada Porcupine [Hystrix dorsata]	"	1	364-369
"	"	On the Northern Hare [Lepus Americanus]	"	1	369-379
"	"	On the Mammoth and the Mastodon	"	1	379-390
1857	January (The cover	On the several species of Squirrels inhabiting the British Provinces	"	1	431-442
"	reads	On the great Horned Owl, Bubo Virginianus	"	1	443-447
"	February)	The Snowy Day Owl. Surnia Nyctea.	"	1	447-450
"	"	The Enemies of the Wheat Fly	"	1	450-457
"	"	Lawrencian Formation	"	1	464-
"	"	Fossils of the Hamilton Group	"	1	473-479
"	March	On the iron ores of Canada and the cost at which they may be worked.	"	2	20-28
"	"	On the Natural History of the Rosignol or Song Sparrow, Fringilla melodia	"	2	47-52
"	May	Notes on the Natural History of the Mountain of Montreal.	"	2	92-101
"	"	The Muskrat [Fiber Zibethicus]	"	2	106-111
"	"	On the Wood-Chuck [Arctomys Monax]	"	2	112-116
"	"	On the "Fisher" or Pekan. "Pennant's Marten" [Mustela Canadensis]	"	2	116-119
"	"	On the Beaver.—Castor fiber	"	2	120-127
"	"	On the Genera of Fossil Cephalopoda occurring in Canada	"	2	135-138
"	December	On the Star-Nosed Mole of America	"	2	446-448

BIBLIOGRAPHY—*Continued.*

Year.	Month.	Title.	Publication.	Volume.	Page.
1857	December	On the Mink [Putorius vison]	Can. Nat	2	448-455
"	"	The Common Weasel [Putorius erminea]	"	2	455-462
"	"	On the Pine Marten [Mustela martes] (The last four articles are neither signed nor indexed as by Billings, but they appear to be the concluding numbers of his series of papers on natural history.)	"	2	463-464
1857	March	Report for the year 1856 (the first) as Palæontologist, containing the following sub-heading "New Species of Fossils from the Silurian Rocks of Canada." (The descriptions of new genera and species in earlier papers are here included together with many new species of Echinodermata, Brachiopoda, Gasteropoda, Cephalopoda and Crustacea, and the genera *Pasceolus* and *Batricca.* No illustrations accompany the descriptions).	G.S.C.	Report of Progress, 1853-56	247-345
1858	March	Report for the year 1857 as Palæontologist. (Contains descriptions of new genera and species of Cœlenterata, without illustrations, and of Lamellibranchiata and Brachiopoda, with illustrations. That part of the above report containing the descriptions of new fossils was published at Montreal, without date, as a separate pamphlet, 31 pp., with the title "Canadian Fossils, containing descriptions of New Genera and Species, from the Silurian and Devonian Formations of Canada, etc.)	"	Report of Progress, 1857	147-192
"	December	New Genera and Species of Fossils from the Silurian and Devonian formations of Canada. (This is merely a reprint of the descriptions and illustrations contained in the report for 1857, referred to immediately above.)	Can. Nat	3	419-444

BIBLIOGRAPHY—*Continued.*

Year.	Month.	Title.	Publication.	Volume.	Page.
1858	June	On the Cystideæ of the Lower Silurian Rocks of Canada. (7 plates and 26 figures with the text)	G.S.C.	Figures and descriptions, Can. Organic Remains, Decade 3.	9-74
"	"	On the Asteriadæ of the Lower Silurian Rocks of Canada. (3 plates and 2 figures with the text)	"	Figures and descriptions, Can Organic Remains, Decade 3.	75-85
"	"	On Cyclocystoides, a new genus of Echinodermata from the Lower and Middle Silurian Rocks, by J. W. Salter and E. Billings. (1 plate)	"	Figures and descriptions, Can. Organic Remains, Decade 3.	86-90
1859	March.	On the Fossil Corals of the Devonian Rocks of Canada West. Read before the Canadian Institute, February 26th, 1859. (Describes 2 new genera and 30 species, some of which were described in Report for 1857, but not illustrated. 29 figures inserted with text. Published separately, pp. 44)	Can Journ.	Ser. 2, V. 4	97-140
"	April.	On some new Genera and Species of Brachiopoda, from the Silurian and Devonian Rocks of Canada. Read before the Natural History Society of Montreal, 28th March, 1859. From the Report of the Geological Survey for 1858. (Not printed in the Report for 1858. Describes 2 new genera and 4 species. 10 figures inserted with text)	Can. Nat.	4	131-135
"	May	On the Crinoideæ of the Lower Silurian Rocks of Canada. (9 plates and 26 figures with the text. Includes a memoir on the genus *Comatula* by John V. Thompson, F.L.S., etc	G.S.C.	Figures and descriptions, Can. Organic Remains, Decade 4.	pp. 72

BIBLIOGRAPHY—*Continued.*

Year.	Month.	Title.	Publication.	Volume.	Page.
1859	August	Description of a new Genus of Brachiopoda, and on the genus Cyrtodonta. From Report of Geological Survey, 1858-59, unpublished. (No illustrations)	Can. Nat	4	301-303
"	October	Fossils of the Calciferous Sandrock, including those of a deposit of white limestone at Mingan, supposed to belong to the formation. Extracted from the Report of the Geological Survey of Canada for 1858-1859. (Not printed in Report. 41 species referred to, covering all Canadian forms from the Calciferous known at this time. 1 new genus and 27 new species described. 12 figures inserted with text)	"	4	345-367
"	"	Descriptions of some new species of Trilobites from the Lower and Middle Silurian rocks of Canada. Extracted from the Report of the Geological Survey of Canada for 1858-1859. (Not printed in Report 15 species referred to, of which 12 are new. 13 figures inserted with text)	"	4	367-383
"	December	Fossils of the Chazy Limestone, with descriptions of new species. Extracted from the Report of the Geological Survey of Canada for 1858-1859. (Not printed in Report. 129 species referred to, covering all Canadian forms from the Chazy known at this time. 37 new species described. 39 figures inserted with the text)	"	4	426-470

BIBLIOGRAPHY—*Continued.*

Year.	Month.	Title.	Publication.	Volume.	Page.
1860	February	Description of some new species of Fossils from the Lower and Middle Silurian Rocks of Canada. From the Report of the Geological Survey for 1860. (Report not published. 7 new species of Brachiopoda and 5 of Crustacea described. 12 figures inserted with the text)	Can. Nat	5	49-69
"	"	Description of a new Palæozoic Starfish of the genus Palæaster, from Nova Scotia. (Describes and illustrates *Palæaster parviusculus*)	"	5	69-70
"	May	On the Devonian Fossils of Canada West. Extracted from the Report of the Geological Survey of Canada for 1860—in preparation. (Report not published. 11 new species of Cœlenterata and 10 of Brachiopoda described. 47 figures inserted with the text and 1 plate)	Can. Journ.	Ser. 2, V. 5	249-282
"	June	New Species of Fossils from the Lower Silurian Rocks of Canada. From the Report of the Geological Survey for 1860. (Report not publlshed. 10 new species of Gasteropoda and 6 of Cephalopoda. 20 figures inserted with the text)	Can Nat	5 (Printed "VI.")	161-177
"	August	On some new species of Fossils from the Limestone near Point Levi, opposite Quebec. (25 new species of Crustacea. 30 figures inserted with the text. Page 301 printed *201* in error. Published separately pp. 24, same date)	"	5	301-324

BIBLIOGRAPHY—*Continued.*

Year.	Month.	Title.	Publication.	Volume.	Page.
1860	September	Description of a new Trilobite from the Potsdam Sandstone, by Frank H. Bradley, with a note by E. Billings. (Republished P.A.A.A.S., Vol. XIV., pp. 161-166, and Can. Nat., Vol. 5, pp. 420-425)	A.J.S.	Ser. 2, V. 30	241-243
"	November	Additional Note on the Potsdam Fossils. (Republished as indicated under previous paper)	"	"	337-338
"	December	On certain theories of the formation of mountains	Can. Nat	5	409-420
"	"	Acadian Geology and a Supplementary Chapter thereto. (Review)	"	5	450-455
1861	March.	On the Devonian Fossils of Canada West. Continued from Vol. V., page 282. No. XXVII., May, 1860. (1 new species of Brachiopoda. 11 figures inserted with the text)	Can. Journ.	Ser. 2, V. 6	138-148
"	"	Note on a New Genus of Palæozoic Brachiopoda	"	"	148
"	April	Description of the new species of Lingula referred to in the foregoing paper. (Appended to "Notes on the Geology of Murray Bay—Lower St. Lawrence." J. W. Dawson. Describes and illustrates *Lingula eva*)	Can. Nat	6	150-151
"	May	On the Devonian Fossils of Canada West. Continued from Vol. VI., page 282. No. XXVIII., May, 1860. (Should read page 148 and March, 1861. 2 new species of Brachiopoda. 44 figures inserted with the text)	Can. Journ.	Ser. 2, V. 6	253-274

BIBLIOGRAPHY—*Continued.*

Year.	Month.	Title.	Publication.	Volume.	Page.
1861	July	On the Devonian Fossils of Canada West. Continued from Vol. VI., page 282. No. XXVIII., May, 1860. (Should read page 274 and May, 1861. 1 new species of Lamellibranchiata 3 of Gasteropoda and 2 of Cephalopoda. 31 figures inserted with the text. The four entries under same title, at May, 1860, and March, May and July, 1861, constitute one paper.)	Can. Journ.	Ser. 2, V. 6	329-363
"	August	On some of the Rocks and Fossils occurring near Philipsburg, Canada East. (1 new species of Brachiopoda, 3 of Gasteropoda and 1 of Crustacea. 6 figures inserted with text.)	Can. Nat.	6	310-328
"	September	On the Age of the Red Sandstone formation of Vermont	A.J.S.	Ser. 2, V. 32	232
"	October	On the occurrence of Graptolites in the base of the Lower Silurian. (No descriptions of fossils)	Can. Nat.	6	344-348
"	November (Cover reads 21st Nov., 1861)	New Species of Lower Silurian Fossils. (The matter in this pamphlet forms the first 24 pages of the first volume of "Palæozoic Fossils," published Oct., 1865, *q.v.*)	G.S.C.	Pamphlet	pp. 24
"		On some new or little known species of Lower Silurian Fossils from the Potsdam Group—"Primordial Zone"	Geol. Verm.	2	942-945
"		On some new species of Fossils from the Calciferous, Chazy, Black River, and Trenton Formations. (The above two papers contain the matter covered by the pamphlet published by the G.S.C., November, 1861)	"	2	955-960

BIBLIOGRAPHY—*Continued.*

Year.	Month.	Title.	Publication.	Volume.	Page.
1862	January (Cover reads 21st Jan., 1862)	New Species of Lower Silurian Fossils. (This constitutes the second part of "Palæozoic Fossils," published October, 1865, *q.v.*)	G.S.C.	Pamphlet	25-56
"	January	Further observations on the age of the Red sandrock formation (Potsdam Group) of Canada and Vermont	A.J.S.	Ser. 2, V. 33	100-105
"	April	On the date of the Report on the Geology of Wisconsin, noticed in this Journal, Vol. VI., p. 465	Can. Nat	7	156-158
"	May	On Prof. J. Hall's claim of Priority in the determination of the Age of the Red Sandrock Series of Vermont	A.J.S.	Ser. 2, V. 33	370-376
"	"	Geology of Vermont, etc. (A Note on the publication of the "Report on the Geology of Vermont")	"	"	416 420
"	"	On the date of the recently published Report of the Superintendent of the Geological Survey of Wisconsin, exhibiting the Progress of the work, Jan. 1, 1861	"	"	420-421
"	"	Correction of the Article on the Red Sandrock in this vol., p 100	"	"	421-422
"	June (Cover reads 6June,1862)	New Species of Lower Silurian Fossils. This constitutes the third part of "Palæozoic Fossils," published October, 1865, *q v.*)	G.S.C.	Pamphlet	57-168
"	October	Remarks upon Prof. Hall's recent publication, entitled "Contributions to Palæontology"	Can. Nat	7	389-393
"	December	Notes on some of the habits of the pine-boring beetles of the genus Monohammus. Read before the Natural History Society of Montreal, 24th November, 1862	"	7	430-438
"	"	Dana's Manual of Geology	"	7	474-476

BIBLIOGRAPHY—*Continued.*

Year.	Month.	Title.	Publication.	Volume.	Page.
1863. (1869 ?)	January	Description of some new species of Fossils, with remarks on others already known, from the Silurian and Devonian rocks of Maine. (10 new species of Brachiopoda, 3 of Lamellibranchiata and 6 of Crustacea. 1 plate. This paper bears date the 12th and was read on the 19th January, 1863. It was published, however, in the second half, consisting of pp. 97-212, of the first volume of proceedings. P.S.N.H., and appeared without title page, the cover bearing date 1869. The building of the Society and the types of the fossils described were burned in 1866, and the second half of the volume did not appear either as a whole or in part until after that date)	P.S.N.H	1	104-126
1863	February	On the Parallelism of the Quebec Group with the Llandeilo of England and Australia, and with the Chazy and Calciferous formations. Read before the Natural History Society of Montreal, 3rd February, 1863.	Can. Nat	8	19-35
"	"	Description of a new species of Harpes from the Trenton Limestone, Ottawa	"	8	36-37
"	"	On the Internal Spiral Coils of the Genus Cyrtina	"	8	37-39
"	April	Description of a new Trilobite from the Quebec Group, by T. Devine (with a note by E. Billings)	"	8	95 98

BIBLIOGRAPHY—*Continued.*

Year.	Month.	Title.	Publication.	Volume.	Page.
1863	April	On the remains of the Fossil Elephant found in Canada. Read before the Natural History Society of Montreal, 23rd February, 1863. (The above five papers appeared in a separate pamphlet published by the Geological Survey of Canada at Montreal, 1863, pp. 36)	Can. Nat	8	135-147
"	May	Geological Survey of Canada. Report of Progress from its Commencement to 1863	G.S.C.	—	pp. 983
		(The following extract from Sir William Logan's preface, page VII., indicates partially Mr. Billings' share in the preparation of this volume : "In order to insure uniformity in the palæontological part of this work, all the palæozoic fossils mentioned in it have been submitted to the inspection of Mr. Billings, and the species are, therefore, all given on his authority. Of the described Lower Silurian species found in Canada, not including those of the Quebec group, he has prepared a catalogue, showing their vertical distribution, and referring to the publications in which the descriptions and figures will be found. This catalogue has been introduced into the appendix to this volume." The catalogue will be found at pp. 936-956. There is also at pp. 862-864 a "List of Fossils from the various bands at Point Levis" (Quebec). There are no descriptions of fossils in the volume, but 498 figures, almost all of fossils, are inserted with the text.)			

BIBLIOGRAPHY—*Continued.*

Year.	Month.	Title.	Publication.	Volume.	Page.
1863	June	Description of a new species of Phillipsia from the lower Carboniferous rocks of Nova Scotia	Can. Nat	8	209-210
"	September	On the genus Centronella, with remarks on some other genera of Brachiopoda	A.J.S.	Ser. 2, V. 36	236-240
"	October	On the Genus Stricklandia; proposed alteration of the name	Can. Nat	8	370
1865	February	New Species of Lower Silurian Fossils. (This constitutes the fourth part of "Palæozoic Fossils." In the case of every other title given in this bibliography except this, I have seen the actual publication. See preface to "Palæozoic Fossils," published October, 1865.)	G.S.C.	Pamphlet	169-344
"	June	Notes on Some of the More Remarkable Genera of Silurian and Devonian Fossils. (On *Receptaculites* and *Pasceolus*. 14 figures inserted with the text)	Can. Nat	N. Ser, V. 2	184-198
"	October	Palæozoic Fossils. Volume 1. (The several parts which here appear as one volume were published as follows: Pp. 1-24 November, 1861—text altered somewhat in 1865, see page 419. 25-56 January, 1862. 57-168 June, 1862—pp. 57-72 reprinted or altered in 1865, see page 419. 169-344 February, 1865. 345-426 with the complete work as above. The volume contains eleven sub-headings with a list of Levis fossils and an appendix. The index gives the names of 529 species, which are illustrated by 401 figures inserted with the text)	G.S.C.	1	pp. 426

BIBLIOGRAPHY—*Continued.*

Year.	Month.	Title.	Publication.	Volume.	Page.
1865	December	Notes on Some of the More Remarkable Genera of Silurian and Devonian Fossils. Continued from page 198. (On *Beatricea*, 3 figures. Continuation of paper dated June, 1865)	Can. Nat.	N. Ser., V. 2	405-409
"	"	Notice of Some New Genera and Species of Palæozoic Fossils. (1 new genus, *Calapœcia*, and 18 new species of Cœlenterata, described but not illustrated)	"	"	425-432
1866	November	Catalogues of the Silurian Fossils of the Island of Anticosti, with Descriptions of some New Genera and Species. (This report contains the following five papers:)	G.S.C.	Spl. Report	pp. 93
		1. Catalogue of the Lower Silurian Fossils of Anticosti, with Descriptions of some of the Species. (Describes 28 new species. Cœlenterata, 1; Polyzoa, 4; Echinodermata, 1; Brachiopoda, 2; Lamellibranchiata, 7; Gasteropoda, 6; Cephalopoda, 2; Pteropoda, 2; Crustacea, 3. 11 figures inserted with the text)			5-28
		2. Catalogue of the Fossils of the Anticosti Group with Descriptions of Some of the Species. (Describes 75 new species. Protozoa, 3; Polyzoa, 19; Brachiopoda, 15; Lamellibranchiata, 9; Gasteropoda, 10; Cephalopoda, 9; Crustacea, 10. 11 figures inserted with the text)			29-72
		3. Additional Species from the Hudson River Group. (Describes 3 species of *Licrophycus* and the new genus *Scrichnites* with one species			72-75

27

BIBLIOGRAPHY—*Continued.*

Year.	Month.	Title.	Publication.	Volume.	Page.
		4. General Observations on the Palæozoic Fossils of Anticosti. (No descriptions of fossils)			75-82
		5. New Species of Fossils from the Clinton and Niagara Formations. (Describes 23 new species and one new genus. Cœlenterata, 6; Polyzoa, 1; Cephalopoda, 13; Echinodermata, 3. 6 figures inserted with the text. This last paper is entered in the publication as a sub-title, but it has no relation to the main title)			82 93
1867	May	Geological Survey of Illinois, etc. (A note on the publication of Vol. II., Palæontology)	A.J.S.	Ser. 2, V. 43	395-398
"	July	On the Classification of the subdivisions of McCoy's Genus Athyris, as determined by the laws of Zoological Nomenclature. Read before the Nat. Hist. Soc., Montreal, March 25th, 1867. (Also published in A.M.N.H., Ser. 3, Vol, XX., pp. 233-247	"	Ser. 2, V. 44	48-61
"	——	Esquisse Géologique du Canada. Restes Organiques	Commission Géologique du Canada.	——	43-49
1868	February	Description of Two New Species of Stricklandinia (one plate)	Geol. Mag.	5	59 64
1868	December	On Leskia mirabilis (Gray) by Prof. S. Lovén. Communicated by Dr. Christian Lütken, Assistant Zoologist in the Museum of the University, Copenhagen. (With a note by Mr. Billings. The article treats of the morphology of *Cystidea*)	Can. Nat.	N. Ser., V. 3	437-445

BIBLIOGRAPHY—*Continued.*

Year.	Month.	Title.	Publication.	Volume.	Page
1869	March	Note on the Blastoidea	Can. Nat	N. Ser., V. 4	89-90
"	May	Note on the structure of the Blastoidea. (Although dealing with the same genera, the two articles, published respectively in March and May, are not identical. The last article was reprinted in A.M.N.H., Ser. 4, Vol. 4, p. 76)	A.J.S.	Ser. 2, V. 47	353
"	September	On Hyponome Sarsi, a recent Cystidean, by S. Loven. Reprinted from the Annals and Magazine of Natural History, September, 1869. (With a note by Mr. Billings)	Can. Nat	N. Ser., V. 4	265-270
"	July	Notes on the structure of the Crinoidea, Cystidea and Blastoidea	A.J S.	Ser. 2, V. 48	69-83
1870	January	Notes on the structure of the Crinoidea, Cystidea and Blastoidea. Continued from this journal, II., Vol. XLVIII., p. 83	"	Ser. 2, V. 49	51-58
"	September	Notes on the structure of the Crinoidea, Cystidea and Blastoidea. Concluded from this journal, II, Vol. XLIX, p. 58. (The three articles above were reprinted as follows: Can. Journ. N. Ser., V. 4, pp. 277-293, September, 1869; pp. 426-433, December, 1869; V. 5, pp. 180-198, June, 1870. A.M.N.H., Ser. 4, V. 5, pp. 251-266; pp. 409-416; V. 7, pp 142-158)	"	Ser. 2, V. 50	225-240

BIBLIOGRAPHY—*Continued.*

Year.	Month.	Title.	Publication.	Volume.	Page.
1870	November	Corrections of errata in the "Notes on the structure of the Crinoidea, etc."	A.J.S.	Ser. 2, V. 50	436
"	"	Notes on Some Specimens of Lower Silurian Trilobites. (On the walking-appendages, Panderian organs, eggs and tracks of trilobites. Abstract of above, Can. Nat., N. Ser., V. 5, p 99)	Q.J.G.S.	26	479-486
1871	May	Notes and Observations on the Gold Fields of Quebec and Nova Scotia, by Alfred R C Selwyn. (With a note by Mr. Billings on the geological horizon of *Eophyton* at p. 269)	G.S.C.	Report of Progress 1870-71	252-282
"	June	Note on Trimerella acuminata. (Reprinted in A.M.N.H., Ser. 4, Vol. VIII., pp. 140-141)	A.J.S.	Ser. 3, V. 1	471
"	December	On Some New Species of Palæozoic Fossils. (Describes 9 new species as follows: Pteropoda, 4; Gasteropoda, 1; Brachiopoda, 4, with 2 new genera or subgenera, *Monomerella* and *Obolellina*. Reprinted in A.J.S., Ser. 3, Vol. 3, pp. 352-360)	Can. Nat.	N. Ser., V. 6	213-222
"	"	Proposed new genus of Pteropoda. (*Hyolithellus* proposed	"	"	240
1872	February	Note on the discovery of fossils in the "Winooski marble" at Swanton, Vt. (Reprinted in Can. Nat., N. Ser., Vol. 6, p. 351)	A.J.S.	Ser. 3, V. 3	145
"	March	Fossils from the so-called Huronian of Newfoundland	"	"	223-224

BIBLIOGRAPHY—*Continued.*

Year.	Month.	Title.	Publication.	Volume.	Page.
1872	April	Remarks on the Taconic Controversy. (Reprinted in A.J.S., Ser. 3, Vol. 3, pp. 466-471)	Can. Nat	N. Ser., V. 6	313-325
"	"	On the Genus Obolellina. (Describes genus *Obolellina* and one new species. 7 figures)	"	"	326-330
"	"	A Question of Priority. (Published under a sub-title to previous article)	"	"	330-333
"	"	Note on a Question of Priority. (Same subject but not identical with previous article)	A.J.S	Ser. 3, V. 3	270-273
"	"	Additional Note on Obolellina, etc. (Neither signed nor in index)	Can. Nat	N. Ser., V. 6	365-367
"	August	Additional Notes on the Taconic Controversy	"	"	460-465
"	"	On Some Fossils from the Primordial Rocks of Newfoundland. (Describes 4 new genera, *Arthraria*, *Iphidea*, *Aspidella*, *Scenella*, and 20 new species as follows: Plantæ, 3; Pteropoda, 4; Gasteropoda, 1; Brachiopoda, 5; Crustacea, 7. 14 figures inserted with the text. Was to have been continued)	"	"	465-479
"	"	Fossils probably of the Chazy era in the Eolian Limestone of West Rutland	A.J.S	Ser. 3, V. 4	133
"	November	Rejoinder to Prof. Hall's Reply to a "Note on a Question of Priority"	"	"	399-400
1873	May	On the Mesozoic Fossils from British Columbia, collected by Mr. James Richardson in 1872. (No descriptions of fossils)	G.S.C.	Report of Progress, 1872-73	71-75

BIBLIOGRAPHY—*Continued.*

Year	Month.	Title.	Publication.	Volume.	Page.
1874	March	On Some New or Little Known Fossils from the Silurian and Devonian Rocks of Ontario. (Describes 2 new genera, *Aulocopina* and *Heterophrentis*, and 16 new species as follows: Protozoa, 1; Cœlenterata, 12; Cephalopoda, 2; Crustacea, 1. 2 figures of *Aulocopina*)	Can. Nat.	N. Ser., V. 7	230-240
"	May	On Mr. Meek's Note, p. 373 of this vol	A.J.S	Ser. 3, V. 7	530
"	July	On Some New Genera and Species of Palæozoic Mollusca. (Describes 2 new genera, *Ilionia* and *Pteronitella*, and one new species. 2 figures)	Can. Nat.	N. Ser., V. 7	301-302
"	August	Palæozoic Fossils. Vol. II., Part I. (Contains the following articles): 1. On some of the Fossils of the Gaspé series of Rocks. 2. On some new species of Fossils from the Primordial rocks of Newfoundland. 3. On the Genus Stricklandinia, with descriptions of the Canadian species. 4. Notes on the Structure of the Crinoidea, Cystidea and Blastoidea. 5. On some of the Fossils of the Arisaig series of rocks, Upper Silurian, Nova Scotia. (10 plates and 85 figures inserted with the text)	G.S.C.	Vol. II., Pt. 1	pp. 144
1876	March	On the structure of Obolella chromatica. (4 figures)	A.J.S.	Ser. 3, Vol. 11	176-178

NOTE.—This bibliography was completed in 1898, and met with the approval of the late Director and other officers of the Geological Survey of Canada, but was, at the suggestion of one of these officers, withheld from publication in the hope that the compiler might find time to extend the notes sufficiently to give the names of all new genera and species described by Mr. Billings. The recent publication of a partial and very inaccurate description of the writings of Mr. Billings has, however, made it necessary to publish this bibliography without further delay.

PROCEEDINGS OF THE NATURAL HISTORY SOCIETY.

MONTREAL, October 29th, 1900.

The first meeting of the Society for the season was held this evening at 8 o'clock.

PRESENT—Rev. Dr. Campbell in the chair; Prof. E. W. MacBride, Edgar Judge, H. McLaren, J. Harper, A. E. Leroy, A. E. Norris, J. B. Williams, E. T. Chambers, Jos. Fortier, Alfred Griffin and a number of visitors.

In the absence of the Recording Secretary, Mr. E. T. Chambers was requested to act in his place.

The minutes of last meeting were read and confirmed.

MEMBERS ELECTED.—On motion, the rule was suspended and the following were elected members of the Society:—Mr. H. Markland Molson, life, proposed by Mr. J. H. Joseph, seconded by Judge Würtele; Rev. J. Edgar Hill, D.D., ordinary, proposed by Rev. R. Campbell, seconded by Judge Würtele; R. Meighen, ordinary, proposed by Rev. R. Campbell, D.D., seconded by Judge Würtele; Mr. E. Goff Penny, ordinary, proposed by Rev. R. Campbell, D.D., seconded by Judge Würtele; Dr. W. S. Morrow, ordinary, proposed by Dr. Wesley Mills, seconded by Judge Würtele; Dr. F. S. Jackson, proposed by Mr. Alfred Griffin, seconded by Mr. E. T. Chambers; Mr. J. G. McKergow, ordinary, proposed by Mr. Alfred Griffin, seconded by Mr. C. S. J. Phillips; Mr. Irving Smith, ordinary, proposed by Mr. F. W. Richards, seconded by Mr. Edgar Judge; Mrs. Barfoot, associate, proposed by Mr. Alfred Griffin, seconded by Mr. F. W. Richards.

The Librarian, Mr. E. T. Chambers, reported the receipt of a number of valuable reports, including those of the U. S. Geological Survey, Royal Society of Canada and the New York State Museum.

Mr. A. E. Norris, Chairman of the Museum Committee, reported, on behalf of the Curator, the following donations to the Museum:—Mr. A. B. Dumouchel, old Spinning Wheel; Mr. J. J. Austin, Sponges from Western Australia; Mr. R. M. Shaw, Cannon Ball, dug out of old building in Quebec 30 years ago), Barnacles taken off ship's bottom in Montreal Harbor three or four years ago; Mr. Lachlan Gibb, two English Vipers (New Forest); Mr. E. D. Wintle, Skin Solitary Snipe, 5 Eggs, Common Snipe; Mr. D. McCulloch, Gospel St. John (Cree language); Mr. Alex. Robertson, Cocoa Nut (Island S. Pacific), Boomerang, S. Australia; Rev. R. Campbell, D.D., 40 specimens of Plants; Mr. H. H. Newcomb, 4 Moths from Dorchester, Mass.

It was proposed by Mr. J. B. Williams, seconded by Mr. E. T. Chambers, that the thanks of the Society be given to the donors. Carried.

The House Committee reported that the Hall had been re-tinted and also entrance to the building painted, and the damage sustained by the recent fire made good, the insurance companies agreeing to pay cost of same.

It was proposed by E. T. Chambers, seconded by Mr. Edgar Judge, that the report be received.

Rev. G. C. Heine reported, on behalf of the Lecture Committee, that the Somerville Lectures would begin on February 7th, and would be seven in number, and the Saturday Afternoon Course would commence on February 9th.

Dr. H. M. Ami having sent word that he would be unable to attend, his paper on "The Utica Formation Around Ottawa," was taken as read, and will be published in the CANADIAN RECORD OF SCIENCE.

Prof. E. W. MacBride being called to the chair, Rev. R. Campbell, D.D., then gave his paper on the "Newly Reported Plants on the Island of Montreal," and in the course of his remarks mentioned many plants not found for many years in Montreal.

A cordial vote of thanks having been given to the author for his valuable and interesting paper, the meeting then adjourned.

MONTREAL, November 26th, 1900.

The second monthly meeting was held this evening at 8 o'clock.

PRESENT—Rev. Dr. Campbell in the chair; Messrs. J. A. U. Beaudry, Edgar Judge, J. S. Buchan, J. Harper, A. E. Norris, E. T. Chambers, Jos. Fortier, Mrs. Duckett, Oswald Duckett, A. B. Dumouchel, Prof. E. W. MacBride, Dr. F. D. Adams, Rev. G. C. Heine, C. S. J. Phillips, A. Griffin and a large number of visitors.

The minutes of last meeting were read and confirmed.

MEMBER ELECTED.—On motion, the rule was suspended, and Mr. Percy Woodcock elected an ordinary member of the Society.

The Curator then reported the following donations:—A case of Stick Insects (showing Life History), donor, Mr. J. B. Williams, Toronto; a number of Shells from the Sandwich Islands, donor, Mr. P. M. Wickham (St. Lambert's); a number of Curios collected during a visit to China, India, etc., etc., by the donor, Mr. Alex. Robertson.

A cordial vote of thanks, proposed by Mr. J. A. U. Beaudry, seconded by Mr. Jos. Fortier, was unanimously carried and tendered to the donors.

After routine business the following papers were read :—"Life History of the Camberwell Beauty Butterfly," by Mr. A. E. Norris; "Was Mount Royal an Active Volcano ?" by J. S. Buchan, Q.C.

These papers created considerable discussion (especially the latter), Prof. MacBride, Dr. F. D. Adams and others taking part.

It was then moved by Prof. MacBride, seconded by Dr. F. D. Adams, that the best thanks of the Society be tendered to Messrs. Buchan and Norris for their very interesting and enjoyable communications. Carried unanimously.

The meeting then adjourned.

MONTREAL, January 28th, 1901,

The third monthly meeting was held in the Library at 8.15.

PRESENT—Rev. R. Campbell, D.D., in the chair ; Messrs. E. T. Chambers, J. A. U. Beaudry, P. S. Ross, Edgar Judge, Jos. Fortier, Dr. F. S. Jackson, Percy Woodcock, Alex. Robertson, H. McLaren, C. T. Williams, F. W. Richards, Miss Howard O'Keefe, Mr. and Mrs. Duckett, Capt. R. C. Adams, A. Griffin, Hy. E. Vennor and a number of visitors.

The minutes of last meeting were read and confirmed.

Mr. E. T. Chambers reported a number of exchanges to the Library since last meeting.

The Curator, Mr. A. Griffin, reported the following donations to the Museum :—Tibia of Dinosaur, donor, Mr. E. C. Felch; Garter Snake (3 feet 4 inches long), donor, Dr. J. A. Hutchinson; two specimens of Conglomerate, Mr. Carey J. Joseph.

On motion, a hearty vote of thanks was accorded to the above donors for their valuable contributions. Carried.

The President, Rev. R. Campbell, D.D., then referred in feeling terms to the sad loss we had sustained by the death of our beloved Queen Victoria, and also extended his sympathy to Hon. J. K. Ward on the loss of his wife. On motion of Mr. J. A. U. Beaudry, seconded by Mr. Jos. Fortier, the President and the two Secretaries were appointed a Committee a draw up resolutions of condolence and forward at once. Carried.

Dr. F. Sclater Jackson then read his paper, "The Human Organism," which was listened to with great interest. A spirited discussion followed, in which Mr. Edgar Judge, Capt. R. C. Adams, Rev. R. Campbell, D.D., and others took part.

It was then moved by Mr. Edgar Judge, seconded by Capt. R. C. Adams, that the cordial thanks of the meeting be tendered to the learned Doctor for his valuable and interesting communication. Carried.

The meeting then adjourned.

MONTREAL, February 25th, 1901.

The fourth monthly meeting of the Society was held this evening.

PRESENT—Rev. R. Campbell, D.D., in the chair; Messrs. J. A. U. Beaudry, H. McLaren, F. W. Richards, Dr. Wesley Mills, P. S. Ross, Rev. G. C. Heine, Dr. A. Fisher, Prof. O. E. Leroy, Miss O'Keefe, A. C. Lyman, Jos. Fortier, F. W. Carter, J. Bruce, Mr. and Mrs. Samuel Finley and a number of visitors—over forty in all.

The minutes of last meeting were read and confirmed.

The President, Rev. R. Campbell, D.D., then referred in feeling terms to the sad loss the Society had sustained in the death of Mr. E. T. Chambers, who had filled the post of Librarian so acceptably for a period extending over 17 years. It was then moved by Prof. E. W. MacBride, seconded by Mr. J. A. U. Beaudry, that a Committee, consisting of the President and the two Secretaries, be requested to draw up a letter of condolence and forward same to the family of the late Mr. E. T. Chambers. Carried.

MEMBER ELECTED.—On motion of Mr. H. McLaren, seconded by Prof. E. W. MacBride, the rules were suspended, and Mr. Harry Swift was duly elected an ordinary member of the Society.

Prof. F. D. Adams was called upon to give his paper, entitled, "The Extinct Volcanoes of Central France."

This proved most interesting and invoked a spirited discussion, in which the following took part:—Rev. Dr. Campbell, Prof. E. W. MacBride, Messrs. P. S. Ross and C. S. J. Phillips.

It was then moved by Mr. P. S. Ross, seconded by Mr. Jos. Fortier, that a cordial vote of thanks be tendered to Dr. Adams for his able exposition of so interesting a subject. Carried.

The meeting then adjourned.

MONTREAL, March 25th, 1901.

The fifth monthly meeting of the Society for session 1900–1901 was held this evening in the Library at 8 o'clock.

PRESENT—Rev. R. Campbell, D.D., in the chair; Messrs. Edgar Judge, J. A. U. Beaudry, C.E.; F. W. Richards, H. McLaren, A. E. Norris, Prof. O. E. Leroy, P. S. Ross, Miss H. O'Keefe, Prof. E. W. MacBride, Messrs. Jos. Fortier, R. W. McLachlan, Alex. Robertson, Mr. and Miss Duckett, C. S. J. Phillips and about 22 others.

The minutes of last meeting were read and confirmed.

Prof. O. E. Leroy then gave a very interesting communication on "Some Characteristic Land Forms of Glacial Origin," which was listened to with great attention, Prof. MacBride, Messrs. Robertson, Duckett and others participating in the discussion.

Then the Rev. R. Campbell, D.D., gave an exhibit of "New Zealand Ferns," comparing them with our Canadian species. At the close a very hearty vote of thanks was given to the two gentlemen for their papers. Carried.

The meeting then adjourned.

MONTREAL, April 29th, 1901.

The sixth monthly meeting of the Society was held in the Library, commencing at 8 o'clock.

PRESENT—Rev. R. Campbell, M.A., D.D., the President, occupied the chair; Messrs. Albert Holden, J. S. Buchan, K.C.; J. A. U. Beaudry, C.E.; C. T. Williams, H. McLaren, J. Harper, A. E. Norris, Alex. Robertson, Mrs. Duckett, Miss H. O'Keefe, Dr. Wesley Mills, P. S. Ross, Dr. A. Fisher and the Recording Secretary.

The minutes of last meeting were read and confirmed.

The Museum Committee reported, through Mr. A. E. Norris, that the Museum was in good order and the following donations had been added to it:—An Excise Officer's Stick, England, 1790, from R. Davidson, Esq.; two Skins Duck-billed Platypus from Mr. Alex. Robertson, B.A.; eight sets of Cariboo Antlers (showing life history from young to adult stage) from the Hamilton Powder Co., per Mr. T. Dwight Brainerd.

Dr. Campbell vacated the chair, which was taken by Dr. Wesley Mills. Dr. Campbell then exhibited "Some Montreal Mosses," collected by himself on this island, and gave a very interesting description of them.

Mr. Alex. Robertson then gave an account of "A Visit to New Zealand in 1885," with some lantern slide illustrations of same, after which Dr. Wesley Mills gave a paper on "Some Recent Methods for the Investigation of the Nervous System and their Results."

This paper was listened to with more than ordinary interest, owing to the marvellous advances made in this branch of science.

Thanks were tendered to the three gentlemen for their communications and for the marvellous revelations contained especially in Dr. Mills's paper.

This was moved by Mr. P. S. Ross, seconded by Mr. J. S. Buchan, and carried after questions and discussion.

There being no other business the meeting adjourned.

MONTREAL, June 3rd, 1901.

ADJOURNED ANNUAL MEETING.

The adjourned annual meeting was held this evening in the lecture hall. The President, Rev. Robert Campbell, D.D., occupied the chair. The minutes of last annual meeting were held as read and sustained.

ANNUAL REPORTS.—The following reports were then read :—Council, A. Holden ; Treasurer, F. W. Richards ; Curator, A. Griffin ; Librarian, A. Griffin, *pro tem ;* Lecture Committee, Rev. G. Colborne Heine ; Editing Committee, Dr. R. Campbell ; Field Day Committee, C. T. Williams.

On motion of Justice Würtele, seconded by Mr. J. S. Buchan, the reports were received and adopted.

Thereupon the President delivered his retiring address :

"In quitting the office of President of the Natural History Society, to which you did me the honor of electing me a third time, I beg to tender you my warm acknowledgment of the uniform courtesy and support which you have extended me during my occupation of the chair.

"I have to congratulate the Society on a good year's work done. The monthly meetings have been particularly well attended, and the liveliest interest has been manifested in the communications laid before the Society.

These were varied in character, touching natural history on many sides, those dealing with local phenomena evoking specially deep interest, and awakening discussion. Thus one very important aim of the Society has been secured. It has brought together those ladies and gentlemen who are students of nature in one or other of its numerous departments, giving them an opportunity of affording mutual help and encouragement. And the increase of the attendance at the ordinary meetings of the Society is a sign that the number of scientific workers in and near the city is growing. There must, however, be many in Montreal who are quietly prosecuting the study of nature, of whom this Society has no knowledge, and I would venture, in your name, to invite their co-operation, and would respectfully suggest that we could help them, as their uniting of their efforts with ours would help us.

" INTEREST IN LECTURES.

" The lectures provided for the public in the Somerville course were of a practical character, mainly dealing with matters in which science is applied for the amelioration of human life, and promotion of civilization, and that the people of the city appreciated them was shown by the large attendance that greeted the lecturers.

" The Saturday afternoon talks, too, were on topics of varied general interest, well calculated to awaken in the minds of the youth of our city an observant turn, which, it may be hoped, will lead to many of them becoming hereafter ardent and successful students of nature.

" The annual field day to Orford afforded not only a pleasant outing to the members of the Society and their friends, but yielded valuable scientific results, especially in the determining of the height of the mountain by Messrs. Leroy and Evans.

" The Saturday afternoon excursions to points of interest in the neighborhood of the city were not largely taken advantage of by the teachers and others for whose benefit they were especially got up; but those who did take part in them have very pleasant memories connected with them.

"The RECORD OF SCIENCE holds on its way, worthily representing the natural history of the Dominion. The two numbers issued during the year contained many original articles of a valuable character.

"The museum has continued to attract the public in increasing numbers since the entrance fee was abolished. It has been visited by a large number of boys and girls, just at the age when their eyes are wide open, and when their minds are impressionable, and excellent seed has thus been sown, which may be expected hereafter to yield good fruit in the way of a crop of students of natural science.

"In these several ways, the Society has prosecuted its work during another year; but it could have done still better work, in every department, had it larger means at its disposal. Application was made to the Government of the province for a renewal of the grant made by the Government of Canada for many years prior to Confederation, and continued for many years afterwards by the provincial treasury, but dropped when the finances became embarrassed. The Society has good reason to feel disappointed that the application was not entertained, as it has very strong claims to consideration, being the only society in the province doing the same class of work, especially as it was understood at the time of Confederation that the province would continue to foster the educational agencies which had previously been recognized by the Government of Canada.

"Failing to receive aid from this quarter, there is nothing left to the Society but to appeal to the generous public of Montreal for support. Were it not for the peculiar situation of our city, it might not be out of place to ask the municipal authorities to come to the Society's rescue. The educational work done by the Society merits such recognition. There is not a city or town in the United States of any importance that has not its museum, and the municipalities, as well as the state governments, make liberal grants for the support of such institutions as ours. Except the $4,000 left by Mr. Somerville to found the lectures bearing his name, the Society has not received any considerable legacy.

"CHANCE FOR BENEFACTOR.

"Here, then, is an opportunity for some large-minded benefactor to do a good turn to Montreal. Let him settle on the Natural History Society an annual income that will enable it, not only to continue, but enlarge its operations. We would not even breathe a proposal to ask help from the Pittsburg millionnaire; it would be a dishonor done to our wealthy and public-spirited citizens to even hint at such a thing. But we hope they will come to our help. The workers in this Society give their time gratuitously, from their love of science, and their desire to see the scientific spirit and scientific attainments more general, and give also liberally of their limited means, believing that they are doing as valuable work for the masses as the great McGill University is doing for the superior intellectual few. Now things have come to such a pass that we cannot, with the means at our disposal, do what is required to keep abreast with the needs of the time. We are straitened for room for our valuable library, and we have nowhere to exhibit the additions constantly making to our museum. Our very efficient superintendent is overwhelmed with work, and needs assistance in the museum. The fact is he is seriously ill at present, and probably this illness is traceable to over-exertion, and what are we to do? Well, I believe we have only to let it be known that the continuance of the important work done by the Society is endangered, to rally to its support our enlightened citizens. Why may we not look to a great many more of them, ladies as well as gentlemen, enrolling themselves in the list of membership of the Society? If we had an addition of even a hundred more members, these, with the modest annual fee attached to membership, would enable us to carry on our work better than we are able to do at present. Shall we make this appeal in vain? I do not believe it.

"I cannot conclude my remarks without referring to the great loss the Society has recently sustained, in the death of Mr. John S. Shearer, who had been for so long a period a prominent member and office-bearer of the Society, and who had in so many ways exerted himself on its behalf; although for a few years back, owing to ill-health, he was unable to continue to take so active a share in our work as formerly.

"The death of Mr. E. T. Chambers, the invaluable chairman of the library committee, has been recorded in the minutes. His loss is irreparable, as it is most unlikely that the Society can replace him by anyone with his special fitness for the position, and, at the same time, as willing as he to devote time to the work required."

OFFICE-BEARERS FOR YEAR.

Two ordinary members were admitted to the Society, and the election of officers for the ensuing year was proceeded with, and resulted as follows, Messrs. A. E. Norris and Alex. Robertson being the scrutineers:—

HON. PRESIDENT.—Lord Strathcona and Mount Royal.

PRESIDENT.—Prof. E. W. MacBride, M.A., D.Sc.

VICE-PRESIDENTS.—Prof. F. D. Adams, Prof. B. J. Harrington, A. Holden, J. H. Joseph, Rev. Dr. Robert Campbell, Prof. Wesley Mills, Hon. J. K. Ward, C. T. Williams and Mr. Justice Würtele.

HON. RECORDING SECRETARY.—Chas. S. J. Phillips.

Hon. Corresponding Secretary.—J. S. Buchan, K.C.

Hon. Treasurer.—J. G. McKergow.

Hon. Curator.—A. E. Norris.

Members of Council.—F. W. Richards, J. A. U. Beaudry, N. N. Evans, Joseph Fortier, Dr. Girdwood, John Harper, Edgar Judge, H. McLaren, J. Bemrose.

Superintendent.—Alfred Griffin.

Editing and Exchange Committee.—Rev. Dr. Robert Campbell, chairman; Prof. F. D. Adams, J. S. Buchan, Prof. J. T. Donald, Dr. A. T. Drummond (Kingston), Prof. E. W. MacBride, G. F. Matthew (St. John, N.B.); T. Wesley Mills, J. F. Whiteaves (Ottawa).

The newly elected council subsequently met, appointed Mr. F. W. Richards its chairman, and elected the following committees:—

Library Committee.—H. McLaren, chairman; J. A. U. Beaudry, Joseph Fortier, Alfred Griffin, A. E. Norris, G. M. Tod, C. T. Williams.

Museum Committee.—A. E. Norris, chairman; Rev. Dr. Robert Campbell, A. B. Dumouchel, G. A. Dunlop, O. E. Leroy, Prof. E. W. MacBride, Prof. Leymarie, H. E. Vennor.

Field Work Committee.—C. T. Williams, chairman; Prof. F. D. Adams, J. S. Buchan, Rev. Dr. Robert Campbell, Rev. G. C. Heine, Alex. Robertson, O. E. Leroy, Prof. E. W. MacBride, J. Bemrose, F. W. Richards.

Lecture Committee.—Prof. Wesley Mills, chairman; J. S. Buchan, Rev. Dr. Robert Campbell, Prof. John Cox, N. N. Evans, Prof. Harrington, Edgar Judge, Rev. G. C. Heine, C. S. J. Phillips, Mr. Justice Würtele.

House Committee.—Albert Holden, chairman; F. W. Richards, C. T. Williams.

Membership Committee.—Alex. Robertson, chairman; J. A. U. Beaudry, Rev. Dr. Robert Campbell, Edgar Judge, H. McLaren, C. S. J. Phillips, J. Bemrose, Hon. J. K. Ward, C. T. Williams.

Session 1900–1901.

Report of Council.

The Chairman of Council begs to submit the following report for the year ending May 31st, 1901 :

Seven meetings of Council have been held during the year, at which reports of the different Committees were received, and all other business of the Society discussed before being submitted to the regular monthly meetings of the Society.

The regular monthly meetings have been held as usual. The following papers, arranged for by the Lecture Committee, were read at these meetings :

October 29th, 1900.—"The Utica Formation Around Ottawa," Dr. H. M. Ami. "Newly Reported Plants of the Island of Montreal," Rev. R. Campbell, D.D.

November 26th, 1900.—"Life History of the Camberwell Beauty Butterfly;" A. E. Norris. "Was Mount Royal an Active Volcano ?" J. S. Buchan, Q.C.

January 28th, 1901.—"The Human Organisms," Dr. F. Sclater Jackson.

February 25th, 1901.—"The Extinct Volcanoes of Central France," Prof. Frank D. Adams.

March 25th, 1901.—"Some Characteristic Land Forms of Glacier Origin," Prof. O. E. Leroy, B.A. "New Zealand Ferns," Rev. R. Campbell, D.D.

April 25th, 1901.—"Some of the Recent Methods for the Investigation of the Nervous System, with their Results," Prof. Wesley Mills, M.A., M.D. "A Visit to New Zealand in 1885," Alexander Robertson, B.A. "Some Montreal Mosses," Rev. R. Campbell, D.D.

New members elected during the year : 1 life, 9 ordinary and 2 associates.

We regret to have to record the removal by death of the following members:

E. T. Chambers and Carey J. Joseph.

The "Somerville Course" of Free Lectures and the "Half Hour Talks to Young People," most of which were illustrated by the electric lantern, were highly successful, and the Lecture Committee who arranged for these lectures are to be congratulated on the great success of the same.

The Annual Field Day to Mount Orford was held on the second Saturday in June. The attendance was not as large as usual, and, we regret to say, was a financial loss to the Society, otherwise it was a success.

The Excursion this year is to be held on the Lake Bonnalie on the Orford Mountain, and it is to be hoped the members of the Society will take more interest in this than they did last year.

A. Holden,
Chairman of Council.

Report of Editing and Exchange Committee.

Your Editing and Exchange Committee beg leave to report that during the year just closed they issued two numbers of the Record of Science, Numbers 4 and 5 of Volume VIII., and have received in exchange a very large number of valuable scientific journals, magazines and reports. These await binding, and will, when bound, form an important addition to our Library. The numbers of the Record of Science issued contained mainly the papers submitted to the Society at its monthly meetings, along with a few articles bearing on the Natural History of Canada by men of science living at a distance. The Committee believe that the contents of the last two numbers were quite up to the usual high standard at which the RECORD has uniformly aimed, and have helped to maintain the reputation of the Natural History Society among men of science at home and abroad.

Respectfully submitted, by instruction of the Committee,

ROBERT CAMPBELL,
Chairman.

MONTREAL, June 3rd, 1901.

MUSEUM REPORT, SESSION 1900–1901.

GENTLEMEN,—I regret to say that owing to my many duties, but more particularly to want of space and the expenditure of a little money, the work on the Museum has not progressed as I could have desired.

I may say that the Museum has arrived at a stage where a thorough overhauling is necessary. Mr. J. Stevenson Brown carried this out very successfully some years ago, but such an undertaking requires a vast amount of labor, also a little financial aid.

The birds require dusting and cleaning with benzine and all the cases thoroughly cleaned.

The Mammals also require overhauling and treating with benzine, and the cases need to be cleaned.

The shells are, I am glad to say, in good order, but the want of more cases prevents us displaying many hundreds more.

The minerals require re-arranging, as the present classification is out of date.

The general collection of antiquities is in good order, and requires but little attention, except a new label here and there.

The donations were numerous and of a valuable character, of which special mention was made at the time they were received.

The visitors to the Museum were approximately about 10,000, considerably in excess of any previous year, due to the fact that the building is open free to the public daily, and also that the colleges and schools have visited us more frequently.

I would call the attention of the House Committee to the necessity of painting the windows in the skylight to prevent the glare of the sun bleaching the birds.

The lighting of the Museum also requires attention, as the present system is altogether out of date and totally inadequate.

In conclusion, I can only urge upon you the necessity of more space and a little financial assistance to make our collection one of the best in Canada.

Respectfully submitted,

ALFRED GRIFFIN,
Curator.

REPORT OF LIBRARIAN, SESSION 1900–1901.

GENTLEMEN,—On behalf of our late Librarian, Mr. E. T. Chambers, whose death is much to be deplored, I beg to submit the following report:

The exchanges received during the closing session have been of a more numerous and valuable character than for some years past. Special mention must be made of donations received from the Smithsonian Institute, U. S. Geological Survey, Geological Society of America, Canadian Geological Survey, Geological Survey of Minnesota, and Dr. H. M. Ami, of the Geological Survey, Ottawa.

The catalogue is still unfinished, but I trust that the new Librarian will take this matter up and carry it to completion.

I would also remind you that we shall have by the end of this month about 500 volumes ready for the binder, so that as soon as funds will permit a grant should be made for this purpose. This is a matter that should be attended to so as to make references to these volumes more accessible.

I would also reiterate what our late Librarian has so many times brought to your notice, viz., the want of space. This is a matter that must be taken up seriously by the incoming House Committee, as at present the shelves and closets are full to overflowing and books have to be packed up on the floor of the Library.

It has been suggested that in view of the financial condition of the Society, the RECORD OF SCIENCE be suspended for a time. This is much to be regretted, as the publication of the RECORD is the only means we have of permanently recording the work done by the Society, much of which is original, and would be entirely lost not only to ourselves but to the world at large. As our journal is sent to scientific and kindred societies all over the world, from which we in return receive many valuable publications, some of which I have mentioned in the beginning of this report, I trust that some means will be taken to provide a fund for the publication of the RECORD so as not to encroach on the general funds of the Society. This was suggested by our Treasurer, Mr. F. W. Richards, last year, but up to now nothing has been done in this direction.

In conclusion, I would again urge upon the Society the necessity of providing more accommodation in the Library, as the work is greatly hampered at present.

To the incoming Librarian, I would say that I will give him every assistance in my power, and endeavor to earn the thanks and appreciation so generously accorded me by his predecessor.

Respectfully submitted,

ALFRED GRIFFIN,

Librarian pro tem.

REPORT OF THE LECTURE COMMITTEE OF THE NATURAL HISTORY SOCIETY OF MONTREAL FOR THE WINTER OF 1901.

Your Committee have pleasure in reporting that the usual Course of Lectures was given, both to the public and the young people, during the months of February and March.

The following gentlemen lectured in the Somerville Course :

Thursday, 7th February, 8 p.m., 1901.—"The Gold Fields of Canada," by John E. Hardman, Esq., S.B., M.E.

Thursday, 14th February, 8 p.m., 1901.—"The Water Works of Montreal," by John Kennedy, Esq., Chief Engineer of the Harbor Commissioners.

Thursday, 21st February, 8 p.m., 1901.—"Bridges and their Development," by Prof. E. G. Coker, B.A. (Cantab.), M.Sc. A.M. Inst., C.E.

Thursday, 28th February, 8 p.m., 1901.—"The History of the Cluck," by Prof. E. W. MacBride, M.A. (Cantab.), D.Sc. (Lond.), late Fellow of St. John's College, Cambridge.

Thursday, 7th March, 8 p.m., 1901.—"Cereal Products and their Transportation," by Edgar Judge, Esq., Merchant, Montreal.

It was a matter of deep regret that only five Somerville Lectures were given. The cause of this was that Mr. Percival St. George, C.E., who had agreed to deliver the sixth lecture of the Course, was suddenly called to England, owing to the serious illness of a relative, before the date of his lecture arrived. Your Committee strove hard to find a substitute, but were unsuccessful. Those that were given were of a high order and full of interest. The best thanks of the Society are due to these gentlemen, and should be conveyed through the proper channel.

The Talks on Natural History subjects were delivered on Saturday afternoons by the following gentlemen:

Saturday, 9th February, 3.30 p.m.—"Fruit and Seed Tramps," by Miss C. M. Derick, M.A.

Saturday, 16th February, 3.30 p.m.—"Instincts," by Prof. T. Wesley Mills, M.A., M.D., F.R.S.C.

Saturday, 23rd February, 3.30 p.m.—"Physiology," by Dr. W. S. Morrow.

Saturday, 2nd March, 3.30 p.m.—"Some Curious Natural Contrivances," by C. T. Williams, Esq.

Saturday, 9th March, 3.30 p.m.—"Hygiene," by Dr. D. J. Evans.

Saturday, 16th March, 3.30 p.m.—"The White Butterfly," by A. F. Winn, Esq.

Saturday, 23rd March, 3.30 p.m.—"How Paper is Made," by Chas. S. J. Phillips, Esq.

Saturday, 30th March, 3.30 p.m.—"Ferns," by Rev. Robert Campbell, M.A., D.D.

The little people were out in full force on every occasion, and manifested, both by their conduct and attention, the greatest interest. The special thanks of the Society are due to the President, who very kindly filled the place of one gentleman, who, at the last moment, was unable to appear. The Convener of your Committee arranged for chairmen at each meeting of the Somerville Course.

Altogether, your Committee is of opinion that the character of the work done was quite up to the average.

Respectfully submitted,

G. Colborne Heine,
Convener.

Report of the Field Work Committee.

The Field Work Committee are not able to make as satisfactory a report of their work for the season as they could wish.

Several attempts have been made to have Saturday afternoon rambles, but with only indifferent success as regards the matter of attendance. Early this spring letters were written to the various teachers in the leading public schools, asking their advice and suggestions in regard to the matter. As may be seen from their replies, all were in favor of such excursions, but found the teachers and older scholars too busy in the spring season to take advantage of them. It is evident that we have not arrived at the best solution of the question as yet, but your Committee is satisfied that patience and perseverance will yet find a way to carry out the wishes of the Society in this direction.

Respectfully submitted,

C. T. Williams,
Chairman Field Committee.

Natural History Society of Montreal

in account with

F. W. Richards, *Hon. Treasurer.*

Cash Statement.

To Cash on hand June 1st, 1900		$15 68	
" Rents	$838 00		
" Members' Subscriptions	579 00		
" W. Kearney	425 81		
" Insurance, Fire Loss	73 36		
" Record of Science	29 25		
" Interest	3 20		
" A. Griffin, Account Repairs	10 00		
		1958 62	
" Bank Loans		751 25	
" Balance due Treasurer		2 80	
By Superintendent's Salary and Commission			$656 54
" Record of Science			285 72
" Repairs and Renovations			284 06
" Sundry Expenses			163 28
" Lighting Account			140 39
" Fuel "			108 55
" Printing "			95 17
" Lecture "			72 15
" Taxes			34 92
" Field Day Deficit			23 14
" Museum Account			15 70
" Deposits, Credit of Loans			841 10
" Interest on Loans			7 53
		$2728 35	$2728 35

Cash Account.

To Balance on hand June 1st, 1901	$ 15 68	
" Receipts as per Cash Book	1958 62	
" Loans as per Bank Book	751 25	
" Balance due Treasurer	2 80	
By Deposits as per Bank Book		841 10
" Interest " "		7 63
" Disbursements as per Cash Book		1879 62
	$2728 35	$2728 35

BANK ACCOUNT.

Due Bank June 1st, 1900	$ 551 50	
" " New Loans	751 25	
Paid " on account Loans		841 10
Due " May 31st, 1901		461 65
	$1302 75	$1302 75

Audited and found correct this 3rd day of June, 1901.

F. W. RICHARDS,
Hon. Treasurer.

H. McLAREN,
C. T. WILLIAMS.

Book Notices.

Essai d'une Monographie des dépot marin et continentaux du Quaternaire Moséen, le plus ancien de la Belgique, par Michel Mourlon (Extrait des annales de la Société Géologique de Belgique), Tome XXV., bis, p. 121, 1900.

Director Mourlon in this essay describes an ancient surface deposit of Belgium, with full details of the localities where it has been recognized.

Northern Belgium is covered with a marine deposit subjacent to the "Campinien," which carries the remains of *Elephas primigenius*, *Rhinoceros tichorhinus*, etc., with flint flakes and other remains of human industry. M. Mourlon traces this marine deposit to central and southern Belgium, where it is represented by terrestrial and fluviatile deposits. In these, down to the very base, he finds flint chips and implements of palæolithic type. This formation he terms the Continental Moséen, and considers it equal in age to the ancient gravels, antedating the present river valleys, which Prestwich has described.

Director Mourlon draws the following conclusion: "I think I may assume from all that precedes, that, in the present state of our knowledge, the presence of flint flakes in the deposit referred to the Landenian of the vicinity of Mons, as well as the mammiferous bone beds in the Bruxillian sands of Ixelles, appear to authorize us to consider these deposits as constituting a new geological horizon, whose age remains to be determined, but which is anterior to the pebble deposits with *Elephas primigenius* at the base of our Quaternary Diluvium—the Campinien.

At the end of the memoir is a map of Belgium showing the area over which the Marine Moséen is spread.

G. F. M.

A New Physical Geography.—Probably in no other scientific branch has there been such a change of method in the matter of presentation as in the study of the topography and physiography of the earth's crust. In the old days it was all included under geography which it was *in toto* with the exception of a brief prefatory explanation of planetary relations and the phenomena of changing seasons and temperatures. Geography in the old days dealt with the rivers and mountain ranges, the valleys and bodies of water, but chiefly with the arbitrary divisions of the earth's surface made by man, the political centres and commercial marts. All this has been changed in recent years. The natural has been separated from the artificial, and the former has been given its right place in school curricula. An import-

30

ant addition to the text-books on physiographical geography is that by Jacques W. Redway, published by Charles Scribner's Sons, New York. This volume, as the author states in his preface, "is designed to show that the distribution of life is governed very largely by the conditions of geographic environment, and that human history and industries are always closely connected with geographic laws—in many instances the direct resultants of them." The book is planned for use in high schools and in normal schools. Some of the more important chapters are: The wasting of the land; by rivers; by underground waters; by avalanches and glaciers, and by imperfect drainage. The dispersal of life; distribution of plants and animals and the industrial regions of the United States are also treated. The matter is excellently arranged. The author's style is succinct and clear. The volume is well printed and freely illustrated with a good grade of half-tones. It is a book to be commended.

JOHN CRAIG.

Cornell University,
Ithaca, N.Y.

SPONGES FROM THE COASTS OF NORTH-EASTERN CANADA AND GREENLAND, by LAWRENCE M. LAMBE, F.G.S.

The paper bearing the above title was read before the Royal Society of Canada at the last annual meeting, and was subsequently published in the Transactions of the Society, appearing in second series, 1900–1901, Volume VI., Section IV. It consists of "identifications or descriptions of species found off the coast of Labrador in Davis Strait and Baffin's Bay," and is an extension of a former paper, entitled, "Sponges from the Atlantic Coast of Canada."

The paper is excellently illustrated by six plates, showing different sponge structures. As the descriptions are purely technical, it is only possible here to refer those interested in sponges to the paper itself, where full information may be had. The painstaking methods employed by the author have yielded gratifying results, and the paper marks a distinct advance in our knowledge of a branch of marine fauna, which, though of lowly organism, is of great scientific and general interest.

O. E. L.

RY, 1901,

Metet. C. H. McLEOD, *Superintendent.*

DAY	Sunshine.	Rainfall in inches.	Snowfall in inches.	Rain and snow melted.	DAY.
1	9	....	0.0	0.00	1
2	0	....	0.2	0.02	2
3	9	....	....	....	3
4	0	....	0.9	0.09	4
5	8	...	....	....	5
SUNDAY.... .. 6	1	....	....	....	6..........SUNDAY
7	0	....	2.7	0.27	7
8	9	0.08	0.0	0.08	8
9	1	0.04	....	0.04	9
10	0	....	4.3	0.43	10
11	0	....	0.4	0.04	11
12	0	....	9.9	0.99	12
SUNDAY........13	6	....	0.0	0.00	13..........SUNDAY
14	0	....	.. .	....	14
15	0	....	3.0	0.30	15
16	0	0.10	0.2	0.12	16
17	9	....	0.2	0.02	17
18	4	....	...	....	18
19	1	....	....	....	19
SUNDAY........20	0	....	0.1	0.01	20..........SUNDAY
21	0	0.05	....	0.05	21
22	5	....	....	....	22
23	5	....	....	....	23
24	1	....	....	....	24
25	9	....	....	....	25
26	0	....	....	....	26
SUNDAY........27	1	....	0.5	0.05	27..........SUNDAY
28	0	....	3.8	0.38	28
29	3	....	0.0	0.00	29
30	6	....	....	....	30
31	0	....	0.9	0.09	31
Means......	4.1	0.27	27.1	2.98	..............Sums.
27 Years means for and including this month	.93	0.856	30.03	3.727	27 Years means for and including this month.

rel and

from

Direction........	
Miles	
Duration in hrs..	
Mean velocity....	

g 100.

s.

t; the

e 19th,

es.

Greatest milea ay was 21st.

0.78 on

Greatest veloc on the hour on the 21st.

Minimum relative humidity observed was 65 on the 19th.

Rain fell on 4 days.

Snow fell on 17 days.

Rain or snow fell on 19 days.

Hoar frost on the 14th.

Lunar Halos on the 30th and 31st.

Lunar Corona on the 9th.

Fog on the 8th, 14th and 21st.

ABSTRACT FOR THE MONTH OF JANUARY, 1901.

Meteorological Observations, McGill College Observatory, Montreal, Canada. Height above sea level, 187 feet. C. H. McLEOD, *Superintendent.*

DAY	THERMOMETER. † Mean.	THERMOMETER. Max.	THERMOMETER. Min.	THERMOMETER. Range.	*BAROMETER. † Mean.	*BAROMETER. Max.	*BAROMETER. Min.	*BAROMETER. Range.	‡Mean relative humidity.	a WIND. General direction.	a WIND. Mean velocity in miles per hour	Per cent. possible Sunshine.	Rainfall in inches.	Snowfall in inches.	Rain and snow melted.	DAY.
1	7.46	30.0	0.5	29.5	30.26	30.45	29.84	.61	84	W.	23.9	89	....	0.0	0.00	1
2	9.26	15.6	— 2.6	18.2	30.37	30.60	30.23	.37	84	W.	23.0	00	....	0.2	0.02	2
3	— 3.97	1.2	—10.1	11.3	30.70	30.78	30.59	.19	74	W.	18.8	69	....	....	....	3
4	14.87	22.2	1.2	21.0	30.20	30.59	30.01	.56	87	W.	18.5	00	....	0.9	0.09	4
5	3.13	11.8	— 4.5	16.3	30.31	30.36	30.22	.14	85	W.	30.1	88	....	....	....	5
SUNDAY...... 6	20.11	24.9	11.8	13.1	30.22	30.30	30.11	.19	85	W.	22.2	31	....	....	....	6..........SUNDAY
7	23.77	26.9	21.0	5.9	29.99	30.15	29.85	.30	93	S.	11.8	00	....	2.7	0.27	7
8	19.87	31.8	10.0	21.8	30.14	30.23	29.79	.44	89	S.	14.6	09	0.08	0.0	0.08	8
9	26.27	36.9	12.0	24.9	30.13	30.48	29.77	.71	82	W.	18.4	71	0.04	....	0.04	9
10	12.54	18.0	8.1	9.9	30.27	30.48	30.03	.45	92	N.	16.4	00	....	4.3	0.43	10
11	15.84	18.4	12.7	5.7	30.03	30.11	29.92	.19	96	N.	16.3	00	....	0.4	0.04	11
12	21.07	25.1	18.4	6.7	29.68	29.92	29.55	.37	91	N.W.	8.8	00	....	9.9	0.99	12
SUNDAY........13	15.42	18.5	12.1	6.4	30.01	30.09	29.74	.35	92	W.	11.6	46	....	0.0	0.00	13..........SUNDAY
14	13.02	18.2	4.3	13.9	29.95	30.08	29.81	.27	84	E.	2.5	00	....	...	....	14
15	22.03	33.0	13.4	19.6	29.78	29.81	29.76	.05	88	N.	6.3	00	....	3.0	0.30	15
16	34.08	37.7	29.0	S.7	29.51	29.76	29.34	.42	84	S.	18.6	00	0.10	0.2	0.12	16
17	29.12	34.7	23.0	11.7	29.53	29.57	29.43	.14	86	W.	22.8	09	....	0.2	0.02	17
18	— 0.28	23.0	— 9.3	32.3	29.75	29.95	29.56	.39	88	W.	12.7	84	....	...	....	18
19	—13.77	— 8.3	—16.7	8.4	30.31	30.63	29.95	.68	71	W.	24.0	91	....	....	....	19
SUNDAY........20	— 2.78	9.9	—14.1	24.0	30.31	30.63	29.91	.72	89	S.E.	16.4	00	....	0.1	0.01	20..........SUNDAY
21	23.60	39.6	1.0	38.6	29.76	30.00	29.60	40	86	S.W.	27.9	00	0.05	....	0.05	21
22	0.06	16.5	— 4.9	21.4	30.43	30.52	30.00	.52	79	N.E.	11.7	85	....	....	....	22
23	2.57	8.6	— 5.7	14.3	30.32	30.47	30.10	37	86	E	11.7	85	....	....	....	23
24	16.62	23.6	6.5	17.1	29.80	30.10	29.60	.50	91	N.E.	11.3	01	....	....	....	24
25	24.88	30.0	17.9	12.1	29.77	30.00	29.60	.40	89	N.	14.3	79	....	....	....	25
26	14.27	17.4	10.9	6.5	29.98	30.09	29.82	27	93	N.	11.2	90	....	....	....	26
SUNDAY........27	11.23	16.2	2.3	13.9	29.34	29.82	29.07	75	92	W.	16.5	11	....	0.5	0.05	27..........SUNDAY
28	17.06	20.2	13.1	7.1	29.11	29.27	29.03	.24	87	W.	20.4	00	....	3.8	0.38	28
29	6.27	13.1	2.9	10.2	29.61	29.88	29.27	6	82	W.	28.4	33	....	0.0	0.00	29
30	4.99	8.9	— 1.4	10.3	29.97	30.03	29.88	.15	81	N.W.	8.6	86	....	....	....	30
31	6.78	12.9	0.2	12.7	29.77	29.95	29.70	.25	91	N.	14.2	00	....	0.9	0.09	31
Means......	12.75	20.53	5.26	15.27	29.978	30.165	29.777	.387	86.5	W 6°38′ N	16.58	34.1	0.27	27.1	2.98	..............Sums.
27 Years means for and including this month	12.32	20.71	4.42	16.28	30.051	....	......	.333	82.4	....	§ 16.57	¶ 34.93	0.856	30.03	3.727	27 Years means for and including this month.

a. ANALYSIS OF WIND RECORD.

Direction........	N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.	CALM.
Miles	1850	626	420	338	728	1389	6284	707	
Duration in hrs..	136	55	49	22	53	54	306	60	9
Mean velocity....	13.6	11.4	8.6	15.4	13.7	25.72	20.5	11.8	

Greatest mileage in one hour was 42 on the 21st.

Greatest velocity in gusts was 45 miles per hour on the 21st.

Resultant mileage, 6717.

Resultant direction, W. 6° 38′ N.

Total mileage, 12,342.

a—Wind velocity on the 13th, 14th and 15th from City Hall Anemometer.

* Barometer readings reduced to sea-level and temperature 32° Fahrenheit.

† Mean of bi-hourly readings taken from self-recording instruments.

‡ Humidity relative, saturation being 100. Mean of observations at 8, 15 and 20 hours.

¶ 20 years only. § 15 years only.

The greatest heat was 39.6 on the 21st; the greatest cold was 16.7 below zero on the 19th, giving a range of temperature of 56.3 degrees.

Warmest day was the 16th. Coldest day was the 19th. Highest barometer reading was 30.78 on the 3rd. Lowest barometer was 29.03 on the 28th, giving a range of 1.75 inches.

Minimum relative humidity observed was 65 on the 19th.

Rain fell on 4 days.

Snow fell on 17 days.

Rain or snow fell on 19 days.

Hoar frost on the 14th.

Lunar Halos on the 30th and 31st.

Lunar Corona on the 9th.

Fog on the 8th, 14th and 21st.

ARY, 1901.

M eet. C. H. McLEOD, *Superintendent.*

DAY	possible Sunshine.	Rainfall in inches.	Snowfall in inches.	Rain and snow melted.	DAY.
1	24	....	0.0	0.00	1
2	91	....	....	....	2
SUNDAY.... ... 3	71	....	....	....	3..........SUNDAY
4	00	....	3.2	0.32	4
5	00	....	3.0	0.30	5
6	57	....	....	....	6
7	95	....	....	....	7
8	99	....	....	....	8
9	36	....	....	....	9
SUNDAY........10	41	....	....	....	10..... .....SUNDAY
11	99	....	....	....	11
12	00	....	....	....	12
13	34	....	2.4	0.24	13
14	00	....	0.3	0.03	14
15	00	....	1.1	0.11	15
16	00	....	1.7	0.17	16
SUNDAY........17	00	....	0.7	0.07	17..........SUNDAY
18	00	....	....	....	18
19	03	....	0.0	0.00	19
20	00	....	0.4	0.04	20
21	53	....	0.3	0.03	21
22	63	....	....	....	22
23	74	....	....	....	23
SUNDAY....... 24	91	....	....	....	24..........SUNDAY
25	56	....	1.8	0.18	25
26	34	....	7.5	0.48	26
27	99	....	....	....	27
28	97	....	....	....	28
Means......	43.5	....	22.4	1.97	.............Sums.
27 Years means for and including this month	2.08	0.792	23.10	3.070	27 Years means for and including this month.

	vel and
	n from
Direction........	
Miles	ng 100.
	rs.
Duration in hrs..	
Mean velocity....	th; the
	a range

Greatest mile day was
West on the 15th 30.39 on
Greatest vel on the
hour on the 15th.

Minimum relative humidity observed was 57 on the 25th.

Snow fell on 13 days.

Lunar Halo observed on the 3rd.

Lunar Corona on the 9th.

Fog on the 3rd.

ABSTRACT FOR THE MONTH OF FEBRUARY, 1901

Meteorological Observations, McGill College Observatory, Montreal, Canada. Height above sea level, 187 feet. C. H. McLEOD, *Superintendent.*

DAY	THERMOMETER. † Mean.	THERMOMETER. Max.	THERMOMETER. Min.	THERMOMETER. Range.	*BAROMETER. † Mean.	*BAROMETER. Max.	*BAROMETER. Min.	*BAROMETER. Range.	‡Mean relative humidity.	a WIND. General direction.	a WIND. Mean velocity in miles per hour	Per cent. possible Sunshine.	Rainfall in inches.	Snowfall in inches.	Rain and snow melted.	DAY.
1	11.76	20.0	2.1	17.9	29.78	29.93	29.73	.20	87	S.W.	14.4	24	....	0.0	0.00	1
2	10.44	14.8	3.3	11.5	30.19	30.33	29.93	.40	68	W.	18.9	91	....	....	....	2
SUNDAY....... 3	7.79	14.1	−1.0	15.1	30.31	30.39	30.18	.21	85	S.	6.5	71	....	....	....	3..........SUNDAY
4	12.45	20.4	8.0	12.4	29.85	30.18	29.73	.45	86	N.	21.1	00	....	3.2	0.32	4
5	15.08	21.0	7.9	13.1	29.80	29.89	29.74	.15	80	N.W.	23.7	00	...	3.0	0.30	5
6	4.11	7.9	0.3	7.6	29.91	29.96	29.87	.09	83	W.	30.9	57	....	....	....	6
7	1.38	6.1	−4.0	10.1	29.99	30.04	29.92	.12	83	W.	35.7	95	....	....	....	7
8	4.13	10.4	−2.6	13.0	30.01	30.04	29.97	.07	87	W.	31.9	99	....	....	....	8
9	8.06	13.7	1.2	12.5	29.86	30.03	29.75	.28	85	W.	10.9	36	....	....	....	9
SUNDAY........10	9.63	14.8	4.2	10.6	30.05	30.21	29.76	.45	85	W.	25.1	41	....	....	....	10..........SUNDAY
11	11.50	16.6	4.2	12.4	30.17	30.28	30.02	.26	77	W.	19.4	99	....	...	....	11
12	15.85	21.1	10.4	10.7	29.89	30.02	29.80	.22	77	N.W.	15.8	00	....	....	....	12
13	6.02	10.4	−0.7	11.1	29.74	29.89	29.64	.25	87	N.W.	32.4	34	....	2.4	0.24	13
14	4.29	9.1	−1.1	10.2	29.60	29.65	29.54	.11	81	W.	23.8	00	....	0.3	0.03	14
15	12.69	19.9	5.8	14.1	29.53	29.60	29.47	.13	81	W.	31.2	00	....	1.1	0.11	15
16	19.72	23.1	15.2	7.9	29.60	29.64	29.56	.08	89	W.	11.1	00	....	1.7	0.17	16
SUNDAY........17	22.72	25.8	18.9	6.9	29.63	29.67	29.57	.10	89	S.W.	11.7	00	....	0.7	0.07	17..........SUNDAY
18	25.51	28.4	23.0	5.4	29.65	29.68	29.62	.06	79	W.	12.4	00	....	....	....	18
19	24.71	29.5	20.8	8.7	29.50	29.63	29.41	.22	86	S.W.	13.4	03	....	0.0	0.00	19
20	16.35	22.9	9.9	13.0	29.50	29.58	29.43	.15	79	N.W.	15.8	00	....	0.4	0.04	20
21	8.17	10.7	5.5	5.2	29.69	29.75	29.58	.17	80	W.	17.2	53	....	0.3	0.03	21
22	12.67	21.0	3.2	17.8	29.77	29.85	29.74	.11	79	W.	13.3	63	....	....	....	22
23	13.54	18.3	8.1	10.2	29.92	29.96	29.85	.11	75	S.W.	10.6	74	....	....	....	23
SUNDAY....... 24	10.83	15.3	2.5	12.8	29.73	29.90	29.64	.26	79	W.	12.3	91	....	....	....	24..........SUNDAY
25	19.43	25.8	9.3	16.5	29.75	29.77	29.71	.06	75	S.W.	17.3	56	....	1.8	0.18	25
26	22.01	27.9	13.9	14.0	29.64	29.76	29.63	.13	75	W.	15.3	34	....	7.5	0.48	26
27	8.75	14.9	1.3	13.6	29.88	30.05	29.73	.32	77	W.	26.0	99	....	....	....	27
28	8.66	14.5	2.0	12.5	30.15	30.21	30.05	.16	78	W.	23.3	97	....	....	....	28
Means......	12.46	17.80	6.13	11.67	29.825	29.925	29.735	.190	81.1	W 3° 43′ N	19.58	43.5	....	22.4	1.97	.... Sums.
27 Years means for and including this month	15.55	23.40	7.43	15.97	30.017	....	......	.307	80.5	....	§ 18.27	¶ 42.08	0.792	23.10	3.070	27 Years means for and including this month.

a. ANALYSIS OF WIND RECORD.

Direction.......	N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.	CALM.
Miles	501	....	20	25	302	1233	9055	2019	
Duration in hrs..	27	....	1	4	34	85	425	96	
Mean velocity....	18.6	....	20.0	6.2	8.8	14.5	21.3	21.0	

Greatest mileage in one hour was 55 from the West on the 15th.

Greatest velocity in gusts was 60 miles per hour on the 15th.

Resultant mileage, 11346.
Resultant direction, W. 3° 43′ N.
Total mileage, 13,153.

* Barometer readings reduced to sea-level and temperature 32° Fahrenheit.

† Mean of bi-hourly readings taken from self-recording instruments.

‡ Humidity relative, saturation being 100. Mean of observations at 8, 15 and 20 hours.

¶ 20 years only. § 15 years only.

The greatest heat was 29.5 on the 19th; the greatest cold was −4.0 on the 7th, giving a range of temperature of 33.5 degrees.

Warmest day was the 18th. Coldest day was the 7th. Highest barometer reading was 30.39 on the 3rd. Lowest barometer was 29.41 on the 19th, giving a range of .98 inches.

Minimum relative humidity observed was 57 on the 25th.

Snow fell on 13 days.

Lunar Halo observed on the 3rd.

Lunar Corona on the 9th.

Fog on the 3rd.

ƆH, 1901

Metéet. C. H. McLEOD, *Superintendent.*

DAY	possible Sunshine.	Rainfall in inches.	Snowfall in inches.	Rain and snow melted.	DAY.
1	4	....	1.4	0.14	1
2	9	....	0.3	0.03	2
SUNDAY....... 3	1	0.00	....	0.00	3..........SUNDAY
4	8	....	....	....	4
5	4	....	1.1	0.11	5
6	6	....	0.0	0.00	6
7	7	....	0.6	0.05	7
8	0	....	4.0	0.34	8
9	1	....	3.3	0.38	9
SUNDAY........10	6	0.20	....	0.20	10.........SUNDAY
11	0	0.02	4.4	2.24	11
12	0	....	1.6	0.18	12
13	7	....	....	....	13
14	0	....	2.4	0.24	14
15	9	....	....	....	15
16	1	....	....	....	16
SUNDAY........17	4	....	0.7	0.07	17..........SUNDAY
18	7	....	0.5	0.05	18
19	8	....	....	....	19
20	3	0.36	1.0	0.46	20
21	0	0.67	0.0	0.67	21
22	0	....	0.2	0.02	22
23	8	....	....	....	23
SUNDAY........24	9	....	....	....	24..........SUNDAY
25	3	....	....	....	25
26	0	1.49	....	1.49	26
27	0	0.16	0.6	0.22	27
28	0	....	0.3	0.03	28
29	0	....	1.4	0.14	29
30	8	....	0.4	0.04	30
SUNDAY........31	0	....	1.8	0.22	31..........SUNDAY
Means......	0.4	2.90	26.0	7.32	..............Sums.
27 Years means for and including this month	.53	1.170	24.43	3.787	27 Years means for and including this month.

Direction........	
Miles	
Duration in hrs..	
Mean velocity....	

ɣel and

from

ıg 100.
ɾs.

h; the
, range

Greatest mileaɡay was
Greatest veloci0.51 on
hour on the 4th. on the
Resultant mile

Minimum relative humidity observed was 57 on the 16th and 19th.

Rain or sleet fell on 7 days.

Snow fell on 20 days.

Rain, sleet, or snow fell on 23 days.

Fog on the 21st.

ABSTRACT FOR THE MONTH OF MARCH, 1901

Meteorological Observations, McGill College Observatory, Montreal, Canada. Height above sea level, 187 feet. C. H. McLEOD, *Superintendent.*

DAY	THERMOMETER. † Mean.	Max.	Min.	Range.	*BAROMETER. † Mean.	Max.	Min.	Range.	‡Mean relative humidity.	WIND. General direction.	Mean velocity in miles per hour	Per cent. possible Sunshine.	Rainfall in inches.	Snowfall in inches.	Rain and snow melted.	DAY.
1	24.89	33.5	11.0	22.5	29.74	30.13	29.46	.67	83	W.	25.2	64	....	1.4	0.14	1
2	18.47	33.5	7.3	26.2	29.86	30.17	29.48	.69	71	N.W.	13.3	69	....	0.3	0.03	2
SUNDAY...... 3	13.66	30.2	0.0	30.2	29.94	30.22	29.46	.76	76	S.E.	20.8	61	0.00	....	0.00	3............SUNDAY
4	35.35	38.6	30.2	8.4	29.70	29.81	29.47	.34	65	S.W.	29.2	68	....	....	....	4
5	22.57	35.1	8.4	26.7	29.66	29.78	29.56	.22	71	W.	20.3	54	....	1.1	0.11	5
6	7.26	11.3	2.3	9.0	29.93	30.08	29.78	.30	76	W.	18.0	66	....	0.0	0.00	6
7	11.40	17.9	1.3	16.6	30.11	30.15	30.07	.08	87	S.	14.1	37	....	0.6	0.05	7
8	24.95	33.5	18.4	15.1	30.02	30.09	29.88	.21	90	S.	8.3	00	....	4.0	0.34	8
9	28.27	31.7	24.0	7.7	29.92	30.19	29.78	.41	85	N.E.	14.5	11	....	3.3	0.38	9
SUNDAY........10	18.52	27.0	8.1	18.9	30.34	30.47	30.13	.34	70	N.E.	20.2	66	0.20	....	0.20	10..........SUNDAY
11	30.73	33.2	25.5	7.7	29.68	30.13	29.45	.68	94	E.	9.1	00	0.02	4.4	2.24	11
12	27.94	34.0	21.9	12.1	29.60	29.81	29.45	.36	90	S.W.	16.2	00	....	1.6	0.18	12
13	24.38	28.0	19.2	8.8	29.99	30.10	29.81	.29	84	N.W.	11.2	47	....	....	....	13
14	22.56	24.7	18.9	5.8	29.83	29.95	29.79	.16	81	N.E.	19.3	00	....	2.4	0.24	14
15	22.84	28.0	20.4	7.6	29.84	29.89	29.82	.07	70	N.E.	21.0	29	....	....	....	15
16	21.61	26.0	14.7	11.3	29.96	29.99	29.89	.10	70	S.W.	19.9	91	....	....	....	16
SUNDAY........17	21.71	28.1	9.9	18.2	29.94	29.99	29.89	.10	86	S.W.	15.7	04	....	0.7	0.07	17..........SUNDAY
18	27.98	36.0	18.3	17.7	29.96	30.12	29.94	.18	84	S.W.	15.7	17	....	0.5	0.05	18
19	11.07	13.7	8.0	5.7	30.44	30.51	30.12	.39	66	N.E.	14.7	58	....	....	....	19
20	26.17	36.0	12.0	24.0	30.16	30.49	29.93	.56	71	S.E.	19.9	23	0.36	1.0	0.46	20
21	35.03	38.9	31.7	7.2	29.74	29.93	29.67	.26	87	W.	19.9	00	0.67	0.0	0.67	21
22	28.47	32.0	24.9	7.1	29.83	29.99	29.74	.25	74	S.W.	21.0	30	....	0.2	0.02	22
23	29.55	35.9	22.7	13.2	30.10	30.14	29.99	.15	73	S.W.	14.9	68	....	....	....	23
SUNDAY........24	33.40	39.0	23.5	15.5	30.08	30.11	30.03	.08	69	N.E.	8.8	09	....	....	....	24............SUNDAY
25	34.67	37.1	29.0	8.1	30.04	30.17	29.86	.31	75	N.E.	17.9	43	....	....	....	25
26	37.85	40.0	35.0	5.0	29.60	29.86	29.36	.50	96	S.E.	21.2	00	1.49	....	1.49	26
27	34.12	37.7	27.9	9.8	29.36	29.46	29.29	.17	91	W.	16.4	00	0.16	0.6	0.22	27
28	22.77	27.9	19.4	8.5	29.54	29.64	29.45	.19	87	W.	27.4	00	....	0.3	0.03	28
29	19.25	24.7	12.2	12.5	29.77	29.90	29.64	.26	87	N.W.	22.4	00	....	1.4	0.14	29
30	25.78	33.8	17.0	16.8	29.86	29.94	29.78	.16	71	N.W.	17.8	38	....	0.4	0.04	30
SUNDAY........31	27.69	30.6	23.1	7.5	29.68	29.78	29.62	.16	89	N.W.	20.5	00	....	1.8	0.22	31............SUNDAY
Means........	24.87	30.89	17.62	13.27	29.878	30.032	29.729	.303	79.6	W.9°42′N.	17.91	30.4	2.90	26.0	7.32	..............Sums.
27 Years means for and including this month	24.33	30.70	16.91	14.55	29.972	....	......	.273	77.1	....	§ 17.89	¶ 46.53	1.170	24.43	3.787	27 Years means for and including this month.

ANALYSIS OF WIND RECORD.

Direction........	N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.	CALM.
Miles	489	2998	784	1076	414	2536	3842	1188	
Duration in hrs..	53	171	71	51	38	122	174	63	1
Mean velocity....	9.2	17.5	11.0	21.1	10.9	20.8	22.1	18.8	

Greatest mileage in one hour was 51 on the 4th.

Greatest velocity in gusts was 58 miles per hour on the 4th.

Resultant mileage, 2850.

Resultant direction, W.9°42′N.

Total mileage, 13,327.

Direction and velocity on 11th and 12th from City Hall anemometer.

* Barometer readings reduced to sea-level and temperature 32° Fahrenheit.

† Mean of bi-hourly readings taken from self-recording instruments.

‡ Humidity relative, saturation being 100. Mean of observations at 8, 15 and 20 hours.

¶ 20 years only. § 15 years only.

The greatest heat was 40.0 on the 26th; the greatest cold was 0.0 on the 3rd, giving a range of temperature of 40.0 degrees.

Warmest day was the 26th. Coldest day was the 6th. Highest barometer reading was 30.51 on the 19th. Lowest barometer was 29.29 on the 27th, giving a range of 1.22 inches.

Minimum relative humidity observed was 57 on the 16th and 19th.

Rain or sleet fell on 7 days.

Snow fell on 20 days.

Rain, sleet, or snow fell on 23 days.

Fog on the 21st.

L, 1901.

Meteet. C. H. McLEOD, *Superintendent.*

DAY	possible Sunshine.	Rainfall in inches.	Snowfall in inches.	Rain and snow melted.	DAY.
1	00	0.04	1.3	0.22	1
2	44	0.01	....	0.01	2
3	00	0.63	....	0.63	3
4	18	0.16	....	0.16	4
5	00	0.02	....	0.02	5
6	00	0.02	0.0	0.02	6
SUNDAY.... ... 7	00	1.00	....	1.00	7..........SUNDAY
8	00	0.43	....	0.43	8
9	00	0.24	....	0.24	9
10	09	....	....	....	10
11	95	....	....	....	11
12	95	....	....	....	12
13	95	....	....	....	13
SUNDAY........14	81	....	....	....	14.... ....SUNDAY
15	48	....	....	....	15
16	70	....	....	....	16
17	94	....	....	....	17
18	42	0.00	....	0.00	18
19	00	0.44	....	0.44	19
20	00	....	....	....	20
SUNDAY........21	01	0.08	....	0.08	21..........SUNDAY
22	01	0.11	....	0.11	22
23	41	0.23	....	0.23	23
24	00	0.18	....	0.18	24
25	78	....	....	....	25
26	96	....	....	....	26
27	96	....	....	....	27
SUNDAY........28	98	....	....	....	28..........SUNDAY
29	70	....	....	....	29
30	00	0.42	....	0.42	30
Means......	39.3	4.01	1.3	4.19	..............Sums.
27 Years means for and including this month	1.45	1.712	5.14	2.236	27 Years means for and including this month.

Direction........	
Miles	
Duration in hrs..	
Mean velocity....	

vel and
from
ng 100.
rs.
h; the
range
ay was
0.48 on

Greatest mileag on the

Greatest velocit was 26 hour on the 4th.

Resultant milea

Rain fell on 16 days.
Snow fell on 2 days.
Rain or snow fell on 16 days.
Lunar corona on the 27th.
Fog on the 6th and 7th.

ABSTRACT FOR THE MONTH OF APRIL, 1901.

Meteorological Observations, McGill College Observatory, Montreal, Canada. Height above sea level, 187 feet. C. H. McLEOD, *Superintendent.*

DAY	THERMOMETER. † Mean.	Max.	Min.	Range.	*BAROMETER. † Mean.	Max.	Min.	Range.	‡ Mean relative humidity.	WIND. General direction.	Mean velocity in miles per hour	Per cent. possible Sunshine.	Rainfall in inches.	Snowfall in inches.	Rain and snow melted.	DAY.
1	34.97	38.2	31.2	7.0	29.88	30.06	29.66	.40	88	N.W.	17.0	00	0.04	1.3	0.22	1
2	37.18	40.8	34.0	6.8	30.07	30.13	29.99	.14	83	N.	6.9	44	0.01	....	0.01	2
3	36.01	38.5	34.1	4.4	29.83	29.99	29.69	.30	93	N.E.	19.6	00	0.63	....	0.63	3
4	36.21	40.8	34.0	6.8	29.69	29.74	29.62	.12	89	N.E.	29.4	18	0.16	....	0.16	4
5	34.79	38.5	33.0	5.5	29.78	29.81	29.72	.09	94	N.E.	15.7	00	0.02	....	0.02	5
6	34.54	36.8	32.3	4.5	29.73	29.79	29.71	.08	97	N.E.	10.8	00	0.02	0.0	0.02	6
SUNDAY...... 7	34.53	35.8	32.3	3.5	29.67	29.73	29.61	.12	96	N.E.*	25.7	00	1.00	....	1.00	7..........SUNDAY
8	35.33	36.7	33.4	3.3	29.67	29.72	29.61	.11	95	N.E.	19.4	00	0.43	....	0.43	8
9	38.80	41.7	37.0	4.7	29.80	29.91	29.72	.19	92	N.	19.4	00	0.24	....	0.24	9
10	38.40	44.0	35.0	9.0	30.08	30.19	29.91	.28	63	N.E.	23.2	09	....	....	....	10
11	37.88	46.0	30.7	15.3	30.23	30.29	30.18	.11	51	N.E.	18.0	95	....	....	....	11
12	40.09	50.0	29.0	21.0	30.27	30.34	30.19	.15	47	N.E.	10.0	95	....	....	....	12
13	45.22	56.0	32.1	23.9	30.15	30.21	30.09	.12	50	N.E.	7.6	95	....	....	....	13
SUNDAY........14	48.42	60.4	35.4	25.0	30.09	30.13	30.03	.10	53	E.	8.7	81	....	....	....	14..........SUNDAY
15	50.80	60.0	39.9	20.1	30.08	30.13	30.04	.09	57	N.E.	10.8	48	....	....	....	15
16	48.22	60.2	38.2	22.0	30.14	30.19	30.04	.15	70	N.E.	11.6	70	....	....	....	16
17	49.99	62.1	35.4	26.7	30.13	30.22	30.05	.17	57	S.E.	11.2	94	....	....	....	17
18	49.76	58.0	41.1	16.9	29.98	30.08	29.88	.20	57	S.	24.2	42	0.00	....	0.00	18
19	42.15	49.6	36.0	13.6	30.14	30.27	29.95	.32	94	W.	16.7	00	0.44	....	0.44	19
20	36.18	37.9	34.0	3.9	30.18	30.26	30.11	.15	88	N.E.	28.7	00	....	....	....	20
SUNDAY........21	43.74	54.7	35.9	18.8	30.06	30.11	30.00	.11	87	N.E.	25.4	01	0.08	....	0.08	21..........SUNDAY
22	46.35	53.5	42.0	11.5	30.06	30.12	30.01	.11	93	N.E.	22.6	01	0.11	....	0.11	22
23	45.40	54.0	42.1	11.9	30.17	30.21	30.12	.09	88	N.E.	23.0	41	0.23	....	0.23	23
24	47.87	57.6	40.0	17.6	30.05	30.15	29.99	.16	81	N.E.	21.0	00	0.18	....	0.18	24
25	53.62	65.0	45.8	19.2	30.02	30.13	29.96	.17	46	N.E.	27.8	78	....	....	....	25
26	47.95	58.6	36.7	21.9	30.28	30.34	30.13	.21	47	N.E.	19.9	96	....	....	....	26
27	51.83	66.0	36.4	29.6	30.42	30.48	30.34	.14	54	N.E.	7.4	96	....	....	....	27
SUNDAY........28	62.61	75.2	43.7	31.5	30.41	30.47	30.34	.13	38	S.W.	14.8	98	....	....	....	28..........SUNDAY
29	55.25	65.0	46.5	18.5	30.35	30.42	30.29	.13	75	N.E.	16.9	70	....	....	....	29
30	44.27	47.7	41.5	6.2	30.07	30.29	29.93	.36	93	N.E.	10.5	00	0.42	....	0.42	30
Means........	43.11	50.98	36.62	14.35	30.049	30.130	29.914	.167	73.9	N. 44° 35' E.	17.47	33.3	4.01	1.3	4.19	..............Sums.
27 Years means for and including this month......	40.59	49.02	32.82	16.21	29.967	....	......	.200	66.7	....	§ 16.34	¶ 51.45	1.712	5.14	2.236	27 Years means for and including this month.

ANALYSIS OF WIND RECORD.

Direction......	N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.	CALM.
Miles	718	9057	449	308	804	316	539	385	
Duration in hrs..	36	473	47	29	47	24	31	33	
Mean velocity....	19.9	19.1	9.5	10.1	17.1	13.2	17.4	11.7	

Greatest mileage in one hour was 43 on the 4th.

Greatest velocity in gusts was 45 miles per hour on the 4th.

Resultant mileage, 12,242.

Resultant direction, N.44°35'E.

Total mileage, 12,576.

* Barometer readings reduced to sea-level and temperature 32° Fahrenheit.

† Mean of bi-hourly readings taken from self-recording instruments.

‡ Humidity relative, saturation being 100. Mean of observations at 8, 15 and 20 hours.

¶ 20 years only. § 15 years only.

The greatest heat was 75.2 on the 28th; the greatest cold was 30.7 on the 11th, giving a range of temperature of 44.5 degrees.

Warmest day was the 28th. Coldest day was the 7th. Highest barometer reading was 30.48 on the 27th. Lowest barometer was 29.61 on the 7th, giving a range of .87 inches.

Minimum relative humidity observed was 26 on the 28th.

Rain fell on 16 days.

Snow fell on 2 days.

Rain or snow fell on 16 days.

Lunar corona on the 27th.

Fog on the 6th and 7th.

, 1901

Metet. C. H. McLEOD, *Superintendent.*

DAY	Sunshine.	Rainfall in inches.	Snowfall in inches.	Rain and snow melted.	DAY.
1	6	....	....	....	1
2	0	0.27	....	0.27	2
3	7	....	....	...	3
4	3	....	....	....	4
SUNDAY.... ... 5	9	....	....	....	5...........SUNDAY
6	4	....	....	....	6
7	7	....	....	....	7
8	7	....	....	....	8
9	0	....	....	....	9
10	7	0.03	....	0.03	10
11	0	0.26	....	0.26	11
SUNDAY........12	0	0.34	....	0.34	12...........SUNDAY
13	0	0.11	....	0.11	13
14	8	0.06	....	0.06	14
15	8	....	....	....	15
16	0	....	....	....	16
17	2	0.10	....	0.10	17
18	0	0.36	....	0.36	18
SUNDAY........19	0	0.25	....	0.25	19...........SUNDAY
20	5	0.03	....	0.03	20
21	3	....	....	....	21
22	0	0.07	....	0.07	22
23	5	0.13	....	0.13	23
24	0	0.15	....	0.15	24
25	7	....	....	....	25
SUNDAY........26	7	0.00	....	0.00	26...........SUNDAY
27	37	0.11	....	0.11	27
28	6	0.01	....	0.01	28
29	00	0.03	....	0.03	29
30	00	0.00	....	0.00	30
31	06	0.19	....	0.19	31
Means......	43.8	2.50	....	2.50	..............Sums.
27 Years means for and including this month	.67	2.901	....	2.950	27 Years means for and including this month.

Direction........	
Miles	
Duration in hrs..	
Mean velocity....	

vel and
from
ng 100.
rs.
d; the
a range
day was
30.24 on

Greatest milea
Resultant mile
Resultant direc
Total mileage,

the 25th. Lowest barometer was 29.40 on the 2nd, giving a range of .84 inches.

Minimum relative humidity observed was 24 on the 3rd.

Rain fell on 19 days.

Fog on the 22nd.

Rainbow on the 31st.

ABSTRACT FOR THE MONTH OF MAY, 1901

Meteorological Observations, McGill College Observatory, Montreal, Canada. Height above sea level, 187 feet. C. H. McLEOD, *Superintendent.*

DAY	THERMOMETER. † Mean.	Max.	Min.	Range.	*BAROMETER. † Mean.	Max.	Min.	Range.	‡Mean relative humidity.	a WIND. General direction.	Mean velocity in miles per hour	Per cent. possible Sunshine.	Rainfall in inches.	Snowfall in inches.	Rain and snow melted.	DAY.
1	52.68	60.9	44.7	16.2	29.94	30.01	29.85	.16	52	W.	5.4	96	....	....	....	1
2	49.79	55.0	45.1	9.9	29 54	29.85	29.40	.45	88	N.W.	8.0	00	0.27	....	0.27	2
3	46.42	54.1	40.1	14.0	29.78	29.98	29.50	.48	38	N.W.	19.4	87	....	....	...	3
4	52.97	63.4	42.1	21.3	29.96	30.07	29.84	.23	39	N.W.	16.3	93	....	....	....	4
SUNDAY.... .. 5	52.22	60.9	45.1	15.8	29.83	29.91	29.80	.11	49	E.	12.7	99	....	....	....	5............SUNDAY
6	54.14	65.8	40.3	25.5	29.88	29.96	29 76	.20	58	S W.	6.6	74	....	....	....	6
7	63.35	74.0	53.5	20.5	29.76	29.79	29.73	.06	50	W.	3.2	97	....	....	....	7
8	63.57	77.9	50.1	27.8	29.80	29.84	29.75	.09	63	N.E.	5.7	67	....	....	....	8
9	65.44	74.1	55.6	18.5	29.95	30.00	29.82	.18	64	E.	5.1	60	....	....	....	9
10	63.75	70.1	57.3	13.8	29.96	30.02	29.87	.15	65	S.E.	2.9	17	0.03	....	0.03	10
11	59.73	66.0	56.0	10.0	29.60	29.87	29.49	.38	88	S.E.	9.0	00	0.26	....	0.26	11
SUNDAY........12	56.11	64.2	51.1	13.1	29.59	29.67	29.51	.16	69	W.	16.4	60	0.34	....	0.34	12............SUNDAY
13	48.22	53.5	44.3	9.2	29.69	29.77	29.65	.12	74	W.	13.6	20	0.11	....	0.11	13
14	48.64	55.2	44.5	10.7	29.94	30.05	29.77	.28	68	W.	20.0	48	0.06	....	0.06	14
15	54.08	63.8	44.0	19.8	30.08	30.10	30.05	.05	58	W.	12.3	98	....	....	....	15
16	58.89	69.6	47.0	22.6	30.09	30.16	30.03	.13	51	S.W.	9.0	100	....	....	....	16
17	57.07	53.2	50.5	2.7	29.93	30.03	29.82	.21	71	N.E.	6.6	02	0.10	....	0.10	17
18	51.11	53.5	48.0	5.5	29.79	29.90	29.75	.15	86	S.E.	9.1	00	0.36	....	0.36	18
SUNDAY........19	50.30	54.5	46.9	7.6	30.03	30.07	29.90	.17	86	E.	14.4	00	0.25	....	0.25	19............SUNDAY
20	55.68	64.0	49.7	14.3	30.06	30.09	30.03	.06	74	S.E.	9.5	05	0.03	....	0.03	20
21	60.05	67.2	53.9	13.3	30.05	30.11	29.99	.12	80	S.W.	1.3	13	....	....	....	21
22	66.98	79.4	53.9	25.5	29.86	29.99	29.71	.28	76	S.W.	3.8	30	0.07	....	0.07	22
23	65.94	73.8	58.0	15.8	29.68	29.79	29.63	.16	75	S.W.	17.2	65	0.13	....	0.13	23
24	49.34	58.0	46.0	12.0	30.03	30.16	29.79	.37	76	S.E.	17.8	00	0.15	....	0.15	24
25	53.34	61.8	45.1	16.7	30.20	30.24	30.16	.08	54	S.E.	8.3	87	....	....	....	25
SUNDAY....... 26	57.42	66.2	44.7	21.5	30.05	30 18	29.88	.30	58	S.	1.9	87	0.00	....	0.00	26............SUNDAY
27	58.19	65.7	53.7	12.0	29.75	29.88	29.62	.26	83	S.	5.0	37	0.11	....	0.11	27
28	56.21	63.0	46.1	16.9	29.66	29.73	29.62	.11	69	E.	15.2	16	0.01	....	0.01	28
29	57.48	64.0	53.1	10.9	29.81	29.84	29.73	.11	73	S.E.	13.8	00	0.03	....	0.03	29
30	55.49	59.6	53.0	6.6	29.77	29.84	29.70	.14	87	E.	5.9	00	0.00	....	0.00	30
31	56.63	61.9	52.4	9.5	29.68	29.71	29.66	.05	88	S.	4.5	06	0.19	....	0.19	31
Means......	56.17	63.69	48.86	14.82	29.863	29.955	29.768	.187	68.0	S 23° 43′ W	9.69	43.8	2.50	....	2.50	..............Sums.
27 Years means for and including this month	54.72	64.00	45.85	18.15	29.928	....	......	.170	66.5	....	§ 14.32	¶50.67	2.901	....	2.950	27 Years means for and including this month.

a ANALYSIS OF WIND RECORD.

Direction.......	N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.	CALM.
Miles	198	475	1255	1352	375	1114	1463	975	
Duration in hrs..	14	45	135	134	112	108	91	62	43
Mean velocity....	14.1	10.6	9.3	10.1	3.3	10.3	16.1	15.7	

Greatest mileage in one hour was 32 on the 23rd.
Resultant mileage, 976.
Resultant direction, S. 23° 43′ W.
Total mileage, 7,207.

a. Wind for the month is from the Anemograph in the Fire Alarm Office, City Hall.

* Barometer readings reduced to sea-level and temperature 32° Fahrenheit.

† Mean of bi-hourly readings taken from self-recording instruments.

‡ Humidity relative, saturation being 100. Mean of observations at 8, 15 and 20 hours.

¶ 20 years only. § 15 years only.

The greatest heat was 79.4 on the 22nd; the greatest cold was 40.1 on the 3rd, giving a range of temperature of 39.3 degrees.

Warmest day was the 22nd. Coldest day was the 3rd. Highest barometer reading was 30.24 on the 25th. Lowest barometer was 29.40 on the 2nd, giving a range of .84 inches.

Minimum relative humidity observed was 24 on the 3rd.

Rain fell on 19 days.

Fog on the 22nd.

Rainbow on the 31st.

E, 1901.

feet. C. H. McLEOD, *Superintendent.*

DAY	Per cent. possible Sunshine.	Rainfall in inches.	Snowfall in inches.	Rain and snow melted.	DAY.
	44	....	....	....	1
SUNDAY....	45	0.08	....	0.08	2..........SUNDAY
	07	0.32	....	0.32	3
	86	0.01	....	0.01	4
	74	....	....	....	5
	90	....	....	....	6
	00	0.31	....	0.31	7
	40	0.03	....	0.03	8
SUNDAY......	00	0.19	....	0.19	9..........SUNDAY
	95	....	....	....	10
	71	0.00	....	0.00	11
	66	0.09	....	0.09	12
	86	....	....	....	13
	85	....	....	....	14
	93	....	....	....	15
SUNDAY......	99	....	....	....	16..........SUNDAY
	99	....	....	....	17
	09	0.00	....	0.00	18
	23	0.39	....	0.39	19
	19	0.08	....	0.08	20
	78	....	....	....	21
	41	....	....	....	22
SUNDAY......	23	0.47	....	0.47	23 ....SUNDAY
	23	....	....	....	24
	85	....	....	....	25
	95	....	....	....	26
	95	....	....	....	27
	91	....	....	....	28
	83	....	....	....	29
SUNDAY......	98	....	....	....	30..........SUNDAY
Means......	61.5	1.97	....	1.97	..............Sums.
27 Years mea for and includi this month	¶54.97	3.527	....	3.527	27 Years means for and including this month.

Direction.....	
Miles	
Duration in hr	
Mean velocity.	

Greatest m
Greatest
on the 27th.
Resultant

-level and
ken from
eing 100.
ours.
29th; the
g a range
t day was
s 30.23 on

the 13th. Lowest barometer was 29.55 on the 29th, giving a range of 0.68 inches.

Minimum relative humidity observed was 40 on the 15th.

Rain fell on 12 days.

Lunar corona on the 26th.

Thunderstorms on the 3rd, 19th, 23rd and 28th

ABSTRACT FOR THE MONTH OF JUNE, 1901

Meteorological Observations, McGill College Observatory, Montreal, Canada. Height above sea level, 187 feet. C. H. McLEOD, *Superintendent.*

DAY	THERMOMETER. † Mean.	Max.	Min.	Range.	*BAROMETER. † Mean.	Max.	Min.	Range.	‡Mean relative humidity.	*a* WIND. General direction.	Mean velocity in miles per hour	Per cent. possible Sunshine.	Rainfall in inches.	Snowfall in inches.	Rain and snow melted.	DAY.
1	60.39	69.9	52.9	17.0	29.76	29.80	29.71	.09	74	S.	4.6	44	....	....	....	1
SUNDAY.... 2	59.92	68.0	53.6	14.4	29.80	29.85	29.72	.13	77	S E.	4.6	45	0.08	....	0.08	2..........SUNDAY
3	54.53	59.0	49.9	9.1	29.71	29.72	29.69	.03	76	S.W.	8.8	07	0.32	....	0.32	3
4	64.34	75.8	53.4	22.4	29.80	29.86	29.72	.14	69	S.W.	14.9	86	0.01	....	0.01	4
5	66.99	76.9	58.0	18.9	29.86	29.91	29.81	.10	68	S.W.	14.2	74	....	....	....	5
6	73.00	84.9	61.0	23.9	29.81	29.87	29.75	.12	66	S.W.	9.6	90	....	....	....	6
7	63.94	69.4	58.0	11.4	29.69	29.77	29.59	.18	91	S.W.	11.8	00	0.31	....	0.31	7
8	54.27	59.7	47.5	12.2	29.70	29.72	29.68	.04	79	S.W.	19.2	40	0.03	....	0.03	8
SUNDAY........ 9	48.77	54.7	43.7	11.0	29.80	29.90	29.72	.18	77	S.W.	21.6	00	0.19	....	0.19	9..........SUNDAY
10	61.51	72.2	49.4	22.8	30.00	30.06	29.90	.16	54	S.W.	19.9	95	....	....	....	10
11	66.55	76.7	56.0	20.7	30.07	30.10	30.02	.08	53	S.W.	18.8	71	0.00	....	0.00	11
12	69 04	78.5	62.3	16.2	30.12	30.19	30.05	.14	71	N.W.	4.8	66	0.09	....	0.09	12
13	67.02	76.7	54.1	22.6	30.14	30.23	29.99	.24	62	N.E.	6.1	86	....	....	....	13
14	73.17	85.7	65.2	20.5	29.92	30.09	29.82	.27	59	S.W.	19.4	85	....	....	....	14
15	60.61	69.0	50.7	18.3	30.12	30.18	30.08	.10	54	S.W.	10.2	93	....	....	....	15
SUNDAY........16	60.23	69.2	49.3	19.9	30.12	30.19	30.04	.15	67	N.E.	10.3	99	....	....	....	16..........SUNDAY
17	62.97	72.9	52.9	20.0	30.01	30.07	29.94	.13	69	E.	5.3	99	....	....	....	17
18	60.41	66.0	52.1	13.9	29.84	29.98	29.90	.08	64	E.	1.5	09	0.00	....	0.00	18
19	64.13	75.0	60.0	15.0	29.95	29.98	29.90	.08	86	W.	3.5	23	0.39	....	0.39	19
20	64.35	73.9	57.3	16.6	29.99	30.03	29.94	.09	85	S.W.	3.3	19	0.08	....	0.08	20
21	69.01	78 8	60.1	18.7	29.95	29.98	29.91	.07	72	W.	11.2	78	....	....	....	21
22	72.08	81.0	62.0	19.0	29.85	29.94	29.69	.25	60	E.	3.5	41	....	....	....	22
SUNDAY....... 23	67.97	74.5	65.0	9.5	29.63	29.69	29.60	.09	84	S.W.	10.0	23	0.47	....	0.47	23 ....SUNDAY
24	68.84	75.1	63.9	11.2	29.87	29.94	29.69	.25	80	W.	6.1	23	....	....	....	24
25	74.21	85.7	61.6	24.1	30.03	30.06	29.94	.12	73	W.	4.5	85	....	....	....	25
26	79.36	87.6	71.0	15.6	30.06	30.11	30.03	.08	66	S.W.	9.0	95	....	....	....	26
27	80.56	89.1	72.0	17.1	29.90	30.03	29.78	.25	73	W.	21.1	95	....	....	....	27
28	82.22	91.4	74.5	16.9	29.80	29.83	29.75	.08	77	S.W.	15.6	91	....	....	....	28
29	81.15	92.0	72.8	19.2	29.66	29.77	29.55	.22	76	S.W.	17.7	83	....	....	....	29
SUNDAY........30	73.34	83.1	65.3	17.8	29.74	29.79	29.62	.17	60	S.W.	23.2	98	....	....	....	30..........SUNDAY
Means......	66.83	75.75	58.55	17.20	29.890	29.955	29 818	137	70.8	W 40° 44′ S	11.15	61.5	1.97	....	1.97	...............Sums.
27 Years means for and including this month	64.97	73.73	56.42	17.31	29.905	....	......	.154	70.2	....	§ 13.20	¶54.97	3.527	....	3.527	27 Years means for and including this month.

a ANALYSIS OF WIND RECORD.

Direction.......	N.	N.E.	E.	S E.	S.	S.W.	W.	N.W.	CALM.
Miles	64	445	317	170	214	5587	1037	197	
Duration in hrs..	12	32	69	41	61	364	80	20	40
Mean velocity....	5.3	13.5	4 6	4.1	3 5	15.3	13.0	9.8	

Greatest mileage in one hour was 31 on the 27th.

Greatest velocity in gusts 33 miles per hour on the 27th.

Resultant mileage, 5,760.

Resultant direction, W. 40° 44′ S.

Total mileage, 8,031.

a. Wind from the 1st to 25th is from Anemograph in the Fire Alarm Office, City Hall.

* Barometer readings reduced to sea-level and temperature 32° Fahrenheit.

† Mean of bi-hourly readings taken from self-recording instruments.

‡ Humidity relative, saturation being 100. Mean of observations at 8, 15 and 20 hours.

¶ 20 years only. § 15 years only.

The greatest heat was 92.0 on the 29th; the greatest cold was 43.7 on the 9th, giving a range of temperature of 48.3 degrees.

Warmest day was the 28th. Coldest day was the 9th. Highest barometer reading was 30.23 on the 13th. Lowest barometer was 29.55 on the 29th, giving a range of 0.68 inches.

Minimum relative humidity observed was 40 on the 15th.

Rain fell on 12 days.

Lunar corona on the 26th.

Thunderstorms on the 3rd, 19th, 23rd and 28th

Price $3.00 the Volume of eight numbers.

VOLUME VIII. NUMBER 7.

THE CANADIAN RECORD OF SCIENCE

INCLUDING THE PROCEEDINGS OF
THE NATURAL HISTORY SOCIETY OF MONTREAL,
AND REPLACING

THE CANADIAN NATURALIST.

CONTENTS.

PAGE

George Mercer Dawson. By Bernard J. Harrington, M.A., Ph.D., LL.D., with Portrait. 413

An Experimental Investigation into the Flow of Marble. By Frank D. Adams, M.Sc., Ph. D., and John T. Nicholson, D.Sc........ 426

Ostracoda of the Basal Cambrian Rocks in Cape Breton. By G. F. Matthew, LL.D., F.R.S.C. 437

Notes on the Albany Meeting of the Geological Society of America, held December, 1900. By H. M. Ami, M.A., D.Sc. 471

Proceedings of Natural History Society of Montreal 477

Inaugural Address of the President of the Natural History Society, E. W. MacBride, M.A., D.Sc........ 479

Book Notices........ 493

MONTREAL:
PUBLISHED BY THE NATURAL HISTORY SOCIETY.

LONDON, ENGLAND:
Collins, 157 Great Portland St.

BOSTON, MASS.:
A. A. Waterman & Co., 36 Bromfield St.

1902.

NATURAL HISTORY SOCIETY OF MONTREAL.

[*Incorporated* 1832.]

OFFICERS—SESSION 1901-1902.

Patron :

HIS EXCELLENCY THE GOVERNOR-GENERAL OF CANADA.

Hon. President :

LORD STRATHCONA AND MOUNT ROYAL.

President :

PROF. E. W. MACBRIDE, M.A., D.Sc.

Vice-Presidents :

FRANK D. ADAMS, Ph.D., F.R.S.C.
REV. ROBT. CAMPBELL, M.A., D.D.
B. J. HARRINGTON, Ph.D., F.R.S.C.
A. HOLDEN.
J. H. JOSEPH.
DR. T. WESLEY MILLS.
HON. J. K. WARD.
C. T. WILLIAMS.
HON. JUSTICE WÜRTELE.

Hon. Recording Secretary :
CHAS. S. J. PHILLIPS.

Hon. Corresponding Secretary :
J. S. BUCHAN, K.C., B.C.L.

Honorary Treasurer :
J. G. MCKERGOW.

Honorary Curator :
A. E. NORRIS.

Members of Council :

F. W. RICHARDS, *Chairman.*

J. A. U. BEAUDRY, C.E.
PROF. J. BEMROSE, F.I.C., F.C.S.
N. N. EVANS, M.A.Sc.
JOSEPH FORTIER.
JOHN HARPER.
EDGAR JUDGE.
H. MCLAREN.
H. MARKLAND MOLSON.

Editing and Exchange Committee :

REV. ROBT. CAMPBELL, M.A., D.D., *Chairman.*

FRANK D. ADAMS, Ph.D., F.R.S.C.
J. S. BUCHAN, K.C., B.C.L.
PROF. J. T. DONALD.
A. T. DRUMMOND, LL.D., Kingston, Ont.
PROF. E. W. MACBRIDE, M.A., D.Sc.
G. F. MATTHEW, LL.D., F.R.S.C., St. John, N.B.
T. WESLEY MILLS, M.A., M.D.
J. F. WHITEAVES, Ottawa, Ont.

Library Committee :

H. MCLAREN, *Chairman.*

J. A. U. BEAUDRY, C.E.
JOSEPH FORTIER,
ALFRED GRIFFIN.
A. E. NORRIS.
G. M. TOD.
C. T. WILLIAMS.

Museum Committee :

A. E. NORRIS, *Chairman.*

REV. ROBT. CAMPBELL, M.A., D.D.
A. B. DUMOUCHEL.
G. A. DUNLOP.
O. E. LEROY, B.A.
PROF. J. B. A. LEYMARIE.
PROF. E. W. MACBRIDE, M.A., D.Sc.
H. E. VENNOR.

Field Work Committee :

C. T. WILLIAMS, *Chairman.*

FRANK D. ADAMS, Ph.D., F.R.S.C.
PROF. J. BEMROSE, F.I.C., F.C.S.
J. S. BUCHAN, K.C., B.C.L.
REV. ROBT. CAMPBELL, M.A., D.D.
REV. G. COLBORNE HEINE, B.A.
O. E. LEROY, B.A.
PROF. E. W. MACBRIDE, M.A., D.Sc.
F. W. RICHARDS.
ALEX. ROBERTSON.

Lecture Committee :

T. WESLEY MILLS, M.A., M.D., *Chairman.*

J. S. BUCHAN, K.C., B.C.L.
REV. ROBT. CAMPBELL, M.A., D.D.
PROF. JOHN COX, M.A.
N. N. EVANS, M.A.Sc.
B. J. HARRINGTON, Ph.D., F.R.S.C.
REV. G. COLBORNE HEINE, B.A.
EDGAR JUDGE.
CHAS. S. J. PHILLIPS.
HON. JUSTICE WÜRTELE.

House Committee :

ALBERT HOLDEN, *Chairman.*

F. W. RICHARDS.
C. T. WILLIAMS.

Membership Committee :

ALEX. ROBERTSON, *Chairman.*

J. A. U. BEAUDRY, C.E.
J. BEMROSE, F.I.C., F.C.S.
REV. ROBT. CAMPBELL, M.A., D.D.
EDGAR JUDGE.
H. MCLAREN.
CHAS. S. J. PHILLIPS.
HON. J. K. WARD.
C. T. WILLIAMS.

Superintendent :

ALFRED GRIFFIN.

Yours truly
George M. Dawson

THE

CANADIAN RECORD

OF SCIENCE.

VOL. VIII. JANUARY, 1902. No. 7.

George Mercer Dawson.

By Bernard J. Harrington, M.A., Ph.D., LL.D.

The widespread expressions of deep regret and personal loss following the death of Dr. G. M. Dawson show that his was no ordinary life. Called away while in his prime, and with a past which gave promise of great achievements yet to come, he has left a blank which will not soon be filled.

Dr. Dawson was the second son of the late Sir J. W. Dawson, and was born on the 1st of August, 1849, in Pictou, Nova Scotia. In 1855 his father, who had for some years been acting as Superintendent of Education for Nova Scotia, received the appointment of principal of McGill University, Montreal, and with his family took up his residence there. Instead of the magnificent structures of to-day, there were then on the college grounds only two " unfinished and partly ruinous buildings, standing amid a wilderness of excavators' and masons' rubbish, overgrown with weeds and bushes. The grounds were unfenced and pastured at will by herds of cattle, which not only cropped the

* Fifty years of work in Canada—Autobiographical notes by Sir William Dawson, p. 98.

grass, but browsed on the shrubs, leaving unhurt only one great elm, which still stands as the "founder's tree,' and a few old oaks and butternut trees." * Surroundings of this kind were not ideal from a university point of view, but made a delightful environment for an intelligent boy. The numerous wild flowers, the birds' nests, the fossil shells in the blue clay, the waste waterway, where leaves and twigs became "petrifactions," the lively brook where mimic fleets could be navigated and dams constructed—these and many other objects of interest were there, and with the guidance and encouragement of an ever-ready father, the boy's inborn love of nature was daily stimulated and increased.

At ten years of age, Dawson entered the Montreal High School, remaining there for one year, and taking a high place in his classes. Subsequently, however, owing to ill-health, his education was carried on for the most part under tutors ; and while this system no doubt cut him off from some advantages, it gave him on the other hand wider opportunities for pursuing and mastering subjects which had special attractions for him. Surrounded by books, chemical apparatus, paints and pencils, the days were never too long, and photography, book-binding, painting magic lantern slides, and even cheese-making, afforded him fascinating occupation and amusement. One who knew him well at that time says : "He seemed to absorb knowledge rather than to study, and every new fact or idea acquired was at once put into its place and proper relations in his orderly mind. He was always cheerful, amusing and popular, other boys flocking round him and invariably submitting to his unconscious leadership"

At the age of eighteen, Dawson entered McGill College as a partial student, attending lectures on English, chemistry, geology, etc., during the session of 1868-9. While a student at this time, he wrote a poem on Jacques Cartier which, while but a boyish effort, was thought very well of by his instructors and gave evidence of his keen love of nature and poetic instinct. The view from the summit of Mount Royal, whither Cartier was conducted by the red men of Hochelaga, is thus described :

> " Far on the western river lay,
> Like molten gold, the dying day.
> Far to the east the waters glide
> Till lost in twilight's swelling tide ;
> While all around, on either hand,
> Spread the broad, silent, tree-clad land ;
> And in the distance far and blue
> Long swelling mountains close the view."

The following year, Dawson went to London and entered the Royal School of Mines, at that time on Jermyn street. He was fond of the sea, and on this occasion made the passage in a sailing ship, he and another young man being the only passengers. During the voyage, he amused himself making observations on the surface life of the ocean, and the phenomena of phosphorescence. He also studied navigation, under the direction of the captain, and the knowledge then acquired afterward stood him in good stead when he had to navigate a schooner along the dangerous coast of British Columbia and the Queen Charlotte Islands.

At the School of Mines, he took the full course of study, extending over three years, and passed as an associate. At the end of his second year, he carried off the Duke of Cornwall's scholarship, given by the Prince of Wales, and on graduation stood first in his class, obtaining the Edward Forbes medal and prize in Palæontology and Natural History, and the Murchison medal in Geology. While at the School of Mines, he paid special attention to the study of geology under Ramsay, Huxley, and Etheridge, but also devoted much time to chemistry and metallurgy, under Frankland and Percy respectively, and to mining, under Warrington Smith. Even in his holidays, he was never altogether idle, and during most of the summer of 1871 he was attached to the British Geological Survey, and worked with the late J. Clifton Ward in the Cumberland Lake district. While in England, he made many warm friends, with some of whom he corresponded regularly for years afterwards.

On returning to Canada in 1872, he was engaged for some months examining and reporting upon mineral properties in Nova Scotia, and subsequently went to Quebec, where he delivered a course of lectures on chemistry at Morrin College, which was attended by a large and appreciative class. In 1873, he was appointed geologist and botanist to Her Majesty's North American Boundary Commission, which had been constituted to fix the boundary line between British North America and the United States, from the Lake of the Woods to the Rocky mountains, and which had been carrying on its labours for about a year. From early boyhood, Dawson had been keenly interested in travel and exploration, and in the Canadian North-West he saw a region ready to yield up a rich harvest of discovery. There was the charm of novelty afforded by a well-nigh untrodden field, and the many hardships to be encountered only seemed to lend attractions to the expedition. In those days, no Canadian trains rolled across the continent. Fort

Garry, now the fast-growing city of Winnipeg, with more than 40,000 inhabitants, was then practically the last outpost of civilization, and the great prairies had to be traversed on horseback or on foot, provisions and equipments of every kind being carried in Red river carts, drawn by oxen or ponies, with shaganappy harness. The two years of Dawson's connection with the Boundary Commission were for him years of incessant activity, but the results of his work were of great scientific value. They were embodied in a report addressed to the head of the commission, major (now general) D. R. Cameron, R.A., and published in Montreal in 1875.* The volume, which is now looked upon as "one of the classics of Canadian geology," is a model of what such reports should be —scientific facts being clearly and succinctly stated and the conclusions logically drawn. The main geological result arrived at was the examination and description of a section over 800 miles in length across the central region of the continent, which had been previously touched upon at a few points only, and in the vicinity of which a space of over 300 miles in longitude had remained even geographically unknown. The report discussed not merely the physical and general geology of the region, and the more detailed characteristics of the various geological formations, but also the capabilities of the country with reference to settlement. The whole edition was long ago distributed, and the volume is now exceedingly scarce and difficult to obtain. While attached to the Boundary Commission, Dawson made large collections of

* Report on the Geology and Resources of the Region in the vicinity of the Forty-ninth Parallel, from the Lake of the Woods to the Rocky Mountains, with Lists of Plants and Animals collected and Notes on the Fossils.

natural history specimens, which were forwarded to England and found a home in the British Museum, as well as at Kew and elsewhere. The British Museum obtained no less than seventeen species of mammals not previously represented in its collections.

More or less in connection with the above work were published papers on the "Lignite Formations of the West," the "Occurrence of Foraminifera, Coccoliths, etc., in the Cretaceous Rocks of Manitoba," on "Some Canadian species of Spongillæ," on the "Superficial Geology of the Central Region of North America," on the "Locust Invasion of 1874 in Manitoba and the North-west Territories," etc.

When the work of the Boundary Commission was brought to a close, Dawson received an appointment on the staff of the Geological Survey of Canada and began in that connection the long series of explorations of the North-West and British Columbia, which brought such great credit to himself and his country. In 1883, he was made an assistant director of the survey, and later, on the retirement of Dr. Selwyn, in 1895, became head of the department, a position which he occupied until the time of his death on the 2nd of March last. Throughout his connection with the survey, his reports were always of a high order, bearing evidence of his striking powers of observation and deduction. Though thoroughly scientific, they always took account of the practical and economic side of geology, and accordingly commanded the attention and confidence of mining capitalists, mine managers and others interested in the development of the mineral resources of the country. When in the field, geology was, of course, the principal object of his investigations, but his wide knowledge of collateral sciences enabled him not merely to collect objects of natural history in an intelligent and discriminating way, and to discuss the flora and faunas of different districts, but also to make important observations on the habits and languages of Indian tribes, to keep continuous meteorological records and to determine latitudes and longitudes. We accordingly find that his reports generally conclude with a series of most valuable appendices, giving special information which could not well be included in the body of the document.

In an elaborate notice of his report on the Queen Charlotte islands, published in Petermann's Mittheilungen (Vol. 27, 1881), the writer, after calling attention to the fact that the report dealt not merely with the geology of the islands, but also with their topography, natural history, climate and ethnology, says : " One is amazed at the rich results which he brought back in all these branches, especially as he had only one assistant, Mr. Rankine Dawson, and remained in the islands only two and a half months, from the 12th of June to the end of August, and that in most unfavourably wet weather."

In addition to his field-books proper, he generally kept copious journals which contain much interesting information. He had a habit, too, of jotting down notes and sometimes verses on scraps of paper or on the backs of telegraph forms. In the wilds of British Columbia, for example, he writes :

" Contorted beds, of unknown age,
  My weary limbs shall bear,
Perchance a neat synclinal fold
  At night shall be my lair.
Dips I shall take on unnamed streams,
  Or where the rocks strike, follow

Along the crested mountain ridge,
  Or anticlinal hollow ;
Or gently with the hammer stroke
  The slumbering petrifaction,
That for a hundred million years
  Has been debarred from action.

* * * * * * * *

We can fancy him, too, sitting by his lonely camp fire on the shores of the Pacific and penning the following lines :

" To rest on fragrant cedar boughs
  Close by the western ocean's rim,
While in the tops of giant pines
  The live-long night the sea-winds hymn,
And low upon the fretted shore
  The waves beat out the evermore."

Dr. Dawson's geological work was carried on chiefly in the region of the great prairies of the North-West and British Columbia, but he was thoroughly informed as to the geology of all parts of the Dominion. In the North-West, he paid particular attention to the relations of the Cretaceous and Laramie formations ; and he discovered the presence in the Cretaceous of southern Alberta of an important series of rocks—the Belly River group—which, he says, " must be considered on the whole as a fresh-water formation." The Kootanie group was also recognized by him as constituting a portion of the early Cretaceous in the Rocky Mountain region. His study of a large area in the interior plateau region of British Columbia established the existence there of a great series of mica-schists and gneisses supposed to be of Archæan age and succeeded by Cambrian, Ordovician, Silurian and Carboniferous strata ; while in the Cordilleran region of the same province he described the occurrence of great deposits of contemporaneous volcanic rocks, in various stages of metamorphism. While working in connection with the Boundary Commission also, he studied the crystalline rocks in the Lake of the Woods district, and concluded that a considerable portion of the Huronian formation there consists of metamorphosed volcanic rocks.

He was a careful student of glacial phenomena and, according to Dr. G. J. Hinde,* was the first to describe the glacial origin of the Missouri Coteau, and, in the interior of British Columbia, he has shown that at one period of the Ice age there was a confluent ice-mass, the surface of which stood at a level of 7,000 feet above the sea, and that it must have been at least from 2,000 to 3,000 feet in thickness. He has further established the fact that the movements of the glacier ice in this region were not only to the south and south-east, and through the transverse valley and gaps of the Coast ranges to the ocean, but that it had also a northerly flow, and passed down the valleys of the Pelly and Lewes branches of the Yukon river. Dr. Dawson also maintained that the northern part of the great plains had been submerged, and that their glaciation was in the main due to floating ice.

With regard to his ethnological work we cannot do better than quote from Mr. W. J. McGee's recent appreciative notice in the *American Anthropologist.* Mr. McGee says : " While several of Dr. Dawson's titles and the prefatory remarks in some of his papers imply that his ethnological researches were subsidiary to his geological work, and while his busy life never afforded opportunity for monographic treatment of Canada's aborigines, it is nevertheless true that he made original observations and records of standard value, that much of his work is still unique, and that

½ Geological Magazine, May, 1897.

his contributions, both personal and indirect, materially enlarged knowledge of our native tribes. It is well within bounds to say, that in addition to his other gifts to knowledge, George M. Dawson was one of Canada's foremost contributors to ethnology, and one of that handful of original observers whose work affords the foundation for scientific knowledge of the North American natives."

Dawson's most notable contribution to ethnology was undoubtedly his memoir on the Haida Indians of the Queen Charlotte islands, but he also published "Notes on the Indian Tribes of the Yukon District and Adjacent Northern Portion of British Columbia," a valuable memoir entitled "Notes and Observations of the Kwakiool People of Vancouver Island," "Notes on the Shuswap People of British Columbia," and other papers.

When, in 1884, the British Association appointed a committee to study the physical characters, languages and social conditions of the north-western tribes of Canada, Dr. Dawson was made a member, and it devolved upon him to organize and administer the work of the committee. The work was carried on for years with much success and small money expenditure, and when, in 1896, an Ethnological Survey of Canada was instituted, Dawson was chosen as the head of the survey committee.

Not the least of his services to his country were those in connection with the Behring sea arbitration. He was one of the commissioners and was sent by the British government to the north Pacific ocean to enquire into the conditions of seal life there. Subsequently, his evidence and forcible arguments undoubtedly secured for the British side of the case a much more favourable finding than would otherwise have been obtained. Lord Alverstone (now Lord Chief Justice of England) writing of him in this connection, says: "It is not possible to overrate the services which Dr. Dawson rendered us in the Behring sea arbitration. I consulted him throughout on many questions of difficulty and never found his judgment to fail, and he was one of the most unselfish and charming characters that I ever met. I consider it a great pleasure to have known him." In recognition of his services on the arbitration, Dr. Dawson was made a Companion of the Order of St. Michael and St. George (C.M.G.).

He received the degree of D.Sc. from Princeton in 1877, and that of LL.D. from Queen's University in 1890, from McGill University in 1891, and from Toronto University some years later. In 1891, he was awarded the Bigsby gold medal by the Geological Society for his services in the cause of geology, and was also elected a Fellow of the Royal Society. In 1893, he was elected President of the Royal Society of Canada, and in 1897 was President of the geological section of the British Association for the Advancement of Science at the Toronto meeting. In 1897, he was awarded the gold medal of the Royal Geographical Society. Last year, he was President of the Geological Society of America, and gave his retiring address at the Albany meeting in December, choosing as his subject, "The Geological Record of the Rocky Mountain Region in Canada." This address was published as a bulletin of the Geological Society of America, and will be prized as giving a summing up of his latest views on some of the problems connected with the complex geology of the west. Many other distinctions, which cannot be enumerated here, fell to his lot, and he had won for himself the esteem and confidence of his fellow-countrymen in all parts of the Dominion. Nowhere was he more beloved than in British Columbia—the province in which he had done so much of his best work, and in which, he sometimes said to the writer, he would like to spend his last days.

After the Toronto meeting of the British Association, in 1897, he accompanied a party of the members on a trip across the continent, and all were struck with the warmth of the welcome everywhere accorded to him. "Among the many distinguished visitors," writes the *Victoria Colonist*, "by whose presence Victoria has been honored during the past few days, none holds a higher or more deserved place in the esteem of Canadians than George M. Dawson. In one sense he is the discoverer of Canada, for the Geological Survey, of which he has been the chief, has done more than all other agencies combined to make the potentialities of the Dominion known to the world. He has been engaged in the work so long that he can look back over it with the profound satisfaction which comes from the knowledge that his judgment on points of extreme interest and value has been justified by events. The development of Kootenay, the hydraulic mines of Cariboo, and the gold mines in the Yukon are all foretold in the interesting pages of Dr. Dawson's earlier reports. Therefore, when we find in the voluminous products of his pen, wherein the results of his observations are recorded, anticipations of great mineral development in parts of the province that are as yet unexplored, we feel almost as if such development were guaranteed. A careful observer, a conservative reasoner, a skilful writer, Canada possesses in Dr. Dawson a public servant the value of whose services can never be over-estimated. His name carries authority with it on any subject on which he speaks. That a long career may be before him is the hope of all, for we all know how much that means to the Dominion."

Dr. Dawson was a ready and prolific writer and a brilliant conversationalist. His quiet humour was infectious, and any dinner party which numbered him among the guests was sure to be a merry one. He seemed to have an inexhaustible fund of information, not merely about his own special lines of work, but covering the widest range of subjects. The marvel was how in his busy life he had acquired so much and such varied knowledge. For one of apparently delicate constitution, his powers of enduring prolonged physical exertion were as remarkable as his capacity for continuous mental activity. He was at work at his office until two days before his death, the immediate cause of which was capillary bronchitis. The secret of Dr. Dawson's widespread popularity, no doubt, lay in his downright unselfishness and in his sunny and sympathetic nature.

An Experimental Investigation into the Flow of Marble.

By Frank D. Adams, M.Sc., Ph.D., and John T. Nicolson, D.Sc.

In a paper read before the Royal Society of London last June and which has since been published in Transactions of the Society, an extended account was given of a series of experiments on the Flow of Marble carried out in the laboratories of McGill University. It is desired here to present a brief summary of this paper, indicating the methods employed in the investigation and the results attained.

That rocks, under the conditions to which they are subjected in certain parts of the earth's crust, become bent and twisted in the most complicated manner is a fact which was recognized by the earliest geologists, and it needs but a glance at any of the accurate sections of contorted regions of the earth's crust which have been prepared in more recent years to show that there is often a transfer or "flow" of material from one place to another in the folds. The manner in which this contortion, with its concomitant "flowing," has taken place is, however, a matter concerning which there has been much discussion, and a wide divergence of opinion. Some authorities have considered it to be a purely mechanical process, while others have looked upon solution and redeposition as playing a necessary *role* in all such movements. The problem is one on which it would appear that much light might be thrown by experimental investigation. If movements can be induced in rocks under known conditions, with the reproduction of the structures found in deformed rocks in nature, much might be learned concerning not only the charcter of the movements, but also concerning the conditions which are necessary in order that the movements in question may take place.

It is generally agreed that three chief factors contribute to bringing about the conditions to which rocks are subjected in the deeper parts of the earth's crust, where folding with concomitant flowing is most marked. These are :—

1. Great pressure.
2. High temperature.
3. Percolating waters.

With regard to the first factor, it must be noted that mere cubic compression does not produce movements of the nature of flowing, although it may produce molecular rearrangement in the rock. A differential pressure is necessary to give movement to the mass. As Heim has pointed out, there is reason to believe that "Umformung ohne Bruch" takes place when a rock is subjected to a pressure which, while greater in some directions than in others, in every direction exceeds the elastic limit of the rock in question. Whether all these factors, or only certain of them, are actually necessary for the production of rock deformation is a question which also requires to be determined by experiment, for by experiment the action of each can be studied separately, as well as in combination with the others.

In the paper a first contribution to such a study is presented, pure Carrara marble being the rock selected for study. The investigation is now being extended to various other limestones, as well as to granites and other rocks.

In order to submit the marble to a differential pressure, under the conditions above outlined, it was sought to enclose the rock in some metal having a higher elastic limit than marble, and at the same time possessing considerable ductility. After a long series of experiments, heavy wrought-iron tubes of special construction were adopted. These were made, following the plan adopted in the construction of ordnance, by rolling thin strips of Low Moor iron around a bar of soft iron, and welding the strips successively to the bar, as they were rolled around it. The core of soft iron composing the bar was then bored out, leaving a tube of Low Moor iron, the sides being about $\frac{1}{4}$ inch in thickness, and so constructed that the fibres of the iron ran around the tube instead of being parallel to its length. These were found to answer the requirements admirably.

The following procedure was then adopted. Columns of the marble, an inch or in some cases 0.8 inch in diameter and about 1.5 inch in length, were accurately turned and polished. The tube was then very accurately fitted around the marble. This was accomplished by giving a very slight taper to both the column and the interior of the tube, and so arranging it that the marble would only pass half way into the tube when cold. The tube was then expanded by heating, so as to allow the marble to pass completely into it and leave about 1.25 inch of the tube free at either end. On allowing the tube to cool, a perfect contact between the iron and the marble was obtained. In some experiments the tube was subsequently turned down, so as to be somewhat thinner immediately around the marble. Into either end of the tube, containing the column, an accurately fitting steel plug or piston was then inserted, and by means of these the pressure was applied. The high pressure required was obtained by means of a powerful press, especially constructed for the purpose, consisting of a double hydraulic "intensifier," the water pressure being in the first instance obtained from the city mains. By means of this machine, pressures up to 13,000 atmospheres could be exerted on the columns having a diameter of 0.8 inch, and the pressures could be readily regulated and maintained at a constant value for months at a time, if required.

It having been ascertained that the columns of the marble 1 inch in diameter and 1½ inch in height crushed at a pressure of from 11,430 to 12,026 lbs. to the square inch, the column enclosed in its wrought-iron tube, in the manner above described, was placed in the machine and the pressure applied gradually, the exterior diameter of the tube being accurately measured at frequent intervals. No effect was noticeable until a pressure upon the marble, varying of course with the thickness of the enclosing tube, but generally about 18,000 lbs. to the square inch, was reached; when the tube was found to slowly bulge, the bulge being symmetrical and confined to that portion of the tube surrounding the marble. The distension was allowed to increase until the tube showed signs of rupture, when the pressure was removed and the experiment concluded. The conditions under which the marble was submitted to pressure were four in number:—

1. At the ordinary temperature in the absence of moisture. (Cold dry crush.)

2. At 300° C. in the absence of moisture. (Hot dry crush.)
3. At 400° C. in the absence of moisture. (Hot dry crush.)
4. At 300° C. in the presence of moisture. (Hot wet crush.)

Eight experiments were made on marble columns at the ordinary temperature, in the absence of moisture, the rate at which the presure was applied differing in different cases, and the consequent deformation being in some cases very slow and in others more rapid, the time occupied by the experiment being from ten minutes to sixty-four days. The amount of deformation was not in all cases equal, as some of the tubes showed signs of rupture sooner than others. On the completion of the experiment, the tube was slit through longitudinally by means of a narrow cutter in a milling machine, along two lines opposite one another. The marble within was found to be still firm and compact, and to hold the respective sides of the tube, now completely severed from one another, so firmly together that it was impossible without mechanical aids to tear them apart. By means of a steel wedge driven in between them, however, they could be separated, but only at the cost of splitting the marble through longitudinally. The half columns of the marble now deformed generally adhere so firmly to the tube that it is necessary to spread the latter in a vice in order to set them free. The deformed marble, while firm and compact, differs in appearance from the original rock in possessing a dead white colour, somewhat like chalk, the glistening cleavage surfaces of the calcite being no longer visible. The difference is well brought out in certain cases owing to the fact that a certain portion of the original marble often remains unaltered and unaffected by the pressure. This when present has the form of two blunt cones of obtuse angle whose bases are the original ends of the columns resting against the faces of the steel plugs, while the apices extend into the mass of the deformed marble and point toward one another. These cones, or rather parabolas of rotation, are developed, as is well known, in all cases when cubes of rock, Portland cement, or cast iron are crushed in a testing machine in the ordinary manner. In the present experiments they seldom form any large portion of the whole mass.

In order to test the strength of the deformed rock, three of the half columns from different experiments, obtained as above described, were selected and tested in compression. The first of these, which had been deformed very slowly, the experiment extending over sixty-four days, crushed under a load of 5350 lbs. per square inch; the second, which had been deformed in $1\frac{1}{2}$ hours, crushed under a load of 4000 lbs, per square inch; while the third, which had been quickly deformed, the experiment occupying only 10 minutes, crushed under a load of 2776 lbs. per square inch. As mentioned above, the original marble, in columns of the dimensions possessed by these before deformation, was found to have a crushing weight of between 11,430 and 12,026 lbs. per square inch. These figures show that, making all due allowance for the difference in shape of the specimens tested, the marble after deformation, while in some cases still possessing considerable strength, is much weaker than the original rock. They also tend to show that when the deformation is carried on slowly the resulting rock is stronger than when the deformation is rapid.

Thin sections of the deformed marble, passing vertically through the unaltered cone and the deformed portion of the rock, were readily made, and when examined under the microscope clearly showed the nature of the movement which had taken place. The deformed portion of the rock can be at once distinguished by its turbid appearance, differing in a marked manner from the clear transparent mosaic of the unaltered cone. This turbid appearance is most marked along a series of reticulating lines running through the sections, which, when highly magnified, are seen to consist of lines or bands of minute calcite granules. They are lines along which shearing has taken place. The calcite individuals along these lines have broken down, and the fragments so produced have moved over and past one another, and remain as a compact mass after the movement ceased. In this granulated material are enclosed great numbers of irregular fragments and shreds of calcite crystals, bent and twisted, which have been carried along in the moving mass of granulated calcite as the shearing progressed. This structure is therefore cataclastic, and is identical with that seen in the felspars of many gneisses.

Between these lines of granulated material the marble shows movements of another sort. Most of the calcite individuals in these positions can be seen to have been squeezed against one another and in many cases a distinct flattening of the grains has resulted, with marked strain shadows, indicating that they have been bent or twisted. They show, moreover, a finely fibrous structure in most cases, which, when highly magnified, is seen to be due to an extremely minute polysynthetic twinning. The chalky aspect of the deformed rock is in fact due chiefly to the destruction by this repeated twinning of the continuity of the cleavage surfaces of the calcite individuals, thus making the reflecting surfaces smaller. By this twinning, the calcite individuals are enabled under the pressure to alter their shape somewhat, while the flattening of the grains is evidently due to movements along the gliding planes of the crystals. In these parts, therefore, the rock presents a continuous mosaic of somewhat flattened grains.

From a study of the thin sections it seems probable that very rapid deformation tends to increase the relative abundance of the granulated material, and in this way to make the rock weaker than when the deformation is slow.

When the marble is heated to 300° C. in a suitably-constructed apparatus and is then subjected to deformation under conditions which otherwise are the same as before, the cataclastic structure is found to be absent and the strength of the deformed marble rises to 10,652 lbs. to the square inch, that is to say, it is nearly as strong as the original rock. The calcite grains, which in the original rock are practically equidimensional, are now distinctly flattened, some of them being three or even four times as long as they are wide. Some grains can be seen to have been bent around others adjacent to them, the twin lamellæ curving with the twisted grain. In others again of these twisted lamellæ, the twinning only extends to a certain distance from the margin, leaving a clear untwinned portion in the centre. The rock consists of a uniform mosaic of deformed calcite individuals.

When the deformation is carried out at 400° C. no trace of cataclastic structure is seen.

An experiment was then made in which the marble was deformed at 300° C., but in the presence of moisture, water being forced through the rock under a pressure of 460 lbs. per square inch during the deformation, which extended over a period of fifty-four days, or nearly two months. Under these conditions the marble yielded in the same manner as when deformed at 300° C., in the absence of moisture, that is, by movements on gliding planes and by twinning, but without cataclastic action. The deformed marble, however, when tested in compression, was found actually to be slightly stronger than a piece of the original marble of the same shape. The structure developed was identical with that of the marble deformed at 300° C. in the absence of water. The presence of water, therefore, did not influence the character of the deformation. It is quite possible, however, that there may have been a deposition, of infinitesimal amount, of calcium carbonate along very minute cracks or fissures, which thus helped to maintain the strength of the rock. No signs of such deposition, however, were visible.

By studying the marble deformed at a temperature of 300° C., or better at 400° C., it will be seen that structures induced in it by the movements, and the nature of the motion, are precisely the same as those observed in metals when they are deformed by impact or by compression. In a recent paper by Messrs. Ewing and Rosenhain, "Experiments in Micro-metallurgy: Effects of Strain," which appeared in these Proceedings, three photographs of the same surface of soft iron, showing the results of progressive deformation under pressure, are shown, which photographs could not be distinguished from those of thin sections of the marble described in the present paper, at corresponding stages of deformation. In both cases, the movements are caused by the constituent crystalline individuals sliding upon their gliding planes or by polysynthetic twinning. In both cases the motion is facilitated by the application of heat. The agreement between the two is so close that the term "flow" is just as correctly applied to the movement of the marble in compression under the conditions described, as it is to the movement which takes place in gold when a button of that metal is squeezed flat in a vice, or in iron when a billet is passed between rolls.

In order to ascertain whether the structures exhibited by the deformed marble were those possessed by the limestones and marbles of contorted districts of the earth's crust, a series of forty-two specimens of limestones and marbles from such districts in various parts of the world were selected and carefully studied. Of these, sixteen were found to exhibit the structures seen in the artificially-deformed marble. In these cases the movements had been identical with those developed in the Carrara marble. In six other cases the structure bore certain analogies to those in the deformed rock but were of doubtful origin, while in the remaining twenty the structure was different.

The following is a summary of the results arrived at :—

1. By submitting limestone or marble to differential pressures exceeding the elastic limit of the rock and under the conditions described in this paper, permanent deformation can be produced.

2. This deformation, when carried out at ordinary temperatures, is due in part to a cataclastic structure and in part to twinning and gliding movements in the individual crystals comprising the rock.

3. Both of these structures are seen in contorted limestones and marbles in nature.

4. When the deformation is carried out at 300° C., or better at 400° C., the cataclastic structure is not developed, and the whole movement is due to changes in the shape of the component calcite crystals by twinning and gliding.

5. This latter movement is identical with that produced in metals by squeezing or hammering, a movement which in metals, as a general rule, as in marble, is facilitated by increase of temperature.

6. There is therefore a flow of marble just as there is a flow of metals, under suitable conditions of pressure.

7. The movement is also identical with that seen in glacial ice, although in the latter case the movement may not be entirely of this character.

8. In these experiments the presence of water was not observed to exert any influence.

9. It is believed, from the results of other experiments now being carried out but not yet completed, that similar movements can, to a certain extent at least, be induced in granite and other harder crystalline rocks.

Ostracoda of the Basal Cambrian Rocks in Cape Breton

By G. F. Matthew, LL. D., F.R.S.C.

Investigations of the Cambrian rocks in Cape Breton has brought to the writer's notice a number of new types of these small Entomostracans, and with the permission of the Director of the Canadian Geological Survey, these are communicated to the Natural History Society of Montreal.

The species all come from the Etcheminian sandstones and shales, and from a body of shales included in the volcanic rocks which underlie them. This part of the Cambrian appears to contain three faunas, one in the shales of the volcanic rocks, and two in the Etcheminian sediments.

Only two species of Ostracoda have been found in the shales of the volcanic rocks, so that the bulk of the fauna is Etcheminian. The distribution of the forms throughout this series of beds will be readily seen by the accompanying table. The three larger divisions of the Etcheminian shown in the table are lithological, and the Lower Etcheminian Fauna is confined to the two lower divisions; the Upper Fauna is in No. 3, the upper division. The letters beneath these divisional spaces indicate the successive assises in which fossils have been found. No Ostracoda of the Protolenus Zone have been recognized in these beds, and so it is supposed they are older than that fauna.

LIST OF OSTRACODA OF THE COLDBROOK AND ETCHEMINIAN TERRANES IN CAPE BRETON WITH THE HORIZONS AT WHICH THEY ARE FOUND.

	NAMES OF SPECIES AND MUTATIONS.	Coldbrook.	ETCHEMINIAN.													
			1					2			3					
			a	*b*	*c*	*d*	*e*	*a*	*b*	*c*	*a*	*b*	*c*	*d*	*e*	*f*
	Leperditia (?) rugosa															x
Rutelliform.	Bradorona perspicator					x										
	" " mut. maxima				x											
	" " " magna								x							
	" " " major															x
	" spectator				x	x										
	" " mut. acuta			x		x										
	" " " spinosa						x							x		
	" " " æquata															
Oblique.	" observator					x										
	" " var. benepuncta					x										
	" " mut. lævis			x						x						
	" " " ligata														x	
Small.	Bradoria scrutator														x	
	" vigilans														x	
	" " mut. obesa, &c			x	x	x										
	" rugulosa														x	

LIST OF OSTRACODA. &c.—*Continued.*

NAMES OF SPECIES AND MUTATIONS.	Coldbrook.	ETCHEMINIAN.														
		1					2			1						
		a	*b*	*c*	*d*	*e*	*a*	*b*	*c*	*a*	*b*	*c*	*d*	*e*	*f*
Bradoria (?) ornata	...	...	...	x											
Escasona rutellum	...	...	...	..	...	...		...	...	...	...	...	...	..	x
" (?) vetus	...	...	..	..	x										
" (??) ingens	x														
Indiana ovalis	...	..	...	...	...	x	...	...	...	...	...	...	...	x	
" " mut prima	x														
" lippa	...	...	..	...	...	...	...	...	...	..	...	...	...		x
Schmidtella (?) pervetus	...	...	...	...	...	..	...	...	...	..	...	...	..	x	
" " mut. concinna	...	..	...	...	x										
" (?) acuta	...	...	...	..	...	...	...	...	...	...	..	...	...	x	x
	2		3	4	8	2		1	1				1	7	5

4 genera.
15 species.
11 mut'ns.
1 variety.
} 27 forms.

OSTRACODA.

The Ostracoda found in those deposits afford a means of discriminating the layers, second only to the Brachiopoda. They are not nearly so numerous as the latter, or they would be even more valuable in this respect, as they show considerable liability to variation.

From their small size they are easily overlooked, but their thick and strong shells have resisted destructive agencies, and give examples that have not suffered so much from distortion and pressure as some of the Brachiopods.

They possess some features of form and structure which are peculiar. One notable feature is the position of the main muscle scar.

Mr. E. O. Ulrich, who has given much attention to the study of the Ordovician and Silurian Ostracoda seems to assume that the place for the muscle is near the centre of the valve. At least he speaks of this as the position of this mark in Leperditia* ; it is from the hinge to this point that the sulcus or transverse groove extends in this genus And if there is any meaning in this connection in the central depression of the valve a similar position for the muscle scar may be inferred for Primitia Primitiella Isochilina, Kerbya, Entomis and other genera.

But in the Etcheminian species of Ostracoda and in many of those of the Protolenus Fauna of the St. John Group, we have not been able to find any in which the muscle scar is so placed. On the contrary many examples occur in which the scar holds an anterior position near the hinge line. This peculiarity would have given great mobility to the valves and it is a fact that while in many cases we find the valves spread somewhat apart, there are others in which they are spread out flat and yet retain their normal connection.

* Lower Silurian Ostracoda of Minnesota. p. 633.

If there is any meaning in these furrows that extend from the hinge as indicating muscular attachment there is a sugestion of a posterior muscle, towards the posterior end of the cardinal line in the depression that exists there in Beyrichona and Hipponicharion, and is faintly shown in Escasona. But of such posterior muscle we have no sure evidence. Of the anterior adductor muscle, however, there are plain indications on the interior of many valves.

It is clear that Ostracods having such a radical difference of structure from those others of a later time, must have had different habits of life, and among other peculiarities noted is that they usually occur solitary. Seldom do we find any aggregations of individuals and never the swarms on a single layer of rock that may be found in occurrences of the later Ostracods ; hence they appear not to have possessed in any marked degree the gregarious habit of these later genera.

Another peculiarity of the Etcheminian and Protolenian forms, as distinguished from the prevalent Ostracoda of Ordovician and Silurian Time, is the unusual convexity of the front moiety of the valve as compared with the other. This for some time led the author to be uncertain as to which was the anterior end of the valve in the genus Beyrichona. He, however, now has no longer any doubt, as the related genus Bradoria, with its prominent ocular tubercle sets this matter at rest, and shows that the thick end of the valves is the anterior one.

Another common feature is the prevalence of species which are as wide or wider than long. This peculiarity is connected with a long hinge line and with more or less abrupt cardinal curves of the margin, before these merge into the true anterior and posterior margins of the valves (see Plate I. figs. 1 to 6, *a* & *b*). When the angle at the lower end of these cardinal curves is acute, a tubercle is sometimes developed, in addition to that which marks the anterior and often the posterior end of the hinge line (Pl. I. fig.13, *a* & *c*.

These laterally expanded valves are in a number of species pointed at the lower margin and in most the ventral margin is more or less angulated (Pl. I figs. 2, 3 and 6). It thus admits of division into two portions which may be designated the anterior and posterior curves (*e* and *d*), according to whether the part of the margin indicated is in front or behind the ventral angulation. Sometimes the anterior curve of the margin will be stronger as in Beyrichona (Fig. 3) (and Escasona? Fig. 6), sometimes the posterior curve, as in Indiana (Fig 1) and Bradorona (Fig. 2), is the stronger. In Hipponicharion (Fig. 4) the two are about equal,

The cardinal curves (Pl.I.figs. 2 etc., *a* and *b*,) extend from the hinge line along the margin until it becomes at right angles to the hinge, and they also vary greatly in direction and extent. Thus in Indiana (Fig. 1) the posterior one is long, the anterior shorter ; in Bradorona (Fig. 2) they are approximatively of equal length ; in Beyrichona (Fig. 3), sp. *papilio,* the posterior one is almost obsolete but in other species (*tinea, planata, etc.,*) of this genus, it is well shown, and with these the species of Escasona (Fig. 6) agree. In Bradoria (Fig. 5) both cardinal curves, and especially the posterior are well shown. In Hipponicharion on the contrary these curves are almost obsolete.

The relation of the muscle scar to the ocular tubercle is also a means of discriminating the genera in these early forms of Ostracoda : thus in Bradorona (Fig. 2) and Bradoria (Fig. 5) it is diagonally behind and below the tubercle, but in Beyrichona it is below and somewhat in front of the tubercle. In Hipponicharion (Fig. 4) the muscle print presses in behind and below the tubercle. In Indiana (Fig. 1) the scar though not well recognized appears to be as in Bradorona (Fig. 2). In Escasona neither muscle scar nor tubercle have been certainly identified.

Comparing this group of genera with those of the Ordovician and Silurian, we note some obvious differences from them. Perhaps the most notable is the way in which the visual and muscular organs are crowded at the front end of the hinge. This would exclude them from the great family of the Leperditidæ, Jones, in which the muscle scar is near the middle of the valve, The lateral expansion of the valves also is characterestic, and still more the way in which many are pointed at the middle of the ventral margin.

We see no nearer relation in these species to the "zoe" group of giants described by Barrande, than to the Leperditidæ; these remind one more of the bivalve carapaces of Phyllopod crustaceans. The Canadian forms, though many are above the average size of the fossil Ostracoda, are far inferior in this respect to Aristozoe and its allies.

It seems to the writer that the position of the main adductor muscle scar separates these species from all described Ostracoda, and he would suggest for them the designation Bradoriidæ, taking as types the genera Beyrichona and Bradoria. Hipponicharion is widely divergant from the others and in its strongly ridged surface simulates Beyrichia and may for the present be placed in the family Beyrichidæ.

LEPERDITIA ? ? RUGOSA, n, sp. Pl. I. fig. 7*a* to *c*.

This species may prove to be of another genus when more numerous examples are found. The single example found does not seem to justify a final reference to any described genus.

Only the right valve is known and this is rather flat, and flattened toward the hinge and the posterior slope; its greatest convexity is in the middle and the lower third The outline is broadly oval, with a hinge line half of the length of the valve. The anterior and posterior cardinal curves are long; the posterior marginal curve and the lower side of the valve are both somewhat straightened, and the anterior marginal curve strongly rounded.

There is an obscure ocular tubercle situated at the upper front angle of the valve; and an obscure, short and weak furrow behind it; about the middle of the cardinal line is a low, faintly marked tubercule. There is a trace of a marginal furrow along the posterior margin.

Sculpture. Corrosion of the surface has obscured the usual markings, leaving a rough surface, which is crossed in several directions by broken ridges, without regularity; except towards the lower margin of the valve, where there are several sub-parallel to the margin.

Size. This is the largest Ostracod obtained from the Etcheminian Group—Length 6½ mm, width 5 mm, depth about 1¼ mm.

Horizon and locality. Assise E. 3. f. Upper Etcheminian, at Gillis', Indian Brook, Escasonie N. S. Scarce.

The flat form and wrinkled surface of this valve indicates a thin chitinous test. It may have distant affinities with *Isoxys*, Walcott, but is entirely different in form. It also approaches in outline *Aristozoe rotundata* Walcott,* but is of different relief.

BRADORONA, n. sub-gen.

The description of the genus Bradoria applies more particularly to the smaller elongate forms, described in the Bulletin of the Natural History Society of New Brunswick.† But beside these the Etcheminian beds contain a group of larger forms, with similar ocular tubercle and muscle scar, but broader and more triangular in form; most of them belong to the Lower Etcheminian Fauna but there are stragglers in the upper. With their more angulated form they have the front marginal curve straightened. These we propose to distinguish as a subgenus under the name Bradorona.

BRADORONA PERSPICATOR, n, sp. Pl. I,, fig. 8*a* to *d*.

This is one of the largest Ostracods, found in the Cape

* Fauna of the Olenellus zone p. 627 pl. i. xxx fig. 3.

† Bull Nat. Hist. Soc. N. B. Vol. iv. p. 204 St John 1899.

Breton Etcheminian rocks and, if the following mutations are properly referred to it, extends through them in varying forms and sizes.

In this typical form the hinge is more than three-fifths of the width of the valves. The posterior cardinal curve is long and straight, the margin bears a thread-like marginal fold on the left valve and there is a narrow obscure furrow, within the margin along the anterior and posterior marginal curves. The hinge margin is thickened, and a tubercle marks the posterior end of the hinge line (of at least the right valve). The ocular tubercle is distinct in each valve, behind which is a shallow furrow extending a short distance below it. There is also a short, obscure ridge extending obliquely downward from the ocular tubercle toward the lower margin of the valve.

The greatest convexity of the valve is two-fifths below the hinge line, and the slope to the anterior margin is steep.

Sculpture. In all the forms of this species obtained, the sculpture has been obscured by corrosion, but remains of the cortex that have escaped this destructive change, show a pitted surface. By a linear arrangement of the pits along the anterior and posterior slopes of the valves an appearance of parallel ridges has been produced.

Size. Length $4\frac{3}{4}$ mm. Width 4 mm. Depth of each valve $1\frac{1}{2}$ mm.

Horizon and locality. This is of the Lower Etcheminian Fauna, and occurs in Assise E. 1. d. at Dugald Brook, Escasonie, N. S.—Frequent.

The following measurements exhibit some variations in size.

A right valve,	length	$4\frac{1}{2}$	mm,	width	$4\frac{1}{2}$	mm,	depth	$1\frac{1}{2}$	mm.
Another	"	4	"	"	$4\frac{3}{4}$	"	"	$1\frac{1}{2}$	"
A left	"	4	"	"	$4\frac{3}{4}$	"	"	$1\frac{1}{2}$	"

Mutation MAXIMA, n. mut. Pl. I., figs. 9 *a, b.*

This is the largest form of the species observed ; it is more rounded at the two ends and below, than the type and is flatter, but is of the same general form.

The hinge-line is two thirds of the length of the valve. The posterior cardinal curve is angulated. There is an obscure furrow behind the ocular tubercle, extending half across the valve; a low ridge extends along the anterior margin, a little within it, and a fainter ridge along and near the posterior cardinal curve; a narrow marginal furrow is visible along the anterior marginal curve; an obscure row of tubercles extends along and near the anterior half of the hinge of line.

Sculpture. Surface pitted, the spaces between the punctures becoming anastomosing ridges near the margin, and presenting ridges on the posterior half of the valve subparallel to the margin.

Size. Length 6mm, width 5mm, depth of a valve $1\frac{3}{4}$mm.

Horizon and locality. Assise E. i *c*, Lower Etcheminian, at Dugald Brook, Scarce.

Mutation MAGNA, n. mut. Pl. I., figs. 11 *a* and *b*.

Valves rather tumid, hinge-line shorter than in the type, two fifths of the length of the valve; ocular tubercle prominent, behind, and around it is a shallow furrow; cardinal curves of the margin long. No marginal furrow is visib*l*

Sceupture. Surface pitted; there are obscure anastomosing ridges between the pits parallel to and near the margin; a narrow obscure band extends from the ocular tubercle obliquely backward and downward.

Size. Length, 5 mm; width, 4 mm.; depth, of a valve $1\frac{1}{2}$ mm.

Horizon and locality. Assise E. 2 b, Lower Etcheminian, at Dugald Brook, Scarce.

Mutation MAJOR, n. mut. Pl. I. figs. 10 *a* and *b*.

Valves rather tumid, hinge-line about three fifths of the length of the valve. Cardinal curves rounded; no marginal furrows seen. Ocular tubercle a little way from the hinge; a broad obscure furrow behind it. An obscure ridge runs from the posterior marginal curve to the anterior middle of the valve, and thence curves up to the lower end of the anterior cardinal curve.

Size. Length $5\frac{1}{2}$mm.; width $4\frac{1}{2}$mm.; depth of a valve $1\frac{1}{2}$mm.

Horizon and locality. Assise E. 3. f., Upper Etcheminian at Dugald Brook, Scarce.

BRADORONA SPECTATOR, n. sp. Pl. I. figs. 12 *a* to *d*.

This species is smaller than the preceding and has a more finely pitted surface. The length and breadth of the valves are about equal. Length of the hinge more than half that of the valve ($\frac{4}{7}$); the anterior and posterior cardinal curves are about equal in length; both anterior and posterior marginal curves are convex. The upper part of the valve is most protuberent as in Schmidtella. A sharp marginal furrow shows on some valves. The ocular tubercle is prominent; some examples show a short thread-like ridge extending diagonally backward from the tubercle; this corresponds to a furrow on the inside of the valve.

Size. Length and breadth each $3\frac{1}{2}$ mm.; depth of a valve 1 mm.

Horizon and locality. In the dark brownish gray sandy shale of Assise E. 1 *d*, Lower Etcheminian, at Boundary Brook, Escasonie, Rather common. Also in Assises E. 1. *b*. and E. 1. *d*. at Dugald Brook, Infrequent

Var. ACUTA, n. var.

This is a large form more pointed below than the type. Anterior marginal slope somewhat straightened. Ocular tubercle distinct.

Sculpture. Surface minutely punctate, and showing a strong striation near the hinge.

Size. Length and breadth each about 4 mm.; depth of a valve 1 mm.

Horizon and locality. Assise E. 1. b., Lower Etcheminian, at Dugald Brook, Infrequent.

A small example, supposed to be the young of this form is narrower, more acutely pointed below, and with straighter anterior and posterior marginal curve, was found in Assise E. 1 *d.* at Boundary Brook

Mutation SPINOSA, n. mut. Pl. I. figs. 13 *a* and *b.*

Wide below the cardinal curves. Anterior marginal curve straightened. A sharp marginal furrow all around except at the hinge.

The ocular tubercle is distinct and there are spines at the ends of the cardinal curves, except at the lower end of the posterior curve.

Sculpture. The surface is minutely punctate ; on the posterior slope of the valves and on a band descending backward from the ocular tubercle, the pits merge into interrupted striæ, divided by inosculating ridges.

Size. Length and breadth each about 4 mm.; depth of a valve $1\frac{1}{4}$ mm.

Horizon and locality. An entire carapace in the Assise E. 1. *e.*, Lower Etcheminian, at Dugald Brook, Scarce.

Mutation ÆQUATA, n. mut. Pl. I. figs. 14 *a* and *b.*

Anterior and posterior sides nearly equal. The form is oval, and is wide below the cardinal curves, which are long. Anterior as well as posterior marginal curve regularly arched.

Sculpture. The surface has been corroded, but shows traces of a minute pitting.

Size. Length and breadth each $3\frac{3}{4}$ mm ; depth of a valve 1 mm.

Horizon and locality. In Assise E. 3. *d.* Upper Etcheminian Fauna, at Dugald Brook, Rare.

BRADORONA OBSERVATOR, n. sp. Pl. I. figs. 15 *a* to *c.*

A small species of the same general form as the preceding, but the anterior marginal curve is more oblique to the hingeline, the ventral angle being opposite to the posterior half of the cardinal line ; this (2 mm. long) is considerably more than half of the length of the valve.

The anterior cardinal curve is angulated at each end ; the posterior is a third longer than the anterior. The anterior marginal curve is straightened and is considerably longer than the posterior, which is strongly arched outward. A narrow thread-like marginal fold is visible in some places. A thickened band within the margin, in some places shows slight protuberences.

Sculpture. In most examples the surface is scabrous from corrosion, but some show traces of a minute pitting, and near the margins of the valve these pit form continuous rows, or furrows. The mould of the interior shows a smooth surface having minute punctures. The muscle scar behind the ocular tubercle, is distinct on the mould.

Size. Length $3\frac{1}{2}$ mm ; width 3 mm ; depth of a valve 1 mm.

Horizon and locality. In Assise E. 1. *d.*, Lower Etcheminian, at Boundary Brook, Common.

The following are measurement of several valves from this locality.

left valve,	length	$3\frac{1}{4}$	mm,	width	$2\frac{1}{2}$	mm,	depth	1	mm.
2 " "	"	$3\frac{1}{2}$	"	"	3	"	"	1	"
" "	"	$3\frac{1}{4}$	"	"	$2\frac{3}{4}$	"	"	$\frac{3}{4}$	"
" "	"	$3\frac{1}{4}$	"	"	$2\frac{3}{4}$	"	"	$\frac{3}{4}$	"
carapace	"	$3\frac{3}{4}$	"	"	$2\frac{3}{4}$	"	"	2	"

Three forms which may be classed as varieties of this species are the following.

Var. BENEPUNCTA, n. var. Pl. I. fig. 16.

Anterior cardinal curve longer than the posterior ; anterior marginal curve straightened and the greatest width of the valve posterior to the middle. Hinge-line nearly half of the length of the valve ($2\frac{1}{2}$ mm). Ocular tubercle distinct; a shallow furrow behind and below it. A faint ridge extends forward from the posterior end of the hinge half way to the furrow below the ocular tubercle. Another example, more oval and more tumid, has an obscure row of tubercules arching outward and forward from the posterior cardinal angle to the anterior cardinal curve. A low ridge extends back from the ocular tubercle to the hinge.

Sculpture. The surface is corroded, but on the posterior slope of the valve are anastomosing ridges parallel to the margin.

Size. Length $4\frac{1}{2}$mm; width $3\frac{1}{2}$mm; depth of a valve 1mm. A carapace from this locality had length $4\frac{1}{4}$ mm; width $3\frac{1}{4}$ mm; depth of the two valves 3 mm.

Horizon and locality. Assise E. 1. *d.*, Lower Etcheminian, at Boundary Brook, Scarce.

Mutation LÆVIS, n. mut.

Oval, cardinal curves long, the anterior one rounded. Hinge line more than half the length of the valve ($\frac{5}{8}$), a tubercle at the posterior end. Ocular tubercle off from the hinge-line and prominent; ocular furrow shallow. The right valve has a thread-like marginal fold; no fold on the posterior slope of the left valve.

Sculpture. Punctation fine, showing anastomosing ridges near to and parallel to the posterior slope of the valve. An example from the higher horizon shows a thickened band near the margin along the posterior marginal slope, that bears obscure elongated tubercles. An example of the mould from the same horizon has three small pits behind the ocular tubercle, parallel to the hinge.

Size. Length $4\frac{1}{4}$mm; Width $3\frac{1}{4}$ mm; depth 1 mm.

Horizon and locality. Occurs in assises E. 1. *b*, and E. 2. *c*, Lower Etcheminian, at Dugald Brook.

The following are measurements of examples from the two horizons:

E. 1. *b*, carapace,	length 4mm;	width 3 mm;	depth $2\frac{1}{4}$mm.
" "	" $3\frac{1}{4}$ "	" 3 "	" $1\frac{1}{2}$ "
E. 2. *c*. right valve	" $4\frac{1}{4}$ "	" $3\frac{1}{4}$ "	" 1

Mutation LIGATA, n. mut. Pl. I., fig. 17.

Oval, cardinal curves long, anterior marginal curve straight, posterior ornamented with a row of small tubercles; a similar row extends direct from the lower end of the posterior cardinal curve toward the lower end of the valve, near which it curves forward. Ocular tubercle obscure, it appears to be represented by four small tubercles ; but the furrow is well marked.

Sculpture. Punctation rather coarse; anastomosing ridges near the two ends of the valve, parallel to the margin.

Size. Length 4 mm ; width 3 mm ; depth of two valves 2 mm.

Horizon and locality . Assise E. 3. *e.*, Upper Etcheminian, at Dugald Brook. Rare.

" BRADORIA.*

" In the Protolenus Fauna are two species of Ostracoda which for want of other known relationship were referred to the genus Primitia. It would appear now that they are representatives of an ancient type of crustaceans which has species in the Etcheminian Fauna. Though having the general form of Primitia, Primitiella and Aparchites they do not have the median pit, or sulcus of the first, the shallow median depression of the second, or the smooth valve of the third. Their most marked character is a prominence or tubercle just at the front of the hinge-line; from the smoothness of the summit of this tubercle, and its advantageous position for vision, it is supposed to be an ocular tubercle. Some of the species have close behind this tubercle, a short vertical furrow ; or the fur-

* Nat, Hist. Soc. N. Brunswick, Bull. vol. iv, p. 204.

Named for the Bras d'or, a salt water lake occupying the interior of the island of Cape Breton.

row may pass around the tubercle. In the five species referred here the marginal furrow is obscure, or in side view along the lower margin, invisible.

The known species are of nearly the same size—about 3 to 4 mm. long—and the surface of the valves is distinctly pitted, tuberculated or wrinkled. The following are the species which fall under this genus. *Primitia oculata* and *P. aurora* of the Protolenus Fauna and the following species."

BRADORIA SCRUTATOR. Pl. II, figs. 1 *a* to *c*.

Bradoria scrutator, n. sp. Nat. Hist. Soc. N. B. Bull. vol iv. p. 204, pl. iv, figs. 1. *a* to *c*.

"Outline of the valves ovate, with a straight hinge-line. Hinge-line more than half the length of the valve, terminating in front at a short transverse furrow, situated immediately behind the tubercle. The hinge is bordered all along its course by a narrow sharp ridge, similar to a marginal ridge. The tubercle is nearly marginal, and is situated just in front of the hinge-line. In front of it the margin of the valve turns downward, and is bordered by a narrow obscure furrow, which extends around the ventral margin of the valve. There is a slight angulation of the outline of the valve at the middle of the anterior border, separating there the cardinal and anterior curves. The posterior margin rounds regularly upward behind to the hinge-line.

Sculpture. The whole surface of the valve is covered with closely set, rather coarse, conspicuous pits that are finer toward the hinge where they have a linear arrangement." On the posterior half, toward the posterior margin the tubercles between the pits have a tendency to coalesce, and thus produce obscure ridges whose course is directed toward the lower border of the valve.

"*Size.* Length 3 mm; width" $2\frac{1}{4}$ mm; depth 1 mm.

Horizon and locality. Assise E. 3. *e.*, Upper Etcheminian, at Dugald Brook.

Additional material shows much better the characters of this species. In this the valves have been of a more distinctly oval form than in those of the preceeding species, the cardinal curves being rounded so that the straightening of the anterior marginal curve alone defines the length of the cardinal curve above it. The posterior cardinal curve is rounded to the hinge, and the lower edge of the valve is broadly rounded.

Sculpture. (2) The interior shows a large muscle scar near the hinge-line, behind the ocular tubercle; and also an unusually long straight groove, directed backward and downward, in front of the tubercle; a fainter, shorter groove directed toward the anterior margin lies in front of this. A thickened band of the shell substance making a slight ridge on the inner surface, exteuds from the posterior cardinal angle, around the ventral slope of the shell to the anterior marginal curve. The following are measurements of some valves;

Left valve,	length	3 mm;	width	$2\frac{1}{4}$ mm;	depth	1 mm.
Right "	"	$3\frac{1}{4}$ "	"	$2\frac{1}{4}$ "	"	1 "
" "	"	3 "	"	$2\frac{1}{3}$ "	"	$1\frac{1}{4}$ "
Carapace	"	$2\frac{3}{4}$ "	"	2 "	"	2 "

As compared with the species of the Protolenus zone—this species is a little larger than *B. oculata,* from which it is easily distinguished by the character of the surface ornamentation; in the Etcheminian species thə pits are coarser and closer together, and it thus has a rougher surface than the species above named. The sculpturing is more like that of *Isochilina ventricosa*, which, however, is a much larger species. *P. aurora* of the Protolenus zone is nearly of the same size, but it differs in the strong anterior furrow, and in its finely pitted surface.

BRADORIA VIGILANS. Pl. II., figs. 2 *a* to *c*.

Bradoria vigilans, n. sp. Nat. Hist. Soc. N. B. Bull, vol. IV. p. 205. pl. iv. figs 2 *a* to *c*.

" Outline of the valves ovate, somewhat pointed behind, moderately arched transversely the valves somewhat ridged lengthwise. The right valve has a hinge-line about half of the length of the valve, which is flattened down at the hinge forming there a lance oval area. There is a prominent tubercle at the front of the hinge surrounded by a shallow groove. The margin is gradually rounded from the front, and projects somewhat at the posterior end, whence the posterior cardinal curve goes directly upward to the back of the hinge.

Sculpture. The surface is marked by close set granulations, that become finer toward the hinge-line and the ocular tubercle; at the posterior quarter of the valves the granulation graduates into a series of subparallel anastomosing ridges.

Size. Length $3\frac{1}{2}$ mm. Width $2\frac{1}{2}$ mm." Depth $\frac{3}{4}$ mm.

Horizon and locality. Found in Assise E. 3 *e*. of the Upper Etcheminian, Dugald Brook, Escasonie, Cape Breton.

"Distinguished from *Aparchites conchiformis* of the Protolenus Fauna, by its smaller size and prominent tubercle; and from *A. secunda* by the tubercle and the coarser ornamentation," as well as by the angulated projection at the end of the valve.

An additional example of this species from the bed in which the original was found, and three others from a layer about a foot lower in the measures, give additional information of the species.

These examples are wider than the type. The ocular tubercle in this species is a little off from the hinge-line. The cardinal slopes are long and the anterior marginal slope is somewhat straightened.

The following are measurements of some valves:—

right valve,	length	$3\frac{1}{4}$	mm.,	width	$2\frac{1}{4}$	mm.,	depth	$\frac{3}{4}$	mm.
" "	"	$3\frac{1}{4}$	"	"	$2\frac{1}{4}$	"	"	1	"
" "	"	3	"	"	2	"	"	1	"
" "	"	3	"	"	$2\frac{1}{4}$	"	"	1	"
" "	"	$3\frac{1}{2}$	"	"	$2\frac{1}{2}$	"	"	1	"
carapace	"	3	"	"	$2\frac{1}{4}$	"	"	2	"

Mutations.

In the lower Etcheminian Fauna some forms occur which may be referred to this species as mutations.

Assise E. 1. b. mut. *obesa*, n mut.

A broader and more tumid form than the type. The hinge-line is three-fifths of the length of the valve and there is a tubercle at the posterior end of the hinge-line The ocular tubercle is prominent and enclosed by the furrow; a row of low and obscure tubercles runs curving from the ocular tubercle to the lower angle of the valve

Sculpture. The surface is marked by a fine punctation, and by anastomosing ridges on the posterior half of the valve; a diagonal band of these ridges runs from the ocular tubercle, diagonally backward and downward to the lower part of the anterior margin.

Size. Length 3mm, width $2\frac{1}{2}$mm, depth two valves together $1\frac{1}{2}$mm.

Assise E. 1. c. A form occurs here which is flatter than the preceeding and smaller.

This form differs from the young of *Bradorona observator* of the lower fauna in the deeper furrow around the tubercle, and in the rounder base of the valve; hence we have associated it with *B. vigilans*

Assise E. 1. d. An imperfectly preserved right valve was obtained here from beds of feldspathic sandy shale. It is considerably smaller than the type, and the surface is rough and dull from corrosion.

Size. Length of a valve $2\frac{1}{2}$mm., width $1\frac{3}{4}$mm., depth $\frac{1}{2}$mm.

BRADORIA RUGULOSA, Pl. II., figs. 3 *a* to *d.*

Bradoria rugulosa, n. sp. Nat. Hist. Soc. N. B. Bull. iv. p. 205. pl. iii, figs. 3 *a* to *d.*

"A suborbicular species of which only the right valve is known. Tubercle rather prominent, some distance below the anterior end of the cardinal line; this line is nearly straight and about half of the length of the valve. There is a faint furrow behind the tubercle. A narrow obscure marginal rim appears at the back of the valve.

Sculpture. The lower slope and the posterior half of the valve are covered with anastomosing ridges, concentric to the upper front part of the valve ; toward the top and front of the valve these ridges become obscure aad the surface of the valve is granulated.

Size Length $2\frac{3}{4}$ mm., width" $2\frac{1}{2}$ mm., depth less than $\frac{1}{2}$ mm.

Horizon and locality. In assise E. 3. *e.,* Upper Etcheminian Fauna, Dugald Brook, Escasonie, Cape Breton Rare.

" This little species is easily distinguished from others of the genus by it orbicular form and rugulose surface which is like that of certain trilobites."

MUTATION.

A small right valve of the form of this is found in Assise E. 1 *c.* Lower Etcheminian, at Dugald Brook. The punctation is fine and distinct, and the rugulose surface is seen only near the margin of the valve.

BRADORIA ? ORNATA, n. sp. Pl. II, figs. 4 *a* to *c.*

The valves in this species are rather flat and are rounded to the hinge and lower margin, but not much to the ends.

Only one example known, which is supposed to be a right valve.

Suboval with a long hinge-line, about three quarters of the length of the valve. Anterior cardinal curve short, posterior longer. Anterior marginal curve long, rounded; posterior shorter, rounded forward. The valve is more tumid in the cardinal third, and rounded to the hinge, where there is a low narrow ridge. A thread-like marginal fold is visible in some parts of the margin.

In this species there is no definite ocular tubercle, but a group of several small tubercles on a slight elevation, occupy its place. The ocular furrow is shallow, and close to the front of the hinge, and extends downward opposite the anterior cardinal curve.

Sculpture. The surface is covered with distinct pits, the spaces between which become inosculating ridges, subparallel to the length of the valve, but tending downward in the direction of the front of the valve; towards the hinge line the pitting is very minute.

Size Length $2\frac{1}{4}$ mm., width $1\frac{1}{2}$ mm., depth of a valve nearly $\frac{1}{2}$ mm.

Horizon and locality. Assise E. 1. *c.* Lower Etcheminian Fauna, at Dugald Brook.

The sculpture, something like that of an Entomis or a Kerbya but finer, separates this little species from the others.

ESCASONA, n gen.

A few forms which cannot be referred to any genus of the Eopalæzoic are present at two horizons in the Etcheminian. The typical form is in one of the highest beds of the Upper Etcheminian. It is short and high and the slight eminence which appears to indicate the ocular tubercle is close to the hinge. There is a long slope from the hinge toward the middle of the valve, it thus resembles Beyrichona; but it does not have the two strong furrows or pits near the hinge which characterize that genus; nor is the slope from the hinge so long. Though tumid in the upper third of the valve this form cannot be classed with Schmidtella, because the slope in the upper third of the valve is not bent down abruptly to the hinge, as in that genus; and furthermore the outline of the valve is that of Beyrichona and Bradorona, and not the round valve of Schmidtella. I refer to this genus *Beyrichona ovata* of the Protolenus fauna. The typical characters of the genus are in the following species, *E. rutellum.*

ESCASONA RUTELLUM, n. sp. Pl. figs. 5 *a* to *c*.

A broad tumid species. Hinge two-thirds of the width of the valve. Anterior cardinal curve obsolete; posterior one half of the length of the hinge, anterior marginal curve long, arched; posterior shorter, nearly straight, lower end of the valve obtusely pointed.

Highest point of the valve one-third from the hinge and two-fifths from the posterior margin. The ocular tubercle is small, close to the hinge and some distance from the anterior end. The posterior slope of the valve is flattened. The cardinal slope of the surface of the valve has a broad shallow furrow extending down nearly to the highest part of the valve. The arched anterior sloped surface of the valve is evenly curved down to the border.

Sculpture.—The surface of the shell has been corroded, and the pitted surface is obscure.

Size.—Length, 3 mm; width, $3\frac{3}{4}$ mm; depth, $1\frac{1}{2}$ mm.

Horizon and Locality.—Assise E. 3 *f.*, Upper Etcheminian, at Gillis' Indian Brook. Scarce.

ESCASONA (?) VETUS, n. sp. Pl. II., figs. 6 *a* and *b*.

This form, represented by a right (?) valve, has a more rounded surface than the type, and the valve is flatter. No ocular tubercle is determinable. The hinge line is very long (sixth-sevenths of length) and there is a shallow furrow extending from it on the cardinal slope of the valve. The valve is most tumid toward the posterior (?) side; and the ventral angle is vertically behind the end of the cardinal line. A broad thickened band runs around the supposed posterior margin.

Sculpture.—The shell is minutely pitted, but it is mostly decorticated.

Size.—Length, 3 mm.; width, $3\frac{1}{2}$ mm.; depth, $\frac{3}{4}$ mm.

Horizon and Locality.—Assise E. 1 *d.* Lower Etcheminian, at Boundary Brook.

ESCASONA (??) INGENS, n. sp. Pl. II. figs. 7 *a* to *c*.

Only one valve known. The unusual form agrees with none of the other genera of the Etcheminian Ostracods. It appears to be a left valve and is so described here. The outline is obliquely subtriangular and somewhat wider than long.

The hinge line is three-quarters of the length of the valve; a shallow furrow runs parallel to the hinge, and near it for two-thirds of the length of the valve. No ocular tubercle could be detected, but at what appears to be the posterior upper angle of the valve is a small tubercle. The anterior cardinal curve is short and nearly in the direction of the hinge; the posterior is wanting. The anterior marginal curve is long and strongly arched; the posterior is shorter and less arched, abruptly rounded below, and at a right angle with the hinge line. The valve is highest at the middle, gently arched toward the hinge, and to the lower margin of the valve, and more abruptly towards the anterior margin. A faint ridge or swelling runs along the back of the valve near the margin. Lower angle of the valve bluntly rounded. Traces of a narrow marginal fold are preserved in some places.

Sculpture.—The surface is corroded, and only in a few places can a fine punctation be seen.

Size.—Length, 6 mm.; width, $6\frac{1}{2}$ mm.; depth, $1\frac{1}{4}$ mm.

Horizon and Locality.—In a fine gray shale, containing grains and lumps of calcium phosphate, included in the Coldbrook volcanic rocks at Dugald Brook, Escasonie. Scarce.

This ancient Ostracod has the outline of a Beyrichona, but there is no flattened cardinal area of the valve, nor any trace of the deep muscle-pit of that genus. It is separated from Bradoria by the absence of ocular tubercle and posterior cardinal slope. It is provisionally placed in Escasona, though lacking the high elevation of the cardinal third of the valve, peculiar to that genus.

INDIANA, n gen.

Two forms of Ostracods of the Etcheminian Fauna differ from any of the preceeding by their marked oval form and do not seem to fall into any of the later genera. The author has heretofore referred resembling forms to Aparchites and Primitia, but omitting from consideration the large size of most of the Basal Cambrian species, they also have usually a well developed ocular tubercle, or the rudiments of one.

In a decorticated example there is a faint muscle mark, where the muscle scar is placed in Bradoria and Bradorona, but it projects less toward the middle of the valve than in those.

The genus consists of large to medium-sized Ostracods, oval or ovate in form, the outline somewhat straightened along the hinge, somewhat sharply rounded at the anterior end, more broadly at the posterior. A ventral angle is scarce traceable, and the greatest fulness is in the posterior half of the valve. The valves are evenly rounded, and highest about the middle. An ocular tubercle, or traces of one, can usually be seen in the upper anterior region of the valve.

Length of the known specie, 3 to 6 mm.

Range.—Through the Etcheminian and Protolenus Faunas.

Besides the species described below the following appear to belong here :

Primitia pyriformis. † } Both of the
P.—— (?) fusiformis. * } Protolenus Fauna.

Aparchites (?) robustus† also of that fauna comes near this group.

This genus is seemingly different from Nothozoe of Barrand. Nothozoe is an oval fossil occurring in the Ordovician of Bohemia, which the above author has referred doubtfully to the Ostracoda. The size, however, is much greater than that of the fossils we are dealing with here ‡ and no ocular tubercle has been recognized. For these reasons, as well as on account of the obscurity of the characters at Nothozoe, it seems inadvisable to use this name for the Etcheminian species described below.

Equal objections may be taken to the referring of the Cape Breton species in question to the genus Primitia, or to Aparchites, which hitherto the author has used for the Lower Cambrian forms. The species of these genera are small, and the absence of an ocular tubercle in one, and the presence of a median sulcus in the other, are further distinctions from the species which the author has referred to Indiana. Few species of the genera Primitia and Aparchites attain a size in which the area of the valve is a tenth that of the shells referred to this genus.

INDIANA OVALIS, n. sp. Pl. I, fig. 8 *a* to *c*.

This species is ovate, broader behind than in front. Hinge line about one half of the length of the valve, Cardinal curve of moderate length. Anterior marginal curve long, arched, posterior short, more strongly arched.

† Roy. Soc. Can. Trans., vol. iv., sec. iv., p. 132, pl. i. figs. 3 *a* to *c* 1 and 4 *a* to *c*.
* N.Y. Acad. Sci., Trans. vol, xiv., pp. 237, pl. vii. figs. 3 *a* and *b*.

‡ Individuals of *Nothozoe pollens* (Syst. Silur. Bohm, vol. i., Supp. p. 536 have an area of valve 70 times greater than the largest species of Indiana.

No marginal furrows seen. Ocular tubercle close to the hinge line; a narrow diagonal furrow behind the eye extends to the lower end of the anterior marginal curve.

Sculpture.—Along the lower margin are fine anastomosing ridges; the decorticated part of the valve shows the lower margin of a semi-circular muscle scar, directly behind the ocular tubercle, near the hinge line. Another example of the valve with the surface somewhat corroded shows small pits and also anastomosing ridges on the surface.

Size.—Length, $4\frac{1}{2}$ mm.; width, $3\frac{1}{4}$ mm.; depth of a valve, 1 mm. Another example is $3\frac{1}{2}$ mm. wide.

Horizon and Locality.—Assise, E. 1 *e*. Lower Etcheminian at Dugald Brook. Scarce.

A form similar to this in size, though proportionately wider, occurs in the same assise; and another smaller, broader and flatter, is found is found in the assize E. 3 *e* Upper Etcheminian, at the same brook.

The following are dimensions of some valves:

E. 1 *e*. left valve,	length $4\frac{1}{2}$ mm.	width, $3\frac{1}{4}$ mm.,	depth, 1mm.
E. 1 *e*. carapace,	" $4\frac{1}{2}$ mm.	" $3\frac{1}{2}$ mm.,	" $3\frac{1}{4}$mm.
E. 3 *e*. left valve.	" $4\frac{1}{2}$ mm.	" 3 mm.,	" 1 mm.

Xestoleberis, Sars ('65), as represented by Prof. T. Rupert Jones' species *S. Wrightii*, from the Ordovician of Kildare, Ireland, is like this in form, but is more tumid, and is not shown to possess an ocular tubercle.

Mutation PRIMA, n. mut. Pl. II., 9 *a* to *c*.

A form resembling this species, but longer and larger, is found in the gray shale of the volcanic rocks. The example is a complete carapace, and the valves are crushed somewhat and displaced. There appears to be an ocular tubercle near the anterior end, and the fullest part of the valves is in the lower half.

Sculpture.—The surface is corroded, but there are traces of a fine punctation and of longitudinal striæ on the middle part of the valve.

Size.—Length of a carapace, $5\frac{1}{2}$ mm.; width, $3\frac{1}{2}$ mm.; depth, $2\frac{1}{4}$ mm.

Horizon and Locality.—In fine gray shale in the midst of the volcanic rocks of the Coldbrook group at Dugald Brook. Scarce.

INDIANA LIPPA, n. sp. Pl. II., figs. 10 *a* to *d*.

Hinge line more than half of the length of the valve. Cardinal curves of moderate length; anterior marginal curve twice as long as the posterior, convexly arched. A very faint elevation in the position of the ocular tubercle; and a very shallow depression behind it. There is a thickened and slightly elevated band all around the margin, except at the hinge.

Sculpture.—The surface has been corroded, but there is a fine and rather distant punctation showing on one example; this becomes very fine towards the hinge-line, where anastomosing ridges are developed, running off toward the posterior slope of the valve.

This species differs from the type of the preceding in its more elongate form, greater plumpness and obscure ocular tubercle.

Size.—Length, $4\frac{1}{2}$ mm.; width, $2\frac{3}{4}$ mm.; depth, 2 mm.

Horizon and locality.—Assise E. 3 *f*, Upper Etcheminian, at Dugald Brook. Infrequent.

SCHMIDTELLA.

The two species referred to this genus are provisionally so placed, because they are tumid toward the hinge, and an ocular tubercle has not with certainty been observed. The broad valve, somewhat pointed below, however, is not a usual character of Schmidtella, and the valves are larger than is usual in that genus. If the tubercle were present the following species might be included in Bradorona

SCHMIDTELLA (?) PERVETUS, Pl. II, figs. 11 *a* to *c*.

Schmidtella ? pervetus, n. sp. Nat. Hist. Soc. N.B. Bull, vol iv., p. 206, pl. iv., figs. 3 *a* to *c*.

"Only the right (?) valve is known, [others found since.] The valve is moderately arched and without furrows, and its greatest fullness is in the upper half. The hinge-margin, which is more than half of the length of the valve, is straight and is formed by an infolding of the edge, which is without a furrow. No marginal fold was observed.

Sculpture.—The surface is covered with minute pits, closely placed; the raised spaces between the pits become so prominent on the lower part of the valve that the surface seems tuberculated, rather than pitted; toward the lateral and the lower edges these tubercles are arranged in rows, so that there the valve seems covered with obscure ridges parallel to the margin. At the opposite side of the valve, towards the hinge-line, the pits become very fine, and the surface of the valve has a shining appearance.

Size.—Length, 3 mm.; width, 2½ mm."; depth, 1 mm.

Horizon and Locality.—In Assise E. 3 *e*. of the Upper Etcheminian, Dugald Brook.

Some examples from the original bed show a valve highest in the middle, and with a hinge-line half of the length of the valve. There are traces of a narrow marginal fold.

"This species differs" from *Bradoria rugulosa* in its coarser ornamentation and in the broader curve of the lower margin. "From *S. cambrica* of the Protolenus Fauna it differs in the less protuberant centre of the valve and the narrower and straighter infolded border at the hinge-line. The marginal fold is also more distinct in *S. cambrica*, which does not have the concentric marginal ridges of this species."

Mutation CONCINNA, n. mut.

Highest part of the valve about two-fifths from the hinge; evenly sloped to the margins, except that the anterior side is somewhat more turgid than the posterior. Hinge line about half of the length of the valve. A very narrow fold runs around the margin.

Sculpture.—Surface with a fine but distinct punctation that develops anastomosing ridges near the margins.

Size.—Length, $2\frac{1}{4}$ mm.; width, $2\frac{1}{2}$ mm.; depth of a valve, $\frac{3}{4}$ mm.

Horizon and Locality.—Assise E. 1 *d.*, Lower Etcheminian, at Boundary Brook, scarce.

This mutation is smaller and rounder than the type.

SCHMIDTELLA ACUTA, Pl. II., figs. 12 *a* to *c*.

Schmidtella acuta, n. sp., Nat. Hist. Soc. N.B., Bull vol. iv. p. 206, pl. iv., figs. 4 *a* to *c*.

" Valves tumid. Hinge line somewhat more than half of the length of the valve, marked by a narrow fold and furrow that extends most of its length. Valves about as wide as long, somewhat acutely pointed at the lower margin. A narrow marginal fold extends along one side of the valve to the pointed end. Greatest protuberance of the valve in the upper half; toward the hinge the curve of the surface of the valve is turned somewhat abruptly inward toward the cardinal line."

This species has a small ocular tubercle.

"*Sculpture.*—The surface is smooth in appearance and somewhat shining, but under the lens is seen to be covered with minute pits or granulations, uniformly distributed."

Size.—Length, $2\frac{1}{2}$ mm.; width, $2\frac{1}{4}$ mm.; depth, nearly 1 mm.

Horizon and Locality.—In Assise E. 3 *e* and *f*, Upper Etcheminian, at Dugald Brook. Frequent.

The following are measurements of the valves of this species:

E. 3 *e*,	left valve,	length	$2\frac{1}{4}$ mm,	width	$2\frac{1}{4}$ mm.,	depth	$\frac{1}{2}$ mm.
E. 3 *e*,	"	"	2 mm,	"	$1\frac{3}{4}$ mm.,	"	$\frac{1}{2}$ mm.
E. 3 *e*,	right "	"	$2\frac{1}{2}$ mm.	"	$2\frac{1}{4}$ mm.,	"	$\frac{3}{4}$ mm.
E. 3 *f*,	" "	"	$2\frac{1}{4}$ mm.	"	2 mm.,	"	$\frac{1}{2}$ mm.

This species by its smooth surface and pointed form recalls the genus Beyrichona of the Protolenus Fauna; but it has not the broad flattened area, near the hinge which marks that genus, on the contrary it is there most prominent; this feature belongs to the genus Schmidtella.

"From *S. pervetus* this species is distinguished by its finer ornamentation and pointed lower margin; and from *S. cambrica* of the Protolenus fauna by its smoother surface and narrow fold at the cardinal line. No Silurian Schmidtella has the pointed valve of this species."

ST. JOHN, N.B., CANADA,
December, 1901.

EXPLANATION OF THE PLATES.

Plate I.

Figs. 1 to 6.—Diagrammatic figures of genera to show important character referred to in the text—*o*, ocular tubercle—*m*, scar of adductor muscle—*c*, cardinal or hinge line—*a*, anterior cardinal curve—*b*, posterior cardinal curve—*e*, anterior marginal curve—*d*, posterior marginal curve—*v*, ventral margin.

Fig. 7.—*Leperditia* (? ?) *rugosa*, n. sp.—*a*, right valve, side view—*b*, same from the front—*c*, same from the hinge. All mag. $\frac{4}{1}$, U.E.* See p. 443.

Fig 8.—*Bradorona perspicator*, n. sp.—*a*, left valve, side view—*b*, same from behind—*c*, same from the hinge. All mag. $\frac{4}{1}$—*d*, a portion of the shell further mag. ($\frac{15}{1}$) L. E. See p. 444.

Fig. 9.—*B. perspicator*, mut. *maxima*, n. mut.—*a*, right valve, side view—*b*, same from the front. Both mag. $\frac{4}{1}$, L. E. See p. 445.

Fig. 10.—*B. perspicator*, mut. *major*, n. mut.—*a*, right valve, side view—*b*, same from the front. Both mag. $\frac{4}{1}$, U. E. See p. 446.

Fig. 11.—*B. perspicator*, mut. *magna*, n. mut. *a*, right valve, side view—*b*, same from the front. Both mag. $\frac{4}{1}$, L. E. See p. 446.

Fig. 12.—*Bradorona spectator*, n. sp.—*a*, left valve, side view—*b*, same from the front—*c*, same from the hinge—*d*, mould of the upper front corner of a right valve showing ocular tubercle and muscle scar. All mag. $\frac{5}{1}$, L. E. See p. 447.

Fig. 13.—*B. spectator*, mut. *spinosa* n. mut.—*a*, left valve, side view—*b*, same from the front. Both mag. $\frac{5}{1}$, L. E. See p. 448.

Fig. 14.—*B. spectator*, mut. *æquata*, n. mut.—*a*, left valve, side view—*b*, same front view. Both mag. $\frac{5}{1}$, U. E. See p. 448.

Fig. 15.—*Bradorona observator*, n. sp.—*a*, left valve—*b*, same from the front—*c*, same from the hinge. All mag. $\frac{5}{1}$, L. E. See p. 448.

Fig. 16.—*B. observator* var. *benepuncta*, n. var. — Carapace partly opened, the valves laterally foreshortened. Mag. $\frac{5}{1}$, L.E. See p. 449.

Fig. 17.—*B. observator*, mut *ligata* n. mut.—Left valve, side view U.E. See p. 451.

---

* U. E. and L. E. indicate Upper and Lower Etcheminian respectively.

Plate II.

Fig. 1.—*Bradoria scrutator*—*a*, left valve, side view—*b*, transverse section—*c*. longitudinal section. All mag. $\frac{6}{1}$, U.E. See p. 452.

Fig. 2.—*Bradoria vigilans*—*a*, right valve, side view—*b*, outline from front—*c*, outline from the hinge. All mag. $\frac{6}{1}$, U. E. N.B.—The ocular tubercle is too near the hinge line in figs. 2 *b* and 2 *a*. See p. 454.

Fig. 3.—*Bradoria rugulosa*—*a*, right valve, side view—*b*, outline from front—*c*, out line from hinge line. All mag. $\frac{5}{1}$—*d*, part of the shell further enlarged ($\frac{10}{1}$) to show sculpture, U. E. See p. 456.

Fig. 4.—*Bradoria* (?) *ornata*, n. sp.—*a*, right valve, side view—*b*, outline from the front—*c*, outline from the hinge. All mag. $\frac{7}{1}$, L.E. See p. 456.

Fig. 5.—*Escasona rutellum*, n. sp.—*a*, right (?) valve, side view—*b*, same front view—*c*, same, from the hinge. All mag. $\frac{5}{1}$, U. E. See p. 458.

Fig. 6.—*Escasona* (?) *vetus*, n. sp.—*a*, right (?) valve—*b*, same from the hinge. Both mag. $\frac{5}{1}$, L. E. See p. 458.

Fig. 7.—*Escasona* (??) *ingens*, n. sp.—*a*, left (?) valve—*b*, same from the front—*c*, same from the hinge. All mag. $\frac{4}{1}$. Coldbrook terrane. See p. 459.

Fig. 8.—*Indiana ovalis* n. sp.—*a*, right valve, side view—*b*, same from the front—*c*, same from the hinge. All mag. $\frac{5}{1}$, L. E. See p. 461.

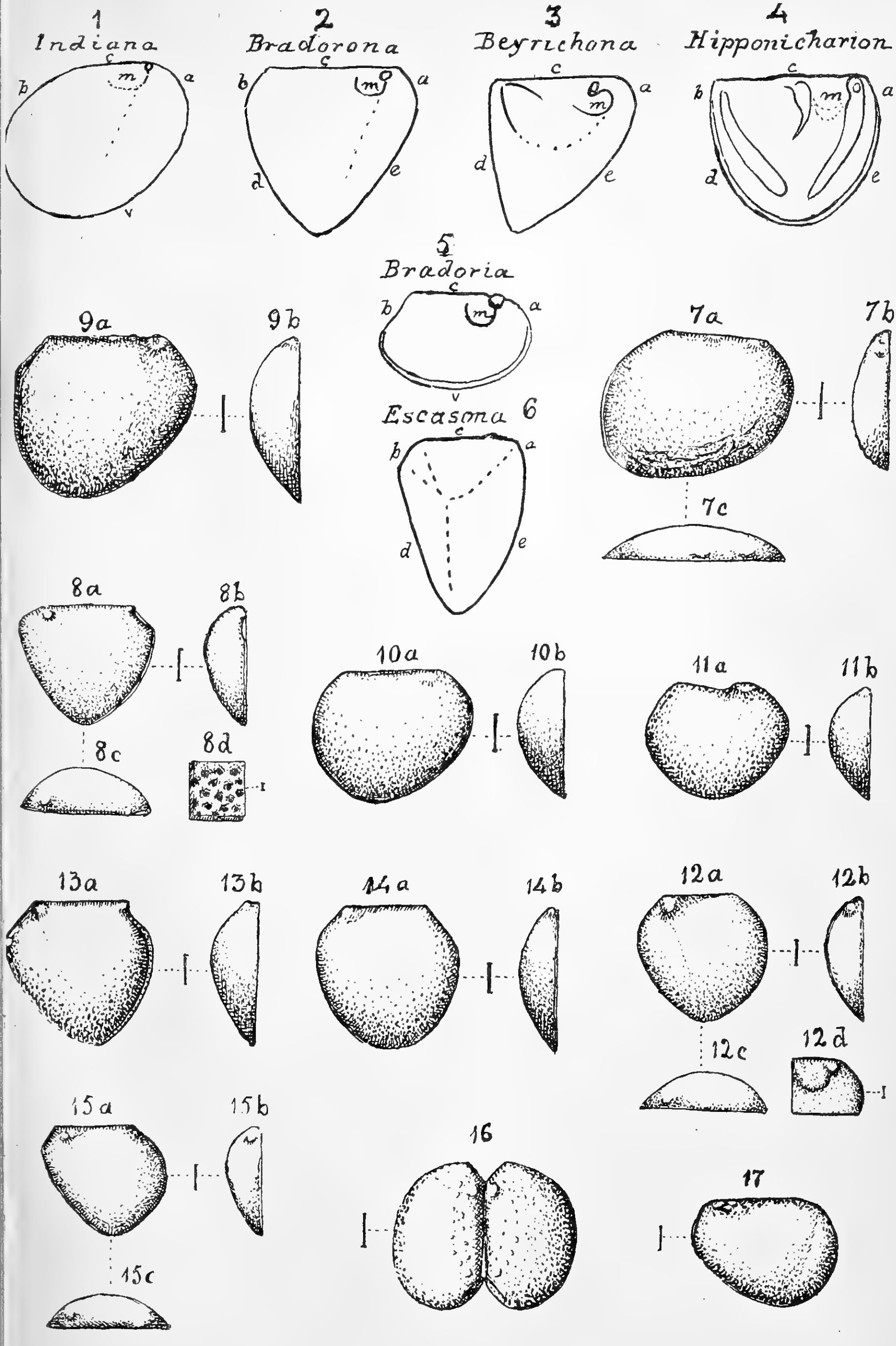
Fig. 9.—*I. ovalis* mut. *prima*, n. mut.—*a*, right valve, side view—*b*, same from the front—*c*, same from the hinge. All mag. $\frac{4}{1}$. Coldbrook terrane. See p. 462.

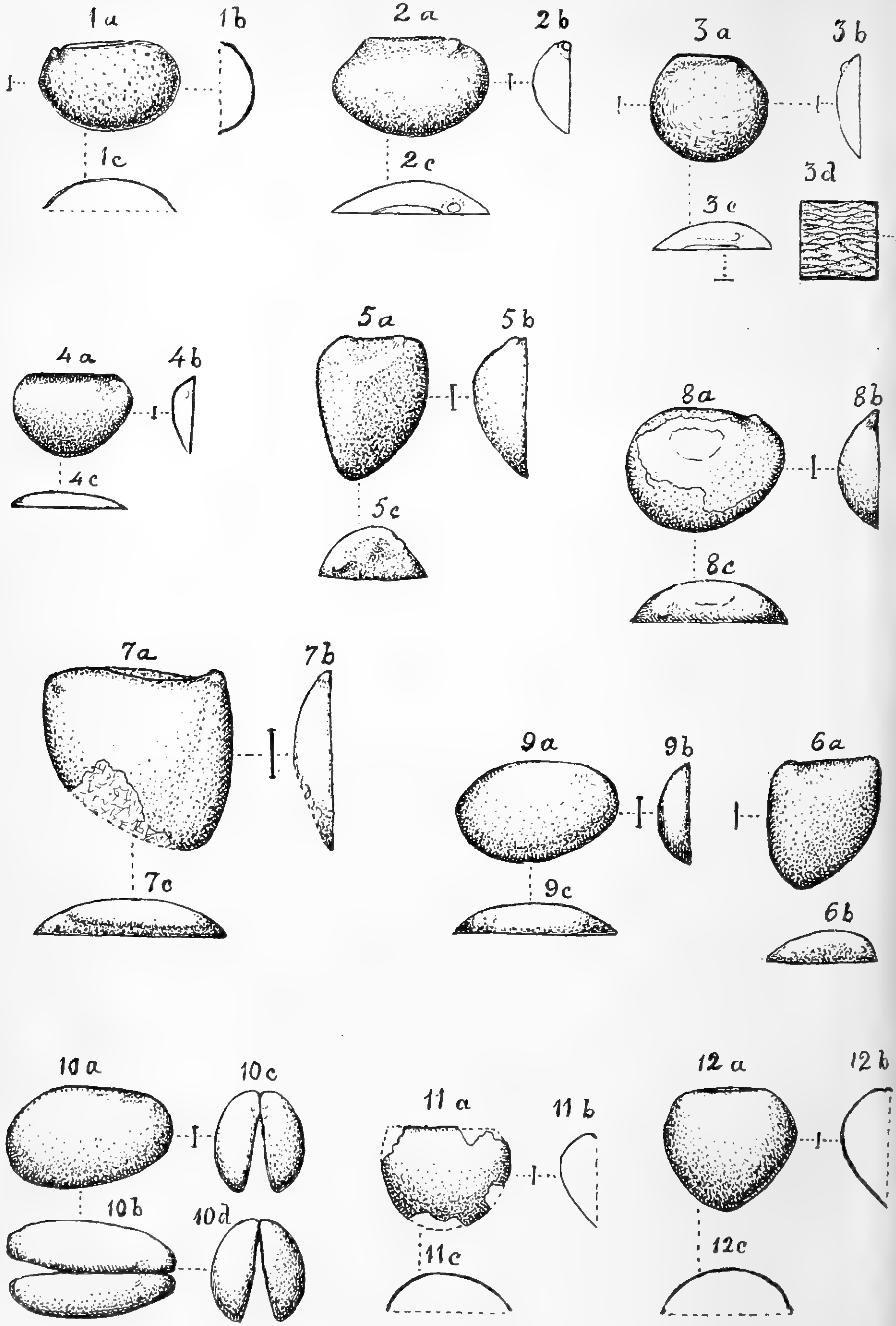
Fig. 10.—*Indiana lippa*, n. sp.—*a*, carapace, right side—*b*, same from the hinge—*c*, same from the front—*d*, same from behind. All mag. $\frac{4}{1}$, U. E. See p. 463.

Fig. 11.—*Schmidtella* (?) *pervetus*—*a*, right (?) valve, side view—transverse section—*c*, longitudinal section. All mag. $\frac{6}{1}$, U. E. See p. 464.

Fig. 12.—*Schmidtella acuta*—*a*, right (?) valve, side view—*b*, transerse section—*c*, longitudinal section. All mag. $\frac{7}{1}$, U. E. See p. 465.

ETCHEMINIAN OSTRACODA. PLATE I.




1a
1b
1c
2a
2b
2c
3a
3b
3c
3d
4a
4b
4c
5a
5b
5c
8a
8b
8c
7a
7b
7c
9a
9b
9c
6a
6b
10a
10b
10c
10d
11a
11b
11c
12a
12b
12c

Notes on the Albany Meeting of the Geological Society of America, Held December, 1900.

The thirteenth Winter meeting of the Geological Society of America was held in the city of Albany, N.Y., during the 27th, 28th and 29th days of December, 1900, under the Presidency of Dr. G. M. Dawson, C.M.G., F.R.S., etc., Director of the Geological Survey of Canada. The following Canadian geologists were present:—Dr. G. M. Dawson, Dr. Robert Bell, Mr. Wm. McInnes, B.A., and the writer, from Ottawa; Prof. A. P. Coleman, Toronto; Prof. F. D. Adams and Mr. O. E. LeRoy, M.A., of Montreal.

The papers read and the discussions which they elicited proved to be unusually interesting, so that the meeting can well be said to have been one of the most successful held The presidential address was not delivered until Saturday morning, December 29th, when Dr. Dawson gave a comprehensive synopsis of the Geology of British Columbia, in which he discussed the relations and genesis of the various geological formations constituting the Laramie Geosyncline to the east of the Archæan axis, as well as of those on the west side of the same axis constituting the Western or Pacific Geosyncline.

The following are abstracts of some of the papers presented and read by Canadian geologists, bearing upon the Geology of the Dominion. These abstracts prepared by the various authors give an excellent summary of the scope of each paper. A few additional notes deemed of interest are also inserted by the writer.

1. "*Experimental Work on the Flow of Rocks recently*

carried out at McGill University," by Prof. Frank Dawson Adams, Montreal, Canada.

" A preliminary paper on this subject was read before the Geological Society at the Montreal meeting in 1897. Since that time the work has been continued and additional results have been obtained. The deformation of marble has been chiefly studied. The rock has been submitted to pressure under conditions which reproduce those obtaining in the deeper portion of the earth's crust. The deformation has been carried out not only when the rock is dry and at the ordinary temperature, but also when it is heated to 300° C. and 400° C. Also when at 300° C. in the pressure of water. Deformed at a temperature of 300° C. or 400° C. the movements which take place in the rock differ from those which are observed when it is deformed at the ordinary temperature. They are identical with those which are observed in the 'flow' of metals under compression."

The experimental methods were carefully described, and the results obtained illustrated by means of lantern slides and specimens.

Dr. Adams's paper was discussed by Prof. G. K. Gilbert, Prof. W. Morris Davis and Prof. N. S. Shaler.

2. " *The Laurentian Limestones of Baffinland,"* by Dr. Robert Bell, Ottawa.

" The discovery of great quantities of crystalline limestones in Baffinland was announced in the writer's summary report of explorations for 1897. The geographical position and physical aspect of the region is then described. General character of the Laurentian in Hudson Straits. The rocks of the north side are newer or Upper Laurentian as far as known, and differ from those on the south shore. Regularity of strike and dip. Enormous development of crystalline limestones in southern Baffinland. Their general characters. Great thickness of the beds, some of them being over a mile and running regularly for long distances. Evidently stratified aqueous deposits. Questions as to the origin of such limestones. The associated rocks and minerals. Owing to the absence of trees the limestones are conspicuous in the landscape. Not more eroded than the gneisses. Comparison with the Laurentian limestones elsewhere. Former physical conditions and the older and newer glaciations of Baffinland as affecting the limestones. The existing glaciers there." This paper was illustrated by lantern slides.

3. "*Marine and Fresh-water Beaches in Ontario*," by Prof. A. P. Coleman, Toronto, Canada.

"Marine deposits, often rich in shells and other fossils, are widely found east of Brockville and Smiths' Falls, in the valleys of the Ottawa and St. Lawrence. They occur at higher levels toward the north-east and east than toward Brockville; they include trees and other forms indicating a climate like that of to-day, and are all evidently post-glacial. The shells occur in clay sand and also coarse gravel. Higher beaches such as the Iroquois, Warren, etc., contain only fresh-water shells if any. Still higher beaches, such as those reaching 1,400 to 1,600 feet above sea level in the highlands between Georgian Bay and Lake Huron, and the beaches found above 1,400 between Lake Huron and Missinaibi, and at the same level on the Hudson Bay watershed north-west of Sudbury, have not yet been found to contain shells, although if marine there must have been complete and widely opened connection with the sea. The wide gravel tearaces on the watershed mentioned contain numerous and large kettle-shaped lake basins, sometimes without outlets, suggesting that they were formed by the burial of large blocks of ice at the border of the Laurentian ice sheet, and hence in ice dammed waters."

In the discussion which followed this paper, Messrs. F. B. Taylor, N. H. Winchell, W. M. Davis and the writer took part.

4. "*The Geology of Rigaud Mountain, Province of Quebec, Canada,*" by Mr. Osmond Edgar LeRoy, Montreal, Can. Introduced by Prof. F. D. Adams.

"The chief topographic feature of the palæozoic plain of Central Canada is a series of hills which occur in the district about Montreal. These are of igneous origin and follow a line of disturbance which is almost at right angles to the trend of the Notre Dame mountains. Rigaud is the most western of the series. It consists of an area of hornblende syenite, which is pierced on its northern flank by a quartz syenite porphyry. The field relations of all the hills with the exception of Rigaud shew them to be of post-Silurian age. In the case of the latter the contact with the Palæozoic is wholly concealed by drift. The object of the research was to ascertain if a genetic connection could be established between Rigaud and the other hills to the east. Investigation shows that it is probably not so connected, but a definite conclusion cannot be reached until a more extended study is made of the rest of the range."

Profs. N. S. Shaler, H. P. Cushing, F. D. Adams and Mr. H. M. Ami took part in the discussion, in which both the rock of the mountain itself and the Pleistocene deposits were taken up.

5. "*The Knoydart Formation in Nova Scotia"—a bit of "The Old Red Sandstone" of Europe,*" by Dr. H. M. Ami, Ottawa, Can.

"The presence of such genera as *Pteraspis, Pterygotus, Onchus, Psammosteus* and *Cephalaspis,* in the red marls, shales and volcanic ash-beds of McArras Brook in Antigonish and Pictou Counties, Nova Scotia, indicate the base of the "Old Red Sandstone" of Great Britain. The paper dealt with the relations, palæontological and stratigraphical of this important formation in the sequence of Devonian strata in Eastern Canada. The result of observations made by Mr. Hugh Fletcher of the Canadian

Geological Survey, as published on this subject, together with important notes by Mr. A. Smith Woodward and Dr. Henry Woodward of the British Museum on some of the fossils discussed will be embodied in the paper." Thə word *Knoydart* is pronounced as if spelt Krodiart.

In the discussion following this paper Profs. C. D. Walcott, H. S. Williams, N. S. Shaler and W. M. Davis took part.

Regarding the relations of this Eo-Devonian formation and the underlying series of Silurian strata at Arisaig, the writer was induced to make a preliminary statement in the course of the discussion as to the four divisions into which he is for the present classing the Silurian formations of Antigonish County adjacent to the strata of the Knoydart formation. These are in descending order as follows :—

IV. THE STONEHOUSE FORMATION. Consisting of red shales and mudstones, holding an abundant lamellibrachiate fauna with *Grammysia Acadica*, Billings as an horizon marker, also interstratified bands of limestone holding trilobites, ganterogoda and brachiopoda. This is the formation called "Lower Helderberg" by Mr. H. Fletcher and other geologists. Neither the fauna nor the character of the strata warrant the correlation of this formation with the Lower Helderberg. In character, it more closely resembles the Ludlow of England than any other series of strata.

III. THE MOYDART FORMATION. Consisting of light greyish-green fine grained and heavier bedded siliceous limestones, holding brachiopoda, gasteropoda, etc.

II. THE MCADAM FORMATION. Consisting of deep gray or black impure shale and mudstones, holding a lamellibrachiate and graptolitic fauna, with here and there an intercalated lenticular sheet or bed of limestone with brachiopoda in abundance.

I. THE ARISAIG FORMATION. Consisting for the most part of hard, compact light yellowish grey rusty and greenish colored sandstones or siliceous rock and shales, holding corals, trilobites, brachiopoda.

An additional note brought out by this paper in the discussion was the fact that in Eastern Canada, not only in the Silurian or in the Devonian, but also in the Cambrian and Devonian as well as in the Carboniferous, it was necessary to introduce a dual formational scale in order to classify the sediments. The Stonehouse formation, for instance, whilst occupying a position well up in the Silurian, was quite distinct from the Silurian formations of Ontario or New York as well as of other parts of Canada and the United States, and could in no sense be used to replace the term Lower Helderberg, being esentially distinct.

There were other papers of special interest to Canadian geologists. (1) Mr. F. B. Taylor "*On the Galt Moraine and the ice-dam which produced them,*" in which the author delineated the courses and structure of the morainic belts recently examined by him in the Huron-Erie Peninsula of Ontario. (2) Prof. H. S. Williams on "*Points involved in the Silurian-Devonian Boundary Question.*" This paper was expected to lead to a lively and interesting discussion, but the author wisely eliminated all doubtful or controversial points which are now pending investigation. The means by which a settlement of the questions at issue may be effected were also discussed. (3) Messrs. Henry Kümmel and Stuart Weller on "*The Palæozoic Limestones of the Kittaniny Valley, N.J.*" (4) Prof. August F. Fœrste on "*The Niagara group along the Western side of the Cincinnati anticline.*" (5) Prof. N. H. Winchell on "*Glacial Lakes of Minnesota.*" (6) Prof. W. M. Davis on "*An Excursion to the Colorado Canyon,*" and other papers by him. (7) Prof. H. P. Cushing on "*Origin and Age of an Adirondack augite-*

syenite." This paper led to considerable discussion, in which some of the petrographical geologists present enunciated the general principle that in the great Archæan complex many of the limestones and gneissic bands may be altered sedimentaries. (8) Prof. S. L. Penfield's paper, "*Stereoscopic Projection in Map Construction*" was a most important contribution both for geographers, mineralogists and petrographers.

H. M. Ami.

Ottawa, January, 1901.

Proceedings of Natural History Society.

Annual Meeting.

The Natural History Society made a new departure this year in inaugurating its season's monthly meetings. It held a conversazione on the evening of Monday, October 28th, 1901, which proved a pleasant and successful function. The meeting took this form especially in honour of Lord Strathcona and Mount Royal, and at the same time afforded the members of the society an opportunity of meeting him for the first time since he was elected Honorary President, in succession to the late Sir William Dawson, and was elevated to the peerage.

The guests were received by the president and Council of the Society. The hall and library were tastefully decorated, and the museum was lighted up with electricity, exhibiting its valuable and varied contents to advantage. The Microscopical and Entomological Societies very kindly united with the Natural History Society in entertaining the guests, and sent interesting exhibits.

Professor MacBride, the President, delivered his inaugural address, which is given below, and he was followed by Lord Strathcona, who called attention to the long, interesting and useful career of the Society, mentioning the names of distinguished office-bearers and members who had adored the Society during the seventy-four years of its existence. Indeed, he said he knew well personally the first president of the Society, and referred to the special services rendered to the Society and to the cause of Science in general by his predecessor in the Honorary Presidency, Sir William Dawson. He concluded with assuring the Society of his continued interest in its work, even although he, so long as he occupied his present public position in another country, might not be able to take such part personally in its proceedings, as he might desire; but he would be glad to help in such ways as he could. Principal Peterson, of McGill University, and Rev. Canon Archambault, of Laval University, also briefly adressed the assembled friends of natural science. Afterwards the guests were introduced to Lord Strathcona and Mount Royal.

INAUGURAL ADDRESS OF THE PRESIDENT OF THE NATURAL HISTORY SOCIETY OF MONTREAL, *October, 1901.*

I feel myself doubly honoured to-night, not only on acount of the high office to which this ancient society has thought fit to elect me, but also by the presence of such a distinguished company, including the High Commissioner, who may be said to be the ambassador of Canada to the Imperial throne.

I feel it a heavy responsibility to undertake to address such an audience, and, therefore, I have avoided as the subject of this address any technical subject, and have chosen rather to say a few words to you on the value of the study of Natural History in general and the aims which in particular the Montreal Society sets before itself. We Canadians are above all a practical people and our tasks in the immediate future lie not so much in attempts to solve the riddle of existence, which as a rule we are content to leave to the members of older civilizations, as in the development and utilization of the vast natural resources which Providence has bestowed upon us, and in the building up of a strong, healthy national life. If the study of Natural History is to be regarded as anything better than a hobby, such as, for instance, stamp collecting, it must be shown to have some relation to the objects which, I venture to think, are in the minds of most Canadians of immediate and pressing importance. In the few minutes which I shall detain you, I shall endeavour to prove to you that this is so.

We must first of all define the scope of Natural History. It is usually held to denote merely the study of animals and plants, but in its original signification it denotes the study of all surrounding nature, inanimate as well as animate. Thus it corresponds to the old meaning of the work Physics, which, as used by the Greeks, comprised all natural knowledge. Just as the scope of Physics has been gradually limited until it is confined to the study of light, heat, sound, electricity and mechanics, so Natural History has come to mean the study of living nature. In Montreal, however, the term is employed in a more generous sense, and an important section of the Society is interested in the structure of the rocks and their arrangement in the crust of the earth.

Now the study of Geology needs no defence from me. The man in the street understands at once its close and intimate connection with the development of those mineral resources which form such an important part of Canada's wealth. On the other hand, the study of plants and animals is often regarded in the light cf an amiable hobby of no practical use.

Now whilst it is true that any study may be pursued as a hobby, and that no study which is pursued in a dilettante fashion is ever likely to lead to important results, yet nothing could be further from the truth than to imagine that the systematic study of zoology and botany is without practical importance.

In order to realize this let us try to picture to ourselves in what relation our lives stand to the lives of the animals and plants which form the subject matter of the sciences of botany and zoology, in a word, of biology.

When the pioneers of civilization reach an unsettled country, they find it covered with certain kinds of vegetation and inhabited by certain species of animals. This population of plants and animals represents the balance which has been arrived at as the result of a long struggle between the various species, each trying to cover the whole ground for itself. Though this balance no doubt alters slowly in the course of ages, yet from the observation of the vegetation which covers long deserted human habitations such as the ruined temples in Mexico, we conclude that when the land has been cleared and then abandoned, so that the struggle recommenced under the same conditions, it leads to the same results, for the proportion of the species in such spots is the same as that obtaining in the surrounding virgin forest.

The population, therefore, of unsettled land represents the state of affairs which Nature is for ever trying to bring about, and which man when he clears and cultivates land alters. It follows that the position of the civilized settler is one of unceasing war against Nature; he maintains an artificial garrison, one might almost call it, of cultivated plants and domestic animals, in the face of a large opposing force of wild plants and wild animals which he is dispossessing of their territory and which are constantly seeking to regain it.

Under these circumstances, it is obvious that the first condition of success would be as complete a knowledge as possible of the habits and powers both of the garrison which the farmer is seeking to maintain, and of the hostile foes he is fighting against. Occasionally, however, still another danger threatens the settler. He may inadvertently augment the hostile forces by introducing powerful enemies from other lands. Plants and animals trained in the fierce struggle that obtains in Europe and Asia often spread to an enormous extent when introduced into the smaller continents, such as America and Australia, as the following instances will show.

With a view of providing themselves with sport some Australian colonists imported rabbits. To-day thousands of acres of land have been rendered useless for cattle by the. descendants of these rabbits, and hundreds of thousands of dollars have been spent in the attempt to keep the race of rabbits within bounds. The sentiment of some Scotch colonists induced them to send home for some thistle-seed. It flourished only too well in Australia, but with dire results for cultivation. The English sparrow, as everybody knows, has worked great destruction amongst our native song birds, and one has only to see in the spring the fields in the Island of Montreal covered with the English ox-eye daisy to realise the danger of introducing European wild plants into this country.

Once indeed a visitor from the New World turned the tables on the Old World population. The common water-weed of the St. Lawrence, Anacharis, was cultivated in a tank in the Botanical Garden at Cambridge, England, where it flourished luxuriantly. The professor of botany, with a carelessness unworthy of his calling, gave orders that some of it should be thrown into the brook which ran outside the garden. This was done, and the Anacharis grew luxuriantly in the brook, from which it reached the river Cam, and from thence the network of canals which traverses the eastern part of England. In these sluggish waters it increased to such an extent as to render navigation almost impossible, and hundreds of pounds had to be spent in the endeavour to keep it within bounds.

But the practical applications of Natural History are far from being exhausted by their utility to the farmer and cattle-breeder. Man himself is part of the garrison maintained by constant struggle against surrounding foes ; he is the subject of attack by minute plants and animals of all kinds, which find in his body a fertile field for their development, with the results of disease and death to him. Our heathen ancestors attributed disease to evil spirits and magic ; our more immediate progenitors to climatic conditions, dust of comets, and I know not what else. Only in recent times has it gradually dawned upon us that disease is merely the outward and visible sign of the conflict which outside Nature is waging with us, the highly cultivated and somewhat abnormal product.

But whilst many would be ready to admit that a study of zoology and botany was of importance to the experts at the Experimental Farm at Ottawa, and to the specialists who devote themselves to the study of disease, they would probably be inclined to doubt whether such study as is pursued by a society like our own would be likely to help either the farmer or the doctor.

Against this position there are the strongest arguments to urge. It is a remarkable fact that the discoveries which are of the greatest use to the human race have hardly ever been made by direct search for them. They have come as the indirect result of the pure search for knowledge.

"Seek ye first the kingdom of God and its righteousness and all these things shall be added unto you." That is a truth which applies in other spheres than that of religion. The man who says to himself, "Go to now, let us discover something useful," rarely discovers anything. The inventor is the man who applies the principles discovered by the student of pure science, so that if the study of pure science were to be discouraged, the practical applications would soon cease also. This may seem to some of my hearers rather a bold statement. I think, however, that I can justify it by giving a few examples :—

Take a discovery that is exciting the greatest interest at the present time, and that promises results of the most far-reaching importance, viz., wireless telegraphy. Let us trace the apostolical succession, to borrow a term from theology, of the idea which underlies this discovery. Thirty or forty years ago, the great Cambridge physicist, Clerk Maxwell, one of the greatest and most penetrative of the geniuses who have filled the chairs of that ancient University, was engaged in determining the value of the electrical unit. As many of my hearers are aware, there are two ways of doing this : we can estimate either the push that an electric charge exerts on another similar charge, or else the pull that an electric current effects on a magnetic needle. In this way, two different values for the unit are arrived at, and the relation between them, or to put it more simply, the number obtained by dividing the one by the other, gives the velocity of light in centimetres per second. This remarkable result suggested to Clerk Maxwell that that mysterious thing called electricity had something to do with the ether which fills all space and transmits the vibrations which we call light, and he thereupon constructed his famous electro-magnetic theory of light, which conceives light to consist of vibrations not of a comparatively gross material like ordinary matter, but of electricity itself.

This theory received at first little support from the German physicists, who are inclined to scoff at every idea that is not of German origin. Amongst a crowd of scoffers, however, one open-minded enquirer was found, who said to himself: "If Clerk Maxwell is right, I ought to find that if I start artificial electric vibrations they will propagate themselves like light waves." This man's name was Hertz, and he promptly set about producing electrical waves, purely with a view of testing the truth of Maxwell's theory. He had many difficulties to overcome before he succeeded in producing them in sufficiently rapid succession, but this was at last accomplished and Maxwell's theory triumphantly vindicated. The electric vibrations comported themselves like light—it is true that a stone wall was as transparent for them as a sheet of glass is for ordinary light, but they were reflected by a metal plate and could be brought to a focus, etc., etc. Now this invisible light, as we may call it, is what Marconi and others have employed in their so-called wireless telegraphy, but without Maxwell and Hertz, it would have remained undiscovreed to this day.

But to come closer to Natural History. There has, I suppose, been no discovery in recent years which promises greater benefit to men than that of the cause of malaria, and the manner in which the disease is transmitted from one patient to another.

I suppose you are all aware that this dreadful disease, which is one of the chief causes which prevent our race leading a healthy life in the tropics, is due to a minute parasite which inhabits the cells of the blood, and which is carried from one person to another by a certain species of mosquito. If one, therefore, goes to the most fever-stricken districts of the tropics and avoids the mosquitoes, one can escape the disease. One of my Cambridge friends, J. S. Budgett, Esq., made two visits to the River Gambia in West Africa in successive years. On the first occasion the manner of the transmission of the malaria infection was still unknown, and Mr. Budgett contracted the disease and suffered severely from it during his stay in Africa, and after his return to England. On the second occasion, the mosquito had been declared to be the source of infection and Mr. Budgett took precautions, in fact he lived and moved and had his being under a mosquito-netting, with the result that he escaped the disease entirely.

The history of this great discovery may be outlined as follows :—About thirty years ago, a zoologist, Lankester, discovered a parasite in the blood-cells of the frog. No notice was taken of his discovery at the time ; but the parasite was re-discovered ten years afterwards by a physiologist called Gaule, who, however, being unacquainted with natural history failed utterly to recognise the parasite as animal. Lankester then repeated his observations and pointed out that the animal, which he called Drepanidium ranarum belonged to a class which had been previously studied by zoologists, and the outlines at least of whose development was known. When doctors, however, commenced to study malaria they were convinced that it was due to a bacillus,(that is to say, to one of the minute moulds which are the cause of so many diseases, and when a French surgeon, Laveran, described parasites in the blood-cells of malarial patients similar to Drepanidium ranarum, his discovery was regarded with scepticism. Even those who accepted these animals as the cause of the disease were utterly at a loss to explain how it was communicated. An Indian observer, Dr. Ross, however, working on birds, which were known to suffer from the presence of a parasite in their blood-cells, found that it produced germs very similar to germs found in mosquitoes. Then it was shown that some mosquitoes carried germs similar to those produced by the human blood-parasite, and, finally, an Italian zoologist, named Grassi, pointed out that it was one particular kind of mosquito only which carried these germs, and thus the whole problem has been narrowed down to this—how are we to fight the mosquito ? To solve this a thorough knowledge of its habits and life-history is necessary, and this the natural historian has supplied. Thus, Natural History showed the way in the beginning at every step a knowledge of zoology was required. But we can go further still—our whole conception of the relation between patient and disease is founded on zoölogical observations. The modern treatment of disease differs from the older in the recognition of the comparatively small value of drugs. In olden days, even so recently as my own childhood, one was dosed with horrid mixtures of drugs in the belief that it was possible to act directly on the disease. Now the position of the modern doctor is almost identical with that of Macbeth, "Throw physic to the dogs—I'll none of it!" He knows that drugs have their uses as temporary expedients in emergencies, just as everyone knows the value of alcohol when given to a person about to faint, but he knows also that the disease is a pitched battle fought between the invading germ and the white blood-cell of the patient, and this all-important fact was first discovered by a Russian zoologist, Metschnikoff, who observed the fight going on under his own eyes in the body of a transparent water flea.

I shall not weary you by giving you further examples of the way in which the whole modern science of medicine, as distinct from surgery, rests on a basis of biology ; how at every step it is confronted with biological problems and must ever look to zoology and botany for help in its progress. In a word, biology bears the same relation to medicine and to agriculture as mathematics and mechanics do to engineering.

Turning now from the general utility of the study of Natural History to the special value of a society such as ours, I may remark that a Natural History society has two functions, a general and a special. The general lies in the encouragement of the study of Nature, which it gives through the opportunities it affords of allowing naturalists to meet one another and to keep alive the sacred fire of enthusiasm in each other's breasts, and in the enlightenment which it spreads by public lectures, and other means.

This is an important duty, for if even an elementary knowledge of natural history were more widely diffused we should be freed from much dense ignorance on subjects affecting our welfare. Two of these have come under my own notice, and they will show what ignorance will lead to. An evening paper in this city published diagrams of a number of "microbes" found in the Montreal reservoir as a proof of the horrid condition of the water. Now, I do not deny that our water is far from being what it ought to be, but all the animals reproduced in the journal are normal inhabitants of healthy spring and brook water.

Again, a case was brought under my notice where a cow doctor was going around in Eastern Ontario professing to cure animals suffering from an inflammatory affection of the nose and mouth. He applied an emulsion made, I believe, with linseed, and got out what he called the "worms," which caused the disease. These worms when submitted to me, I found to be nothing more than the tiny seedlings of the flax which had been squeezed out of the seeds used to form the emulsion.

But the special function of the local Natural History society I regard as considerably more important than the general, and it is this, to acquire an accurate knowledge of the plants and animals which live in our immediate neighbourhood, and to maintain a museum which shall not be a mere storehouse of curiosities, but which shall enable any visitor to see at a glance the flora and fauna of the surrounding country. Before any problem affecting the relation of animals to man can be attempted, we must know the species with which we have to deal. In the great Zoological Station at Naples large sums have been expended by the director in getting accurate lists of the species of animals and plants living in the Bay of Naples published. Now this is work which a local Natural History society can do better than any other agency, if it sets to work in a systematic manner. Our former President, Dr. Campbell, has in this respect shown us all a good example by his untiring labours in producing a complete list of the plants found in the vicinity of Montreal. I only wish that his example had been more widely followed by those members of the society who are devoted to the study of animals, for our knowledge of the local fauna is still wofully incomplete. England has been specially prolific in good natural historians. Few of them were professional zoologists ; most of them had only a comparatively limited leisure to devote to the subject, and yet German specialists have to turn to their work as the foundation for their special biological researches. Spence-Bate, whose knowledge of the Crustacea was unrivalled, was a dentist in Plymouth, and amongst the greatest living authorities on the British fauna may be mentioned two Anglican clergymen, Norman and Stebbings. But we need not go to England. You are surely all of you familiar with that wonderful collection of shells stored in the cases of the Redpath museum. That collection, the duplicate of which has been presented to the British Museum, is the work of a former honoured citizen of this city, and member of this society, Dr. Carpenter, who pursued the calling of a schoolmaster.

Having made a tolerably accurate list of the animals and plants of the neighbourhood, the next thing is to study them in their relation to one another, in a word, to make out their life history and their habits. And here there is an endless field for open-air work of the most entrancing kind, and this is the kind of work on which scientific agriculture directly rests. I often wish that I could give the future farmers of our country a short course in Natural History at McGill, so as to open their eyes to the nature of their biological surroundings, provided that a sojourn at the University would not make them wish to desert farming in order to join the ranks of the overcrowded professions.

In England the University of Cambridge, ever in the van of scientific teaching, has already instituted courses in biology and chemistry leading to a diploma in agricultural science.

The great secrets of successful work in natural history are perseverance and concentration. In this study, as in every other occupation, it is only the man who keeps steadily at it year after year who ever achieves anything. But concentration is of equal importance. The animal kingdom is such an enormously wide field, that unless the energies of the natural historian are confined to one small part of it they are dissipated and wasted. We want to be specialists in this society ; we want not merely those who take a more or less active interest in Natural History as a whole, but we want also the special student of insects, the lover of shells, the sportsman who knows all about game birds, and so on. There is no fear that the man who makes a specialty of one branch will find it dull to listen to the record of the observations of the students of another department. Any honest study of even a small part of the field rouses far more interest in the field as a whole than a hazy and languid study of general zoology. And here perhaps I may make a suggestion or two with regard to our field work. It is one of the great disadvantages of our society that owing to the peculiarity of our Canadian climate, the time when we hold our meetings is just the time when we can do no out-of-doors work. The summer before last I was privileged to take part in some of our excursions, and the defect which struck me most about them was the absence of definite aim. It seems to me that we should know what we are going to look for before we start, else we are not likely to accomplish anything. We should go out in search of flowers, or of insects, or of shells, but not of everything together. After all, however, the work that is really important in this line is done by each for himself, and our great need is the accession of more young enthusiasts to our ranks. Let us hope that in the future all who have any love for any department of Natural History will be drawn to a society where they shall meet with sympathy and support.

THE NATURE AND DEVELOPMENT OF ANIMAL INTELLIGENCE: —By WESLEY MILLS, M.A., M.D., D.V.S., F.R.S.C., Professor of Physiology in McGill University, Montreal, Canada. London, T. Fisher Unwin, Paternoster Square, 1898.

Few men possess such eminent qualifications for dealing with the subject treated of in this volume as Dr. Wesley Mills possesses. To begin with, he is well known as the friend and protector of all animals. An ancient poet-philosopher took credit to himself that he counted nothing relating to man foreign to him. The range of Professor Mills' interest and sympathies is vastly more comprehensive; it embraces everything that lives. To him no bird or beast is an object of indifference. And this is a prime qualification for one who would interpret animal life. To understand them one must love them, as indeed love is the true organ of man's perception and his interpretation of the entire field of his observations. It is inconceivable that any one who is repelled by the lower creatures, or to whom their welfare is a matter even of indifference, could ever do them justice in any opinion he formed of them. Longfellow ascribes the remarkable skill in various kinds of woodcraft of his Indian hero, Hiawatha, to the tenderness of his sympathies with the tenants of the forest; in consequence, they readily yielded up their secrets to him. He "learned of every bird its language; where they built their nests in summer; where they hid themselves in winter." According to this law, animal nature must be an open book to Dr. Wesley Mills.

Then our author loves truth above all things. This disposition is manifest throughout the treatise before us. How earnestly he plans, and how patiently he waits and works to get at the truth. The scientific spirit is his pre-eminently. Nothing is taken for granted, and no detail is deemed unimportant in his observations on the development of the intelligence of the animals under study. In no portion of this book is his love of truth more conspicuously shown than in the correspondence regarding instinct, with which it closes. Dr. Wesley Mills is well known to be an evolutionist in a general way; but he evidently prefers facts, and is prepared to cling to them rather than to any hard and fast theory of evolution. If the theory will not square with the facts, so much the worse for the theory.

Dr. Mills' devotion to science is exhibited not only in the time and patient labour he has bestowed upon it, but also in the expenditure to which he has gone in its interest. It was Agassiz who said that he had not time to make money. But Prof. Wesley Mills is not only indifferent to the making of money, which he deems an aim beneath a philosopher ; what little he has or earns he spends largely on the prosecution of scientific investigations. These long continued observations on animals could be carried on only at great expense : but he has borne it willingly, and how could filthy lucre be laid out to better purpose ? And he is amply repaid by the results achieved; no chapters in human biography are more interesting than his diaries of dogs and cats, and squirrels, and rabbits. What he does not know of dogs especially is not worth knowing.

The main thesis he sets out to establish is that brute creatures have mind ; and he has undoubtedly made it good. Of course, this is no new claim put forth on behalf of the lower creation. Long ago, unthrifty people were sent to the ants to learn lessons of prudence ; mental qualities being predicated of them which the sluggard was to emulate. Virgil and Ovid wrote about the domestic bee in a way which showed what high mental qualities that active little creature possessed. No one of an observing turn of mind who has had much to do with domestic animals will deny them the possession of reasoning powers. As the author properly maintains, most of the lower creatures in some one or more particulars, show greater mentality than man himself. The faculty of memory is specially highly developed in several of them. Whether there is any means by which the different genera can hold intercommunication or not, there can be little question but that there are signs and sounds employed by which the same species can hold converse together—the equivalent of speech among men. Rev. James George, D.D., Professor of Mental and Moral Philosophy in Queen's College, Kingston, when the writer was a student in that institution, nearly fifty years ago—a most original thinker and an inspiring teacher—did not hesitate to give forth that the brutes have mind ; no matter what consequences the admission might lead to, and this before "The Origin of Species" was written. But he went beyond allowing them to be possessed of mental faculties, although he held that such capacities were hedged about by their "life in sensuism," to use his own phrase; he claimed for many of them high degrees of intelligence, and used to entertain his students by relating to them the results of his own observations and experiments with bees, ants and other creatures, carried on much in the same way as those of Dr. Wesley Mills. He especially maintained that all creatures have a language of their own. And who that has heard a squirrel or catbird scold, or a sentinel crow give warning to the flock he belongs to of the approach of a gunner, can doubt that they have a most effective capacity of utterance?

Prof. Mills' second thesis is that the hereditary mental capacity of the lower animals, which usually goes by the name of instinct, is capable of great expansion, from the moment of the creature's birth until the time it has reached its full growth and maturity. The series of observations he has recorded go to show that while certain tokens of the possession of power for gaining sustenance are exhibited from the first, there is a rapid development of intelligence in the way of experimental knowledge, on the part of each individual. Of course, such acquirements as any animal makes by experience, have relation to the sphere it fills in the total sum of being. Each species has its own functions and displays its characteristic capacity and applies its intelligence in attaining those functions, and whilst the individual species learn from each other, by imitation and otherwise, they do not seem to take lessons from beyond the limits of their own kind, unless, indeed, domestic animals generally are helped upward in the scale of being, as our author hints at, by their contact with man.

At the same time, Dr. Mills has given instances in which individuals have risen higher in intelligence than the ordinary level of their species. Any one who has taken note of the cats and dogs with which he has been acquainted, to go no further, must have marked great differences in their capacity, and in the degree of intelligence which they reached. In herds of cattle, too, there is often one cow that has a power of initiative that gives her pre-eminence, and often makes her exceedingly troublesome. It may be that it was by accident that she first learned to open the gate leading to the cabbage garden; but once having acquired such knowledge, it becomes hard to keep the "breachy" animal out of mischief. The same is true of horses in breaking down fences with their bodies, or in learning to jump the fences to get at the oats beyond.

All this is conceded ; but whether the offspring of such smart animals inherit the advanced position reached by their sires and dams, and thus in time an elevation above the old level is attained by a whole family, is a moot point. The Darwinians would call such clever individuals the "fittest" among their contemporaries ; but whether they have any special advantages in the struggle of existence, and thus are "selected" by nature, can scarcely be regarded as established by proof. But Dr. Mills may claim to have established by proof that inherited capacities and acquired knowledge must be regarded as co-ordinate factors in the development of general animal intelligence.

An interesting side issue has been raised in this volume. It grows out of the demonstration of the superior energy and earlier catering power of mongrels, as compared with pure bred animals. Does this also hold of the human race ? Are we in this way to account for the characteristic qualities of the Englishman of to-day ? Has he, too, acquired by the mingling of the blood of many nations in his veins, activity and catering force at the expense of modesty and gentleness ?

R. C.

Problems and Possibilities of Systematic Botany.—Address of Benjamin Lincoln Robinson, Ph.D., Retiring President of the Botanical Society of America, delivered before the Society, August 28th, 1901. Reprinted from "Science," Vol. xiv., No. 352.

In this comprehensive address, Dr. Robinson touches on some of the most important practical matters requiring to-day the attention of botanists. His experience as Professor of Botany and Curator of the Gray Herbarium, Harvard University, must have impressed upon him the lack of uniformity and the absence of the precision in the manner of dealing with specimens, on the part of his correspondents ; and he invites botanical workers everywhere to co-operate in securing the best systematic results. He attacks the prevailing desire to erect new species, and criticises, perhaps not too severely, the looseness of description too often furnished by those claiming to have discovered such species. As a partial remedy for the wordy analyses with which he finds fault, he would not be averse to seeing the adoption in America of the use of Latin for the purpose of plant description, as that language lends itself more readily than English does to terseness and clearness of expression, as seen in European treatises on Botany, in which it is used. Diligent field-work, he holds to be the great desideratum for accuracy in systematic determinations; the accumulation and careful comparison of specimens alone can secure true scientific results.

R. C.

NOTES ON A COLLECTION OF CRATÆGUS MADE IN THE PROVINCE OF QUEBEC NEAR MONTREAL.—By Charles S. Sargent, Reprinted from "Rhodora," Vol. 3, No. 28, April, 1901.

NEW OR LITTLE KNOWN NORTH AMERICAN TREES. III.—By Charles S. Sargent. Reprinted from the "Botanical Gazette," Vol. xxxi., April, 1901.

The former of these pamphlets is of special interest to those occupied with the Natural History of the District of Montreal. Anything bearing on trees or shrubs proceeding from the pen of Professor Sargent, is sure to be of value; and when he writes of the native thorns of the continent, a subject which he has made his own, his conclusions will be received with the deference accorded to an expert. The first thing we note, in connection with this paper, is the fact that the collection of Crataegus on which the notes are based, was made by Mr. J. G. Jack, a name honourably associated with the plant life of this province. We are glad that Mr. Jack does not forget his old home, although winning his bread under another flag; and that he patriotically desires to have the flora of his native Chateauguay and its neighbourhood made generally known. The next thing we have to remark is the advance made in the views of the author of this monograph. He now admits to the dignity of a species series of plants which as late as 1889, when the 6th edition of "Gray's Manual of the Botany of the Northern United States" was issued, he is represented as classing as mere varieties; for the list of the crataegus species contained in that work, pp. 165-67, is given as characterized by Prof. C. S. Sargent. This advance movement is in obedience to the prevailing tendency among men of science to multiply species; although there are some of conservative temper to oppose it. A series of plants, separated from other members of its genus by a quality or qualities easily discernible, constant, and perhaps functional, it is now usual to erect into a species. Prof. Sargent has found such differences in the collection of Crataegus from the neighbourhood of Montreal, furnished by Mr. Jack, as satisfy him that the number of species, hitherto recognised, in this part of the continent, is much too limited. Several of these were probably entirely new to him, while as to others, the result of longer experience and the use of wider opportunities of observation have given greater clearness of vision and more confidence in his own convictions, enabling him to announce his new determinations without hesitation. Nothing else can take the place of comparison of a large number of specimens, in the differentiation of species. Whether all the conclusions of Prof. Sargent, put forth in this brochure, be accepted or not, he has earned the gratitude of the botanists of this district. Any one who has made a collection of the hawthorns of the Island of Montreal and its neighbourhood, as the writer has done, has felt how inadequate was the list of Crataegus given in Macoun's Catalogue, and the description of species in Gray's Manual, or in the more recent publication of Britton and Brown, to embrace all the well marked differences of the specimens he obtained. All collectors will welcome this enlarged list. The first person to call attention to the large variety of Crataegus growing on the adjacent banks of the St. Lawrence, was Dr. T. J. W. Burgess, Medical Superintendent to the Hospital for the Insane at Verdun. Many years ago, he declared that there were not fewer than twelve well defined species to be found within a mile or two of Verdun ; and the one regret his friends now feel is that he did not proceed at once to describe them, as they urged him to do. He pleaded lack of time then, and now he is anticipated in this work by Prof. Sargent. But although we should have naturally enough been glad if a local naturalist had been the first to communicate to the world substantially what is now published by the Director of the Arnold Arboretum, science fortunately knows no national boundaries, and is not bound up with the claims to distinction of those who labour in its domain.

Accepting Prof. Sargent's catalogue of the Crataegus family of this province, we find him crediting it with twenty distinct species of native hawthorns, where Macoun allowed only five species and three varieties. They are collected into eight groups—CRUS-GALLI, PUNCTATÆ, MOLLES, FLABELLETÆ, TENUIFOLLÆ, DILITATÆ, TOMENTOSÆ, and COCCINEÆ. Six of the species are minutely described in this pamphlet,—*Crataegus suborbiculata, C. Canadensis, C. anomala, C. densiflora,* *C. Laurentiana* and *C. integriloba.* The rest had been described in previous issues of the "Rhodora," or in other publications.

The conjoint labours of Mr. Jack and Prof. Sargent in this connection cannot fail to give a fresh impetus to the local study of this interesting genus, especially as it is intimated in this paper that there are probably other species in the district remaining yet to be found and named.

Prof. Sargent's second pamphlet is of less interest to the botanists of Canada, perhaps, but is of equal importance as a contribution to the Natural History of this continent. In it he describes thirteen species of Crataegus to which he calls attention as "new or little known American trees." The majority of these were found in the States of Arkansas, Missouri and Texas, although one of them, *C. pedicellata,* is credited to Rochester, N.Y. The special point of interest to science in both brochures is the apparent sensitiveness to environment of the Crataegus family. This group of plants is now known to be represented by a much greater variety than was formerly assumed. Whether they are all to be counted distinct species or whether some of them are to be regarded rather as crosses between species hitherto acknowledged, it must be left to further observation in the future to determine.

Professor Sargent also describes in this paper, BETULA ALASKANA, a new species of Rocky Mountain birch, nearly allied to the *Betula papyrifera* of the east, and also BETULA OCCIDENTALIS HOOKER of the same region as well as a new species of Cypress, CYPRESSUS PYGMÆA, the habitat of which Mendocino County, California.

R.C.

A REVISION OF THE GENERA AND SPECIES OF CANADIAN PALÆOZOIC CORALS : *The Madreporaria Aporosa and the Madreporaria Rugosa.*—By Lawrence M. Lambe, P.G.S., Assistant Palaeontologist.

This is part of Vol. IV. of the Contributions to Canadian Palaeontology, furnished by the Geological Survey of Canada and published by the Government. It is an ideal work of its kind which cannot fail to win for Mr. Lambe a still higher reputation as a careful and skilful palaeontologist. In this volume he has described ninety-five species and two varieties, ninety-seven in all, embraced in twenty-four genera. The localities in which these fossil corals were found, the dates and the names of the collectors are given, and we are glad to see some of the names of members of the Geological Survey staff honoured by being chosen to designate species,—Richardson, Bell, Dawson, Whiteaves and Macoun,—as well as those of foreign geologists. The work is illustrated by eighteen admirable plates, in which sixty-nine of the species are described in side views and sections.

Addresses.—By D. C. MacCallum, M.D., M.R.C.S. Eng., Emeritus Professor of Midwifery and Diseases of Women and Children, McGill University. Montreal, Desbarats & Co., Printers, 1901.

This tastefully got up volume of 170 pages contains seven addresses delivered at different times by Dr. MacCallum during the course of his long and honoured career as a Professor in McGill College, and a practising physician in this city. It is dedicated to the memory of two of his former colleagues, Dr. George W. Campbell and Dr. R. P. Howard. All old time citizens and friends of McGill will be glad to possess a copy of this book. One feature of interest in it is that it carries the memory back to the days when the Medical Faculty had its quarters in the modest building which it occupied in Coté Street, but when it laid the foundations of that high reputation as a school of medicine which it still maintains in a more commodious and impressive environment. All who knew Doctors Campbell and Howard will appreciate the desire of Dr. MacCallum to do them honour ; for they were professional gentlemen of the highest mark, whose name is held in loving remembrance both by their former patients and by those who were students under them. And Dr. MacCallum was worthy to be associated with men of their eminence, as these addresses amply prove. They bear evidence of the widest culture. While Dr. MacCallum has clearly done a great deal of thinking of his own, this volume shows that he has been at great pains to familiarize himself with what other great thinkers have said and written, and he has given his students the benefit of the whole. Dr. MacCallum's outlook for medical men is a very wide one. The loftiest ideals were held up before the young men both entering upon their studies and commencing their professional career. Truth, honour, humanity, self-sacrifice, devoutness, loyalty, these were the sentiments appealed to as those which befitted men practising the noble healing art.

And as the matter of this book is admirable, so its style is attractive, having a decided literary flavour which makes it delightful reading. Nor it it without its interest to students of Natural History, as it contains a fitting tribute to Dr. Holmes, at one time Dean of the Medical Faculty of McGill, the founder of the gold medal which bears his name, which is the coveted prize of the graduating class in Medicine, but who is known specially among botanists as one of the Canadian pioneers of that science, he having made, eighty years ago, the first large collection of the plants to be found in and around the district of Montreal. This collection, which was tolerably complete at the time, he bequeathed to McGill University, and it is still of the highest interest and value, even with all the advancement which botany has made since his day. Dr. Holmes was also one of the warmest friends and most active spporters of the Natural History Society of Montreal.

R. C.

LY, 1901

M 187 feet. C. H. McLEOD, *Superintendent.*

DAY	Per cent. possible Sunshine.	Rainfall in inches.	Snowfall in inches.	Rain and snow melted.	DAY.
1	68	....	....	....	1
2	67	0.49	....	0.49	2
3	81	....	....	....	3
4	20	....	....	....	4
5	29	....	....	....	5
6	00	0.30	....	0.30	6
SUNDAY........7	17	0.64	....	0.64	7..........SUNDAY
8	66	....	....	....	8
9	78	....	....	....	9
10	27	0.00	....	0.00	10
11	89	....	....	....	11
12	99	....	....	....	12
13	89	....	....	....	13
SUNDAY........14	94	....	....	....	14..........SUNDAY
15	93	....	....	....	15
16	95	....	....	....	16
17	55	0.16	....	0.16	17
18	61	0.01	....	0.01	18
19	83	....	....	....	19
20	62	....	....	....	20
SUNDAY........21	35	0.00	....	0.00	21..........SUNDAY
22	82	....	....	....	22
23	72	....	....	....	23
24	05	0.13	....	0.13	24
25	48	....	....	....	25
26	95	....	....	....	26
27	15	....	....	....	27
SUNDAY........28	00	0.99	....	0.99	28..........SUNDAY
29	77	0.33	....	0.33	29
30	27	2.18	....	2.18	30
31	66	0.04	....	0.04	31
Means........	57.9	5.27	....	5.27	..............Sums.
27 Years means for and including this month	¶59.14	4.290	....	4.290	27 Years means for and including this month.

sea-level and

Direction........ taken from

Miles .... n being 100.

Duration in hrs. 20 hours.

Mean velocity....

the 16th; the

Greatest mile giving a range

Greatest vel rmest day was

on the 21st.

Resultant mi 30.24 on the

13th; lowest barometer was 29.59 on the 30th, giving a range of 0.65 inches.

Minimum relative humidity observed was 39 on the 12th.

Rain fell on 12 days.

Thunderstorms on the 2nd (two on the 2nd), 7th, 17th and 18th.

ABSTRACT FOR THE MONTH OF JULY, 1901

Meteorological Observations, McGill College Observatory, Montreal, Canada. Height above sea level, 187 feet. C. H. McLEOD, *Superintendent.*

DAY	THERMOMETER. † Mean.	Max.	Min.	Range.	*BAROMETER. † Mean.	Max.	Min.	Range.	‡Mean relative humidity.	WIND. General direction.	Mean velocity in miles per hour	Per cent. possible Sunshine.	Rainfall in inches.	Snowfall in inches.	Rain and snow melted.	DAY.
1	73.23	80.7	65.2	15.5	29.94	29.99	29.78	.21	66	W.	16.8	68	....	....	....	1
2	78.28	89.0	68.7	20.3	29.85	29.96	29.77	.19	80	S.W.	16.7	67	0.49	....	0.49	2
3	73.54	79.4	69.8	9.6	29.86	29.89	29.78	.11	59	N.W.	10.0	81	....	....	....	3
4	68.77	76.0	63.5	12.5	29.88	29.92	29.85	.07	68	W.	7.3	20	....	....	....	4
5	66.10	72.1	60.5	11.6	29.88	29.94	29.81	.13	51	E.	11.5	29	....	....	....	5
6	61.88	65.4	58.2	7.2	29.76	29.85	29.73	.12	91	E.	9.5	00	0.30	....	0.30	6
SUNDAY.... 7	62.56	72.0	56.1	15.9	29.76	29.86	29.72	.14	92	E.	10.0	17	0.64	....	0.64	7..........SUNDAY
8	62.85	71.5	55.1	16.4	30.03	30.13	29.86	.27	70	E.	11.5	66	....	....	....	8
9	68.42	79.2	56.0	23.2	39.11	30.16	30.05	.11	71	S.W.	5.5	78	....	....	....	9
10	70.38	77.0	64.3	12.7	29.94	30.06	29.85	.21	77	W.	13.7	27	0.00	....	0.00	10
11	67.70	73.6	63.1	10.5	29.99	30.09	29.85	.24	57	N.E.	12.2	89	....	....	....	11
12	69.02	79.8	58.0	21.8	30.19	30.22	30.09	.13	56	N.E.	5.8	99	....	....	....	12
13	71.98	83.3	59.5	23.8	30.18	30.24	30.11	.13	61	W.	9.2	89	....	....	....	13
SUNDAY........14	77.15	86.8	68.6	18.2	30.03	30.11	29.91	.20	65	W.	18.2	94	....	....	....	14..........SUNDAY
15	81.25	92.0	72.0	20.0	29.86	29.93	29.78	.15	61	W.	23.6	93	....	....	....	15
16	82.84	93.7	75.1	18.6	29.74	29.80	29.65	.15	59	W.	18.0	95	....	....	....	16
17	78.24	86.5	70.2	16.3	29.75	29.78	29.69	.09	70	N.E.	6.3	55	0.16	....	0.16	17
18	76.04	83.7	70.7	13.0	29.75	29.83	29.72	.11	66	N.E.	8.6	61	0.01	....	0.01	18
19	68.13	74.9	61.0	13.9	29.93	29.97	29.83	.14	57	N.E.	9.3	83	....	....	....	19
20	71.42	80.2	62.7	17.5	29.92	29.99	29.85	.14	57	W.	9.4	62	....	....	....	20
SUNDAY 21	76.27	87.1	67.7	19.4	29.69	29.85	29.61	.24	66	W.	22.8	35	0.00	....	0.00	21..........SUNDAY
22	74.54	84.3	68.8	15.5	29.80	29.89	29.65	.24	61	N.W.	11.8	82	....	....	....	22
23	72.95	83.4	63.0	20.4	29.94	29.97	29.89	.08	53	N.W.	11.9	72	....	....	....	23
24	59.62	69.0	55.0	14.0	29.93	30.01	29.87	.14	78	N.E.	10.1	05	0.13	....	0.13	24
25	61.19	70.1	53.7	16.4	30.04	30.08	30.00	.08	66	N.	8.0	48	....	....	....	25
26	63.55	72.1	53.8	18.3	30.12	30.16	30.07	.09	59	N.E.	7.4	95	....	....	....	26
27	67.52	76.0	56.0	20.0	30.13	30.20	30.04	.16	57	E.	4.1	15	....	....	....	27
SUNDAY........28	65.08	69.0	61.3	7.7	29.88	30.04	29.82	.22	90	E.	7.9	00	0.99	....	0.99	28..........SUNDAY
29	67.54	78.7	56.1	22.6	29.84	29.91	29.73	.18	72	E.	10.3	77	0.33	....	0.33	29
30	70.95	78.1	64.7	13.4	29.67	29.73	29.59	.14	87	W.	13.1	27	2.18	....	2.18	30
31	69.42	77.3	62.5	14.8	29.71	29.73	29.68	.05	75	W.	17.9	66	0.04	....	0.04	31
Means..........	70.27	78.77	62.61	16.16	29.907	29.977	29.827	.150	67.7	W 22° 51′ N	11.56	57.9	5.27	....	5.27	..............Sums.
27 Yearsmeans for and including this month	68.89	77.36	60.83	16.54	29.897	....	......	.143	71.7	....	§ 12.96	¶59.14	4.290	....	4.290	27 Years means for and including this month.

ANALYSIS OF WIND RECORD.

Direction.......	N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.	CALM.
Miles	302	1335	1250	193	227	549	3913	834	
Duration in hrs..	37	148	142	22	22	46	242	80	5
Mean velocity....	8.2	9.0	8.8	8.8	10.3	11.9	16.2	10.4	

Greatest mileage in one hour was 32 on the 15th.

Greatest velocity in gusts 34 miles per hour on the 21st.

Resultant mileage, 2,784.

Resultant direction, W. 22° 51′ N.

Total mileage, 8,603.

* Barometer readings reduced to sea-level and temperature 32° Fahrenheit.

† Mean of bi-hourly readings taken from self-recording instruments.

‡ Humidity relative, saturation being 100. Mean of observations at 8, 15 and 20 hours.

¶ 20 years only. § 15 years only.

The greatest heat was 93.7 on the 16th; the greatest cold was 53.7 on the 25th, giving a range of temperature of 40.0 degrees. Warmest day was the 16th. Coldest day was the 24th.

Highest barometer reading was 30.24 on the 13th; lowest barometer was 29.59 on the 30th, giving a range of 0.65 inches.

Minimum relative humidity observed was 39 on the 12th.

Rain fell on 12 days.

Thunderstorms on the 2nd (two on the 2nd), 7th, 17th and 18th.

JST, 1901

Me feet. C. H. McLEOD, *Superintendent.*

DAY	Per cent. possible Sunshine.	Rainfall in inches.	Snowfall in inches.	Rain and snow melted.	DAY.
	19	0.00	....	0.00	1
	51	....	....	....	2
	27	0.04	....	0.04	3
SUNDAY....	94	....	....	....	4..........SUNDAY
	88	....	....	....	5
	35	....	....	....	6
	00	1.11	....	1.11	7
	64	0.05	....	0.05	8
	58	0.04	....	0.04	9
	00	1.33	....	1.33	10
SUNDAY........	36	....	....	....	11..........SUNDAY
	47	....	....	....	12
	82	....	....	....	13
	86	....	....	....	14
	08	0.00	....	0.00	15
	77	....	....	....	16
	76	0.00	....	0.00	17
SUNDAY........	88	....	....	....	18..........SUNDAY
	74	....	....	....	19
	07	0.28	....	0.28	20
	41	....	....	....	21
	54	0.12	....	0.12	22
	33	0.87	....	0.87	23
	03	0.02	....	0.02	24
SUNDAY.......	80	....	....	....	25..........SUNDAY
	63	....	....	....	26
	85	....	....	....	27
	74	....	....	....	28
	76	....	....	....	29
	04	0.24	....	0.24	30
	00	1.34	....	1.34	31
Means......	¶49.2	5.44	....	5.44	..............Sums.
27 Yearsmeans for and including this month	57.81	3.57	....	3.57	27 Years means for and including this month.

Direction........

Miles ....

Duration in hrs.

Mean velocity...

Greatest mil

and 24th.

Greatest ve

hour on the 8th.

Resultant m

-level and

ken from

being 100.

hours.

22nd; the

ng a range

st day was

28 on the

6th; lowest barometer was 29.71 on the 10th, giving a range of .57 inches.

Minimum relative humidity observed was 43 on the 6th.

Rain fell on 14 days.

Thunderstorms on the 8th, 10th, 22nd, 23rd, and two on the 30th.

ABSTRACT FOR THE MONTH OF AUGUST, 1901

Meteorological Observations, McGill College Observatory, Montreal, Canada. Height above sea level, 187 feet. C. H. McLEOD, *Superintendent.*

DAY	THERMOMETER. † Mean.	THERMOMETER. Max.	THERMOMETER. Min.	THERMOMETER. Range.	* BAROMETER. † Mean.	* BAROMETER. Max.	* BAROMETER. Min.	* BAROMETER. Range.	‡ Mean relative humidity.	WIND. General direction.	WIND. Mean velocity in miles per hour	Per cent. possible Sunshine.	Rainfall in inches.	Snowfall in inches.	Rain and snow melted.	DAY.
1	62.28	65.0	58.3	6.7	29.83	29.92	29.73	.19	80	W.	12.5	19	0.00	....	0.00	1
2	65.77	72.1	59.0	13.1	29.89	29.94	29.81	.13	74	W.	9.1	51	....	....	....	2
3	66.65	74.1	59.5	14.6	29.81	29.85	29.79	.06	79	W.	11.5	27	0.04	....	0.04	3
SUNDAY...... 4	68.57	77.0	61.0	16.0	29.94	30.06	29.85	.21	60	N.	9.2	94	....	....	....	4............SUNDAY
5	65.75	73.4	58.3	15.1	30.17	30.21	30.06	.15	59	N.W.	7.5	88	....	....	....	5
6	66.48	75.4	55.5	19.9	30.24	30.28	30.18	.10	64	S.E.	8.1	35	....	....	....	6
7	61.97	67.1	58.2	8.9	29.92	30.18	29.79	.39	94	W.	13.4	00	1.11	....	1.11	7
8	66.42	77.0	59.2	17.8	29.82	29.88	29.72	.16	83	W.	15.5	64	0.05	....	0.05	8
9	63.23	72.6	57 0	15.6	30.01	30.05	29.83	.22	69	W.	10.9	58	0.04	....	0.04	9
10	59.92	66.0	55.7	10.3	29.80	30.03	29.71	.32	99	N.E.	10.8	00	1.33	....	1.33	10
SUNDAY........11	61.32	66.0	56.1	9.9	30.01	30.10	29.79	.31	67	N.E.	6.7	36	....	....	....	11...........SUNDAY
12	65.42	73.7	57.0	16.7	30.07	30.10	30.03	.07	75	N.	5.0	47	....	....	....	12
13	68.85	78.3	58.3	20.0	30.09	30.13	30.05	.08	76	W.	8.7	82	....	....	....	13
14	72.46	82.0	61.0	21.0	29.99	30.07	29.93	.14	73	W.	10.1	86	....	....	...	14
15	71.41	78.7	65.0	13.7	29.85	29.93	29.75	.18	81	W.	13.0	08	0.00	....	0.00	15
16	68.57	74.8	64.2	10.6	29.86	29.94	29.75	.19	70	N.W.	17.9	77	....	....	....	16
17	70.08	79.0	61.1	17.9	29.91	29.95	29.85	.10	73	N.W.	18.3	76	0.00	....	0.00	17
SUNDAY........18	63.32	71.2	57.0	14.2	30.08	30.13	29.92	.21	63	N.E.	9.4	88	....	....	....	18...........SUNDAY
19	66.85	77.8	55.0	22.8	30.11	30.17	30.04	.13	70	E.	7.2	74	....	....	....	19
20	67.51	72.0	64.0	8.0	30.05	30 07	30.02	.05	94	E.	5.4	07	0.28	....	0.28	20
21	68.83	79.0	61.5	17.5	30.09	30.15	30.06	.09	78	E.	7.8	41	....	....	....	21
22	71.12	84.7	60.6	24.1	30.05	30.10	30.01	.09	90	W.	11.0	54	0.12	....	0.12	22
23	74.70	83.5	69.5	14.0	30.00	30.06	29.94	.12	88	W.	12.9	33	0.87	....	0.87	23
24	68.86	73.8	65.1	8.7	30.03	30.11	29.95	.16	79	W.	15.3	03	0.02	....	0.02	24
SUNDAY....... 25	68.44	75.0	63.0	12.0	30.09	30.13	30.05	.08	68	N.W	7.3	80	....	....	....	25 ....SUNDAY
26	69.12	76.7	62.2	14.5	30.06	30.10	30.02	.08	69	N.W.	6.5	63	....	....	....	26
27	69.25	78.0	60.6	17.4	30.11	30.16	30.05	.11	75	E.	4.9	85	....	....	....	27
28	70.66	80.0	61.7	18.3	30.15	30.21	30.11	.10	68	E.	6.5	74	....	....	....	28
29	74.26	81.7	65.4	16.3	30.03	30.11	29.94	.17	67	N.W.	16.4	76	....	....	....	29
30	68.24	73.9	64.6	9.3	29.90	29.94	29.88	.06	85	W.	9.4	04	0.24	....	0.24	30
31	59.19	64.6	56.6	8.0	29.98	30 00	29.92	.08	96	N.	13.0	00	1.34	....	1.34	31
Means......	67.31	74.97	60.36	14.61	29.998	30.066	29.920	.146	76.0	W.26° 29′ N.	§10.36	¶49.2	5.44	....	5.44	..............Sums.
27 Yearsmeans for and including this month	66.78	75.07	58.88	16.19	29.942	....	......	.133	73.5	....	12.16	57.81	3.57	....	3.57	27 Years means for and including this month.

ANALYSIS OF WIND RECORD.

Direction........	N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.	CALM.
Miles	773	432	1049	185	88	155	3685	1340	
Duration in hrs..	80	47	151	20	8	10	306	120	2
Mean velocity....	9.7	9.2	6.9	9.2	11.0	15.5	12.0	11.2	

Greatest mileage in one hour was 24 on the 17th and 24th.

Greatest velocity in gusts was 36 miles per hour on the 8th.

Resultant mileage, 3673.

Resultant direction, W. 26° 29′ N.
Total mileage, 7,707.

* Barometer readings reduced to sea-level and temperature 32° Fahrenheit.

† Mean of bi-hourly readings taken from self-recording instruments.

‡ Humidity relative, saturation being 100. Mean of observations at 8, 15 and 20 hours.

¶ 20 years only. § 15 years only.

The greatest heat was 84.7 on the 22nd; the greatest cold was 55.0 on the 19th, giving a range of temperature of 29.7 degrees. Warmest day was the 23rd. Coldest day was the 31st.

Highest barometer reading was 30.28 on the 6th; lowest barometer was 29.71 on the 10th, giving a range of .57 inches.

Minimum relative humidity observed was 43 on the 6th.

Rain fell on 14 days.

Thunderstorms on the 8th, 10th, 22nd, 23rd, and two on the 30th.

MBER, 1901.

M37 feet. C. H. McLEOD, *Superintendent.*

DAY	Per cent. possible Sunshine.	Rainfall in inches.	Snowfall in inches.	Rain and snow melted.	DAY.
SUNDAY.... ...	39	....	....	....	1 ....SUNDAY
	52	....	....	....	2
	66	....	....	....	3
	85	....	....	....	4
	78	....	....	....	5
	93	....	....	....	6
	94	0.84	....	0.84	7
SUNDAY........	95	....	....	....	8..........SUNDAY
	64	....	....	....	9
	78	....	....	....	10
	00	0.33	....	0.33	11
	01	0.38	....	0.38	12
	33	0.01	....	0.01	13
	86	....	....	....	14
SUNDAY........	01	0.14	....	0.14	15..........SUNDAY
	79	0.06	....	0.06	16
	02	0.42	....	0.42	17
	73	0.13	....	0.13	18
	41	0.07	....	0.07	19
	31	0.02	....	0.02	20
	91	0.02	....	0.02	21
SUNDAY........2	89	....	....	....	22..........SUNDAY
2	85	....	....	....	23
2	67	....	....	....	24
2	94	....	....	....	25
2	68	0.00	....	0.00	26
2	84	....	....	....	27
2	79	....	....	....	28
SUNDAY........2	00	1.53	....	1.53	29 ....SUNDAY
3	50	....	....	....	30
Means...... ..	¶60.3	3.95	....	3.95	................Sums.
27 Years means for and including this month	53.90	3.30	....	3.30	27 Years means for and including this month.

ea-level and

Direction.......
Miles ....
Duration in hrs.
Mean velocity...

taken from

being 100.

hours.

he 6th; the

Greatest mil ving a range

Greatest ve hest day was hour on the 30th

Resultant m 0.57 on the

25th; lowest barometer was 29.49 on the 12th, giving a range of 1.08 inches.

Minimum relative humidity observed was 31 on the 30th.

Rain fell on 13 days.

Thunderstorms on the 7th and 16th.

Fog on the 3rd. Lunar halo on the 28th.

ABSTRACT FOR THE MONTH OF SEPTEMBER, 1901.

Meteorological Observations, McGill College Observatory, Montreal, Canada. Height above sea level, 187 feet. C. H. McLEOD, *Superintendent.*

DAY	THERMOMETER. † Mean.	Max.	Min.	Range.	* BAROMETER. † Mean.	Max.	Min.	Range.	‡Mean relative humidity.	WIND. General direction.	Mean velocity in miles per hour	Per cent. possible Sunshine.	Rainfall in inches.	Snowfall in inches.	Rain and snow melted.	DAY.
SUNDAY........ 1	63.71	70.4	57.7	12.7	30.02	30.05	30.00	.05	84	N.	10.6	39	....	....	....	1..........SUNDAY
2	68.47	75.2	62.0	13.2	30.00	30.02	29.98	.04	80	N.E.	6.2	52	....	....	....	2
3	68.77	77.0	60.0	17.0	30.07	30.12	30.02	.10	85	E.	6.4	66	....	....	....	3
4	73.39	81.0	66.0	15.0	30.01	30.06	29.97	.09	74	E.	17.2	85	....	....	....	4
5	73.73	81.5	65.8	15.7	30.07	30.12	30.00	.12	81	N.W.	8.5	78	....	....	....	5
6	76.29	83.0	70.2	12.8	30.08	30.14	30.03	.11	71	N.W.	16.1	93	....	....	....	6
7	71.97	81.7	56.2	25.5	29.93	30.03	29.80	.23	79	N.W.	17.3	94	0.84	....	0.84	7
SUNDAY........ 8	54.59	60.2	46.1	14.1	30.07	30.14	29.99	.15	60	N.W.	14.4	95	....	....	....	8..........SUNDAY
9	56.88	65.7	47.6	18.1	30.04	30.10	30.00	.10	73	W.	14.8	64	....	....	....	9
10	61.52	70.0	53.3	16.7	30.00	30.07	29.92	.15	63	W.	8.8	78	....	....	....	10
11	57.24	59.0	55.5	3.5	29.80	29.92	29.74	.18	91	S.E.	6.4	00	0.33	....	0.33	11
12	58.78	62.8	52.2	10.6	29.63	29.74	29.49	.25	94	N.	6.3	01	0.38	....	0.38	12
13	63.94	70.9	57.8	13.1	29.65	29.77	29.52	.25	74	N.W.	6.9	33	0.01	....	0.01	13
14	62.87	70.4	52.9	17.5	29.91	29.96	29.77	.19	76	W.	5.5	86	....	....	....	14
SUNDAY........ 15	62.97	68.5	56.2	12.3	29.73	29.96	29.59	.37	94	S.	6.0	01	0.14	....	0.14	15..........SUNDAY
16	64.33	72.2	58.5	13.7	29.71	29.81	29.59	.22	77	S.W.	19.5	79	0.06	....	0.06	16
17	54.92	56.7	52.3	4.4	29.78	29.81	29.71	.10	91	W.	14.2	02	0.42	....	0.42	17
18	54.16	60.8	48.3	12.5	29.93	30.02	29.78	.24	76	W.	13.4	73	0.13	....	0.13	18
19	50.78	56.5	46.7	9.8	30.16	30.31	30.02	.29	74	W.	9.6	41	0.07	....	0.07	19
20	48.78	56.0	39.6	16.4	30.19	30.31	30.01	.30	79	W.	5.7	31	0.02	....	0.02	20
21	51.75	57.7	46.8	10.9	30.09	30.19	30.00	.19	74	W.	14.7	91	0.02	....	0.02	21
SUNDAY........ 22	56.95	68.2	44.0	24.2	30.09	30.19	30.01	.18	74	W.	15.7	89	....	....	....	22..........SUNDAY
23	62.84	73.6	51.0	22.6	29.99	30.09	29.90	.19	72	W.	21.6	85	....	....	....	23
24	57.29	64.0	44.0	20.0	30.17	30.43	29.95	.48	60	N.E.	18.2	67	....	....	....	24
25	45.56	53.0	38.0	15.0	30.51	30.57	30.43	.14	64	N.	10.4	94	....	....	....	25
26	48.09	56.9	36.9	20.0	30.45	30.54	30.37	.17	69	E.	5.6	68	0.00	....	0.00	26
27	56.98	67.6	48.0	19.6	30.32	30.39	30.25	.14	76	S.W.	11.8	84	....	....	....	27
28	61.01	69.9	50.0	19.9	30.16	30.25	30.08	.17	75	S.W.	13.3	79	....	....	....	28
SUNDAY........ 29	64.28	66.7	58.0	8.7	29.85	30.08	29.56	.52	96	E.	11.3	00	1.53	....	1.53	29..........SUNDAY
30	57.92	64.5	49.3	15.2	29.87	30.09	29.56	.53	61	W.	19.7	50	....	....	....	30
Means..........	60.36	67.39	52.36	15.02	30.011	30.109	29.901	.208	76.6	W. 13° 28′ N.	§11.87	¶60.3	3.95	....	3.95	..............Sums.
27 Years means for and including this month	58.53	66.53	50.84	15.70	30.015	....	......	.185	76.2	....	12.81	53.90	3.30	....	3.30	27 Years means for and including this month.

ANALYSIS OF WIND RECORD.

Direction........	N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.	CALM.
Miles	640	487	595	237	139	973	3905	1568	
Duration in hrs..	64	52	60	24	19	69	290	129	13
Mean velocity....	10.0	9.4	9.9	9.9	7.3	14.1	13.5	12.1	

Greatest mileage in one hour was 34 on the 30th.

Greatest velocity in gusts was 36 miles per hour on the 30th.

Resultant mileage, 4723.

Resultant direction, W. 13° 28′ N.

Total mileage, 8,544.

* Barometer readings reduced to sea-level and temperature 32° Fahrenheit.

† Mean of bi-hourly readings taken from self-recording instruments.

‡ Humidity relative, saturation being 100. Mean of observations at 8, 15 and 20 hours.

¶ 20 years only. § 15 years only.

The greatest heat was 83.0 on the 6th; the greatest cold was 36.9 on the 26th, giving a range of temperature of 46.1 degrees. Warmest day was the 6th. Coldest day was the 25th.

Highest barometer reading was 30.57 on the 25th; lowest barometer was 29.49 on the 12th, giving a range of 1.08 inches.

Minimum relative humidity observed was 31 on the 30th.

Rain fell on 13 days.

Thunderstorms on the 7th and 16th.

Fog on the 3rd. Lunar halo on the 28th.

BER, 1901.

Me7 feet. C. H. McLEOD, *Superintendent.*

DAY	Per cent. possible Sunshine.	Rainfall in inches.	Snowfall in inches.	Rain and snow melted.	DAY.
1	65	....	....	....	1
2	00	0.59	....	0.59	2
3	51	....	....	....	3
4	58	....	....	....	4
5	50	0.04	....	0.04	5
SUNDAY...... 6	13	....	....	....	6..........SUNDAY
7	90	....	....	....	7
8	07	....	....	...	8
9	00	....	....	....	9
10	00	0.30	....	0.30	10
11	42	....	....	....	11
12	51	....	....	....	12
SUNDAY........13	00	0.60	....	0.60	13..........SUNDAY
14	07	....	....	....	14
15	93	....	....	....	15
16	00	0.13	0.0	0.13	16
17	00	0.62	....	0.62	17
18	79	....	....	0.00	18
19	14	0.85	1.0	0.95	19
SUNDAY........20	39	0.02	....	0.02	20..........SUNDAY
21	80	0.06	....	0.06	21
22	70	....	....	....	22
23	32	0.02	....	0.02	23
24	01	....	....	0.00	24
25	78	....	....	....	25
26	63	0.00	0.0	0.00	26
SUNDAY........27	83	0.27	....	0.27	27..........SUNDAY
28	99	....	....	....	28
29	58	....	....	....	29
30	37	....	....	....	30
31	41	....	....	....	31
Means...... ..	41.8	3.50	1.0	3.60	..............Sums.
27 Yearsmeans for and including this month	¶41.60	3.03	....	3.13	27 Years means for and including this month.

-level and

Direction........	
Miles	
Duration in hrs..	
Mean velocity....	

ken from

being 100.

ours.

12th; the

Greatest mileang a range

Greatest velocist day was hour on the 23rd.

Resultant milea5 on the

29th; lowest barometer was 29.36 on the 23rd giving a range of 1.29 inches.

Minimum relative humidity observed was 47 on the 18th.

Rain fell on 12 days.

Snow fell on 3 days.

Rain or Snow fell on 14 days.

Lunar Corona on 31st.

Fog on the 29th.

ABSTRACT FOR THE MONTH OF OCTOBER, 1901.

Meteorological Observations, McGill College Observatory, Montreal, Canada. Height above sea level, 187 feet. C. H. McLEOD, *Superintendent.*

DAY	THERMOMETER. † Mean.	Max.	Min.	Range.	* BAROMETER. † Mean.	Max.	Min.	Range.	‡ Mean relative humidity.	WIND. General direction.	Mean velocity in miles per hour	Per cent. possible Sunshine.	Rainfall in inches.	Snowfall in inches.	Rain and snow melted.	DAY.
1	54.74	63.0	44.2	18.8	29.98	30.13	29.74	.39	79	S.W	10.0	65	....	....	....	1
2	53.86	62.7	44.5	18.2	29.61	29.74	29.49	.25	88	S.E.	16.6	00	0.59	....	0.59	2
3	40.57	54.1	41.2	12.9	29.69	29.75	29.66	.09	77	W.	6.6	51	....	....	....	3
4	44.63	54.1	39.0	15.1	29.92	30.11	29.75	.36	82	W.	12.0	58	....	....	....	4
5	33.72	47.7	39.1	8.6	30.08	30.17	29.89	.28	79	W.	12.8	50	0.04	....	0.04	5
SUNDAY...... 6	42.62	49.0	35.5	13.5	30.13	30.36	29.85	.51	77	N.W.	13.5	13	....	....	....	6..........SUNDAY
7	44.77	51.0	36.7	14.3	30.41	30.47	30.35	.12	72	W.	14.6	90	....	....	....	7
8	50.80	58.7	43.3	15.4	30.24	30.35	30.11	.24	75	S.W.	13.3	07	....	....	...	8
9	54.35	62.0	47.1	14.9	30.09	30.11	30.06	.05	82	S.W.	13.3	00	....	....	....	9
10	56.83	61.0	53.0	8.0	30.14	30.17	30.09	.08	94	S	11.1	00	0.30	....	0.30	10
11	58.94	66.0	53.0	13.0	30.15	30.21	30.08	.13	90	S.W.	11.8	42	....	....	....	11
12	61.17	70.0	54.6	15.4	29.94	30.08	29.86	.22	83	S. E.	15.8	51	....	....	....	12
SUNDAY........13	59.17	63.0	54.9	8.1	29.77	29.86	29.67	.19	89	S.E.	19.3	00	0.60	....	0.60	13..........SUNDAY
14	53.84	57.0	50.7	6.3	29 94	29.99	29.81	.18	76	S.W.	10.8	07	....	....	....	14
15	52.37	59.0	47.0	12.0	30.00	30 02	29.94	.08	70	S.W.	14.7	93	....	....	....	15
16	50.35	52.2	46.2	6.0	29.99	30.03	29.94	.09	87	S.W.	13.7	00	0.13	0.0	0.13	16
17	40.87	47.5	35 5	12.0	29.82	29.94	29.78	.16	82	N.E.	8.3	00	0.62	....	0.62	17
18	37.21	41.0	34.1	6.9	29.9[illegible]	29.99	29.82	.17	60	W.	14.9	79	....	....	0.00	18
19	39.12	47.0	32.9	14.1	29.86	30.19	29.94	.25	78	N.	18.0	14	0.85	1.0	0.95	19
SUNDAY........20	35.34	38.8	30.5	8.3	30.34	30.40	30.19	.21	72	W.	14.0	39	0.02	....	0.02	20..........SUNDAY
21	39.15	42.0	35.5	6.5	30.27	30.34	30.16	.18	76	W.	11.8	80	0.06	....	0.06	21
22	49.32	55.3	35.0	20.3	29.87	30.16	29.83	.33	73	W.	20.4	70	....	....	....	22
23	52.89	62.6	42.1	20.5	29.53	29.83	29.36	.47	71	W.	27.5	32	0.02	....	0.02	23
24	40.02	43.8	36.0	7.8	29.88	30.11	29.63	.48	62	N.W.	20.6	01	....	....	0.00	24
25	37 72	42.1	31.0	11.1	30.18	30.24	30.11	.13	61	N.W.	13.7	78	....	....	....	25
26	46.44	57.0	35.0	22.0	29.96	30.14	29.82	.32	69	W.	18.6	63	0.00	0.0	0.00	26
SUNDAY........27	43.57	53.0	37.0	16.0	30.11	30.35	29.82	.53	58	N.W.	15.1	83	0.27	....	0.27	27..........SUNDAY
28	36.07	40.8	31.6	9.2	30.55	30.63	30.35	.28	68	N.W.	6.7	99	....	....	....	28
29	38.52	49.4	30.0	19.4	30.56	30.65	30.45	.20	73	E.	7.9	58	....	....	....	29
30	53.84	58.1	41.2	16.9	30.27	30.45	30.17	.28	74	S.W.	15.4	37	....	....	....	30
31	53.53	63.0	46.1	16.9	30.08	30.17	29 91	.26	74	S.	14.7	41	....	....	....	31
Means...... ..	47.17	53.93	40.76	13.17	30.041	30.166	29.924	.242	75.8	W.16°15′S.	14.11	41.8	3.50	1.0	3.60	..............Sums.
27 Yearsmeans for and including this month	45.95	52.93	39.05	13.88	30.014	....	......	.217	76.9	....	§ 13.44	¶41.60	3.03	....	3.13	27 Years means for and including this month.

ANALYSIS OF WIND RECORD.

Direction.......	N	N.E.	E.	S.E.	S.	S.W.	W.	N.W.	CALM.
Miles	676	205	197	987	864	2711	3274	1587	
Duration in hrs..	54	22	29	64	66	193	207	105	4
Mean velocity....	12.5	9.3	6.8	15.4	13.1	14.0	15.8	15.1	

Greatest mileage in one hour was 34 on the 23rd

Greatest velocity in gusts was 40 miles per hour on the 23rd.

Resultant mileage, 5480.

Resultant direction, W. 16° 15′ S.

Total mileage, 10,501.

* Barometer readings reduced to sea-level and temperature 32° Fahrenheit.

† Mean of bi-hourly readings taken from self-recording instruments.

‡ Humidity relative, saturation being 100. Mean of observations at 8, 15 and 20 hours.

¶ 20 years only. § 15 years only.

The greatest heat was 70.0 on the 12th; the greatest cold was 30.0 on the 29th, giving a range of temperature of 40.0 degrees. Warmest day was the 12th. Coldest day was the 20th.

Highest barometer reading was 30.65 on the 29th; lowest barometer was 29.36 on the 23rd giving a range of 1.29 inches.

Minimum relative humidity observed was 47 on the 18th.

Rain fell on 12 days.

Snow fell on 3 days.

Rain or Snow fell on 14 days.

Lunar Corona on 31st.

Fog on the 29th.

MBER, 1901.

M feet. C. H. McLEOD, *Superintendent.*

DAY	Per cent. possible Sunshine.	Rainfall in inches.	Snowfall in inches.	Rain and snow melted.	DAY.
	71	0.02	....	0.02	1
	47	....	....	....	2
SUNDAY.......	89	....	....	....	3..........SUNDAY
	76	....	....	....	4
	01	....	....	....	5
	69	....	....	....	6
	00	....	....	....	7
	06	0.01	....	0.01	8
	01	0.04	....	0.04	9
SUNDAY.......	91	....	....	....	10..........SUNDAY
	00	....	0.0	0.00	11
	00	0.88	0.6	1.02	12
	00	....	4.4	0.44	13
	00	....	9.7	0.99	14
	02	....	3.2	0.32	15
	00	....	1.0	0.10	16
SUNDAY.......	63	....	1.4	0.14	17..........SUNDAY
	33	....	0.3	0.03	18
	00	....	0.5	0.05	19
	00	....	....	....	20
	71	....	0.0	0.00	21
	00	....	1.2	0.12	22
	60	....	....	....	23
SUNDAY.......	00	0.10	0.0	0.10	24..........SUNDAY
	00	....	4.1	0.41	25
	00	....	2.0	0.20	26
	27	....	0.5	0.05	27
	00	....	0.2	0.02	28
	00	....	0 0	0.00	29
	00	....	0.1	0.01	30
Means......	23.8	1.05	29.2	4.07	..............Sums.
27 Years mea for and includi this month	28.69	2.32	13.90	3.74	27 Years means for and including this month.

-level and	10th; lowest barometer was 29.11 on the 14th, giving a range of 1.34 inches.
ken from	Minimum relative humidity observed was 46 on the 4th.
Direction.....	
Miles .... eing 100.	Rain fell on 5 days.
ours.	Snow fell on 18 days.
Duration in hr	Rain or Snow fell on 21 days.
Mean velocity. 1st; the	Depth of snow on ground at end of month, 13 inches.
a range	

Greatest m t day was 9th, 13th and 2

Greatest v5 on the hour on the 5th

Fog on the 7th.

ABSTRACT FOR THE MONTH OF NOVEMBER, 1901.

Meteorological Observations, McGill College Observatory, Montreal, Canada. Height above sea level, 187 feet. C. H. McLEOD, *Superintendent.*

DAY	THERMOMETER. † Mean.	THERMOMETER. Max.	THERMOMETER. Min.	THERMOMETER. Range.	* BAROMETER. † Mean.	* BAROMETER. Max.	* BAROMETER. Min.	* BAROMETER. Range.	‡ Mean relative humidity.	WIND. General direction.	WIND. Mean velocity in miles per hour	Per cent. possible Sunshine.	Rainfall in inches.	Snowfall in inches.	Rain and snow melted.	DAY.
1	52.58	57.7	48.5	9.2	29.94	30.01	29.86	.15	70	S.W	20.7	71	0.02	....	0.02	1
2	44.02	49.0	37.0	12.0	30.25	30.37	30.01	.36	64	N.W.	12.0	47	....	....	....	2
SUNDAY........ 3	38.67	47.0	33.2	13.8	30.24	30.36	30.06	.30	72	N.E.	9.5	89	....	....	....	3..........SUNDAY
4	43.75	53.9	34.0	19.9	30.01	30.09	30.04	.05	66	S.	15.9	76	....	....	....	4
5	27.07	40.1	34.1	6.0	30.17	30.21	30.04	.17	75	W.	14.5	01	....	....	....	5
6	36.86	42.1	33.2	8.9	30.16	30.21	30.14	.07	68	W.	10.9	69	....	....	....	6
7	35.57	40.1	28.6	11.5	30.06	30.20	29 91	.29	77	E.	7.6	00	....	....	....	7
8	38.65	43.0	35.0	8.0	29.97	30.08	29.88	.20	79	W.	13.0	06	0.01	....	0.01	8
9	37.82	41.6	30.5	11.1	29.97	30.06	29.88	.18	78	W.	15.6	01	0.04	....	0.04	9
SUNDAY........10	25.67	30.5	21.2	9.3	30.32	30.45	30.04	.41	74	N.W.	19.9	91	....	....	....	10..........SUNDAY
11	25.72	29.7	20.2	9.5	30.17	30.44	29.86	.58	87	E.	10.0	00	....	0.0	0.00	11
12	31.38	33.7	27.0	6.7	29.45	29.86	29.26	.60	96	E.	14.7	00	0.88	0.6	1.02	12
13	27.40	32.0	24.0	8.0	29.39	29.44	29.29	.15	94	N.W.	24.4	00	....	4.4	0.44	13
14	25.97	28.9	23.0	5.9	29.18	29.29	29.11	.18	92	W.	17.8	00	....	9.7	0.99	14
15	27.03	29.0	25.0	4.0	29.43	29.49	29.27	.22	94	S.E.	5.3	02	....	3.2	0.32	15
16	30.07	30.9	27.0	3.9	29.63	29.77	29.46	.31	88	W.	17.8	00	....	1.0	0.10	16
SUNDAY........17	30.07	33.6	27.0	6.6	29.86	29.94	29.77	.17	86	W.	16.8	63	....	1.4	0.14	17..........SUNDAY
18	31.90	34.3	30.0	4.3	30.01	30.03	29.94	.09	88	N.W.	8.8	33	....	0.3	0.03	18
19	27.92	29.5	24.2	5.3	30.09	30.17	30.01	.16	89	W.	8.5	00	....	0.5	0.05	19
20	20.69	26.0	19.5	6.5	30.23	30.26	30.17	.09	90	W.	10.9	00	....	....	....	20
21	26.14	30.5	20.5	10.0	30.26	30.27	30.25	.02	80	W.	13.0	71	....	0.0	0.00	21
22	32.77	38.1	22.3	15.8	30.14	30.25	30.05	.20	87	W.	18.1	00	....	1.2	0.12	22
23	16.40	22.3	11.1	11.2	30.34	30.43	30.23	.20	89	N. E.	13.5	60	....	....	....	23
SUNDAY........24	22.15	28.2	14.5	13.7	29.98	30.23	29.79	.44	89	N.E.	18.0	00	0.10	0.0	0.10	24..........SUNDAY
25	28.23	32.5	26.0	6.5	29.63	29.79	29.54	.25	95	N.E.	21.1	00	....	4.1	0.41	25
26	21.59	27.0	16.0	11.0	29.75	29 90	29.56	.34	87	N.W.	21.5	00	....	2.0	0.20	26
27	12.32	16.0	6.1	9.9	30.05	30.18	29.90	.28	82	W.	23.0	27	....	0.5	0.05	27
28	12.22	15.3	6.2	9.1	30.20	30.24	30.16	.08	83	W.	20.2	00	....	0.2	0.02	28
29	12.16	17.0	4.3	12.7	29.95	30.17	29.85	.32	89	W.	8.2	00	....	0 0	0.00	29
30	19.22	22.2	13.8	8.4	30.00	30.04	29.87	.17	77	W.	13.3	00	....	0.1	0.01	30
Means......	28.73	33.39	24.10	9.29	29.963	30.074	29.840	.234	82.8	W.19°47′N.	14.81	23.8	1.05	29.2	4.07	..............Sums.
27 Yearsmeans for and including this month	31.73	38.69	26.62	12.08	30.013	....	......	.269	80.48	....	§ 15 95	¶28.69	2.32	13.90	3.74	27 Years means for and including this month.

ANALYSIS OF WIND RECORD.

Direction........	N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.	CALM.
Miles	214	1302	781	209	239	714	4488	2715	
Duration in hrs..	18	89	72	23	20	48	301	150	2
Mean velocity....	11.9	14.6	10.8	9.1	11.9	14.9	14.9	18.1	

Greatest mileage in one hour was 30 on the 5th, 9th, 13th and 27th.

Greatest velocity in gusts was 32 miles per hour on the 5th and 27th.

Resultant mileage, 6307.
Resultant direction, W. 19° 47′ N.
Total mileage, 10,662.

* Barometer readings reduced to sea-level and temperature 32° Fahrenheit.

† Mean of bi-hourly readings taken from self-recording instruments.

‡ Humidity relative, saturation being 100. Mean of observations at 8, 15 and 20 hours.

¶ 20 years only. § 15 years only.

The greatest heat was 57.7 on the 1st; the greatest cold was 4.3 on the 29th, giving a range of temperature of 53.4 degrees. Warmest day was the 1st. Coldest day was the 29th.

Highest barometer reading was 30.45 on the 10th; lowest barometer was 29.11 on the 14th, giving a range of 1.34 inches.

Minimum relative humidity observed was 46 on the 4th.

Rain fell on 5 days.

Snow fell on 18 days.

Rain or Snow fell on 21 days.

Depth of snow on ground at end of month, 13 inches.

Fog on the 7th.

IBER, 1901.

M7 feet. C. H. McLEOD, *Superintendent.*

DAY	Per cent. possible Sunshine.	Rainfall in inches.	Snowfall in inches.	Rain and snow melted.	DAY.
SUNDAY........	00	....	....	....	1..........SUNDAY
	05	0.06	....	0.06	2
	11	....	....	....	3
	00	....	1.1	0.11	4
	00	....	....	....	5
	00	....	....	....	6
	00	....	....	....	7
SUNDAY........	00	0.01	1.8	0.19	8..........SUNDAY
	00	0.47	....	0.47	9
1	00	0.40	1.3	0.53	10
1	93	....	....	....	11
1	00	....	0.0	0.00	12
1	00	....	....	....	13
1	00	0.95	....	0.95	14
SUNDAY........1	00	1.00	0.8	1.08	15..........SUNDAY
1	69	....	....	....	16
1	00	....	....	....	17
1	01	....	....	....	18
1	00	....	0.3	0.03	19
2	08	....	0.2	0.02	20
2	13	....	....	....	21
SUNDAY........2	00	....	0.0	0.00	22..........SUNDAY
2	00	....	0.5	0.05	23
2	00	....	1.4	0.14	24
2	44	....	....	....	25
2	16	....	....	....	26
2	08	....	1.7	0.17	27
2	00	....	....	....	28
SUNDAY........2	00	....	3.8	0.72	29..........SUNDAY
3	00	....	....	....	30
3	00	....	2.2	0.16	31
Means...... ...	‖08.6	2.89	15.1	4.68	...............Sums.
27 Years means or and including his month	¶26.99	1.38	23.23	3.65	27 Years means for and including this month.

Direction.......
a-level and
aken from

Miles ....
being 100.
hours.

Duration in hrs.

Mean velocity...
e 14th; the
ing a range
est day was

Greatest mil
10th.
0.58 on the

Greatest vel
ng was 29.42
hour on the 10th.
es.

Resultant mi

Minimum relative humidity observed was 62 on the 13th.

Rain or sleet fell on 6 days.

Snow fell on 13 days.

Rain, sleet or snow fell on 16 days.

Depth of snow on ground at end of month, 6.5 inches.

Ground clear of snow on the 15th.

Rainbow on the 16th.

Lunar corona on the 22nd.

Light fog on the 6th and 28th.

ABSTRACT FOR THE MONTH OF DECEMBER, 1901.

Meteorological Observations, McGill College Observatory, Montreal, Canada. Height above sea level, 187 feet. C. H. McLEOD, *Superintendent.*

DAY	THERMOMETER. † Mean.	Max.	Min.	Range.	* BAROMETER. † Mean.	Max.	Min.	Range.	‡Mean relative humidity.	WIND. General direction.	Mean velocity in miles per hour	Per cent. possible Sunshine.	Rainfall in inches.	Snowfall in inches.	Rain and snow melted.	DAY.
SUNDAY........ 1	29.83	36.3	20.4	15.9	29.84	29.99	29.73	.26	79	S.	17.0	00	....	....	....	1..........SUNDAY
2	34.21	41.5	19.0	22.5	29.71	29.99	29.59	.40	76	S.W	25.0	05	0.06	....	0.06	2
3	14.33	19.0	10.9	8.1	30.13	30.21	29.99	.22	81	N.E.	15.9	11	....	....	....	3
4	12.94	15.6	10.2	5.4	30.04	30.17	29.97	.20	91	N.W.	17.5	00	....	1.1	0.11	4
5	9.87	12.9	6.8	6.1	30.32	30.44	30.17	.27	80	W.	15.4	00	....	....	....	5
6	7.03	11.0	3.2	7.8	30.53	30.58	30.44	.14	87	E.	5.3	00	....	....	....	6
7	9.02	17.0	1.7	15.3	30.45	30.58	30.29	.29	84	N.E.	10.7	00	....	....	....	7
SUNDAY........ 8	20.92	25.5	18.0	7.5	30.24	30.36	30.00	.36	87	N.E.	8.6	00	0.01	1.8	0.19	8..........SUNDAY
9	34.22	39.3	25.5	13.8	29.87	30.00	29.75	.25	91	W.	17.1	00	0.47	....	0.47	9
10	30.27	35.0	26.1	8.9	29.62	29.95	29.43	.52	82	S.W.	25.7	00	0.40	1.3	0.53	10
11	23.74	26.1	21.4	4.7	30.21	30.37	29.87	.50	81	S.W.	19.7	93	....	....	....	11
12	23.08	26.5	19.9	6.6	30.39	30.43	30.35	.08	85	E.	6.6	00	....	0.0	0.00	12
13	35.57	43.5	22.0	21.5	30.13	30.36	29.99	.37	72	S.E.	22.6	00	....	....	....	13
14	52.49	59.1	43.5	15.6	29.75	29.99	29.56	.43	83	S.E.	27.6	00	0.95	....	0.95	14
SUNDAY........15	21.02	50.0	6.6	43.4	29.82	30.10	29.56	.54	..	W.	28.2	00	1.00	0.8	1.08	15..........SUNDAY
16	—0.21	6.6	—4.7	11.3	30.18	30.23	30.09	.14	..	W.	15.6	69	....	....	....	16
17	1.55	5.0	—2.7	7.7	30.16	30.21	30.07	.14	..	N.E.	7.4	00	....	....	....	17
18	6.67	10.0	2.5	7.5	30.11	30.21	30.06	.15	..	N.E.	3.6	01	....	....	....	18
19	7.29	10.3	4.3	6.0	30.28	30.32	30.21	.11	..	E.	3.0	00	....	0.3	0.03	19
20	9.81	15.2	4.2	11.0	30.34	30.38	30.31	.07	..	E.	2.2	08	....	0.2	0.02	20
21	6.71	9.0	3.2	5.8	30.37	30.45	30.32	.13	..	W.	3.7	13	....	....	....	21
SUNDAY........22	15.71	23.3	5.3	18.0	29.99	30.32	29.71	.61	78	S.	14.7	00	....	0.0	0.00	22..........SUNDAY
23	28.64	31.9	23.3	8.6	29.71	29.72	29.68	.04	89	S.	16.3	00	....	0.5	0.05	23
24	32.52	34.0	28.3	5.7	29.85	29.74	29.65	.09	86	W.	11.6	00	....	1.4	0.14	24
25	27.22	32.0	23.2	8.8	29.86	30.06	29.74	.32	77	S.W.	18.0	44	....	....	....	25
26	30.46	35.0	28.0	7.0	30.13	30.22	30.02	.20	90	S.W.	14.7	16	....	....	....	26
27	30.57	33.0	27.3	5.7	30.01	30.22	29.89	.33	88	N.W.	9.8	08	....	1.7	0.17	27
28	30.43	33.2	26.5	6.7	30.19	30.29	29.98	.31	75	S.E.	10.9	00	....	....	....	28
SUNDAY........29	33.30	34.3	32.1	2.2	29.66	29.98	29.46	.52	97	N.	8.8	00	....	3.8	0.72	29..........SUNDAY
30	29.48	34.5	20.8	13.7	29.65	29.69	29.55	.14	81	W.	13.0	00	....	....	....	30
31	20.19	30.7	4.5	26.2	29.62	29.97	29.42	.55	87	W.	26.7	00	....	2.2	0.16	31
Means......	21.58	26.98	15.53	11.45	30.038	30.178	29.898	.280	83.6	W.32°55'S.	14.23	‖08.6	2.89	15.1	4.68	..............Sums.
27 Years means for and including this month	19.24	26.22	12.13	14.08	30.030	....	......	.295	83.4	....	§ 16.13	¶26.99	1.38	23.23	3.65	27 Years means for and including this month.

ANALYSIS OF WIND RECORD.

Direction........	N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.	CALM.
Miles	448	1192	538	1267	1510	1620	3237	775	
Duration in hrs..	60	107	93	71	93	72	164	64	20
Mean velocity....	7.5	11.1	58	17.8	16.3	22.5	19.7	12.1	

Greatest mileage in one hour was 45 on the 10th.

Greatest velocity in gusts was 50 miles per hour on the 10th.

Resultant mileage, 3156.

Resultant direction, W. 32° 55′ S.

Total mileage, 10,587.

Wind from City Hall on 10th, 11th, 15th, 16th and 21st.

* Barometer readings reduced to sea-level and temperature 32° Fahrenheit.

† Mean of bi-hourly readings taken from self-recording instruments.

‡ Humidity relative, saturation being 100. Mean of observations at 8, 15 and 20 hours.

¶ 20 years only. § 15 years only.

The greatest heat was 59.1° on the 14th; the greatest cold was 4.7° below zero; giving a range of temperature of 63.8 degrees. Warmest day was the 14th. Coldest day was the 16th.

Highest barometer reading was 30.58 on the 6th and 7th; lowest barometer reading was 29.42 on the 31st, giving a range of 1.16 inches.

Minimum relative humidity observed was 62 on the 13th.

Rain or sleet fell on 6 days.

Snow fell on 13 days.

Rain, sleet or snow fell on 16 days.

Depth of snow on ground at end of month, 6.5 inches.

Ground clear of snow on the 15th.

Rainbow on the 16th.

Lunar corona on the 22nd.

Light fog on the 6th and 28th.

1901.

Observations n N. 45° 30′ 17″. Longitude 4^h 54^m $18{\cdot}67^s$ W.

C. H. McLEOD, *Superintendent.*

Month.	Precipitation.					Month.
	Inches of snow.	Number of days on which snow fell.	Inches of rain and melted snow.	No. of days on which rain *and* snow fell.	No. of days on which rain *or* snow fell.	
January	27.1	17	2.98	2	19	January
February	22.4	13	2.01	..	13	February
March	26.0	20	7.32	4	23	March
April	1.3	2	4.19	2	16	April
May	....	..	2.50	..	19	May
June	....	..	1.97	..	12	June
July	....	..	5.27	..	12	July
August	....	..	5.44	..	14	August
September	....	..	3.95	..	13	September
October	1.0	3	3.60	3	12	October
November	29.2	18	4.07	2	21	November
December	15.1	13	4.68	3	16	December
Sums for 1901	121.1	86	47.98	16	190	Sums for 1901
Means for 1901	....	..	4.00	..	..	Means for 1901
Means for 27 years endi Dec. 31, 1901	20.93	80	40.94	16	201	Means for 27 years ending Dec. 31, 1901.

* Barometer read ken from self-recording instruments, beginning 1 h. 0 m. Eastern Standard time. ¶ "+' midity relative, saturation being 100; the humidity means are derived from observati t Royal, 54 feet above the ground and 807 feet above sea level. The wind tower on th e readings for the intervening period were obtained from the anemometer and wind

The greatest hea was, therefore 110.4°. Greatest thermometer range in one day was 38.6° on Jan. 21; least ay was Jan. 19th, when the mean temperature was 13.77° below zero. The minimum greatest velocity in gusts was at the rate of 60 miles per hour on Feb. 15th. The total n halos were observed; on 4 nights; lunar coronas on 6 nights; fog on 13 days; thund wfall of the antumn was on Oct. 19th. The first trace of snow was on Oct. 18th.

Note.—The year

Meteorological Abstract for the Year 1901.

Observations made at McGill College Observatory, Montreal, Canada.—Height above sea level 187 ft. Latitude N. 45° 30′ 17″. Longitude 4h 54m 18·67s W.

C. H. McLEOD, *Superintendent.*

Month.	Thermometer.					* Barometer.				‡Mean relative humidity.	Wind.		Per cent. possible bright sunshine	Precipitation.							Month.
	† Mean.	¶ Deviation from 27 years, means.	Max.	Min.	Mean daily range.	† Mean.	Max.	Min.	Mean daily range.		Resultant direction.	Mean velocity in miles per hour.		Inches of rain.	Number of days on which rain (or sleet) fell.	Inches of snow.	Number of days on which snow fell.	Inches of rain and melted snow.	No. of days on which rain *and* snow fell.	No. of days on which rain *or* snow fell.	
January	12 75	+ 0.43	39.6	— 16.7	15.27	29.978	30.78	29.03	.387	86.5	W. 6°38′N.	16 58	34.1	0.27	4	27.1	17	2.98	2	19	January
February	12.46	— 3.09	29.5	— 1.0	11.67	29.825	30.39	29.41	.190	81.1	W. 3°43′N.	19.58	43.5	....	..	22.4	13	2.01	..	13	February
March	24.87	+ 0.54	40.0	— 0.0	13.27	29 878	30.51	29.29	.303	79.6	W. 9°42′N.	17.91	30.4	2.90	7	26.0	20	7.32	4	23	March
April	43 61	+ 3.02	75.2	30.7	14.35	30.049	30.48	29.61	.167	73.9	N. 44°38′E.	17.47	39.3	4.01	16	1.3	2	4.19	2	16	April.
May	56.17	+ 1.45	79.4	40.1	14.82	29.863	30.24	29.40	.187	68.0	S. 23°43′ W.	9.69	43.8	2 50	19	....	..	2.50	..	19	May
June	66.83	+ 1.86	92.0	43.7	17.20	29.890	30.23	29.55	.137	70.8	W.40°44′ S.	11.15	61.5	1.97	12	....	..	1.97	..	12	June
July	76.27	+ 1.38	93.7	53 7	16.16	29.907	30.24	29.59	.150	67.7	W.22°51′N.	11.56	57.9	5.27	12	....	..	5.27	..	12	July
August	67.31	+ 0.53	84.7	55.0	14.61	29.998	30.28	29.71	.116	76.0	W.27°29′N.	10.36	49.2	5.44	14	....	..	5.44	..	14	August
September	60.36	+ 1.83	83.0	36.9	15.02	30.011	30.57	29.49	.208	76.6	W.13°28′N.	11.87	60.3	3.95	13	....	..	3.95	..	13	September
October	47.17	+ 1.22	70.0	30.0	13.17	30.041	30.65	29.36	.242	75.8	W.16°15′ S.	14.11	41.8	3.50	12	1.0	3	3.60	3	12	October
November	28.73	— 3.00	57.7	4.3	9.29	29.963	30.45	29.11	.234	82.8	W.19°47′N.	14.81	23.8	1.05	5	24.2	18	4.07	2	21	November
December	21.58	+ 2.34	59.1	— 4.7	11.45	30.038	30.58	29.42	.280	83.6	W.32°55′ S.	14.23	08 6	2.89	6	15.1	13	4.68	3	16	December
Sums for 1901	...	....	....	....	....	.. ..	....	....	....	....	....	....	....	33.75	120	121.1	86	47.98	16	190	Sums for 1901
Means for 1901	42.67	+ 0.71	....	....	13.94	29.953	....	....	.219	76.87	W. 8′ N.	14 07	41.18	....	....	....	..	4.00	..	..	Means for 1901
Means for 27 years ending Dec. 31, 1901	42.03	....	... .	....	....	29.980	....	....	....	75.49	....	*a* 14.95	§45.75	28.84	134	120.93	80	40.94	16	201	Means for 27 years ending Dec. 31, 1901.

* Barometer readings reduced to 32° Fah. and to sea level. † The monthly thermometer and barometer means are derived from bihourly readings taken from self-recording instruments, beginning 1 h. 0 m. Eastern Standard time. ¶ "+" indicates that the temperature has been *higher*: "—" that it has been *lower* than the average for 27 years inclusive of 1901. ‡ Humidity relative, saturation being 100; the humidity means are derived from observations made at 8 *h*, 15 *h* and 20 *h*. § For 20 years only. *a* For 15 years only. The anemometer and wind vane are on the summit of Mount Royal, 54 feet above the ground and 807 feet above sea level. The wind tower on the mountain was burned down on April 29th; it was replaced by a steel structure, and the instruments were set up on June 26th; the readings for the intervening period were obtained from the anemometer and wind vane on the City Hall.

The greatest heat was 93.7° above zero (Fah.) on July 16th; the greatest cold was 16.7 below zero on Jan. 19th. The extreme range of temperature was, therefore 110.4°. Greatest thermometer range in one day was 38.6° on Jan. 21; least range was 2.2° on Dec. 29th. The warmest day was July 16th, when the mean temperature was 82.84° above zero. The coldest day was Jan. 19th, when the mean temperature was 13.77° below zero. The minimum relative humidity observed was 24 on May 3rd. The greatest mileage of wind recorded in one hour was 55 on Feb. 15th, and the greatest velocity in gusts was at the rate of 60 miles per hour on Feb. 15th. The total mileage of wind was 123,240. The resultant direction of the wind for the year was W. 8′ N., and the resultant mileage 59200. Lunar halos were observed on 4 nights; lunar coronas on 6 nights; fog on 13 days; thunderstorms on 15 days; total number of thunderstorms 17. First sleighing of winter in city was on Nov. 13th. The first appreciable snowfall of the autumn was on Oct. 19th. The first trace of snow was on Oct. 18th.

Note.—The yearly means of the above are the averages of the monthly means, except for the velocity of the wind.

Price $3.00 the Volume of eight numbers.

VOLUME VIII. NUMBER 8.

THE CANADIAN RECORD OF SCIENCE

INCLUDING THE PROCEEDINGS OF
THE NATURAL HISTORY SOCIETY OF MONTREAL,
AND REPLACING

THE CANADIAN NATURALIST.

CONTENTS.

PAGE

Bibliography of the late George Mercer Dawson. By H. M. AMI, M.A., D.Sc. 503

Some Notes on Mount Royal. By J. S. BUCHAN, K.C., B.C.L. 517

Some Recent Folds in the Lorraine Shales. By W. G. WILSON, of McGill University. 525

Proceedings of the Natural History Society, Session 1901-1902 532

MONTREAL:

PUBLISHED BY THE NATURAL HISTORY SOCIETY.

LONDON, ENGLAND:
COLLINS, 157 Great Portland St.

BOSTON, MASS.:
A. A. WATERMAN & Co., 36 Bromfield St.

1902.

NATURAL HISTORY SOCIETY OF MONTREAL.

[*Incorporated* 1832.]

OFFICERS—SESSION 1901-1902.

Patron:

His Excellency the Governor-General of Canada.

Hon. President:

Lord Strathcona and Mount Royal.

President:

Prof. E. W. MacBride, M.A., Sc.D.

Vice-Presidents:

Frank D. Adams, Ph.D., F.R.S.C.
Rev. Robt. Campbell, M.A., D.D.
B. J. Harrington, Ph.D., F.R.S.C.
A. Holden.
J. H. Joseph.
Dr. T. Wesley Mills.
Prof. D. P. Penhallow.
Hon. J. K. Ward.
Hon. Justice Würtele.

Hon. Recording Secretary:
F. W. Richards.

Hon. Corresponding Secretary:
J. A. U. Beaudry, C.E.

Honorary Treasurer:
Chas. S. J. Phillips.

Honorary Curator:
A. E. Norris.

Members of Council:

C. T. Williams, *Chairman.*

J. S. Buchan, K.C., B.C.L.
S. Finley.
Joseph Fortier.
John Harper.
Edgar Judge.
H. McLaren.
J. G. McKergow.

Editing and Exchange Committee:

Rev. Robt. Campbell, M.A., D.D., *Chairman.*

Frank D. Adams, Ph.D., F.R.S.C.
J. S. Buchan, K.C., B.C.L.
Prof. J. T. Donald.
A. T. Drummond, LL.D., Kingston, Ont.
Prof. E. W. MacBride, M.A., Sc.D.
H. McLaren.
G. F. Matthew, St. John, N.B.
T. Wesley Mills, M.A., M.D.
J. F. Whiteaves, Ottawa, Ont.

Library Committee:

H. McLaren, *Chairman.*

J. A. U. Beaudry, C.E.
Joseph Fortier,
Alfred Griffin.
A. E. Norris.
C. M. Tod.
C. T. Williams.

Museum Committee:

A. E. Norris, *Chairman.*

Rev. Robt. Campbell, M.A., D.D.
A. Holden.
O. E. LeRoy, B.A.
Prof. E. W. MacBride, M.A., Sc.D.
J. G. McKergow.
C. J. Stuart.
H. E. Vennor.

Field Work Committee:

C. T. Williams, *Chairman.*

Frank D. Adams, Ph.D., F.R.S.C.
Prof. J. Bemrose, F.I.C., F.C.S.
J. S. Buchan, K.C., B.C.L.
Rev. Robt. Campbell, M.A., D.D.
Rev. G. Colborne Heine.
O. E. LeRoy, B.A.
Prof. E. W. MacBride, M.A., Sc.D.
F. W. Richards.
Alex. Robertson.

Lecture Committee:

N. N. Evans, M.A.Sc., *Chairman.*

J. S. Buchan, K.C., B.C.L.
Rev. Robt. Campbell, M.A., D.D.
Prof. John Cox, M.A.
B. J. Harrington, Ph.D., F.R.S.C.
Rev. G. Colborne Heine.
Edgar Judge.
Dr. T. Wesley Mills.
Chas. S. J. Phillips.
Hon. Justice Würtele.

House Committee:

Albert Holden, *Chairman.*

F. W. Richards.
C. T. Williams.

Membership Committee:

Alex. Robertson, *Chairman.*

J. A. U. Beaudry, C.E.
Prof. J. Bemrose, F.I.C., F.C.S.
Rev. Robt. Campbell, M.A., D.D.
A. Holden.
Edgar Judge.
H. McLaren.
Chas. S. J. Phillips.
Hon. J. K. Ward.
C. T. Williams.

Superintendent:

Alfred Griffin.

THE

CANADIAN RECORD

OF SCIENCE.

VOL. VIII. JULY, 1902. No. 8.

Bibliography of Dr. George M. Dawson.

By Dr. H. M. Ami, of the Geological Survey Department, Ottawa.

1870.

On Foraminifera from the Gulf and River St. Lawrence. *Canadian Naturalist*, N. S. Vol. vii. No. 5, pp. 172-180, June, 1870. Montreal. (Also separately, pp. 1-8.) Also in Annals and Magazine of Natural History, 8vo. pp. 83-90, February, 1871.

1874.

The Lignite Formations of the West. *Canadian Naturalist*, Vol. vii., No. 5, pp. 241-252, April, Montreal. (Also separately with the next.)

Note on the Occurrence of Foraminifera, Coccoliths, etc., in the Cretaceous Rocks of Manitoba. *Canadian Naturalist*, Vol. vii., pp. 252-257, April. Montreal. (Also separately, with the foregoing.)

Marine Champlain deposits on lands north of Lake Superior. *American Journal of Science*, 3rd series, p. 143 (1-4 p.).

The Fluctuations of the American Lakes and the Development of Sun Spots. *Nature*, 4to., pp. 504-506, April, 1874. London. Also in *Canadian Naturalist*, Vol. vii., No. 6, pp. 310-317, November. Montreal.

Report on the Tertiary Lignite Formation in the Vicinity of the Forty-ninth Parallel. (British North American Boundary Commission.) 8vo., pp. 1-31. Montreal.

(Abstract, *American Journal of Science*, 3rd series, Vol. 8, pp. 142-143, 112 p. 1874.)

1875.

Report on the Geology and Resources of the Region in the Vicinity of the Forty-ninth Parallel. (British North American Boundary Commission.) 8vo. pp. 1-XI.-1-387. Dawson Bros., Montreal.

On some Canadian Species of Spongillae. *Canadian Naturalist,* Vol. viii., No. 1, pp. 1-5, November. Montreal. (Also separately, same pagination.)

On the Superficial Geology of the Central Region of North America. *Quarterly Journal* Geological Society, 8vo. pp. 603-623, November. London. (Also separately, same pagination.)

1876.

Communication in J. A. Allen's Monograph, "The American Bisons, living and extinct," 173-174, with map on p. 173. Mem. Mus. Comp. Zool., Harvard College, Cambridge, Mass. Vol. 4, No. 10. 1876.

Notes on the Locust Invasion of 1874 in Manitoba and the North-west Territories. *Canadian Naturalist,* Vol. viii., No. 3, pp. 119-134. Montreal. (Also separately, pp. 1-16.)

Review of "Report on the Geol. and Resources, etc., Forty-ninth Parallel." (Anon.) *Canadian Naturalist,* Vol. viii., No. 2, p. 118. 1876.

1877.

Notes on some of the more recent Changes in Level of the Coast of British Columbia and adjacent regions. *Canadian Naturalist,* Vol. vii., No. 4, pp. 241-248, April. Montreal. (Also separately, pp. 1-8.)

Notes on the Appearance and Migrations of the Locust in Manitoba and the North-west Territories, Summer of 1875. *Canadian Naturalist,* Vol. viii., No. 4, pp. 207-226, April. Montreal. (Also separately, pp. 1-20.)

Mesozoic Volcanic Rocks of British Columbia and Chili. Relation of Volcanic and Metamorphic rocks. *Geological Magazine,* 8vo. pp. 314-317, July. London. (Also separately, pp. 1-4.)

Note on the Economic Minerals and Mines of British Columbia. First List of Localities in the Province of British Columbia, known to yield Gold, Coal, Iron, Copper and other Minerals of Economic Value. (Appendix R.) Report on Surveys, Canadian Pacific Railway, 8vo. pp. 218-245. Ottawa.

Report on Explorations in British Columbia. Report of Progress, Geological Survey of Canada. 1875-76. 8vo. pp. 233-

280. Montreal. (Abstract, *American Journal of Science*, 3rd series, Vol. 14, page 70,-1-8 p.)

Note on Agriculture and Stock-Raising and Extent of Cultivable Land in British Columbia. (Appendix S.) Report of Surveys, Canadian Pacific Railway, 8vo. pp. 246-253. Ottawa.

1878.

On the Superficial Geology of British Columbia. *Philosophical Magazine*, Vol. 4, p. 237, 1877. *Quarterly Journal Geological Science*, Vol. 34, pp. 89-123. February. (Also separately, same pagination.)

Travelling Notes on the Surface Geology of the Pacific Coast. *Canadian Naturalist*, Vol. viii., No. 7, pp. 389-399. February. Montreal. (Also separately, pp. 1-11.)

Notes on the Locust in the North-west in 1876. *Canadian Naturalist*, Vol. viii., No. 7, 411-417, April. Montreal. (Also separately, pp. 1-7.)

Erratics at High Levels in North-western America.—Barriers to a Great Ice Sheet. *Geological Magazine*, 8vo. pp. 209-212, May. London.

Report of Explorations in British Columbia, chiefly in the Basins of the Blackwater, Salmon and Nechacco Rivers, and on François Lake. Report of Progress, Geological Survey of Canada, 1876-77, 8vo. pp. 17-94. Montreal.

Report on Reconnaissance of Leech River and Vicinity. Report of Progress, Geological Survey of Canada, 1876-77, 8vo. pp. 95-102. Montreal.

General Note on the Mines and Minerals of Economic Value of British Columbia, with a list of localities, with appendix. Report of Progress. Geological Survey of Canada, 1876-77, 8vo. pp. 103-145. Montreal. (Also separately, same pagination.) (Abstract, *American Journal of Science*, 3rd series, Vol. 16, p. 149. (1-2 p.) 1878.)

1879.

On a Species of Loftusia from British Columbia. *Quarterly Journal Geological Society*, 8vo. pp. 69-75, February. London. (Also separately, same pagination.)

Notes on the Glaciation of British Columbia. *Canadian Naturalist*, N. S. Vol. ix., No. 1, pp. 32-39, March. Montreal. (See separately pp. 1-8.)

Sketch of the Past and Present Condition of the Indians of Canada. *Canadian Naturalist*, Vol. ix., No. 3, pp. 129-159, July. Montreal. (Also separately, pp. 1-31.)

Preliminary Report of the Physical and Geological Features of the Southern Portion of the Interior of British Columbia. Report of Progress, Geological Survey of Canada, 1877-78. 8vo. pp. 1B-187B.

Report of Explorations in the Southern Portion of the Interior of British Columbia. Report of Progress, Geological Survey of Canada, 1877-78, 8vo. pp. 1B-173B. Montreal. Abstract, *American Journal of Science,* 3rd series, Vol. 18, pp. 482-483. (1-3 pp.)

1880.

Memorandum on the Queen Charlotte Islands. British Columbia. (Appendix, No. 9.) Report Canadian Pacific Railway, 8vo. pp. 139-143. Ottawa.

Notes on the Distribution of Some of the More Important Trees of British Columbia. *Canadian Naturalist,* Vol. ix., No. 6, pp. 321-331, August. Montreal. (Also separately, pp. 1-11.) Reprinted as an appendix to Report on an Exporation from Fort Simpson, etc. Report of Progress, Geological Survey of Canada, 1879-80.

Report on the Climate and Agricultural Value, General Geological Features and Minerals of Economic Importance of part of the Northern portion of British Columbia and of the Peace River Country. (Appendix 7.) Report Canadian Pacific Railway, 8vo. pp. 107-131. Ottawa.

Report on the Queen Charlotte Islands. With Appendices A to G, etc. Report of Progress, Geological Survey of Canada, 1878-79, 8vo. pp. 1B-239B. Montreal. (Abstracts, *American Journal of Science,* 3rd series, Vol. 21, p. 243 (1-3 p.) 1881. *American Naturalist,* Vol. 15, p. 647 (1-3 p.) 1881.)

On the Haida Indians of the Queen Charlotte Islands. Report of Progress, Geological Survey of Canada, 1878-79. Appendix A to Report of the Queen Charlotte Islands, etc. (G. M. Dawson.)

Sketch of the Geology of British Columbia. See 1881.) British Association Report, Vol. 50. Transactions, pp. 588-589, 1880. *Canadian Naturalist,* Vol. 9, N. S. pp. 445-447.

Vocabulary of the Haida Indians. Report of Progress, Geological Survey of Canada, 1878-79. Appendix B to Report on the Queen Charlotte Islands, etc.

1881.

Note on the Geology of the Peace River Region. *Canadian Naturalist,* Vol. x., No. 1, pp. 20-22, April, 1881. Montreal. Also in *American Journal of Science,* 8vo, pp. 391-394, May, 1881. New Haven.

Meteorological Observations in the Northern Part of British Columbia and the Peace River Country. Report of Progress, Geological Survey of Canada, 1879-80. Appendix II. to Report on an Exploration from Fort Simpson, etc. (G. M. Dawson.)

Note on the Latitudes and Longitudes used in preparing the Map of the Region from the Pacific Coast to Edmonton. Report of Progress, Geological Survey of Canada, 1879-80. Appendix III. to Report on an Exploration from Fort Simpson, etc.

Der Queen Charlotte-Archipel. Petermann's Mitt., Vol. 27, pp. 331-347, map 4°.

On the Lignite Tertiary Formation from the Souris River to the one hundred and eighth meridian. Report of Progress, Geological Survey of Canada, 1879-80, 8vo. pp. 12A-49A. Montreal. (Abstract, *Philadelphia Magazine,* N. S. Vol. 14, pp. 70-71 (1-3 p.) 1881.)

Report on an Exploration from Fort Simpson on the Pacific Coast to Edmonton, on the Saskatchewan, embracing a portion of the northern part of British Columbia and the Peace River Country. Report of Progress, Geological Survey of Canada, 1879-80, 8vo. pp. 1B-177B. Montreal.

1882.

The Haidas. *Harper's Magazine,* Vol. XLV., 8vo. pp. 401-408, August. New York.

Descriptive Note on a General Section from the Laurentian Axis to the Rocky Mountains north of the 49th parallel. Transactions Royal Society of Canada, Vol. i., Sec. 4, 4to. pp. 39-44, 1883. (Also separately, same pagination.)

1883.

Notes on the more important Coal-seams of the Bow and Belly River Districts. *Canadian Naturalist,* 8vo. pp. 423-435, March. Montreal.

Note on the Triassic of the Rocky Mountains and British Columbia. Transactions of Royal Society of Canada, Vol. i., Sec. 4, 4to. pp. 143-145. (Also separately, same pagination.)

Preliminary on the Geology of the Bow and Belly River Region, North-west Territory. With special reference to the Coal Deposits. Report of Progress, Geological Survey of Canada, 1880-82, 8vo. pp. 1B-23B. Montreal.

Glacial Deposits of the Bow and Belly River Country. *Science,* Vol. i., pp. 477-479.

List of Elevations. Report of Progress, Geological Survey of Canada, 1882-83-84. Appendix I. to Report on a region in the vicinity of the Bow and Belly Rivers, N.W.T. (G. M. Dawson.)

(Abstracts, *Canadian Naturalist*, N.S., Vol. 10, pp. 423-435, Montreal, Que.; *Science*, Vol. i., pp. 429-430 (2-5 p.) New York City.

1884.

On the occurrence of Phosphates in Nature. Transactions Ottawa Field-Naturalists' Club, 8vo. pp. 91-98, February, Ottawa.

(and Selwyn, A. R. C.) Descriptive Sketch of the Physical Geography and Geology of the Dominion of Canada, 8vo. pp. 1-55. Montreal.

(and Tolmie, W. F.) Comparative Vocabularies of the Indian Tribes of British Columbia. With a map illustrating distribution, 8vo. pp. 1-131. Montreal.

(Abstract, *Science*, Vol. v., 156-157 (4-5 p.) New York City.

Recent Geological Observations in the Canadian North-west Territory. *Science*, Vol. 3, pp. 647-648.

Notes on the Coals and Lignites of the Canadian Northwest. 8vo. pp. 1-21. Montreal Printing and Publishing Co., Montreal.

1885.

On the Microscopic structure of certain Boulder Clays and the Organisms contained in them. Bulletin Chicago Academy of Science, 8vo. pp. 59-69, June. Chicago. (Also separately, same pagination.) 13th Annual Report Geological and Natural History Survey, Minnesota, pp. 150-163. St. Paul, Minn.

The Dominion of Canada. (Part thus entitled in "Macfarlane's American Geological Railway Guide.") 8vo. pp. 51-83, June. D. Appleton & Co., New York. (Also separately, same pagination.)

The Saskatchewan Country. *Science*, Vol. 5, pp. 340-342, with map, 1885.

Report on the region in the vicinity of Bow and Belly Rivers, N.W.T. Report of Progress, Geological Survey of Canada, 1882-84, 8vo. pp. 1C-169C. Montreal.

On the Superficial Deposits and Glaciation of the District in the vicinity of the Bow and Belly Rivers. (Reprinted from the Report of Progress, Geological Survey of Canada, 1882-84, 8vo. pp. 1-14.)

(Abstracts, *Science*, Vol. 6, pp. 522 (1-8 p.) *American Journal of Science*, 3rd series, Vol. 29, pp. 408-411, *American Naturalist*, Vol. 21, pp. 171-172 (with comments by G. M. Dawson.)

1886.

On Certain Borings in Manitoba and the North-west Territory. Transactions Royal Society of Canada, Vol. IV., sec. 4, 4to. pp. 85-99. (Also separately, same pagination.)

(Abstract, *Geological Magazine*, 3rd decade, Vol. 4, pp. 278-289, 1887.)

Preliminary Report on the Physical and Geological Features of that Portion of the Rocky Mountains between Latitudes 49 degrees and 51° 30′. Annual Report Geological Survey of Canada (N.S.) Vol. i., 8vo. pp. 1B-169B. Montreal. (Also separately, same pagination.)

(Abstracts, *American Journal of Science*, 3rd series, Vol. 33, p. 317 (1-2 p.) 1887. *Geological Magazine*, decade 3, Vol. 4, pp. 176-178. 1887.)

1887.

On the Canadian Rocky Mountains, with special reference to that part of the range between the forty-ninth parallel and the headwaters of the Red Deer River. *Canadian Record of Science*, Vol. ii., No. 5, pp. 285-300, April, 1887. Montreal. (Also separately, pp. 1-16.)

Note on the Occurrence of Jade in British Columbia and its Employment by the Natives. With extracts from a paper by Prof. Meyer. *Canadian Record of Science*, Vol. II., No. 7, pp. 364-378, April, 1887. Montreal. (Also separately, pp. 1-15.)

Notes and Observations on the Kwakiool People of Vancouver Island. Transactions Royal Society of Canada, Vol. IV., Sec. 2, 4to. pp. 1-36, 1887. (Also separately, same pagination.)

(Abstract, without geology, British Association Report of 56th meeting, pp. 638-639.)

Notes on the Exploration in Yukon District. *Science*, Vol. 10, pp. 165-166, from Montreal *Gazette*.

Report on Geological Examination of the Northern part of Vancouver Island and adjacent coasts. Report *Geological and Natural History Survey, Canada*, part B, pp. 1-107, plates map No. 1, in atlas. Montreal. (Abstract *Geological Magazine*, 3rd decade, Vol. 6, 130-133.)

Notes to accompany a geological map of the northern portion of the Dominion of Canada, east of the Rocky Mountains. Report of the Geological and Natural History Survey of Canada, 1886, part R. 62 pp., colored map, 1887. Montreal. (Abstract, *Geological Magazine*, 3rd decade, Vol. 6, pp. 137-138.)

Meteorological Observations, 1885, Appendix III. to Report on a Geological Examination of the Northern Part of Vancouver Island, and adjacent Coasts. Annual Report, Geological Survey of Canada, New series, Vol. 2, 1886, issued 1887. Montreal.

1888.

Recent Observations on the Glaciation of British Columbia and Adjacent Regions. *Geological Magazine*, 8vo. pp. 347-350, August, 1888. London. *American Geologist*, Vol. 3, pp. 249-253, 1889. (Also separately, same pagination.)

Report on the Exploration in the Yukon District, N.W.T., and adjacent Northern Portion of British Columbia. Annual Report, Geological Survey of Canada, (N.S.) Vol. iii., 8vo. pp. 1B-277B, 1888. Montreal. (Abstracts, ibid., Report A., pp. 4-12 ; *American Geologist*, Vol. 5, pp. 240-241 (2-3 p.) ; *American Journal of Science*, 3rd series, Vol. 39, p. 238 (1-2 p.) 1888.

Notes on the Distribution of Trees and of certain Shrubs in the Yukon District and Adjacent Northern Portion of British Columbia. Annual Report, Geological Survey of Canada, New Series, Vol. III., 1887-88. Appendix I. to Report of an Exploration in the Yukon District, N.W.T., etc. (G. M. Dawson.) Montreal.

Notes on the Indian Tribes in the same district. Annual Report, Geological Survey of Canada, New Series, Vol. III., 1887-88. Appendix II. to Report of an Exploration in the Yukon District, N.W.T., etc. (G. M. Dawson.) Montreal. (Out of print).

Meteorological Observations in the same district. Annual Report, Geological Survey of Canada, New Series, Vol. III., 1887-88. Appendix VI. to Report of an Exploration in the Yukon District, N.W.T., etc. (G. M. Dawson.) Montreal.

Summary of Astronomical Observations employed in the construction of Maps, Nos. 274-277. Annual Report, Geological Survey of Canada, New Series, Vol. III., 1887-88. Appendix VII. to Report of an Exploration in the Yukon District, N.W.T., etc. (G. M. Dawson.) Montreal.

Account of Explorations in Southern interior British

Columbia. Report Geological Survey of Canada, Vol. 3, N.S., pp. 60A-66A. Montreal.

Note on the Cascade Anthracite basin Rocky Mountains. *American Geologist,* Vol. 1, pp. 332-333.

The Geological Observations of the Yukon Expedition, 1887. *Science,* Vol. ii., pp. 185-186, 4°.

Notes on the Indian Tribes of the Yukon District and adjacent Northern Portion of British Columbia. (Reprinted from the Annual Report of Geological Survey of Canada, 1887.) 8vo. pp. 1-23.

Mineral Wealth of British Columbia with annotated list of localities of Minerals of Economic Value. Annual Report, Geological Survey of Canada (N.S.) Vol. 3, 8vo. pp. 1R-163R. (Also separately, same pagination.)

Views of the Archaean. Report American Committee, International Congress of Geologists, 1889, A, 1888. *American Geologist,* Vol. 2, pp. 146-184, in part, 1888.

1889.

Glaciation of High Points in the Southern Interior of British Columbia. *Geological Magazine,* 8vo. pp. 350-352, August. London. (Also separately, same pagination.) Abstracts, *Ottawa Naturalist,* Vol. 3, pp. 112-113 (4-5 p.) ; *American Naturalist,* Vol. 24, pp. 771, 4 lines.

On the earlier Cretaceous Rocks of the North-western Portion of the Dominion of Canada. *American Journal of Science,* 8vo. pp. 120-127, August. New Haven. (Also separately, same pagination.) Abstract, *Nature,* Vol. 40, p. 404 (11 lines).

Notes on the Ore Deposit of the Treadwell Mine, Alaska. *American Geologist,* 8vo. pp. 84-93, August. Minneapolis. (Also separately, same pagination.)

1890.

Notes on the Cretaceous of the British Columbia Region. The Nanaimo Group. *American Journal of Science,* 8vo. pp. 180-183, March. New Haven. (Also separately, same pagination.) (Abstract, *American Naturalist,* Vol. 24, p. 764 (1-2 p.)

On some of the larger unexplored Regions of Canada. *Ottawa Naturalist,* 8vo. pp. 29-40, May. Ottawa. (Also separately, 1-12.) Also printed as Appendix to Pike's Barren Ground of Northern Canada, 1892, London, 8vo. pp. 277-289, 1892. Macmillan & Co., London.

On the Glaciation of the Northern Part of the Cordillera, with an attempt to correlate the events of the Glacial Period in the Cordillera and Great Plains. *American Geologist,* 8vo. pp. 155-162, September. Minneapolis. (Also separately, same pagination.)

On the Later Physiographical Geology of the Rocky Mountain Region in Canada, with special reference to Changes in Elevation and the History of the Glacial Period. Transactions Royal Society of Canada, Vol. VIII., Sec. 4, 4to. pp. 3-74 pl. 1-3.) (Also separately, same pagination.)

Report on a Portion of the West Kootanie District, British Columbia. Annual Report, Geological Survey of Canada (N.S.), Vol. IV., 8vo. pp. 1B-66B. Montreal. (Also separately, same pagination.) (Abstracts ibid Reports, A. pp. 7-12 ; *American Geologist,* Vol. 8, pp. 392-394.)

Introductory Note on an Expedition down the Begh-ula or Anderson River, by R. Macfarlane. *Canadian Record of Science,*, Vol. 4, pp. 28-29.

The Chalk from the Niobrata Cretaceous of Kansas. *Science,* Vol. 16, p. 276 (1-4 col.) 4°.

Northern Pacific Railroad. Macfarlane's Geological Railway Guide, 2d edition, pp. 258-260 ; 261, 262.

The Dominion of Canada. Macfarlane's Geological Railway Guide, 2d edition, pp. 51-83.

1891.

Note on the Geological Structure of the Selkirk Range. Bulletin Geological Society of America, 8vo. pp. 165-176. February, 1891. Rochester. (Also separately, same pagination.)

Northern Extension of earlier Cretaceous in Western British North America. Bulletins Geological Society of America, Vol. 2, p. 207 (1-4 p.) (In discussion of paper by G. F. Becker, "Notes on the Early Cretaceous of California and Oregon.")

Remarks on the Glaciation of the Great Plains Region. Bulletins Geological Society America, Vol. 2, pp. 275-276, 1891. (Abstract, *American Geologist,* Vol. 7, p. 143, 5 lines.) Discussion of paper by W. Upham, "Glacial Lakes of Canada."

Note on the Geological Structure of the Selkirk Range. Bulletin American Geological Society, Vol. 2, pp. 156-176. (Discussed by C. D. Walcott, p. 611 (1-4 p.) Abstracts, *American Geologist,* Vol. 7, pp. 262-263 (1-2 p.) ; *American Naturalist,* Vol. 25, p. 658, 3 lines.

Notes on the Shuswap People of British Columbia.

Transactions Royal Society of Canada, Vol. IX., Sec. 2, 4to. pp. 3-44. (Also separately, same pagination.)

1892.

(and Alex. Sutherland.) Geography of the British Colonies, 8vo. pp. 1-XIII.-1-330. Macmillan & Co., London.

(and Baden-Powell, Sir G.) Report of the British Behring Sea Commissioners London Government, pp. 1-VII.; 1-241. London, Eng.

Notes on the Geology of Middleton Island, Alaska. Bulletin Geological Society of America, Vol. IV., 8vo. pp. 427-431. Rochester.

1893.

Mineral Wealth of British Columbia. Proceedings of the Royal Colonial Institute, Vol. XXIV., 8vo. pp. 238-264.

Notes on the occurrence of Mammoth Remains in the Yukon District of Canada and in Alaska. Abstracts and notice of papers read before the Geological Society, London. *Quarterly Journal, Geological Society,* Nov. 8th. Proc. of meeting, *Geological Magazine,* Dec., No. 354.

Mammoth Remains. (Abstracts and notice of paper read before the Geological Society, No. 8, *Nature,* Vol. 49, No. 1256, Nov. 23, p. 94.)

1894.

Geographical and Geological Sketch of Canada, with notes on Minerals, Climate, Immigration and Native Races. Baedeker's Dominion of Canada Hand Book, 12mo. pp. 23-48. Leipsic, Germany.

Notes on the Occurrence of Mammoth Remains in the Yukon District of Canada and in Alaska. *Quarterly Journal, Geological Society,* 8vo. pp. 1-9, February. London. (Also separately, same pagination.) Also in *Geological Magazine,* Dec., No. 354.

Geological Notes on some of the Coasts and Islands of Behring Sea and vicinity. Bulletin Geological Society of America, 8vo. pp. 117-146, February, 1894. Rochester. (Also separately, same pagination.)

1895.

Interglacial Climatic Conditions. *American Geologist,* Vol. 16, No. 1, pp. 65-66, 1895.

Summary Report of the Geological Survey Department for the year 1894. Printed by order of Parliament, No. 13a-1895, 126 pages. S. E. Dawson, Printer, Ottawa.

1896.

Some observations tending to show the occurrence of secular climatic changes in British Columbia. Transactions Royal Society of Canada, 2nd series, Sec. 4, Vol. 2, pp. 159-166.

Summary Report of the Director for the year 1894. With map No. 554. (Reprint from Blue Book.) pp. 124. Annual Report Geological Survey of Canada, new series, Vol. VII. Ottawa.

Report on the Area of the Kamloops, Map-sheet, British Columbia. With Appendices I.-IV., and Maps Nos. 556 and 557, pp. 427. Report B, Annual Report Geological Survey of Canada, new series, Vol. VII., 1894. Ottawa.

Shuswap names of places within the area of the Kamloops map-sheet. Annual Report, Geological Survey of Canada, new series, Vol. VII., 1894. Appendix II. to Report on the Area of the Kamloops Map-sheet, British Columbia. (G. M. Dawson.) Ottawa.

Notes on the Upper and Lower Limits of Growth of some trees and other Plants in different places within the area of the Kamloops Map-sheet. Annual Report, Geological Survey of Canada, N.S., Vol. VII., 1894. Appendix III. to Report on the Area of the Kamloops Map-sheet, British Columbia. (G. M. Dawson.) Ottawa.

Comparative Observations of Temperatures at different Altitudes in or near the Region embraced by the Kamloops Sheet, Southern Interior of British Columbia, during parts of the years 1888, 1889 and 1890. Annual Report, Geological Survey of Canada, N.S., Vol. VII., 1894. Appendix IV. to Report on the Area of the Kamloops Map-sheet, British Columbia. (G. M. Dawson.) Ottawa.

1897.

Summary Report of the Geological Survey Department for the year 1896. Printed by order of Parliament, 144 pages. S. E. Dawson, Printer, Ottawa, 1897.

Summary Report of Director for the year 1895, pp. 154. (Reprint from Blue Book.) Annual Report, Geological Survey of Canada, N.S., Vol. VIII., Report A. Ottawa.

(The nature and relations of the more ancient rocks of North America.) Address to the Geological Section (Section C) of the Brit. Assoc. Adv. Sc, (Toronto meeting 1897), 13 pp., Spottiswoode, London, 1897.

1898.

Summary Report of the Director for the year 1896. (Reprint from Blue Book) pp. 144. Annual Report, Geological Survey of Canada, N.S., Vol. IX., Report A. Ottawa.

Annual Report, Geological Survey of Canada, new series, Vol. 9, 1896 (1898), 816 pp., maps, containing the Director's Summary Report for 1896, and reports by Tyrrell, Bell, Low, Bailey, Hoffman and Ingall, etc., also 20 plates. Ottawa.

Duplication of geologic formation names. (Discussion and correspondence.) *Science*, N.S., Vol. ix., pp. 592-593, 1899.

Summary Report of the Geological Survey of Canada for the year 1897. Geological Survey of Canada, 156 pp. Ottawa.

1899.

Summary Report of the Geological Survey Department for the year 1898 (containing also reports of the several technical officers of the Geological Survey Staff, on the geology, etc., of various portions of the Dominion of Canada), 208 pp. Ottawa.

(On Mammoth and musk-ox remains from the Saskatchewan gold-bearing gravels of the Edmonton district, Alberta.) Summary Report, 1898, Geological Survey Department, pp. 19-20. Ottawa.

Summary Report of the Director for the year 1897. (Reprint from Blue Book), pp. 156, with Map No. 639. Annual Report, Geological Survey of Canada, N.S., Vol. XX., 1897. Report A., 1899. Ottawa.

Summary Report of the Director for the year 1898. (Reprint from Blue Book), pp. 208. Annual Report Geological Survey of Canada, N.S., Vol. XI. Report A, in progress.

1900.

Summary Report of the Geological Survey Department for the year 1899, 224 pp. Ottawa, 1900.

Economic Minerals of Canada. Paris International Exhibition, 1900, with map, 54 pp. Toronto, Canada.

Remarkable landslip in Portneuf county, Quebec. Bull. Geol. Soc., Amer., Vol. x., pp. 484-490, plates 51 and 52. Rochester, N.Y., 1900.

1901.

On the Geological Record of the Rocky Mountain Region in Canada. Address by the President. Bull. Geol. Soc., Amer., Vol. xii., pp. 57-92. Rochester, N.Y., Feb., 1901. Abstract of same in *Scientific American Supplement*, No. 1307, pp. 20948 and 20949, Jan. 19th, 1901. In part published in *Science*, N.S., Vol. xiii., No. 324, pp. 401-407, March 15th, 1901, under the title: "Physical History of the Rocky Mountain Region in Canada."

(The late George Mercer Dawson) with portrait. Obituary notice by H. M. Ami, Sc.D., in *The Ottawa Naturalist*, Vol. xv., No. 2, pp. 43-52, May, 1901.

Some Notes on Mount Royal.

By J. S. Buchan, K.C., B.C.L.

Mount Royal may be described as bounded by Sherbrooke Street on the East, a line about a quarter of a mile beyond the Electric Railway on the West, at Outremont; Park Avenue on the North, and the Electric Railway on the South. The area thus enclosed, from the scale on the map, is about 16,000 feet, or over three miles, from North to South, and 11,500 feet, or over two miles, from East to West.

In shape it is a somewhat irregular oval, and has a superficial area of about five square miles. In this space there are three principal peaks, one at the Observatory, 739 feet above low water in the Harbor, another opposite to this, and divided from it by Mount Royal Cemetery, 730 feet, and the Westmount, or Little Mountain, about 600 feet, from a Barometer reading, which has, however, not been verified, as stated below. These points are separated from each other, the first two by the depression in which the Mount Royal Cemetery is situated, and the latter from the others by the Cote des Neiges valley.

It will be understood that these and all measurements used in this paper do not pretend to give those of an accurate survey, and in the sketches showing the line of division between the limestone and trap of the mountain, the irregularities of the lines have been neglected, as they could not be correctly shown on a small scale plan, and, further, were not necessary for the purposes of the present paper, the object of which is to show in a general and comprehensive manner the area, position and boundaries of the respective trap and limestone formations of which the mountain is composed.

To assist the description, I have prepared some rough sketches, on which the heavy black line on Figures 1, 2 and 3 marks the division between the trap and the unaltered limestone, the part covered by the latter being shown by the space below the line, the Theralite by the perpendicular lines, the altered limestone by the dotted shading, and the crosses indicating Nepheline Syenite.

On the map, Fig. 4, the shaded portion enclosed by the heavy black line shows the position and general appearance of the part occupied by the trap and altered limestone, as referred to above.

This part of the mountain as shown on the map is also an irregular oval, with a length of about 9,000 feet from East to West, by 5,700 in width, and having an approximate area of from 1,000 to 1,200 acres. This is somewhat larger than that estimated by Logan, Geology of Canada, p. 172, which he placed at about 700 acres.

On the map, Fig. 4, it will be noted that the margin of the dark portion is dotted, while the central part, with a slight exception, is shaded in black. The former is principally altered crystalline limestone, with several heavy bands of Nepheline Syenite, marked by crosses, while the black represents the Theralite, which forms the great mass of the mountain.

From the map, Fig. 4, it will be seen that the crystalline limestone is found at the margin, almost completely encircling the area occupied by the trap. Besides this, there are a few small, isolated patches near the Park Ranger's house, and it is also found extending across the lowest part of Mount Royal Cemetery, in the direction of the Westmount outcrop, but it can only be traced where excavations have been made, owing to a heavy covering of drift.

At the northern end of the mountain, the altered limestone passes in several places under the road near the Incline Railway, where it is 410 feet above the river. Further south, the Syenite appears at one point beyond the look-out, while on Westmount almost the whole of the mountain included in the dotted shading is occupied by the altered limestone, the trap formation being represented by some heavy bands of Theralite, alternated by others of Syenite, of which there is also a small exposure further to the south, and shown by crosses at the point A outside the black line.

On the south and west sides, where the broken lines are shown, the rock is deeply covered with drift, and the line is consequently drawn to connect the nearest points where the formation can be seen.

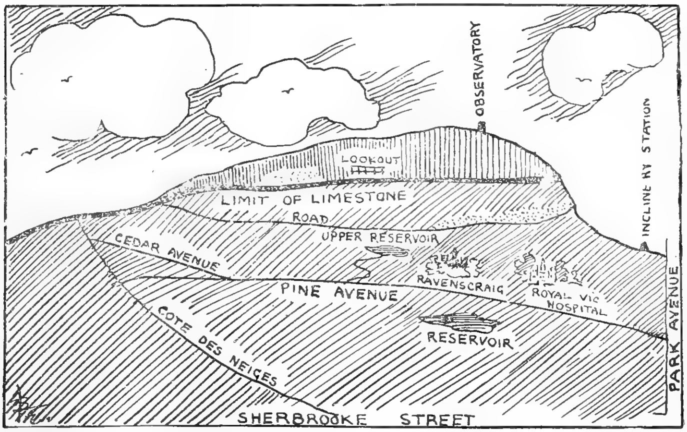


FIG. 1.

Beginning with the sketch Fig. 1, which shows the easterly side of the mountain, we have the view which is the most familiar. The black line showing the limit of the limestone, it will be seen, reaches well up to the top of the mountain. At a point near the centre of the sketch, a short distance to the east of Cote des Neiges road, this line reaches the summit, the height being about 660 feet above low water in the harbor.

From this point it runs in an easterly direction, passing below the look-out, where it is about 560 feet above the harbor, until it reaches the natural look-out point above the high level reservoir, where it is 590 feet above the river.

A short distance to the south of this point there is an isolated patch of Utica shale, resting against the trap outside the black line on Fig. 4.

The summit of the mountain at the Observatory is 739 feet above the river, which would give a height of about 150 feet for the trap above the line of the limestone. These measurements may be considered as accurate, as they are taken from the plan in the Road Department of the city, but the line being fixed by local points, such as

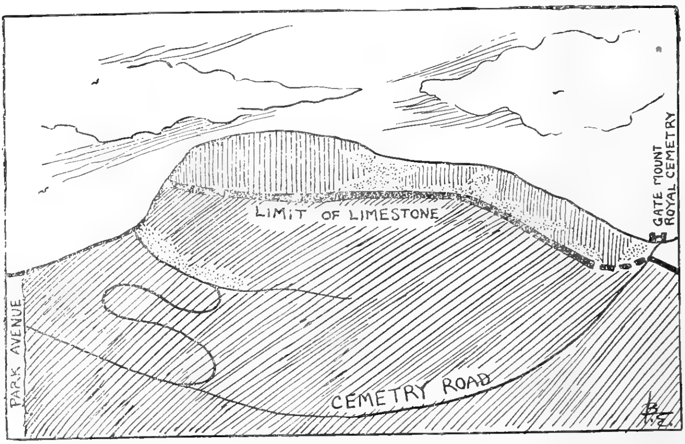


FIG. 2.

the look-out, roads or other marks, its location must necessarily be approximate, but sufficiently accurate to show its general position.

Passing towards the northern end of the mountain, the altered crystalline limestone is exposed in several places where the rock has been removed in making the road, its position being shown by the dotted shading on Fig. 1.

Fig. 2 shows the northern end of the mountain from a point near the Incline Railway to the Mount Royal Cemetery gate. This part, especially that near the

Incline Railway, which includes the bold, almost perpendicular bluff, is encumbered by large blocks of Theralite to such an extent that it is difficult to determine the limits of the different formations, but at least a fairly approximate idea can be formed as to their position from the exposures which can be seen at different points.

Here the altered limestone is also found exposed at different places, and towards the Cemetery it reaches well up to the top of the mountain, from which point it appears to extend across the Cemetery in the direction of Westmount.

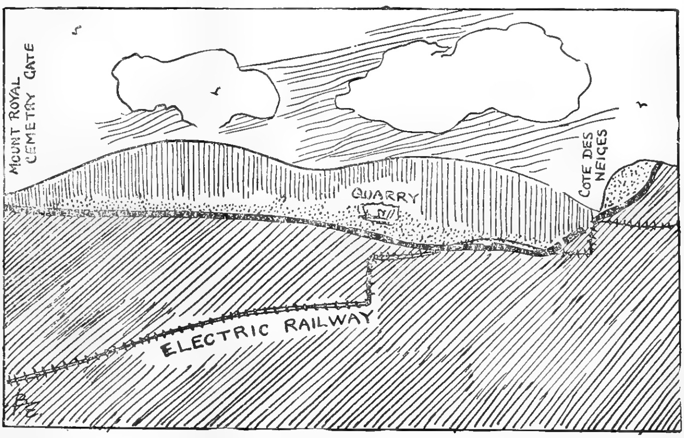


FIG. 3.

From the Cemetery gate, the division between the two formations runs in almost a direct line past Outremont Quarry, to a point near Cote des Neiges, where it crosses the Electric Railway, Fig. 3, and then re-crossing it in the direction of Westmount, passes under a heavy deposit of drift, by which it is concealed until it re-appears at the foot of the West-mount, or the Little Mountain.

From the Mount Royal Cemetery gate to Westmount there is a continuous and extensive exposure of altered limestone, that found in the Outremont Quarry being the most highly crystalline, while the outbreak of Nepheline Syenite found at this point is of greater importance than at any other on the mountain, some of it having the appearance of a very fine granite. The specimens from the quarry show some of the different forms which are found at this part of the mountain.

Beyond the quarry the altered limestones occupy all the space between the railway and the points where the mountain begins to rise more abruptly, approximately shown by the narrow black line inside the larger one, the parts which present a rough, craggy appearance being for the most part Theralite, while these limestones usually take the form of a smooth floor or rounded mass, through the erosion which has taken place.

Where the line crosses the railway, a quarry has been opened, and the altered limestone can there be seen, but covered in places by the ordinary limestone rock, from which point to that at which it reaches the Theralite, the distance is about 100 yards, forming an almost level platform, cut in different directions by a large number of exceedingly hard, dark colored dykes, frequently cutting and crossing each other, and which in many cases rise above the softer limestone, through the latter having been eroded and worn away, apparently by the action of the surf which has left extensive beds of water-worn gravel covering the rock at different points to a considerable depth.

On the West-mount, or Little Mountain, what may be called the normal limestone completely covers the highest point, which a barometer reading gives as 600 feet, but which, however, has not been otherwise verified, the line passing near the southern limit of the McGill University property, thence past the western end of the reservoir on one side, and crossing Summit Avenue opposite the gate of Cote des Neiges Cemetery, Fig. 4.

This space, it will be seen, occupies a comparatively

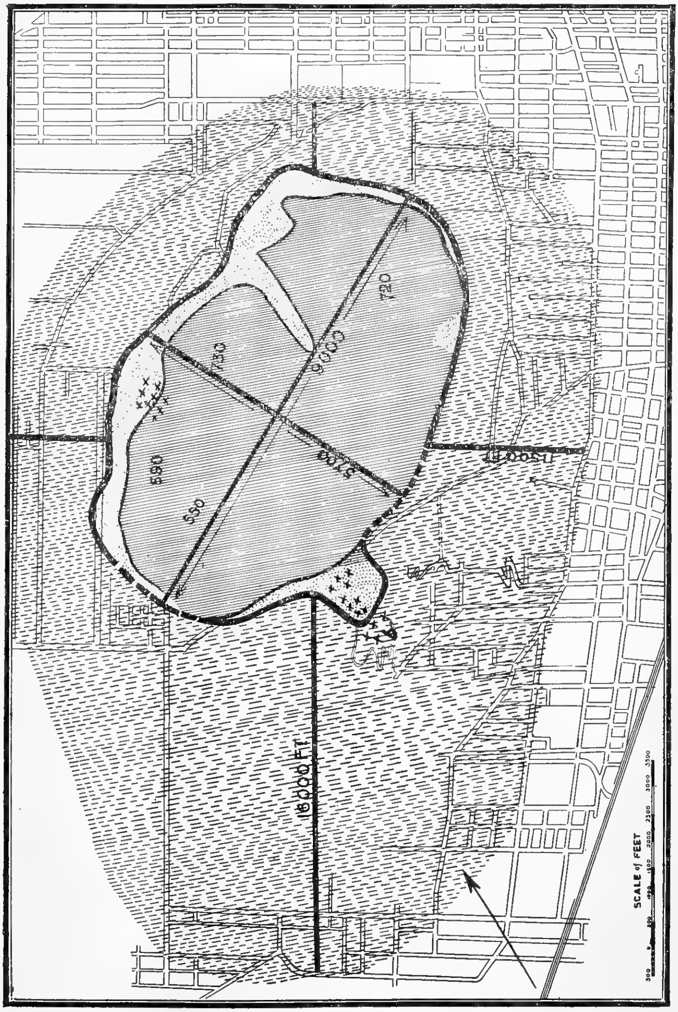


FIG. 4.

small part of the mountain, and is altogether covered by the altered limestone, with the exception of some heavy bands of Theralite and smaller ones of Syenite, indicated by the crosses on Fig. 4, which appear to have broken through it, and to extend in a northerly direction towards the main body of trap in Cote des Neiges Cemetery.

There is, however, at various points on the Little Mountain evidence of intense volcanic activity. On the eastern side, in a large quarry, the limestone has been changed by the action of heat so that it resembles a fine marble, and in some cases has been reduced to what appears to be a quicklime, which readily slacks on exposure to the atmosphere or moisture.

Another side of the quarry is cut by narrow dykes in different directions, while a large part of it is occupied by a breccia, cut by a heavy dyke of Theralite. Specimens of these are also shown.

On Summit Avenue, at a point about 100 feet below the top of the mountain, there is a large dyke of gray Syenite, about 8 feet in thickness. About twenty-five feet, in a north-easterly direction, there is another dyke of dark, close-grained trap 12 inches in thickness, and between them a horizontal outcrop of Theralite.

Besides this, there are on this side of the mountain a large number of dykes, from 1 inch up to 2½ feet in thickness, for the most part a hard, dark colored trap, but showing Theralite at different points, and in some instances much decomposed.

At the northern end of the mountain, near the reservoir, there is another large quarry, showing an outbreak of massive, dark, fine-grained trap, flanked by a heavy deposit of breccia, while the limestone is greatly altered by the action of heat, which does not appear, however, to have produced the same effects on the lime as in the quarry on the eastern side, but left it with a dark bluish purple tint instead of white.

Questions of much interest are suggested by the conditions which are found to exist on a survey of the mountain, such as the age of the different outcrops of trap and their relation to each other, the conditions and the nature of the force which in one case has changed the limestone and apparently reduced it to something resembling a common quicklime, in another has given it a dark purple color, and in still another has changed it to a metamorphic rock, ranging from a soft, easily deocmposed substance, on the one hand, to one that is hard and highly crystalline on the other.

A careful study of these and many other questions which arise in this connection would doubtless throw much light on the history of Mount Royal, and at the same time possibly add something to the sum of our general knowledge respecting such matters.

Some Recent Folds in the Lorraine Shales.

By Dr. Alfred W. G. Wilson, McGill University.

At the point on the north shore of Lake Ontario, about one mile west of Lorne Park, and fourteen miles west of Toronto, the Lorraine shales are exposed in a low cliff. Occasionally this cliff is fronted by a narrow gravel beach, but along most of the section, which is about one mile in length, the waves wash the foot of the cliff. Where the shales are exposed at the eastern end of the section, the cliff is about eight feet in height. The height increases slightly westward, the maximum section being about sixteen feet. The blue-grey shales are thin bedded, incoherent, and quite soft, with many small nodules which are somewhat arenaceous and occasionally pyritiferous. Interbedded with the shales are brown-tinted hard-bands of a ripple-marked calcareous sandstone, sometimes varying to an arenaceous limestone. These bands vary from half an inch to about six inches in thickness. In cross section they are seen to be lenses varying from about twenty feet or less, to over two hundred yards in length. The distance between the hard bands varies from six inches to several feet. As a general rule the wider bands are separated by a greater thickness of softer shales. The average of a number of observations shows the dip of the beds to lie between twenty and twenty-five minutes towards a point about eight degrees west of south. The upper eight feet of the shales is more or less oxidized to a brownish tint.

These beds constitute the upper portion of the Lorraine shales, the reddish Medina sandstones appearing on the lake shore at a point a little further west, just east of Oakville.

The beds are capped by a covering of boulder-till varying in depth from a few inches to about three feet. The till carries a few boulders of gneiss and granite and numerous fragments of the harder sandstones. Where the till rests upon the soft shales, it is often difficult to determine the line of demarcation between the two.

The feature of particular interest in the section is the occurrence of a number of anticlinal folds in the upper beds. The first of these, from the west, is shown in Plate I. It occurs about fifty yards east of the road which comes down to the lake shore about two miles west of Lorne Park. At this place the cliff is about twelve feet in height, and the upper nine feet exposed above the shingle beach show the beds to be folded upward in a sharp anticline, the change from the nearly horizontal to a steep dip being quite abrupt. The fold is about seven feet across. The east side, as shown in the plate, is partly obscured by a recent fall of boulder clay, It is probable that the disturbance does not extend much below lake level. The arch of the anticline has been thrust upward into the boulder clay, so that now the shales at the arch

PLATE I.

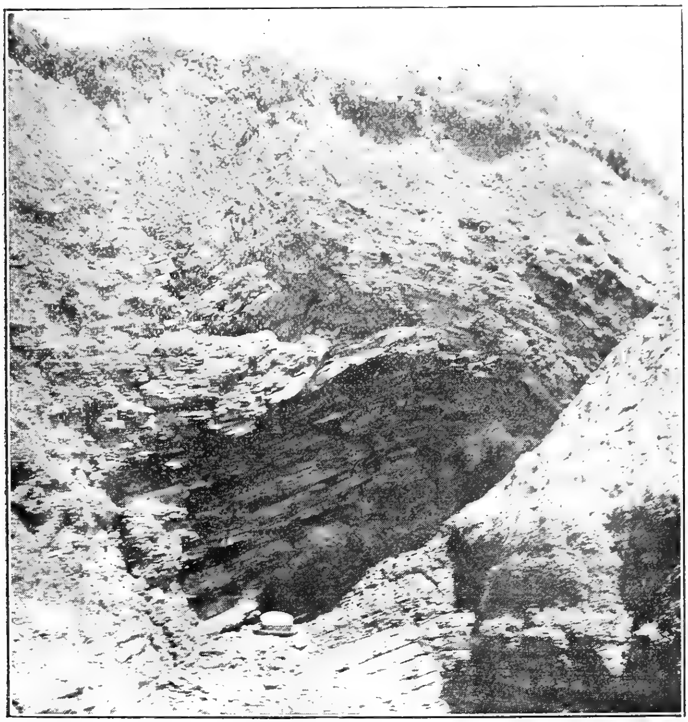


PLATE II.

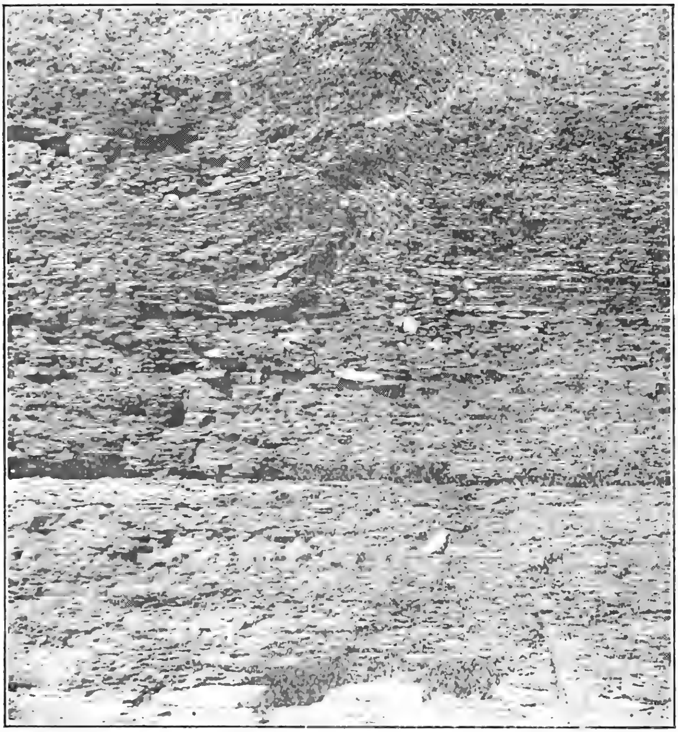


PLATE III.

PLATE IV.

reach to the surface, the clay on either side over the undisturbed part being nearly three feet in depth.

The second fold occurs about seventy yards further east where the cliff section is about fourteen feet in height. This second fold (Plate II.) is somewhat larger, the folded part, as exposed above the shingle, being twelve feet in height. The lower part of the anticline, which contains some of the harder bands, before referred to, is thrust towards the east of north, while the upper portion, more free from harder beds, is nearly vertical and in places is thrust towards the west of south. The dome of this arch also reaches to the surface.

In both cases the shales are much crushed and fractured where they are pinched along the axes of the anticlines. It is probable that at one time both arches extended some distance above the present level of the ground, before the shoreline was cut back to its present position, and that they were evened off by the cultivation of the land overlying. In both cases the folding of the shales has materially weakened them, and as a result the waves have made a small incision along the axis of each fold. The axis of the first strikes N.10°W. and dips 73° towards the west.

Nearly a quarter of a mile further east there are a series of four small folds. One of them is shown in Plate III. This fold affects only the upper three and a half feet of the shales, is about three feet across, and the arch rises about twenty inches into the boulder clay, here thirty inches in depth. About ten feet west of the one shown in the plate, is a larger fold affecting about twice the depth of strata, but in such a position that it could not be photographed successfully. A few feet east of the one shown in the plate are two small folds, each affecting about three feet of the upper beds, but not more than ten inches across. The folding is well marked, however, as over the arches the shale beds are nearly vertical.

The most interesting fold of the series occurs just east of the end of the concession road, a short distance west of the first point on the laks shore west of Lorne Park. There are here two bands of sandstone interbedded with the shales, the lower one about four and a half inches in thickness and the upper about two inches. When the writer first noticed the anticlines, two years ago, the beds were folded so that the section appeared as shown in the figure (Figure 1). The upper portion of the

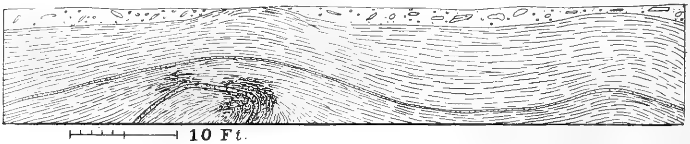


FIGURE 1.—Horizontal and vertical scales equal.

beds was somewhat obscured by mud which had trickled down with rain water from above, and the condition of the shales above the upper hard band was uncertain. On visiting the locality this spring it was found that the lake had cut back a short distance, exactly how far could not be ascertained, and the fold now presents the appearance shown in Plate IV. The lower heavy hard band has been fractured at the arch of the anticline and has been thrust forward into the softer shales. As now exposed the disturbance is confined to the beds in the immediate vicinity of this competent member; the overlying beds to the surface (about six feet) show no signs of disturbance.

A search for similar folds along the low sections exposed in a few small creeks in the vicinity failed to reveal their occurrence. Whether the similar folds occur in the Medina shales and sandstones west of Oakville is also uncertain. There are large sections of cliff which cannot be studied in detail unless we approach the front in a boat or canoe. The writer did not note any while traversing the section between Oakville and Hamilton on foot.

G. K. Gilbert has described some similar "small post-glacial anticlines in the horizontal limestones of Jefferson County, N.Y., and in the shales near Dunkirk in the western part of the State, and states that they may have resulted from expansion caused by the warming up of the surface layers of the rocks as they recovered from the cold of the glacial period."[1] He has also described a similar small anticlinal disturbance of Devonian shales in Ripley, the most western township, of New York.[2] In a third paper he has described another similar form occurring at Thirty-Mile Point, New York.[3]

It is quite probable that the seven small folds which occur in the beds of this section are also to be attributed to the same cause. There are no salt wells or saline springs in the vicinity to cause folding by the sinking of the overlying strata as at Caledonia, New York.

1. "Some New Geologic Wrinkles," Amer. Jour. Sci., 3rd ser., Vol. 32, 1886, p. 324.

2. "Post-Glacial Anticlinal Ridges near Ripley and Caledonia, N.Y., Amer. Geol., Vol. 8, 1591, p. 230.

3. "Dislocation at Thirty-Mile Point, New York, Bull. Geol. Soc. Amer., Vol. 10, 1898, p. 131.

Proceedings of Natural History Society.

SECOND MONTHLY MEETING—SESSION 1901-'02.

Montreal, Nov. 25th, 1901.

The second monthly meeting was held this evening at 8.15 o'clock.

The chair was occupied by Prof. E. W. MocBride, and the following were also present:—J. A. U. Beaudry, Rev. R. Campbell, A. E. Norris, Alex. Robertson, W. Godbee Brown, R. W. McLachlan, R. R. Samuel, H. McLaren, Mrs. Duckett, Dr. H. B. Cushing, W. Ormiston Roy, J. S. Buchan, Prof. O. E. Leroy, Mrs. Snowdon, E. S. Phillips, C. S. J. Phillips and a great number of visitors.

The minutes of last meeting were read and approved.

The Curator, A. E. Norris, then reported the following donations to the Museum:—

Balloon Fish—Donor, J. G. McKergow.

Skull of Wolf—Donor, E. D. Wintle.

Skin of Rattle Snake—Donor, H. J. Tiffin.

Sparrow Hawk—Donor, Alfred Joyce.

120 specimens of British Wild Flowers—Donor, Rev. R. Campbell, D.D.

The Librarian then reported the following donations to the Library:—

"Popular Sociology," by Dr. Arthur Fisher, presented by the author.

"The Nature and Development of Animal Intelligence," by Dr. Wesley Mills, presented by the author.

It was then moved by J. A U. Beaudry, seconded by Alex. Robertson, that the thanks of the Society be accorded to the above donors. Carried.

It was then resolved, on the recommendation of Council, that the thanks of the Society be tendered to the

Entomological Society, Microscopical Society and Messrs. Henry Morgan & Co. for the assistance rendered at the conversazione last month. Carried unanimously.

Mr. J. S. Buchan was then called upon to read a communication, "Some Notes on Mount Royal." Such a subject naturally created a lively discussion, the following taking part:—Prof. MacBride, Rev. R. Campbell, H. McLaren, A. E. Norris, Dr. H. B. Cushing and O. E. Leroy.

A vote of thanks, proposed by Prof. E W. MacBride, and seconded by C. S. J. Phillips, and unanimously carried, was tendered to the lecturer for what proved a very interesting and instructive paper.

There being no further business, the meeting then adjourned.

CHAS. S. J. PHILLIPS, Recording Secretary.

E. W. MacBRIDE, President.

THIRD MONTHLY MEETING—SESSION 1901-'02.

Montreal, Jan. 27th, 1902.

The third monthly meeting was held this evening at 8.15.

The chair was occupied by the President, Prof. E. W. MacBride. There were also present J. S. Buchan, A. E. Norris, Thos. Craig, H. McLaren, Dr. F. D. Adams, C. E. H. Phillips, A. Griffin, H. E. Vennor, C. S. J. Phillips, Jos. Fortier, Miss E. Luke, Edgar Judge, Miss Kay and a number of visitors.

On motion of J. S. Buchan, seconded by C. S. J. Phillips, the rule was suspended, and the following were elected ordinary members of the Society:—Thomas Craig and Miss Edith Luke. Prof. H. D. Adams then gave his communication, "Notes on Some Ore Deposits of Southern

British Columbia." This was ably treated by the author, many questions being answered by him in the discussion that followed.

A hearty vote of thanks, proposed by Prof. E. W. MacBride, seconded by J. S. Buchan, was then tendered to Dr. Adams for his interesting and instructive discourse.

The meeting then adjourned.

R. CAMPBELL,
Chairman pro tem.

FOURTH MONTHLY MEETING—SESSION 1901-'02.

MONTREAL, Feb. 24th, 1902.

The fourth monthly meeting of the Society was held this evening in the Library at 8 o'clock.

In the absence of the President, the chair was occupied by Albert Holden, and the following were also present :—Rev. R. Campbell, Hon. Mr. Justice Wurtele, Dr. Wesley Mills, H. McLaren, A. E. Norris, J. G. McKergow, H. C. Vennor, Miss E. Luke and A. Griffin. In the absence of C. S. J. Phillips, the Secretary, A. E. Norris was requested to act in his stead. On motion of the Rev. R. Campbell, seconded by A. E. Norris, the minutes of the last meeting were taken as read. Carried.

It was then proposed by the Rev. R. Campbell, seconded by H. McLaren, that the rules be suspended, and the following elected ordinary members of the Society:—J. Emile Vanier, C.E., and Henry J. Cohn. Carried.

As the Somerville lecture was to be delivered this evening, it was moved by H. McLaren, seconded by A. E. Norris, that this meeting be adjourned to the 3rd of March to enable Prof. O. E. Leroy and W. G. McNaughton to read their respective communications before the Society. Carried.

R. CAMPBELL,
Chairman pro tem.

FIFTH MONTHLY MEETING—SESSION 1901-'02.

MONTREAL, March 3rd, 1902.

The fifth monthly meeting of the Society was held this evening at 8.15, the chair being occupied by the Rev. R. Campbell, D.D. There were also present: Thomas Craig, F. W. Richards, A. E. Norris, J. Harper, Prof. O. E. Leroy, Alex. Robertson, Mrs. Duckett, J. G. McKergow, Mr. and Mrs. W. Godbee Brown, H. E. Vennor, A. Griffin, W. G. McNaughton, G. Sumner, C. S. J. Phillips, and a number of others.

The minutes of last meeting were read and confirmed.

It was then resolved, on motion of F. W. Richards seconded by Alex. Robertson, that the Rev. R. Campbell, C. S. J. Phillips and J. S. Buchan be a committee to draw up a resolution of condolence and forward same to the family of the late James Ferrier, who so ably filled the position of Treasurer to the Society from 1860 to 1874. Carried.

Mr. W. G. McNaughton, B.A., then gave his communication on "The Chateauguay Mounds," followed by Prof. O. E. Leroy, who read an interesting paper on "The Niagara Gorge." Both of the above papers were illustrated with lantern slides, adding greatly to what proved to be very instructive communications.

A vote of thanks, moved by Geo. Sumner, seconded by J. Harper, was accorded Messrs. Leroy and McNaughton, after which the meeting adjourned.

CHAS. S. J. PHILLIPS,
Recording Secretary.

E. W. MACBRIDE,
President.

SIXTH MONTHLY MEETING—SESSION 1901-'02.

MONTREAL, April 2nd, 1902.

The sixth monthly meeting of the Society was held this evening at 8.15, Prof. E. W. MacBride in the chair. There were also present: The Rev. R. Campbell, John Harper, J. A. U. Beaudry, H. McLaren, A. E. Norris, Hon. J. K. Ward, A. Holden, Prof. Binmore, F. W. Richards, Alex. Robertson, Mrs. Duckett, Rev. J. Y. Gilmour, Jos. Fortier, A. Griffin, C. S. J. Phillips and a number of visitors.

The minutes of last meeting were read and confirmed.

The report of Council was read and adopted.

Prof. E. W. MacBride then introduced Dr. J. Stafford, who then gave his paper, "Some Earth Worms of Canada," followed by Prof. E. W. MacBride, who gave a very interesting paper on the "Star Fish of Canada."

Both of the above communications were illustrated with the aid of lantern slides, and were much appreciated by an attentive audience.

A discussion followed, many questions being asked and replied to by both of the lecturers.

A vote of thanks, proposed by John Harper, and seconded by H. McLaren, was unanimously accorded to Prof. MacBride and Dr. Stafford for their very instructive and original papers.

It was then announced that the following papers would be read at the next monthly meeting of the Society:—

"Some of the Mushrooms of Canada," by Miss Van Horne.

"An Unusual Display of the Aurora Polaris," by Charles J. Stuart.

The meeting then adjourned.

WESLEY MILLS,
Chairman pro tem.

SEVENTH MONTHLY MEETING—SESSION 1901-'02.

MONTREAL, April 28th, 1902.

The seventh monthly meeting was held this evening, Dr. Wesley Mills occupied the chair. There were also present: J. A. U. Beaudry, A. E. Norris, J. G. McKergow, H. McLaren, A. Holden, Jos. Fortier, Miss Van Horne, Rev. J. Y. Gilmour, A. Griffin, J. Harper and about 50 others.

On motion, the minutes of last meeting were taken as read.

The Curator, A. E. Norris, then reported the following donations :—

Nest of Red-eyed Vires, 2 Green Snakes—Donor, A. E. Norris.

A number of Indian Relics—Donor, Thomas Roddick, M.D.

On motion of F. W. Richards, seconded by the Rev. R. Campbell, a hearty vote of thanks was accorded the above donors.

Miss Van Horne then read her paper, "Some of the Mushrooms of Canada." The subject was treated in a very exhaustive manner, and was additionally interesting on account of the number of specially prepared lantern slides.

Mr. Charles J. Stuart then gave his communication, 'An Unusual Display of the Aurora Polaris." This proved to be a very interesting paper, many colored diagrams made by the author assisting everyone to a proper grasp of the subject.

On motion of the Rev. R. Campbell, seconded by C. S. J. Phillips, a vote of thanks was unanimously tendered to Miss Van Horne and Mr. Stuart for their valuable and interesting communications. Carried.

ANNUAL MEETING.

The adjourned annual meeting of the Natural History Society of Montreal was held in the hall of the Society on Monday evening, June 9th, 1902, Hon. Justice Würtele in the chair, in the absence of the President.

There were present, among others, the following:—Messrs. J. H. Joseph, A. Holden, J. A. U. Beaudry, Prof. Frank D. Adams, Joseph Fortier, John Harper, H. McLaren, Alex. Robertson, A. E. Norris, Rev. Dr. R. Campbell, J. S. Buchan, F. W. Richards, Dr. Wesley Mills, Edgar Judge, Hon. J. K. Ward, J. G. McKergow, C. S. J. Phillips and A. Griffin.

The following donations were reported since the last monthly meeting:—

From Frank Wilkinson—Coronation Medal of Queen Victoria.

From H. J. Tiffin—Alligator Eggs.

The minutes of last annual meeting were held as read and approved of.

Reports of their proceedings for the year were presented by the Council, Editing and Exchange Committee, House Committee, Curator, Librarian, Lecture Committee, and Treasurer, which were severally received and adopted.

The election of office-bearers for the year was then proceeded with, the result being as follows:—

NATURAL HISTORY SOCIETY OF MONTREAL.

Patron:

HIS EXCELLENCY THE GOVERNOR-GENERAL OF CANADA.

Hon. President:

LORD STRATHCONA AND MOUNT ROYAL.

President:

PROF. E. W. MACBRIDE, M.A., SC.D.

Vice-Presidents:

FRANK D. ADAMS, Ph.D., F.R.S.C.
REV. ROBT. CAMPBELL, M.A., D.D.
B. J. HARRINGTON, Ph.D., F.R.S.C.
A. HOLDEN.
J. H. JOSEPH.
DR. T. WESLEY MILLS.
PROF. D. P. PENHALLOW.
HON. J. K. WARD.
HON. JUSTICE WÜRTELE.

Hon. Recording Secretary:
F. W. Richards.

Hon. Corresponding Secretary:
J. A. U. Beaudry, C.E.

Honorary Treasurer:
Chas. S. J. Phillips.

Honorary Curator:
A. E. Norris.

Members of Council:
C. T. Williams, *Chairman.*

J. S. Buchan, K.C., B.C.L.
S. Finley.
Joseph Fortier.
John Harper.
Edgar Judge.
H. McLaren.
J. G. McKergow.

Editing and Exchange Committee:
Rev. Robt. Campbell, M.A., D.D., *Chairman.*

Frank D. Adams, Ph.D., F.R.S.C.
J. S. Buchan, K.C., B.C.L.
Prof. J. T. Donald.
A. T. Drummond, LL.D., Kingston, Ont.
Prof. E. W. MacBride, M.A., Sc.D.
H. McLaren.
G. F. Matthew, St. John, N.B.
T. Wesley Mills, M.A., M.D.
J. F. Whiteaves, Ottawa, Ont.

Subsequently the Council met, and the following Committees were struck:—

Library Committee:
H. McLaren, *Chairman.*

J. A. U. Beaudry, C.E.
Joseph Fortier,
Alfred Griffin.
A. E. Norris.
C. M. Tod.
C. T. Williams.

Museum Committee:
A. E. Norris, *Chairman.*

Rev. Robt. Campbell, M.A., D.D.
A. Holden.
O. E. LeRoy, B.A.
Prof. E. W. MacBride, M.A., Sc.D.
J. G. McKergow.
C. J. Stuart.
H. E. Vennor.

Field Work Committee:
C. T. Williams, *Chairman.*

Frank D. Adams, Ph.D., F.R.S.C.
Prof. J. Bemrose, F.I.C., F.C.S.
J. S. Buchan, K.C., B.C.L.
Rev. Robt. Campbell, M.A., D.D.
Rev. G. Colborne Heine.
O. E. LeRoy, B.A.
Prof. E. W. MacBride, M.A., Sc.D.
F. W. Richards.
Alex. Robertson.

Lecture Committee:
N. N. Evans, M.A.Sc., *Chairman.*

J. S. Buchan, K.C., B.C.L.
Rev. Robt. Campbell, M.A., D.D.
Prof. John Cox, M.A.
B. J. Harrington, Ph.D., F.R.S.C.
Rev. G. Colborne Heine.
Edgar Judge.
Dr. T. Wesley Mills.
Chas. S. J. Phillips.
Hon. Justice Würtele.

House Committee:
Albert Holden, *Chairman.*

F. W. Richards.
C. T. Williams.

Membership Committee :

Alex. Robertson, *Chairman.*

J. A. U. Beaudry, C.E.	Edgar Judge.
Prof. J. Bemrose, F.I.C., F.C.S.	H. McLaren.
Rev. Robt. Campbell, M.A., D.D.	Chas. S. J. Phillips.
A. Holden.	Hon. J. K. Ward.

C. T. Williams.

Superintendent :

Alfred Griffin.

REPORT OF COUNCIL.

To the Officers and Members of the Natural History Society of Montreal :

Ladies and Gentlemen,—

Your Council beg to submit the following Report for the year ending May 31st, 1902:

The usual meetings of Council have been held during the past session, for the reception of reports from the various Committees, and discussion of all other business, before being submitted to the regular monthly meetings of the Society.

We have to deplore the removal by death of the following members during the past year:—Messrs. Andrew Allan, E. A. Small, Hector Mackenzie, A. S. Ewing, E. L. Bond,—and James Ferrier. The last named gentleman was a member of long standing, a former treasurer, and, up to a recent period, an active and useful member. Advancing age, and physical infirmity alone, for the last few years, prevented his taking any prominent part in our sessions. He will long be remembered for his geniality, kindliness and courtliness. The Society is fortunate that the name of Ferrier will still be identified with our work in the person of his son, Mr. Walter Ferrier, of the Geological Department, Ottawa.

Thirteen new members have been elected during the session, and it is hoped that a renewed and energetic effort will be made by the new Membership Committee, assisted by all the members, to greatly increase this record during the coming season.

Your Council is pleased to be able to report a better attendance at the regular monthly meetings, evincing a deeper interest in the work of the Society. The papers submitted have been of a high order, and many spirited and interesting discussions took place. The following is the list:—

Nov. 25.—" Some notes on Mount Royal," by J. S. Buchan, K.C., B.C.L.

Jan. 27.—" Notes on some ore deposits of Southern British Columbia," by F. D. Adams, Ph.D., F.R.S.C.

March 3.—" The Chateauguay Mounds," by W. G. MacNaughton, B.A.

March 3.—" The Niagara Gorge," by Prof. O. E. Leroy.

April 2.—" The star fish of Canada," by the President.

April 2. " Some earthworms of Canada," by Dr. Stafford.

May 2.—" Some of the mushrooms of Canada," by Miss Van Horne.

May 2.—" An unusual display of the Aurora Polaris," by Charles J. Stuart.

The Somerville Course of lectures was also very well attended, as were the Saturday afternoon half hour talks to young folks, particulars of which will no doubt be given by the Lecture Committee, who are worthy of commendation for the successful result of their efforts.

The Annual Field Day was, on the invitation of Judge Foster, of Knowlton, held at Lake Bonnalie, on the side of Mount Orford, and, thanks to the Judge's hospitality, proved a very enjoyable outing. Unfortunately, however, it was not a success from a financial point of view. The indications for this year, we are glad to say, are more favorable in this respect.

The visitors to the Museum have been more numerous than ever, many schools and colleges availing themselves of the opportunity of viewing our excellent collections.

The Superintendent, Mr. A. Griffin, ably assisted by Mrs. Griffin, have thoroughly and efficiently performed the duties allotted to them.

Respectfully submitted,

F. W. RICHARDS,
Chairman of Council.

REPORT OF THE EDITING AND EXCHANGE COMMITTEE.

Your Editing and Exchange Committee beg leave to report that two numbers of the Record of Science were issued during the year, one in August, and another in February, making 158 pages, overrunning the space supposed to be covered by two issues by thirty pages. But there was a press of matter in the hands of the Committee which they were anxious to publish at once. The seven numbers of Volumes VIII., have already taken up 492 pages,—so that the last issue must be a small one, of only 34 pages, if the volume is to be kept within the limits prescribed in the contract with the printer. The reports to be submitted at the annual meeting must find a place in the remainder of the volume, leaving little space for other matter.

The contents of the two numbers issued during the year, have been of the high order usual in the "Record of Science," consisting mainly of the papers submitted to the Society at the monthly meetings; and the varied exchanges received in former years have continued to come to the Library, adding greatly to its value.

In name and by authority of the Committee,

ROBERT CAMPBELL,
Chairman.

MUSEUM REPORT,—SESSION 1901-1902.

Gentlemen,—

I think I may safely say that the Museum this year has been a success, in more ways than one. The Saturday afternoon lectures have proved very popular, as many as four hundred children being present at a time, which is most encouraging, showing an awakened interest in Natural History, as a result of these illustrated lectures.

A larger number of people have visited the Museum this year, in consequence, no doubt, of the admission fee being abolished.

With the assistance of the Museum Committee a number of the birds have been dusted and treated with benzine, and several cases containing fossils and minerals re-papered and cleaned. One noticeable defect is that in some instances there is not room for the donations to be advantageously displayed.

The matting on the centre staircase was renewed, and twenty-five new metal-plates painted and placed on different specimens.

A successful conversazione was held by the Society on Oct. 28th, 1901, at which the Microscopic and Entomological Societies contributed interesting specimens, and also six large cases of the Dental Collection, loaned for this occasion.

I would like to call the attention of the House Committee to the condition of the windows in the skylight as the sun penetrates the worn panes, bleaching many of the specimens. We experienced considerable annoyance during the conversazione with the inefficient lighting of the Museum. The effect of the Entomological exhibits was entirely lost through this cause.

The donations this year were of various kinds, and include 200 specie of Swiss and English plants, from Dr. Campbell, as will be found recorded in the minute book. As the Society has already seen them, it will not be necessary to give them again in detail.

Respectfully submitted,

A. E. NORRIS,
Curator.

REPORT OF THE LIBRARY COMMITTEE.

This Committee was summoned in October, 1901, but sufficient members did not respond to form a quorum. The Committee was not again called during the season.

The Chairman and Mr. Griffin have devoted considerable time to cleaning and clearing up the large accumulation of books, periodicals, etc., that had been for a long time obstructing the floor. Room has been found for most of them by doubling the rows on some of the shelves, but this is not a convenient or satisfactory method of disposal. There is a very large number of unbound volumes, and it is hoped the Society may be able to make an appropriation, early next season, sufficient for the binding of these, and for the purchase of additional shelf accommodation.

H. McLAREN,
Chairman.

June 9th, 1902.

REPORT OF THE LECTURE COMMITTEE.

The lectures of the Somerville Course were of a high order of successful merit, and the attendance was encouraging.

The subjects, dates and lecturers were as follows:—

Feb. 20th.—"The place occupied by water in the economy of Nature," Howard T. Barnes, D.Sc.

Feb. 24th.—"Marine Station Work in the Straits of Fuca," Prof. Conway McMillan.

Mar. 6th.—"How we get our knowledge of the world about us," Wesley Mills, M.A., M.D.

Mar. 13th.—"The history of the progress of Botany in the Nineteenth Century," Rev. Robert Campbell, D.D.

Mar. 20th.—"Alchemy. A chapter in the History of Science," Feredrick Loddz, B.A., Oxon.

Mar. 27th.—"Some lessons to be drawn from the Life History of Frogs and Newts," E. W. MacBride, M.A., D.Sc.

The Saturday afternoon talks to children were more popular than ever, many, on one or two occasions, being turned away.

The course was as follows:—

Feb. 15th.—"History of a loaf of Bread," J. S. Buchan, K.C., B.C.L.

Feb. 22nd.—"What we eat and what becomes of it," Prof. Wesley Mills, M.D.

Mar. 1st.—"About our Hearts," W. S. Morrow, M.D.

Mar. 8th.—"Hygiene," D. J. Evans, M.D.

Mar. 15th.—"Water Babies," C. T. Williams, Esq.

Mar. 22nd.—"Mosquitoes," Thomas Craig, F.R.M.S.

Mar. 29th.—"Montreal Asters and Golden Rods," Rev. Robert Campbell, D.D.

April 5th.—The Butterflies and Moths of Mount Royal," A. E. Norris, Esq.

An important question in regard to the future of the Somerville Course has been under discussion, but as yet no conclusion has been reached.

WESLEY MILLS,
Chairman.

Natural History Society of Montreal

in account with

J. G. McKergow, *Hon. Treasurer.*

Cash Statement for Year ended 31st May, 1902.

To Rents	$913 00	
" Members' Subscriptions	534 00	
" Record of Science	16 20	
" Conversazione.	132 90	
" Bank Loans.	888 46	
" Balance due Treasurer 31st May, 1902	47 93	
By Balance due former Treasurer 1st June, 1901		$ 2 80
" Superintendent's Salary and Commission...		640 00
" Record of Science		110 58
" Repairs................................		131 19
" Sundry Expenses		144 69
" Lighting Account.......................		192 50
" Fuel "		124 62
" Printing "		10 25
" Lecture "		30 25
" Taxes..................................		34 92
" Field Day Deficit		7 50
" Museum Account.........................		13 80
" Conversazione		146 75
" Deposits to credit of Loans		911 19
" Interest on Loans......................		19 45
" Cash on hand...........................		12 00
	$2532 49	$2532 49

Bank Account.

Due Bank 1st June, 1901..................	$461 65	
" " Additional Loans	888 46	
Paid " on account of Loans...............		$911 19
Due " 21st May, 1902		438 92
	$1350 11	$1350 11

In addition to the amounts due the Bank and the Treasurer, there were unpaid accounts of $280.33, or a total liability of $767.18 at 31st May, 1902.

Audited and found correct this 9th June, 1902.

J. G. McKergow,
Hon. Treasurer.

Alexander Robertson.
H. McLaren.

INDEX.

PAGE

ADAMS, (FRANK D.), Ph.D., F.R.S.C. :—

Studies in the Geology of the Vicinity of Montreal which might be Overtaken by Members of the Natural History Society 65

In Memoriam—Sir John William Dawson.... 137

Book Notice. A. E. Barlow's Report on Nipissing and Temiscaming 198

Book Notice. L. M. Lambe's Madreporaria and Alayonaria. 201

An Experimental Investigation into the Flow of Marble.... 426

Ami, (H. M.), M.A., D.Sc., F.G.S. :—

Notes on Some of the Formations Belonging to the Carboniferous System in Eastern Canada 149

Notes and Comments.... 195

Book Notice. Dr. G. M. Dawson's Report of the Geological Survey 201

Progress of Geological Work in Canada during 1899.... 232

On a New or Hitherto Unrecognized Geological Formation in the Devonian System of Canada 296

Addenda and Corrigendum to Progress of Geological Work in Canada during 1899 329

Palæontological Note.... 331

Notes on the Albany Meeting of the Geological Society of America, held December, 1900.... 471

Bibliography of Dr. George Mercer Dawson 503

BONNEY, (T. G.), D.Sc., LL.D., V.P.R.S. :—

The Parent Rock of the Diamond in South Africa.... 95

Buchan, (J. S.), K.C., B.C.L. :—

The Rock Formation of the Bermudas.... 219

Was Mount Royal an Active Volcano ?.... 321

Notes on Mount Royal.... 517

CAMPBELL, (ROBERT), M.A., D.D. :—

The Gramineæ, Cyperaceæ and Juncaceæ of Montreal Island. 11

Botany in the Island of Montreal.... 84

Book Notice. Britton and Brown's Illustrated Flora of the Northern United States and Canada.... 134

The Flora of the Rocky Mountains.... 163

PAGE

North American Golden Rods 192
Additional Notes on the Flora of Cap-a-L'àigle 281
The Flora of Montreal Island 349
Book Notice. Dr. Wesley Mills' The Nature and Development of Animal Intelligence 493
Book Notice. Problems and Possibilities of Systematic Botany, by Prof. B. L. Robinson 496
Book Notice. Charles S. Sargent's Notes on a Collection of Cratægns made in Province of Quebec. Do. on Little Known North American Trees 497
Book Notice. Dr. D. C. MacCallum's Address 500

Craig, (John) :—
Book Notice. Professor Atkinson's Elementary Botany 62
Book Notice. An Elementary Text Book on Botany by L. H. Bailey 333
Book Notice. A New Physical Geography by Jacques W. Redway 411

Cushing (Harold B.), B.A., M.D. :
The Gramineæ, Cyperaceæ and Juncaceæ of the Island of Montreal 11

Dawson, (Sir John William), F.G.S., F.R.S., LL.D., C.M.G., Knight :—
Letter to Natural History Society 148

Dearness, (John) :—
An Hour's Botanizing on Side of Mount Royal 306

Dresser, (John A.) :—
On the Height of Mount Orford 225
A Hornblende Lamprophyre Dyke at Richmond, Que. 315

Drummond, (A. T.), LL.D. :—
The Lake on the Mountain near Picton, Ont 90

Ells, (R. W.), LL.D., F.R.S.C. :—
The Devonian of the Acadian Provinces 335

Evans, (Neville Norton), M.A.Sc. :—
On the Height of Mount Orford 225

Field Day to Montfort 267

Griffin, (Alfred) :—
Duck Hawk on Mount Royal 265

Harrington, (Bernard J. Harrington), M.A., Ph.D., LL.D. :—
George Mercer Dawson 413

PAGE

JACKSON, (F. SLATER), M.D. :—
The Canadian Marine Biological Station.................... 308

LEROY, (O. E.), B.A. :—
On the Height of Mount Orford............................ 225
Book Notice. L. M. Lambe's Sponges from the Coasts of North-eastern Canada and Greenland 412
Lyman, (H. H.), M.A. :—
Dimorphism and Polymorphism in Butterflies.............. 24

MACBRIDE, (E. W.), M.A., D.Sc. :—
Zoological Problems for the Natural History Society of Montreal 2
Inaugural Address as President of Natural History Society of Montreal 479
Mackay (A. H.), LL.D., F.R.S.C. :—
Phenological Observations in Canada..................... 71
Matthew, (G. F.), LL.D., F.R.S C. :—
A Forest Fire at St. John about 2,000 Years Ago.......... 213
Letter on D. White's Article on the Upper Palæozoic in Nova Scotia.. 344
Book Notice. Michel Mourlon's Essay on Ancient Deposit of Belgium... 411
Ostrocoda of the Basal Cambrian Rocks in Cape Breton.... 437
Morrow, (Dr. W. S.) :—
The Rate of Propagation of the Venous Pulse.............. 205

NATURAL HISTORY SOCIETY :—
Proceedings of 43, 114, 246, 388, 477, 532
Nicholson, (John T.), D.Sc. :—
An Experimental Investigation into the Flow of Marble..... 426
Norris, (A. E) :—
Life History of the Camberwell Beauty Butterfly........... 345

WALKER, (B E.), F.G.S. :—
List of the Published Writings of Elkanah Billings, F.R.S., Palæontologist 366
White, (Professor David), United States National Museum :—
Some Palæobotanical Aspects of the Upper Palæozoic in Nova Scotia.. 271
Wilson, (Dr. A. W. G.) :—
Some Recent Foldings in the Lorraine Shales.............. 525

JARY, 1902

Mete 187 feet. C. H. McLEOD, *Superintendent.*

DAY		Per cent. possible Sunshine.	Rainfall in inches.	Snowfall in inches.	Rain and snow melted.	DAY.
1		80	....	....	....	1
2		00	....	0.5	0.05	2
3		39	....	0.1	0.01	3
4		00	....	....	....	4
SUNDAY........ 5		00	....	0.8	0.05	5...........SUNDAY
6		00	....	0.2	0.02	6
7		00	....	....	....	7
8		73	....	0.0	0.00	8
9		51	....	....	....	9
10		00	....	....	....	10
11		00	....	0.5	0.05	11
SUNDAY........12		00	....	5.6	0.52	12...........SUNDAY
13		00	....	1.5	0.15	13
14		43	....	....	....	14
15		00	....	1.4	0.14	15
16		00	....	6.1	0.20	16
17		71	....	....	....	17
18		00	....	1.9	0.22	18
SUNDAY........19		82	....	0.0	0.00	19..........SUNDAY
20		62	....	....	....	20
21		00	....	4.3	0.43	21
22		00	0.61	1.0	0.71	22
23		22	....	1.3	0.13	23
24		87	....	....	....	24
25		16	....	....	....	25
SUNDAY........26		00	....	1.4	0.14	26 ....SUNDAY
27		33	0.20	0.0	0.20	27
28		83	....	0.0	0.00	28
29		95	....	....	....	29
30		95	....	....	....	30
31		64	....	....	....	31
Means......		32.4	0.81	26.6	3.02	..............Sums.
28 Years means for and including this month		¶34.81	0.855	29.91	3.702	28 Years means for and including this month.

Direction........	
Miles	
Duration in hrs..	
Mean velocity....	1

Greatest mileage 27th.

Greatest velocity

o sea-level and

s taken from

on being 100.
20 hours.

above zero on
5° below zero;
erature of 46.5°.
st day was the

Highest barometer reading was 30.71 on the 29th; lowest barometer was 29.17 on the 12th, giving a range of 1.54 inches.

Minimum relative humidity observed was 61 on the 14th.

Rain fell on 2 days.

Snow fell on 18 days.

Rain or snow fell on 18 days.

Fog on the 18th, 20th and 25th.

ABSTRACT FOR THE MONTH OF JANUARY, 1902

Meteorological Observations, McGill College Observatory, Montreal, Canada. Height above sea level, 187 feet. C. H. McLEOD, *Superintendent.*

DAY	THERMOMETER. † Mean.	Max.	Min.	Range.	* BAROMETER. † Mean.	Max.	Min.	Range.	‡Mean relative humidity.	WIND. General direction.	Mean velocity in miles per hour	Per cent. possible Sunshine.	Rainfall in inches.	Snowfall in inches.	Rain and snow melted.	DAY.
1	—0.55	5.6	—8.5	14.1	30.44	30.58	29.97	.61	88	W.	25.6	80	....	....	....	1
2	17.52	34.3	3.1	31.2	30.00	30.57	29.60	.97	80	S.E.	23.6	00	....	0.5	0.05	2
3	12.84	34.0	2.3	31.7	29.95	30.25	29.60	.65	82	N.W.	24.2	39	....	0.1	0.01	3
4	0.14	4.5	—3.8	8.3	30.38	30.42	30.25	.17	85	W.	24.4	00	....	....	....	4
SUNDAY........ 5	19.35	25.5	4.5	21.0	30.23	30.38	30.17	.21	85	S.W.	15.5	00	....	0.8	0.05	5..........SUNDAY
6	15.97	25.5	13.0	12.5	30.27	30.30	30.22	.08	85	N.E.	13.3	00	....	0.2	0.02	6
7	12.67	16.2	9.5	6.7	30.18	30.22	30.15	.07	85	E.	14.1	00	....	....	....	7
8	16.87	20.0	12.5	7.5	30.23	30.18	30.11	.07	80	N.E.	15.1	73	....	0.0	0.00	8
9	17.84	23.7	12.4	11.3	30.12	30.18	30.05	.13	87	E.	8.6	51	....	....	....	9
10	18.49	21.8	14.0	7.8	29.86	30.05	29.73	.32	87	N.W.	7.5	00	....	....	....	10
11	18.68	22.0	16.2	5.8	29.56	29.73	29.44	.29	92	N.E.	11.4	00	....	0.5	0.05	11
SUNDAY........ 12	18.08	20.4	16.3	4.1	29.26	29.44	29.17	.26	90	N.W.	19.8	00	....	5.6	0.52	12..........SUNDAY
13	14.96	18.0	10.7	7.3	29.61	29.81	29.30	.51	85	W.	22.1	00	....	1.5	0.15	13
14	6.23	14.0	—2.0	16.0	29.99	30.04	29.81	.23	73	W.	20.5	43	....	....	....	14
15	14.61	20.0	6.4	13.6	29.85	30.01	29.82	.19	91	E.	16.7	00	....	1.4	0.14	15
16	22.72	28.0	11.8	16.2	29.82	29.96	29.75	.21	92	W.	14.6	00	....	6.1	0.20	16
17	0.17	11.8	—8.4	20.2	30.06	30.12	29.96	.16	83	S.W.	13.0	71	....	....	....	17
18	11.82	26.0	1.7	24.3	29.82	30.03	29.66	.37	92	S.	15.2	00	....	1.9	0.22	18
SUNDAY........ 19	12.72	28.0	0.0	28.0	30.11	30.39	29.66	.73	81	W.	24.3	82	....	0.0	0.00	19..........SUNDAY
20	3.52	14.0	—2.8	16.8	30.43	30.48	30.38	.10	89	W.	10.6	62	....	....	....	20
21	10.04	24.5	—2.3	26.8	30.19	30.38	30.02	.36	81	N.E.	10.5	00	....	4.3	0.43	21
22	30.70	32.6	24.5	8.1	29.63	30.02	29.43	.59	93	N.E.	16.3	00	0.61	1.0	0.71	22
23	22.82	32.0	16.5	15.5	29.55	29.69	29.43	.26	87	W.	12.9	22	....	1.3	0.13	23
24	13.40	17.0	9.8	7.2	29.95	30.19	29.69	.50	77	W.	15.8	87	....	....	....	24
25	12.90	20.0	5.8	14.2	30.50	30.54	30.19	.35	85	N.E.	4.8	16	....	....	....	25
SUNDAY........ 26	19.10	35.3	2.9	32.4	30.27	30.54	29.99	.55	92	S.	16.0	00	....	1.4	0.14	26 ....SUNDAY
27	26.25	38.0	14.5	23.5	29.92	30.11	29.80	.31	81	S.W.	32.7	33	0.20	0.0	0.20	27
28	6.20	14.5	—2.1	16.6	30.52	30.68	30.11	.57	83	W.	33.7	83	....	0.0	0.00	28
29	1.95	9.0	—5.1	14.1	30.59	30.71	30.42	.29	69	W.	18.0	95	....	....	....	29
30	8.49	13.1	3.6	9.5	30.34	30.44	30.29	.15	76	W.	14.1	95	....	....	....	30
31	2.56	8.0	—4.7	12.7	30.42	30.50	30.33	.17	81	N.E.	10.7	64	....	....	....	31
Means......	13.19	21.20	5.56	15.65	30.066	30.224	29.887	.336	84.4	W.5°6′S.	16.95	32.4	0.81	26.6	3.02	..............Sums.
28 Years means for and including this month	12.35	20.73	4.46	16.26	30.051	....	......	.333	82.5	....	§ 16.60	¶34.81	0.855	29.91	3.702	28 Years means for and including this month.

ANALYSIS OF WIND RECORD.

Direction........	N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.	CALM.
Miles	421	1479	1053	826	1085	795	6471	488	
Duration in hrs..	25	123	98	46	61	32	320	39	
Mean velocity....	16.8	12.0	10.8	18.0	17.8	24.8	20.2	12.5	

Greatest mileage in one hour was 45 on the 27th.

Greatest velocity in gusts was 48 on the 27th.

Resultant mileage, 4710.
Resultant direction, W. 5° 6′ S.
Total mileage, 12,608.

* Barometer readings reduced to sea-level and temperature 32° Fahrenheit.

† Mean of bi-hourly readings taken from self-recording instruments.

‡ Humidity relative, saturation being 100. Mean of observations at 8, 15 and 20 hours.

¶ 21 years only. § 16 years only.

The greatest heat was 38.0° above zero on the 27th; the greatest cold was 8.5° below zero; on the 1st; giving a range of temperature of 46.5°. Warmest day was the 27th. Coldest day was the 1st.

Highest barometer reading was 30.71 on the 29th; lowest barometer was 29.17 on the 12th, giving a range of 1.54 inches.

Minimum relative humidity observed was 61 on the 14th.

Rain fell on 2 days.

Snow fell on 18 days.

Rain or snow fell on 18 days.

Fog on the 18th, 20th and 25th.

RY, 1902

C. H. McLEOD, *Superintendent.*

D	Sunshine.	Rainfall in inches.	Snowfall in inches.	Rain and snow melted.	DAY.
		....	4.9	0.43	1
SUNDAY.		....	1.35	1.35	2..........SUNDAY
		....	3.6	0.36	3
		....	0.1	0.01	4
		....	....	....	5
		....	....	....	6
		....	0.1	0.01	7
		....	3.8	0.38	8
SUNDAY..		....	0.5	0.05	9..........SUNDAY
		....	0.1	0.01	10
		....	1.4	0.11	11
		....	0.5	0.03	12
		....	....	....	13
		....	....	....	14
		....	....	....	15
SUNDAY..		....	....	....	16..........SUNDAY
		....	1.5	0.15	17
		....	3.5	0.35	18
		....	0.3	0.03	19
		....	....	....	20
		....	....	....	21
		....	....	....	22
SUNDAY..		....	....	....	23..........SUNDAY
		....	0.7	0.07	24
		....	....	....	25
		....	....	....	26
		....	....	....	27
		0.05	....	0.05	28
Means....		0.05	34.5	3.39	..............Sums.
28 Years for and inc this month	8	0.766	23.51	3.082	28 Years means for and including this month.

and

Direction.. from

Miles ..... 100.

Duration in

Mean veloc o on zero

Greates 50.0°.

Greates s the

and 8th.

Highest barometer reading was 30.33 on the 1st ; lowest barometer was 28.29 on the 2nd, giving a range of 1.44 inches.

Minimum relative humidity observed was 70 on the 23rd.

Rain fell on 1 day.

Snow fell on 14 days.

Rain or snow fell on 15 days.

Fog on the 6th, 7th 24th and 25th.

Lunar Halo on the 16th and 23rd.

ABSTRACT FOR THE MONTH OF FEBRUARY, 1902

Meteorological Observations, McGill College Observatory, Montreal, Canada. Height above sea level, 187 feet. C. H. McLEOD, *Superintendent.*

DAY	THERMOMETER. † Mean.	Max.	Min.	Range.	* BAROMETER. † Mean.	Max.	Min.	Range.	‡Mean relative humidity.	WIND. General direction.	Mean velocity in miles per hour	Per cent. possible Sunshine.	Rainfall in inches.	Snowfall in inches.	Rain and snow melted	DAY.
1	11.90	20.0	3.7	16.3	30.21	30.33	30.10	.23	95	N. E.	9.8	00	....	4.9	0.43	1
SUNDAY........ 2	24.53	29.7	20.0	9.7	29.48	30.10	28 89	1 21	96	N.E.	25.1	00	....	1.35	1.35	2..........SUNDAY
3	11.78	23.5	2.6	20.9	29.29	29.61	28 89	.72	89	W.	35 8	00	....	3.6	0.36	3
4	5.04	12.0	—2 7	14.7	29.70	29.77	29.61	.16	89	W.	14.4	23	....	0.1	0.01	4
5	0.46	12.2	1.8	10.4	29.98	30.15	29.77	.38	85	W.	9.8	69	....	....	....	5
6	5.65	13.0	—1.7	14.7	30.09	30.15	30.02	.13	82	W.	14.0	65	....	....	....	6
7	6 21	11.4	—3.4	14.8	29.78	30.02	29.62	.40	93	W.	4.9	00	....	0.1	0.01	7
8	11.92	18.4	6.3	12.1	29.39	29 62	29 23	.39	92	W.	35.2	00	....	3.8	0.38	8
SUNDAY........ 9	25.22	30.0	18.4	11.6	29 44	29.59	29 23	.36	83	N.W.	25.6	00	....	0.5	0.05	9..........SUNDAY
10	14.65	21.4	3.9	17.5	29.68	29.76	29.59	.17	83	W.	27.8	42	....	0.1	0.01	10
11	7.90	14.7	1.1	13.6	29.73	29 77	29.68	.09	86	W.	18.9	66	....	1.4	0.11	11
12	9.63	14.0	5.2	8.8	29.79	29 91	29.68	.23	89	N.E.	9.6	15	....	0.5	0.03	12
13	13.17	20.0	5.9	14.1	29.89	30.05	29.90	.15	83	N.W.	15.8	00	....	....	....	13
14	20.80	25.8	17.0	8.8	30.14	30.18	30.05	.13	83	W.	20.0	87	....	....	....	14
15	15.56	19.5	11.2	8.3	30.23	30.26	30.18	.08	85	N.W.	11.2	85	....	....	....	15
SUNDAY........16	8.60	15 9	1.3	14.6	30.11	30.25	29.92	.33	86	W.	6.7	08	....	....	....	16..........SUNDAY
17	16.17	23.4	7.4	16.0	29.61	29 92	29.22	.70	88	N.E.	22.2	00	....	1.5	0.15	17
18	22 67	27.5	16.8	10.7	29.18	29.31	29.22	.10	88	W.	22.6	00	....	3.5	0.35	18
19	13.31	16.8	9.9	6.9	29.78	30.13	29.32	.81	84	W.	33.0	62	....	0.3	0.03	19
20	15.60	25.7	5.5	20.2	30.19	30.22	30.12	.10	80	W.	31.1	77	....	....	....	20
21	22 00	27.2	16.8	10.4	30.17	30.24	30.09	.15	83	W.	11.3	34	....	....	....	21
22	18.85	27.0	10.7	16.3	30.01	30.09	29.96	.13	78	N.E.	18.3	61	....	....	....	22
SUNDAY........23	16.87	22.2	10.0	12.2	30.03	30.06	29.98	.08	75	N.E.	10.7	77	....	....	....	23..........SUNDAY
24	24.10	32.0	14.6	17.4	30 03	30.06	29.97	.09	87	S.	12.3	00	....	0.7	0.07	24
25	32.19	34.9	29 1	5.8	30.19	30.16	30.04	.12	97	N.E.	7.8	21	....	....	....	25
26	32.08	37.4	24.0	13.4	29.86	30.05	29.75	.30	87	N.E.	8.6	20	....	....	....	26
27	35.53	39.0	34.0	5.0	29.82	29.85	29.75	.10	79	N.E.	8.1	72	....	....	....	27
28	39.05	46.6	31.7	14.9	29.67	29.84	29.43	.41	88	S.E.	16.8	00	0.05	....	0.05	28
Means...... . ..	17.34	23.61	10.75	12.86	29.838	29.980	29 686	.295	86.2	W.25°36′ N.	17.50	31.5	0.05	34.5	3.39	..............Sums.
28 Years means for and including this month	15.62	23.44	7.54	15.86	30.010	......	......	.307	80.7	....	§18.22	¶41.58	0.766	23.51	3.082	28 Years means for and including this month.

ANALYSIS OF WIND RECORD.

Direction........	N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.	CALM.
Miles	385	2717	517	303	337	276	6265	956	
Duration in hrs..	34	172	53	24	31	24	274	52	8
Mean velocity....	11.3	15.8	9.8	12.6	10.9	11.5	22.8	18.4	

Greatest mileage in one hour was 49 on the 8th.
Greatest velocity in gusts was 52 on the 3rd and 8th.

Resultant mileage, 4965.
Resultant direction, W. 25° 36′ N.
Total mileage, 11,758.

* Barometer readings reduced to sea-level and temperature 32° Fahrenheit.

† Mean of bi-hourly readings taken from self-recording instruments.

‡ Humidity relative, saturation being 100. Mean of observations at 8, 15 and 20 hours.

¶ 21 years only. § 16 years only.

The greatest heat was 46.6° above zero on the 28th; the greatest cold was 3.4° below zero on the 7th; giving a range of temperature of 50.0°. Warmest day was the 28th. Coldest day was the 7th.

Highest barometer reading was 30.33 on the 1st; lowest barometer was 28.29 on the 2nd, giving a range of 1.44 inches.

Minimum relative humidity observed was 70 on the 23rd.

Rain fell on 1 day.

Snow fell on 14 days.

Rain or snow fell on 15 days.

Fog on the 6th, 7th 24th and 25th.

Lunar Halo on the 16th and 23rd.

RCH, 1902

Me 187 feet. C. H. McLEOD, *Superintendent.*

DAY	Per cent. possible Sunshine.	Rainfall in inches.	Snowfall in inches.	Rain and snow melted.	DAY.
1	00	0.50	....	0.50	1
SUNDAY........ 2	00	1.75	....	1.75	2............SUNDAY
3	00	....	0.8	0.08	3
4	00	....	0.1	0.01	4
5	01	....	....	....	5
6	92	....	....	....	6
7	00	....	....	....	7
8	72	....	....	....	8
SUNDAY........ 9	00	....	4.7	0.58	9...........SUNDAY
10	95	....	....	....	10
11	35	0.05	....	0.05	11
12	00	0.28	....	0.28	12
13	00	0.18	0.4	0.22	13
14	87	....	....	....	14
15	61	....	....	....	15
SUNDAY........16	00	0.97	....	0.97	16...........SUNDAY
17	00	....	....	....	17
18	94	....	0.0	0.00	18
19	00	....	1.6	0.20	19
20	00	0.14	....	0.14	20
21	31	0.09	....	0.09	21
22	44	....	....	....	22
SUNDAY........23	95	....	....	....	23...........SUNDAY
24	88	....	....	....	24
25	95	....	....	....	25
26	83	....	....	....	26
27	10	0.10	....	0.10	27
28	51	....	....	....	28
29	00	1.40	....	1.40	29
SUNDAY...... 30	00	....	....	....	30.............SUNDAY
31	00	0.04	1.8	0.24	31
Means...... ...	33.6	5.50	9.4	6.61	...............Sums.
28 Years means for and including this month	¶45.92	1.324	23.89	3.887	28 Years means for and including this month.

o sea-level and

s taken from

Direction........

Miles .... ion being 100. 20 hours.

Duration in hrs. .

Mean velocity... above zero on 10.0° above zero erature of 47.4°.

Greatest mil est day was the

Greatest vel

Highest barometer reading was 30.60 on the 8th; lowest barometer was 28.87 on the 2nd, giving a range of 1.73 inches.

Minimum relative humidity observed was 37 on the 26th.

Rain fell on 11 days.

Snow fell on 7 days.

Rain or snow fell on 16 days.

Fog on the 12th and 27th.

ABSTRACT FOR THE MONTH OF MARCH, 1902

Meteorological Observations, McGill College Observatory, Montreal, Canada. Height above sea level, 187 feet. C. H. McLEOD, *Superintendent.*

DAY	THERMOMETER. † Mean.	Max.	Min.	Range.	* BAROMETER. † Mean.	Max.	Min.	Range.	‡Mean relative humidity.	WIND. General direction.	Mean velocity in miles per hour	Per cent. possible Sunshine.	Rainfall in inches.	Snowfall in inches.	Rain and snow melted.	DAY.
1	40.69	45.7	36.7	9.0	29.46	29.64	29.31	.33	93	S. W.	16.5	00	0.50	....	0.50	1
SUNDAY........ 2	36.09	38.8	33.9	4.9	29.31	29.64	28.87	.77	97	N. E.	20.2	00	1.75	....	1.75	2..........SUNDAY
3	31.89	38.0	26.4	11.6	29.39	29.64	28.87	.77	90	W.	31.5	00	....	0.8	0.08	3
4	22.75	27.0	18.0	9.0	29.92	30.11	29.64	.47	72	W.	20.1	00	....	0.1	0.01	4
5	21.88	25.6	17.0	8.6	30.05	30.16	29.92	.24	71	N.E.	12.4	01	....	....	....	5
6	18.87	24.2	12.4	11.8	30.03	30.09	29.90	.19	77	N.	17.0	92	....	....	....	6
7	29.37	37.7	22.0	15.7	30.19	30.45	30.06	.39	72	S.W.	15.4	00	....	....	....	7
8	17.48	22.5	10.0	12.5	30.51	30.60	30.38	.22	72	N.E.	10.9	72	....	....	....	8
SUNDAY........ 9	27.06	31.0	18.2	12.8	30.17	30.38	30.10	.28	94	N.E.	8.3	00	....	4.7	0.58	9..........SUNDAY
10	30.47	34.1	27.3	6.8	30.27	30.34	30.13	.21	74	N.	9.1	95	....	....	....	10
11	33.89	41.1	24.0	17.1	30.09	30.33	29.91	.42	84	S.	19.7	35	0.05	....	0.05	11
12	38.51	42.5	36.0	6.5	29.77	29.91	29.56	.35	97	W.	10.9	00	0.28	....	0.28	12
13	33.91	36.8	28.0	8.8	29.09	30.08	29.44	.64	80	N.E.	21.7	00	0.18	0.4	0.22	13
14	24.66	29.3	19.1	10.2	30.38	30.48	30.08	.40	69	N.	9.5	87	....	....	....	14
15	35.38	44.8	20.9	23.9	30.38	30.48	30.24	.24	66	S.E.	14.6	61	....	....	....	15
SUNDAY........16	42.28	48.2	35.7	12.5	30.03	30.24	29.79	.45	93	S.E.	23.1	00	0.97	....	0.97	16..........SUNDAY
17	34.64	47.7	26.6	21.1	29.93	30.05	29.70	.35	69	W.	27.9	00	....	....	....	17
18	24.63	30.1	20.1	10.0	30.10	30.14	30.05	.09	66	N.W.	14.0	94	....	0.0	0.00	18
19	22.85	30.2	15.8	14.4	29.96	30.11	29.88	.23	81	N.	19.7	00	....	1.6	0.20	19
20	36.06	44.0	30.2	13.8	29.87	29.91	29.83	.08	86	N.	11.8	00	0.14	....	0.14	20
21	43.46	49.7	37.3	12.4	29.96	30.03	29.87	.16	77	N.E.	11.9	31	0.09	....	0.09	21
22	44.75	50.6	39.0	11.6	30.03	30.07	30.01	.06	75	W.	12.2	44	....	....	....	22
SUNDAY........23	40.72	48.0	33.5	14.5	30.05	30.08	30.02	.06	56	N.	14.2	95	....	....	....	23..........SUNDAY
24	36.06	42.0	30.2	11.8	30.14	30.18	30.08	.10	60	N.E.	12.7	88	....	....	....	24
25	36.86	45.0	31.0	14.0	30.26	30.30	30.18	.12	58	N.E.	7.5	95	....	....	....	25
26	38.73	47.0	29.0	18.0	30.31	30.38	30.22	.16	55	E.	7.0	83	....	....	....	26
27	41.58	53.0	29.2	23.8	30.01	30.22	29.86	.36	69	S.	12.0	10	0.10	....	0.10	27
28	46.80	57.4	40.8	16.6	29.86	29.92	29.78	.14	73	S.	11.2	51	....	....	....	28
29	46.01	53.6	35.1	18.5	29.47	29.78	29.32	.46	96	E.	20.1	00	1.40	....	1.40	29
SUNDAY........30	44.65	48.0	41.4	6.6	29.63	29.72	29.48	.24	81	W.	13.5	00	....	....	....	30..........SUNDAY
31	34.95	41.4	32.5	8.9	29.37	29.56	29.27	.29	92	N.E.	7.6	00	0.04	1.8	0.24	31
Means......	40.71	40.48	27.65	12.83	29.935	30.098	29.798	.299	77.3	N. 24°20′ W.	15.01	33.6	5.50	9.4	6.61	................Sums.
28 Years means for and including this month	24.91	31.76	17.29	14.49	29.970	......	......	.274	77.2	....	§ 17.71	¶ 45.92	1.324	23.89	3.887	28 Years means for and including this month.

ANALYSIS OF WIND RECORD.

Direction........	N.	N. E.	E.	S.E.	S.	S.W.	W.	N.W.	CALM.
Miles	1793	2546	519	1016	1012	813	2768	705	
Duration in hrs..	126	206	49	53	71	43	147	48	1
Mean velocity....	14.2	12.4	10.6	19.2	14.1	18.9	18.8	14.7	

Greatest mileage in one hour was 43 on the 3rd.
Greatest velocity in gusts was 46 on the 17th.

Resultant mileage, 1958.
Resultant direction, N. 24° 20′ W.
Total mileage, 11,172.

* Barometer readings reduced to sea-level and temperature 32° Fahrenheit.

† Mean of bi-hourly readings taken from self-recording instruments.

‡ Humidity relative, saturation being 100. Mean of observations at 8, 15 and 20 hours.

¶ 21 years only. § 16 years only.

The greatest heat was 57.4° above zero on the 28th; the greatest cold was 10.0° above zero on the 8th; giving a range of temperature of 47.4°. Warmest day was the 28th. Coldest day was the 8th.

Highest barometer reading was 30.60 on the 8th; lowest barometer was 28.87 on the 2nd, giving a range of 1.73 inches.

Minimum relative humidity observed was 37 on the 26th.

Rain fell on 11 days.

Snow fell on 7 days.

Rain or snow fell on 16 days.

Fog on the 12th and 27th.

RIL, 1902.

Met 87 feet. C. H. McLEOD, *Superintendent.*

DAY	Per cent. possible Sunshine.	Rainfall in inches.	Snowfall in inches.	Rain and snow melted.	DAY.
1	00	0.21	2.0	0.41	1
2	00	0.16	....	0.16	2
3	62	....	....	....	3
4	04	....	....	....	4
5	75	....	....	....	5
SUNDAY........ 6	83	....	....	....	6..........SUNDAY
7	85	....	....	....	7
8	05	....	....	....	8
9	00	0.04	....	0.04	9
10	00	0.01	....	0.01	10
11	00	0.01	...	0.01	11
12	00	*r*	1.4	0.14	12
SUNDAY........13	05	0.26	....	0.26	13..........SUNDAY
14	31	....	....	....	14
15	80	....	....	....	15
16	88	....	....	....	16
17	00	*r*	....	0.00	17
18	51	*r*	....	0.00	18
19	12	....	....	....	19
SUNDAY........20	50	0.18	....	0.18	20..........SUNDAY
21	11	0.04	....	0.04	21
22	25	0.11	....	0.11	22
23	34	*r*	....	0.00	23
24	23	*r*	*s*	0.00	24
25	00	....	....	....	25
26	00	0.80	....	0.80	26
SUNDAY........27	00	0.03	....	0.03	27..........SUNDAY
28	95	....	....	....	28
29	91	0.05	....	0.05	29
30	08	0.65	....	0.65	30
Means......	30.6	2.55	3.4	2.89	..............Sums.
28 Years means for and including this month	¶50.5	1.74	5.1	2.26	28 Years means for and including this month.

sea-level and

Direction........	taken from
Miles	being 100.
Duration in hrs..	) hours.
Mean velocity....	

ove zero on
9° above zero
ture of 45.3°.
day was the

Greatest mileage in
Greatest velocity in

Highest barometer reading was 30.26 on the 25th ; lowest barometer was 29.19 on the 1st and 2nd ; giving a range of 1.07 inches.

Minimum relative humidity observed was 26 on the 29th.

Rain fell on 18 days.
Snow fell on 3 days.
Rain or snow fell on 18 days.
Lunar halo on the 18th.
Thunder and lightning on the 26th and 30th.

ABSTRACT FOR THE MONTH OF APRIL, 1902.

Meteorological Observations, McGill College Observatory, Montreal, Canada. Height above sea level, 187 feet. C. H. McLEOD, *Superintendent.*

DAY	THERMOMETER. † Mean.	Max.	Min.	Range.	* BAROMETER. † Mean.	Max.	Min.	Range.	‡ Mean relative humidity.	WIND. General direction.	Mean velocity in miles per hour	Per cent. possible Sunshine.	Rainfall in inches.	Snowfall in inches.	Rain and snow melted.	DAY.
1	34.8	37.7	32.7	5.0	29.21	29.25	29.19	.06	94	W.	12.5	00	0.21	2.0	0.41	1
2	38.0	44.7	33.8	10.9	29.32	29.54	29 19	.35	79	W.	22.3	00	0.16	....	0.16	2
3	37.2	42.8	31.1	11.7	29.80	30.01	29.54	.47	66	W.	17.7	62	....	....	....	3
4	37.0	43.0	31.0	12.0	30.02	30.08	29.99	.09	65	W.	7.6	04	....	....	....	4
5	39.4	46.7	29.9	16.8	29.95	30.00	29.89	.11	71	W.	4.8	75	....	....	....	5
SUNDAY........ 6	43.3	52.8	31.4	21.4	29.89	29.94	29.83	.11	59	S.E.	6.9	83	....	....	....	6..........SUNDAY
7	45.1	56.8	32.9	23.9	29.99	30.12	29.86	.26	65	E.	7.9	85	....	....	....	7
8	47.1	58.0	37.8	20.2	30.11	30.19	30 03	.16	60	N.E.	18.1	05	....	...	....	8
9	41.5	43.0	36.2	6.8	29.84	29.96	29.76	.20	62	N.E.	36.0	00	0.04	....	0.04	9
10	36.4	39.0	33.7	5.3	29.80	29 83	29.79	.04	89	N.E.	21.7	00	0.01	....	0.01	10
11	38.5	43.2	33.5	9.7	29.81	29.84	29.77	.07	76	N.E.	8.9	00	0.01	...	0.01	11
12	38.7	42.7	33.1	9.6	29.67	29.77	29.62	.15	87	E.	4.7	00	*r*	1.4	0.14	12
SUNDAY........13	41.4	47.0	36.0	11.0	29.66	29.81	29.59	.22	64	N.W.	17.4	05	0.26	....	0.26	13..........SUNDAY
14	37.4	47.0	32.0	15.0	29.98	30.06	29.81	.25	53	N. W.	17.1	31	....	....	....	14
15	46.2	57.8	35.9	21.9	30.04	30.10	29.97	.13	48	W.	23.0	80	....	....	....	15
16	47.9	56.8	35.7	21.1	30.01	30.08	29.97	.11	45	S.	10.0	88	....	....	....	16
17	48.3	55.0	41.5	13.5	29.89	29.95	29.85	.10	65	S.E.	7.6	00	*r*	....	0.00	17
18	47 2	54.6	40.7	13.9	29.96	29.99	29.91	.08	69	S.E.	5.8	51	*r*	....	0.00	18
19	48.1	60.0	36.0	24.0	29.93	29.98	29.89	.09	69	S.E.	10.7	12	....	....	....	19
SUNDAY........20	48.5	55.0	43.7	11.3	29.90	29.93	29.88	.05	64	W.	16.8	50	0.18	....	0.18	20..........SUNDAY
21	44.0	49.6	39.3	10.3	30.00	30.06	29.98	.08	59	W.	13.2	11	0.04	....	0.04	21
22	42.3	50.0	38.5	11.5	29.83	29.98	29.78	.20	88	N. E.	15.0	25	0.11	....	0.11	22
23	50.3	72.0	37.3	34.7	29.71	29.80	29.59	.21	65	W.	24.6	34	*r*	....	0.00	23
24	41.4	46.5	36.4	10.1	30.02	30.19	29.80	.39	46	W.	24.2	23	*r*	*s*	0.00	24
25	44.4	53.6	34.0	19.6	30.19	30.26	30.07	.19	49	S.W.	13.8	00	....	....	....	25
26	47.3	54.0	43.5	10.5	29.63	30.07	29.38	.69	87	S.E.	20.3	00	0.80	....	0.80	26
SUNDAY........27	46.4	50.7	41.8	8.9	29.64	29.90	29.44	.46	76	W.	25.6	00	0.03	....	0.03	27..........SUNDAY
28	55.0	65.0	42.0	23.0	30.05	30.13	29.90	.23	54	W.	17.8	95	....	....	....	28
29	61.7	75.2	46.6	28.6	30.09	30.18	29.96	.22	45	S.E.	10.8	91	0.05	....	0.05	29
30	56.9	64.5	52.2	12.3	29.89	29.96	29.82	.14	80	S.W.	16.5	08	0.65	....	0.65	30
Means...... . ..	44.38	52.16	37.01	15.15	29.856	29.97	29.77	.20	66.6	N. 71° W.	15.31	30.6	2.55	3.4	2.89	..............Sums.
28 Years means for and including this month	40.72	49.14	32.97	16.17	29.960	......	......	.20	66.8	....	‖ 16.28	¶ 50.5	1.74	5.1	2.26	28 Years means for and including this month.

ANALYSIS OF WIND RECORD.

Direction.......	N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.	CALM.
Miles	358	2334	383	1232	434	689	4526	1086	
Duration in hrs..	33	120	50	110	43	47	255	59	3
Mean velocity....	10.8	19.4	7.7	11.2	10.1	14.7	17.7	18.4	

Greatest mileage in one hour was 43 on the 23rd.
Greatest velocity in gusts was 48 on the 9th & 23rd.

Resultant mileage, 3,050.
Resultant direction, N. 71° W.
Total mileage, 11,040.

* Barometer readings reduced to sea-level and temperature 32° Fahrenheit.

† Mean of bi-hourly readings taken from self-recording instruments.

‡ Humidity relative, saturation being 100. Mean of observations at 8, 15 and 20 hours.

¶ 21 years only. ‖ 16 years only.

The greatest heat was 75.2° above zero on the 29th; the greatest cold was 29.9° above zero on the 5th; giving a range of temperature of 45.3°. Warmest day was the 29th. Coldest day was the 1st.

Highest barometer reading was 30.26 on the 25th; lowest barometer was 29.19 on the 1st and 2nd; giving a range of 1.07 inches.

Minimum relative humidity observed was 26 on the 29th.

Rain fell on 18 days.
Snow fell on 3 days.
Rain or snow fell on 18 days.
Lunar halo on the 18th.
Thunder and lightning on the 26th and 30th.

AY, 1902,

Mete 187 feet. C. H. McLEOD, *Superintendent.*

DAY	y es ur	Per cent. possible Sunshine.	Rainfall in inches.	Snowfall in inches.	Rain and snow melted.	DAY.
1		25	0.02	....	0.02	1
2		72	....	....	....	2
3		00	....	....	....	3
SUNDAY........ 4		29	0.06	....	0.06	4..........SUNDAY
5		48	0.02	....	0.02	5
6		52	....	....	....	6
7		21	0.41	....	0.41	7
8		80	0.23	....	0.23	8
9		05	0.15	....	0.15	9
10		89	....	....	....	10
SUNDAY........11		85	....	....	....	11..........SUNDAY
12		34	....	....	....	12
13		97	....	....	....	13
14		52	r	....	r	14
15		81	....	....	....	15
16		57	....	....	....	16
17		83	....	....	....	17
SUNDAY........18		93	....	....	....	18..........SUNDAY
19		00	0.04	....	0.04	19
20		88	....	....	....	20
21		81	....	....	....	21
22		11	0.05	....	0.05	22
23		51	0.27	....	0.27	23
24		25	0.33	....	0.33	24
SUNDAY........25		64	0.06	....	0.06	25..........SUNDAY
26		07	0.73	....	0.73	26
27		05	0.79	....	0.79	27
28		00	0.26	....	0.26	28
29		67	r	....	r	29
30		92	0.38	....	0.38	30
31		97	....	....	....	31
Means......		51.3	3 80	....	3.80	..............Sums.
28 Years means for and including this month		¶50.7	2.93	....	2.98	28 Years means for and including this month.

Direction.......	
Miles	
Duration in hrs..	
Mean velocity....	

o sea-level and

s taken from

on being 100. 20 hours.

above zero on 23.0 above zero erature of 58.6°.

Greatest mileage in

Greatest velocity in

Warmest day was the 23rd. Coldest day was the 10th.

Highest barometer reading was 30.51 on the 31st; lowest barometer was 29.38 on the 9th; giving a range of 1.13 inches.

Minimum relative humidity observed was 29 on the 20th.

Rain fell on 17 days.

Thunder and lightning on the 23rd.

ABSTRACT FOR THE MONTH OF MAY, 1902.

Meteorological Observations, McGill College Observatory, Montreal, Canada. Height above sea level, 187 feet. C. H. McLEOD, *Superintendent.*

DAY	THERMOMETER. † Mean.	Max.	Min.	Range.	* BAROMETER. † Mean.	Max.	Min.	Range.	‡ Mean relative humidity.	WIND. General direction.	Mean velocity in miles per hour	Per cent. possible Sunshine.	Rainfall in inches.	Snowfall in inches.	Rain and snow melted.	DAY.
1	51.7	57.8	47.0	10.8	30.08	30.19	29.94	.25	57	N.	15.7	25	0.02	....	0.02	1
2	50.9	58.4	40.3	18.1	30.12	30.21	29 99	.22	51	N.E.	11.5	72	....	....	....	2
3	52.0	56.0	48.0	8.0	30.03	30.16	29.95	.21	69	S.E.	11.5	00	....	....	....	3
SUNDAY........ 4	51.4	58.9	43.0	15.9	30.06	30.16	29.88	.28	83	S.E.	13.2	29	0.06	....	0.06	4...........SUNDAY
5	56.3	68.0	50.1	17.9	29.93	30.13	29.86	.27	64	N.W.	15.7	48	0.02	....	0.02	5
6	50.5	58.8	47.9	10.9	30.12	30.26	29.84	.42	51	E.	9.4	52	....	....	....	6
7	56.3	65.7	47.4	18.3	29.62	29.84	29.49	.35	72	W.	24.4	21	0.41	....	0.41	7
8	55.9	69.7	46.8	22.9	29.76	29.83	29.55	.28	56	W.	17.4	80	0.23	....	0.23	8
9	40.5	54.0	29.0	25.0	29.68	30.07	29.38	.69	76	W.	35.4	05	0.15	....	0.15	9
10	34.5	46.5	23.0	23.5	30.14	30.20	30.07	.13	57	N. W.	20.8	89	....	....	....	10
SUNDAY........11	44.7	52.8	34.5	18.3	30.21	30.25	30.16	.09	52	N.	11.4	85	....	....	....	11...........SUNDAY
12	52.2	61.1	42.0	19.1	30.08	30.22	29.92	.30	50	W.	12.3	34	....	....	....	12
13	44.0	49.6	37.6	12.0	30.05	30.15	29.91	.24	47	N.E.	12.9	97	....	....	....	13
14	48.3	57.5	39.4	18.1	30.06	30.12	29.98	.14	52	N. W.	11.0	52	r	....	r	14
15	46.3	55.8	35.5	20.3	30.18	30.24	30.12	.12	60	N. W.	9.8	81	....	....	....	15
16	54.5	62.0	45.4	16.6	29.98	30.12	29.88	.24	57	W.	21.2	57	....	....	....	16
17	52.5	61.2	42.5	18.7	29.96	30.06	29.85	.21	47	S.W.	12.2	63	....	....	....	17
SUNDAY........18	56.5	68.0	43.0	25.0	29.97	30.04	29.92	.12	51	N.E.	5.2	93	....	....	....	18...........SUNDAY
19	51.2	57.0	47.0	10.0	29.92	29.98	29.85	.13	83	N.	9.2	00	0.04	....	0.04	19
20	54.1	62.3	47.0	15.3	30.09	30.29	29.92	.37	47	N.E.	11.7	88	....	....	....	20
21	57.6	67.5	43.9	23.6	30.24	30.36	30.12	.24	44	N.W.	12.1	81	....	....	....	21
22	64.7	79.6	50.0	29.6	29.91	30.12	29.66	.46	62	N.W.	15.7	11	0.05	....	0.05	22
23	70.2	81.6	62.3	19.3	29.74	29.80	29.66	.14	78	N.W.	17.4	51	0.27	....	0.27	23
24	68.0	76.1	64.0	12.1	29.67	29.76	29.59	.17	91	W.	8.7	25	0.33	....	0.33	24
SUNDAY........25	67.8	75.5	60.9	14.6	29.75	29.81	29.60	.21	72	N.E.	6.7	64	0.06	....	0.06	25...........SUNDAY
26	60.4	69.3	57.0	12.3	29.57	29.72	29.51	.21	89	N.W.	8.2	07	0.73	....	0.73	26
27	54.8	61.5	49.0	12.5	29.61	29.67	29.49	.18	91	W.	9.7	05	0.79	....	0.79	27
28	45.8	49.5	41.5	8.0	29.57	29.70	29.45	.25	85	N.W.	17.0	00	0.26	....	0.26	28
29	49.3	59.8	36.9	22.9	29.79	29.83	29.70	.13	56	N.W.	17.7	67	r	....	r	29
30	52.0	64.5	44.8	17.7	29.99	30.33	29.74	.59	57	N.W.	11.1	92	0.38	....	0.38	30
31	52.5	63.5	36.9	26.6	30.42	30.51	30.33	.18	47	S.	1.2	97	....	....	....	31
Means......	53.14	62.18	44.63	17.55	29.947	30.07	29 82	.25	62.7	N. 53° W.	13.46	51.3	3 80	....	3.80	..............Sums.
28 Years means for and including this month	54.66	63.94	45.81	18.13	29.929	......	......	.17	66.4	....	§ 14.27	¶ 50.7	2.93	....	2.98	28 Years means for and including this month.

ANALYSIS OF WIND RECORD.

Direction........	N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.	CALM.
Miles	888	1193	297	485	97	432	3177	3443	
Duration in hrs..	82	111	43	49	17	30	187	220	6
Mean velocity....	10.8	10.7	6.9	9.9	5.7	14.4	16.9	15.6	

Greatest mileage in one hour was 45 on the 9th.
Greatest velocity in gusts was 46 on the 9th.

Resultant mileage, 5,590.
Resultant direction, N. 53° W.

Total mileage, 10,012.

* Barometer readings reduced to sea-level and temperature 32° Fahrenheit.

† Mean of bi-hourly readings taken from self-recording instruments.

‡ Humidity relative, saturation being 100. Mean of observations at 8, 15 and 20 hours.

¶ 21 years only. § 15 years only.

The greatest heat was 81.6 above zero on the 23rd; the greatest cold was 23.0 above zero on the 10th; giving a range of temperature of 58.6°.

Warmest day was the 23rd. Coldest day was the 10th.

Highest barometer reading was 30.51 on the 31st; lowest barometer was 29.38 on the 9th; giving a range of 1.13 inches.

Minimum relative humidity observed was 29 on the 20th.

Rain fell on 17 days.

Thunder and lightning on the 23rd.

NE, 1902,

Mete 187 feet. C. H. McLEOD, *Superintendent.*

DAY	Per cent. possible Sunshine.	Rainfall in inches.	Snowfall in inches.	Rain and snow melted.	DAY.
SUNDAY........ 1	75	0.01	....	0.01	1..........SUNDAY
2	27	0.04	....	0.04	2
3	19	1.02	....	1.02	3
4	00	0.70	....	0.70	4
5	98	....	....	....	5
6	39	....	....	....	6
7	00	0.32	....	0.32	7
SUNDAY........ 8	00	0.32	....	0.32	8..........SUNDAY
9	90	0.04	....	0.04	9
10	27	0.40	....	0.40	10
11	75	0.19	....	0.19	11
12	24	....	....	....	12
13	13	0.04	....	0.04	13
14	89	....	....	....	14
SUNDAY 15	01	*r*	....	0.00	15..........SUNDAY
16	00	0.11	....	0.11	16
17	68	*r*	....	0.00	17
18	95	....	....	....	18
19	34	....	....	....	19
20	78	....	....	....	20
21	00	0.61	....	0.61	21
SUNDAY........22	86	....	....	....	22..........SUNDAY
23	25	0.13	....	0.13	23
24	64	0.34	....	0.34	24
25	91	....	....	....	25
26	34	1.37	....	1.37	26
27	15	0.04	....	0.04	27
28	93	....	....	....	28
SUNDAY........29	48	....	....	....	29..........SUNDAY
30	28	0.03	....	0.03	30
Means...........	44.5	5.71	....	5.71	..............Sums.
28 Years means for and including this month	54.5	3.61	....	3.61	28 Years means for and including this month.

Direction........	
Miles	
Duration in hrs..	
Mean velocity....	

Greatest mileage in

Greatest velocity in

o sea-level and

s taken from

on being 100.
20 hours.

above zero on
.0 above zero
rature of 39.0°.

Warmest day was the 2nd. Coldest day was the 4th.

Highest barometer reading was 30.39 on the 1st; lowest barometer was 29.19 on the 26th; giving a range of 1.20 inches.

Minimum relative humidity observed was 43 on the 14th.

Rain fell on 19 days.

Rainbow on the 8th, 17th and 26th.

Thunder and lightning on the 24th.

Hail on the 24th.

ABSTRACT FOR THE MONTH OF JUNE, 1902.

Meteorological Observations, McGill College Observatory, Montreal, Canada. Height above sea level, 187 feet. C. H. McLEOD, *Superintendent.*

DAY	THERMOMETER.				* BAROMETER.				‡Mean relative humidity.	WIND.		Per cent. possible Sunshine.	Rainfall in inches.	Snowfall in inches.	Rain and snow melted.	DAY.
	† Mean.	* Max.	Min.	Range.	† Mean.	Max.	Min.	Range.		General direction.	Mean velocity in miles per hour.					
Sunday........ 1	65.1	78.5	47.5	31.0	30.28	30.39	30.15	.24	68	E.	2.8	75	0.01	....	0.01	1..........Sunday
2	69.4	80.0	64.0	16.0	29.97	30.15	29.80	.35	86	W.	11 9	27	0.04	....	0.04	2
3	65.3	76.1	50.1	26.0	29.71	29.80	29.62	.18	86	W.	10.8	19	1.02	....	1.02	3
4	53.2	58.8	46.3	12.5	29.80	29.97	29.64	.33	85	N.E.	7.1	00	0.70	....	0.70	4
5	56.9	66.2	47.0	19.2	30.11	30.17	29.97	.20	52	N.	6.2	98	....	....	....	5
6	59.0	69.9	46.0	23.9	30.13	30.25	29.97	.28	66	N.	2.6	39	....	....	....	6
7	61.4	65.0	57.1	7.9	29.68	29.97	29.55	.42	88	S.W.	4.0	00	0.32	....	0.32	7
Sunday........ 8	53.8	64.5	48.0	16.5	29.63	29.78	29.53	.25	81	N.	12.0	00	0.32	....	0.32	8..........Sunday
9	53.7	65.0	41.0	24.0	29.81	29.91	29.72	.19	64	N.W.	17.4	90	0.04	....	0.04	9
10	56.6	61.5	48.0	13.5	29.66	29.87	29.51	.36	76	N.W.	14.9	27	0.40	....	0.40	10
11	53.3	61.5	42.8	18.7	29.84	29.96	29.68	.28	64	E.	3.2	75	0.19	....	0.19	11
12	56.3	64.1	49.9	14.2	29.79	29.87	29.67	.20	78	N.E.	3.1	24	....	....	....	12
13	60.8	67.3	53.5	13.8	29.81	29.90	29.77	.13	84	W.	7.9	13	0.04	....	0.04	13
14	68.2	78.0	56.0	22.0	29.99	30.08	29.90	.18	61	E.	4.0	89	....	....	....	14
Sunday........15	68.6	73.5	63.0	10.5	29.75	29.91	29.60	.31	84	S.E.	4.9	01	*r*	....	0.00	15..........Sunday
16	68.8	75.8	61.5	14.3	29.49	29.60	29.43	.17	86	N.W.	8.8	00	0.11	....	0.11	16
17	58.9	63.9	51.8	12.1	29.59	29.82	29.42	.40	67	N.W.	19.3	68	*r*	....	0.00	17
18	60.4	70.8	47.2	23.6	29.89	29.95	29.82	.13	61	N.W.	14.0	95	....	....	....	18
19	62.6	69.1	58.9	10.2	29.76	29.85	29.73	.12	76	W.	4.6	34	....	....	....	19
20	62.3	71.4	52.5	18.9	29.85	29.91	29.73	.18	66	N.W.	6.9	78	....	....	....	20
21	56.3	59.5	52.5	7.0	29.81	29.91	29.68	.23	90	N.E.	7.2	00	0.61	....	0.61	21
Sunday........22	56.7	64.8	48.0	16.8	29.88	29.92	29.85	.07	55	S.W.	10.0	86	....	....	....	22..........Sunday
23	54.6	61.3	50.0	11.3	29.90	29.94	29.87	.07	83	W.	14.4	25	0.13	....	0.13	23
24	56.9	65.7	50.5	15.2	29.87	29.92	29.83	.09	85	W.	14.8	64	0.34	....	0.34	24
25	61.0	71.0	49.8	21.2	29.78	29.90	29.56	.34	71	W.	13.3	91	....	....	....	25
26	59.4	68.4	51.5	16.9	29.32	29.56	29.19	.37	80	W.	21.2	34	1.37	....	1.37	26
27	57.5	65.5	49.2	16.3	29.52	29.74	29.39	.35	77	W.	23.9	15	0.04	....	0.04	27
28	61.2	68.2	52.2	16.0	29.87	29.95	29.74	.21	66	N. W.	17.9	93	....	....	....	28
Sunday........29	60.3	67.4	52.5	14.9	29.92	29.98	29.85	.13	72	N.	5.8	48	....	....	....	29..........Sunday
30	64.4	71.6	54.2	17.4	29.88	29.93	29.83	.10	72	W.	8.2	28	0.03	....	0.03	30
Means......	60.11	68.14	51.41	16.73	29.810	29.93	29.70	.23	74.7	N. 58° W.	10.12	44.5	5.71	....	5.71	..............Sums.
28 Years means for and including this month	64.79	73.53	56.24	17.29	29.902	......	......	.156	70.4	....	12.93	54.5	3.61	....	3.61	28 Years means for and including this month.

ANALYSIS OF WIND RECORD.

Direction........	N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W	Calm.
Miles	586	489	291	210	153	286	[illegible]	2834	
Duration in hrs..	86	70	59	34	35	52	193	191	
Mean velocity....	6.7	7.0	4.9	6.2	4.4	5.5	12.6	14.8	

Greatest mileage in one hour was 36 on the 26th.
Greatest velocity in gusts was 30 on the 26th.

Resultant mileage, 4,560.
Resultant direction, N. 58° W.

Total mileage, 7,280.

* Barometer readings reduced to sea-level and temperature 32° Fahrenheit.

† Mean of bi-hourly readings taken from self-recording instruments.

‡ Humidity relative, saturation being 100. Mean of observations at 8, 15 and 20 hours.

¶ 21 years only. § 15 years only.

The greatest heat was 80.0 above zero on the 2nd; the greatest cold was 41.0 above zero on the 9th; giving a range of temperature of 39.0°.

Warmest day was the 2nd. Coldest day was the 4th.

Highest barometer reading was 30.39 on the 1st; lowest barometer was 29.19 on the 26th; giving a range of 1.20 inches.

Minimum relative humidity observed was 43 on the 14th.

Rain fell on 19 days.

Rainbow on the 8th, 17th and 26th.

Thunder and lightning on the 24th.

Hail on the 24th.

NOTICES.

All communications and exchanges should be carefully addressed to Canadian Record of Science, Natural History Society, 32 University Street, Montreal.

Rejected articles will be returned if desired, and if stamps are enclosed for that purpose. The editors will not hold themselves responsible for any views expressed by authors.

Subscribers who fail to receive the Record, or who change their residences, are requested to notify the Editors accordingly.

Back Numbers of the Record may be obtained of the Editors, at forty cents per number.

Volumes, unbound, may be had as follows:

Vol. I., 4 Nos. - - - - - -	$1.50
Vols. II. to VII., 8 Nos. each, - - -	3.00 per vol.

The Record contains eight numbers, or 512 pages, in each volume. The subscription price, postage paid is as follows:

Canada and the United States, - -	$3.00
Great Britain, - - - - - -	£0 13 0

ISSUED OCTOBER, 1902.