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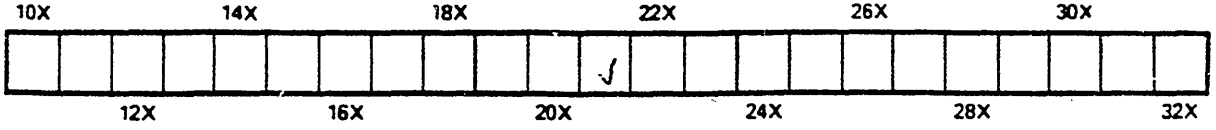

THE LATE SIR JOHN WILLIAM DAWSON, C.M.G., F.R.S., LL.D., D.C.L.

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 15, 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 pleisto-

cene 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 enter-

taining 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 grandœvus*, 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-Carboniferous.	Stellarton.	Meso-Carb.	*Unconformity.*
	Westville.		Millstone grit.	Millstone grit.
	Hopewell and Windsor.		*Unconformity?*	*Unconformity (?)* Hopewell sandstones, etc., and Windsor form.
Eo-Carboniferous.	Union.	Eo-Carb.	*Unconformity.*
	Riversdale.		Union.
			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 Goose-foot.*—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.) GRÆN. 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.

SYMPHORICARPUS 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 SCABRICUSCULA 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-formations 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, Québec. 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 gabbro 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 during 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 attention 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.*

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	29.898	.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.	9.60	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	1.5	7	0	93	....	....	.. .	28
29	72.80	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. ε 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.

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	...	..	..	93	....	....	....	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	.2710	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	63.3	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 35°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 29th. 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 SEPTEMBER, 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	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	3	34	....	...	....	2
SUNDAY. 3	.....	77.6	37.0	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	30.0582	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	.4030	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	.2867	61.2	43.7	N.W.	5.84	9	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	4.78	86	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 6	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	6.3	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	5.8	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.

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 52	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.	8.56	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.	16.07	5.7	10	0	37	0.00	....	0.00	14
SUNDAY.....15	.....	57.5	43.5	14.0	.....	.....	.....	.....	.....	....	....	N.	10.23	....	..	..	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 22	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.	15.70	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.	10.57	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.	14.12	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	35.07	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	5[8]
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.

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	.[illegible]3	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	38.9	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	36.75	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	29.896	.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	29.940	.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.	ε 15.88	7.27	.	..	¶28 93	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, 5,279.
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. ε 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. 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	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	c.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	....	0.0	0.00	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	....	3 0	0.30	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	0.2	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	30.3313	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	.....	94.4	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	....	....	s 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. s 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 29.063 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.

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 4h 54m 18·67s 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 melted snow.	No. of days on which rain and snow fell.	No. of days on which rain or snow fell.	Month.
	Mean.	¶ Deviation from 25 years, means.	Max.	Min.	Mean daily range.	Mean.	Max.	Min.	Mean daily range.				Resultant direction.	Mean velocity in miles per hour.										
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	29.9426	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	— 5.0	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	+ 2.50	82.0	21.5	15.94	30.0372	30.469	29.395	.176	.2042	70.7	33.5	S. 45½° 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. 64½° 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	68.84	+ 2.13	88.8	51.2	16.64	29.9518	30.270	29.623	.114	.5013	70.7	58.2	S. 38½° W.	11.43	44	64.3	2.52	11	...	..	2.52	..	11	August
September	54.80	— 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. 61½° 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	29.0	S. 79½° W.	13.52	66	28.7	1.69	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.