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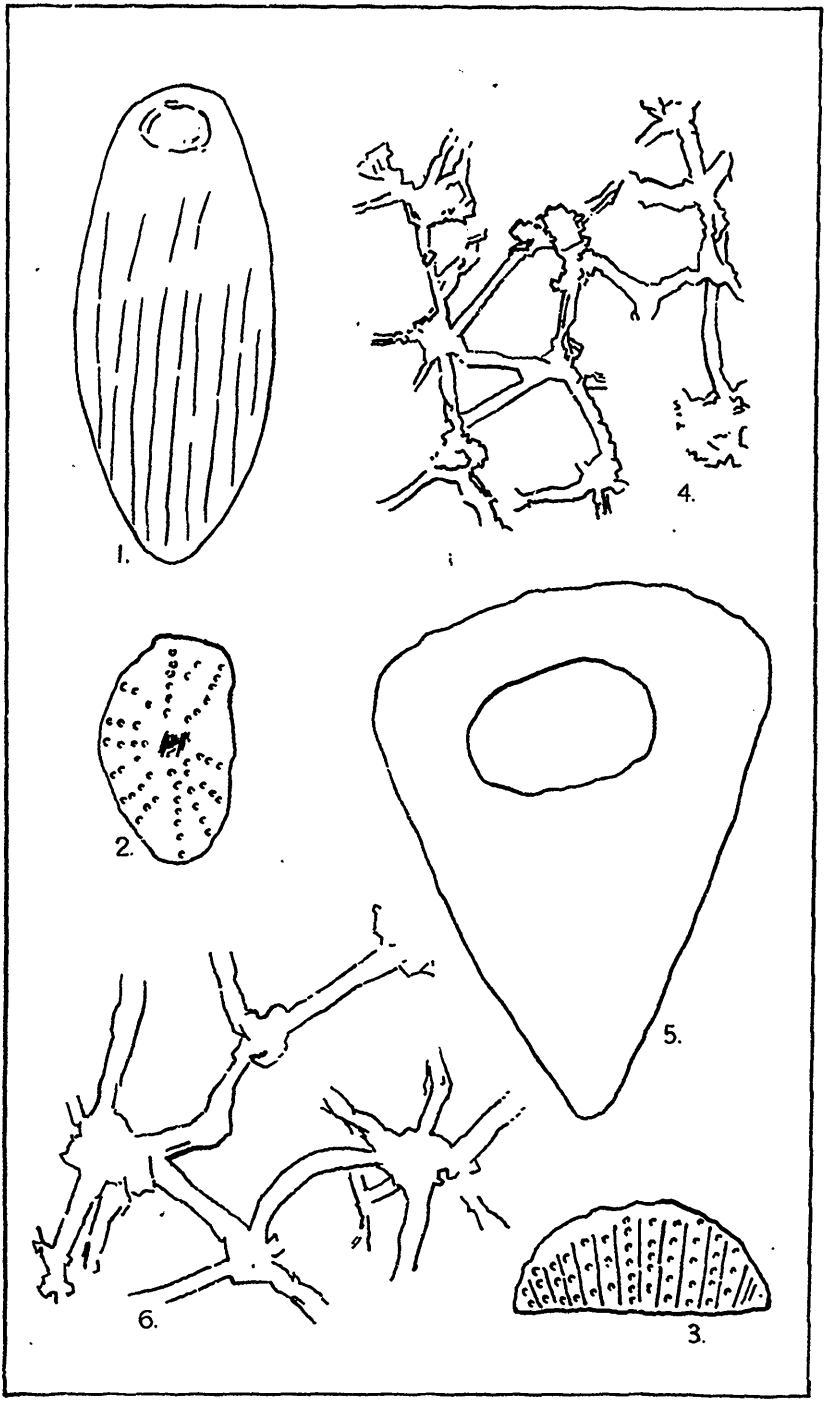
SPONGES FROM THE TRENTON LIMESTONE AT OTTAWA.



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On the Cambrian Organisms in Acadia. *

By G. F. Matthew, M.A., F.R.S.C.

[*Abstract.*]

The earlier papers describing the Cambrian animals of Eastern Canada, read by the writer, before this Society, have related to the fauna of the St. John (or Acadian) group, but having lately made examinations of the measures which underlie the Paradoxides beds, he has found evidence of a physical break below these beds, and that the underlying beds carry a different fauna. This fauna is very imperfectly exhibited, but is sufficiently developed to show that this lower, or basal series is the equivalent of the blue clay of Russia and the Eophyton sandstone, &c. of Sweden.

Late developments in the palæontology of the oldest Cambrian beds, show that the Olenellus beds of the State of New York and elsewhere, are of about the same age as these old Acadian beds, and indications of the Olenellus fauna have been found by me from the middle of this basal series upward to the Paradoxides beds.

* Read before the Royal Society of Canada, May, 1889.

In the lower part of the Basal or Georgian series have been found worm tracks, casts and burrows, referred to in a communication to this journal. Of lower organisms, sponges are well represented. Remains of basket sponges (Euplectellidæ) are quite common in the finer beds. Of these, beside the sponges with regular transverse bars, there are others which possess an irregular mesh with diagonal and forked spicules. Another family of sponges is represented by forms with a thick parenchyma and numerous irregular loculi; the oscules in these sponges are sometimes arranged with an approach to a regular order, but more frequently they are irregular. A third family (probably) of sponges has left skeletons of small rods in which no spicules have been found, these are studded with minute elevations marking the place of denser globular masses in the body.

Certain minute bodies with the sponges appear to be Radiolarians, some are club-shaped, others globular, and one is oval with a raised hexagonal ornamentation.

The flora of this series consists of sea-weeds. One of the oldest of these, a Palæochorda, is found in the lowest sandstone beds, where it is associated with the remains of sponges; although a plant of such great antiquity, it is comparatively highly organized in the structure of the stem, to which large jointed setæ were attached.

In the arrangement of its barren fronds, another interesting species recalls the *Fucoides circinnatus* of Brongniart, but in the Acadian species, the branches are flat, and not round, as those of that species are said to be. The Acadian species had narrow, fertile fronds, bearing spikelets (stichidia) after the manner of some of the red sea-weeds.

Brachiopods so far, appear to be rare in this series of beds; there is however, near the middle of the series, a large one having the appearance of an Obolus, and resembling the *Mickwitzia monilifera*, Schmidt, (*Lingula?* or *Obolus? monilifera Linrs.*), but apparently distinct.

Undoubted examples of *Platysolenites* of Pander, a crinoidal genus of the Blue Clay of Russia, have been found with this brachiopod.

ORGANISMS OF THE ST. JOHN OR ACADIAN GROUP (SERIES).

Fauna and Flora of Division (Stage) 1.—(Paradoxides Beds).

The fauna of Band *b* of this stage, resembles in many respects that of the series just described. There is the same prevalence of sponges. The basket sponges and the rod-like sponges (?) are common to both, but the latter here attain a much larger size, and are more plentiful. In all the fine layers of this band, traces of Protospongiadæ may be found, but no examples of the typical Protospongias of the Paradoxides beds have been observed. The Protospongiadæ of this band have either a minute rectangular reticulation, or the mesh is coarser, and crossed by large diagonal and branching spicules. Even the sandstone beds of this band exhibit numerous fragments of spicules.

The brachiopods are represented in this band by several genera, some of which have been already described. This paper contains descriptions of additional species—an Obolus, a Lingulella, and three species of Leperditia.

The Algæ are present in several different types, among which are a Buthotrephis, and a microscopic form parasitic on the larger organisms. This little thing spread itself in a minute network over the mud of the sea bottom, by jointed filaments, which at their intersection formed enlarged nodes. There are also some quite small oval forms of dark color resembling Hydrocystium, which may have been algoid.

Among the new species of the Paradoxides beds is a little Platyceras. New facts have been obtained, relative to the smaller Stenotheca, to *Lepidella anomala* and to two species of the Paradoxides that have been described: *P. pontificalis* is found to be a narrow, and *P. Micmac* a broad form of *P. Hicksii*.

Fauna of Division (Stage) 2.—(Olenus Beds).

Abundant remains of large Protospongia are found in these beds. Among them are *Protospongia fenestrata*, Salt,

Protospongia (?) cf. *major* Hicks and another large species, whose branches or cups were ten inches or more in length. These large sponges must have lived in quite shallow water, as they are found bedded between ripple marked sandy layers.

Many of the beds of this division abound with the tracks, burrows and casts of worms, among which are a Monocraterion, whose straight ray-like tracks spread from the burrow, a distance of eight or ten inches. Two species of Arenicolites are common, one quite small, another larger with a space of one to one and a half inches between the burrows. The cast of the gallery of this species, seen from below, greatly resembles Mr. Billings Arthraria, as the gallery is enlarged a little at each extremity; and short examples thus look somewhat like dumb-bells.

Among fossils which appear to have their place in the upper part of Division 2, are some that have been found in the Kennebecasis basin of Cambrian rocks. These are *Leptoplasti* one allied to *L. stenotus*, Ang. *Agnostus pisiformis*, var. and *Agnostus Nathorsti*, var. The association of these trilobites would indicate a horizon at the top of this division.

Fauna of Division (*Stage*) 3.—(Peltura Beds).

The species which indicate this horizon are two species of *C. tenopyge* (cf. *C. flagillifer* and *C. spectabilis*,) *Orthis lenticularis* and a *Kutorgina*, these occur in the middle of this division. At the bottom of the division *Lingulella lepis* is found, and another larger species (*L. ampla*, var ?)

Beds in Cape Breton corresponding to this stage, have *Peltura scarabeoides*, *Sphœrophthalmus alatus*, and *Orthis lenticularis*.

Fauna of Arenig Group (*Ordovician*).

This horizon is indicated by certain fossils lately discovered in the St. John basin, at the summit of the Cambrian measures.

They consist of graptolites of the genera Bryograptus, Tetragraptus and Dichograptus, with a large Orthis and a Cyclognathus

The physical history of this part of Canada, in Cambrian times as shown by the Cambrian terreins in southern New Brunswick, was briefly as follows:

The basal series is marked throughout by the waning effects on its sediments of the eruptive activities of the preceding age. The series is variable in thickness, the conglomerates have some closely cemented breccias as well as the ordinary rubbly conglomerates of sedimentary origin. Occasional thin beds of felsite and petrosilex are found, and the finer sediments have a strong green or red tint, and are more or less charged with iron.

In the St. John group, the rocks of Division 1 show a gradual deepening of the sea without disturbance; and without any trace of eruptive activities after the first few bands were laid down.

When the second division of the St. John group was being deposited, the sea-bottom again came up to the surface, and was awash, or was under a thin covering of sea-water throughout this stage.

At the beginning of the third stage, the land again sank, and continued under a considerable depth of water throughout the whole of this age, as we see from the great body of fine dark grey slates, which form the bulk of the measures of this division.

Finally the sea-bottom sank deeper still, and in tranquil waters, comparatively free from currents, lived the graptolites which we now find buried in the soft carbonaceous mud (now changed to slate) found to have been deposited in this region after the close of Cambrian time.

Notes on the Lake St. John Country,

By E. T. Chambers.

The Lake St. John region is about one hundred miles north of the city of Quebec, and has for the last two years been the subject of much attention, from the fact that it contains a large amount of very fertile land, and has a climate remarkably mild for such a northern situation,—a fertility and temperature much better than is enjoyed by the settlers around the old fortress city, and nearly equal to that of Montreal. Separated from Quebec by the Laurentian Mountains, the tedious journey was a great hindrance to its settlement, but during the last five or six years a first-class railway has been constructed from the old capital to the very borders of the lake. This, after running some forty miles westward to the pretty town of St. Raymond, in the fertile valley of the St. Anne river, turns to the north, boldly making its way through the midst of the mountains, and after a course of 137 miles more, reaches the town of Chambord near the Lake St. John. A branch line of five miles goes to the mouth of the Metabetchouan where a steamboat is able to come close to the shore. A few notes on this somewhat remarkable route and on the lake itself may be, perhaps, of some interest.

After leaving the alluvial clay of the river St. Charles at Quebec, the track has a somewhat steep incline of 132 feet in the mile. At St. Ambroise, about ten miles from Quebec, it passes through the post-pleiocene in a cutting, and two or three years ago, before they were overgrown with herbage, the banks on each side exhibited a large deposit of shells of *Saxicava rugosa* and *Mya truncata*, chiefly of the former, and in such quantities that the banks were quite white. I am told by the railway people that the elevation here is 533 feet above the St. Lawrence. Soon after this the line passes through a marshy country, but a few miles after leaving St. Raymond, comes upon the grey Laurentian gneiss; which appears to form the mass of the mountains till we reach Lake Bouchette, about twenty miles from Lake St. John. This gneiss varies much in the size and

arrangement of its constituents. Here it is seen with the ingredients pretty equally mixed, forming a granite; in another place, the components are in regular layers, again these layers are bent and contorted in every possible way. In many places the mountains are much shattered, broken into larger and smaller masses as if by some violent explosion; sometimes these large masses present a very threatening appearance as the train rushes along under them, so slightly do they appear to be supported.

At about sixty-five miles from Quebec, the line of railway comes to the east side of the River Batiscan, and continues its course along the sides of the mountains forming its bank for nearly thirty miles. The scenery along this river is singularly beautiful. The Batiscan, about 150 yards wide, in this part of its course is an alternation of foaming rapids, some of them cascades, and stretches of less boisterous, beautifully clear water running between high mountains, clothed, except where too steep, with arborescent verdure from the river to the summit. As the track rises—and there are some very steep grades in this part—the mountains increase in elevation, some of the highest rising to the height of 1500 or 1600 feet (perhaps more) above us. Towards the south their shape is a sort of elliptical curve, on the north side they are nearly perpendicular and show bare surfaces of rock some hundreds of square feet in extent.

The whole of the country abounds in lakes. It is said that in a rectangle reaching in length from Quebec to Lake St. John, and twenty miles wide, 500 lakes have been counted by the railway surveyors. Several of these are large. Lake Edward, or Lac des grandes iles, is twenty-one miles long, and seven and a half miles wide, and contains many large islands, which, with the hills which encircle the lake, are covered with forest, healthy trees, in no place disfigured by the black half-burned stumps which so often spoil the beauty of our woodlands.

Near Lake Kiskisink or Cedar Lake, the railway crosses the height of land between Quebec and Lake St. John, its

elevation being 1504 feet above the St. Lawrence. The land here is very sandy, so exceedingly fine and white in some places that I think it might be employed in glass manufacture. Around this lake the country is so covered with blocks of gneiss, that nothing grows under the trees but ferns, lichens and mosses; I looked in vain while here for a blade of grass.

Lake Kiskis.ak is about four and a half miles long, and is the source of the River Bostonnais, a tributary of the St. Maurice. About a mile and a half east of the lake is the Metabetchouan river, which, rising a few miles to the south east, flows into Lake St. John. Most of the journey northward from Cedar Lake is down a steep incline. As the Lake (St. John) is approached, the larger size of the trees, the more healthy vegetation and signs of successful cultivation give evidence of a more genial and fertile region. Near the lake we may perceive in the railway cuttings, the same grey gneiss, but here and there is red gneiss, the crystals of red orthoclase of large size, and in some places boulders of Labradorite.

From Chambord to the western extremity of the lake, and apparently extending under its bed, filling up a depression in the Laurentian, are beds of Silurian limestone. These beds appear to have been but little disturbed, and lie in a nearly horizontal position, the bed of the lake having a very gentle slope from the shore. The limestones appear to be formed entirely of fossil-shells. These are scarcely discernible in freshly broken pieces, but in places on the borders of the lake, especially in front of the town of Roberval, south of the River Ouiatchouanish, the weathered surfaces of the limestone forming the beach exhibit very fair examples of Trenton fossils, among them *Murchisonia, Pleurotomaria, Halysites* and others, characteristic of this formation. These fossils are protruding from the upper surfaces of slabs, generally two or three inches in thickness. So plentiful are they that the difficulty lies not in the finding, but in the selection of the most perfect or most characteristic specimens. This exposure seems to extend about two and

a half miles. Among the specimens I collected here were the following:—

Columnaria Alveolata.	*Murchisonia bicincta.*
Petraia.	*Murchisonia gracilis.*
Rhynconella.	*Murchisonia holopae.*
Maclurea Logani.	*Metoptoma erata.*
Straparollus (?)	*Bellerophon Argo.*
Pleurotomaria.	*Orthoceras.*

The most interesting however, was a large fossil some twelve inches long and eight inches in diameter, spheroidal in form, apparently consisting of a number of concentrically laminated masses, and somewhat resembling *Stromatopora.* It lay near the bank, and might have been washed up from the lake by the storms of winter, or had perhaps been left near its original position; its great weight, and hard imperishable nature having resisted the forces by which the more perishable rock-bed was washed away. Sir William Dawson has come to the conclusion that this is a new species of Cryptozoon and has named it *Cryptozoon boreale.*

It is probable that a description of this will be given by Sir William Dawson in a future number of the *Record.*

The dip of the strata is toward the lake. At Point Bleu, the limestone has a rough crystalline form, is in layers from an inch to nearly a foot in thickness, and forms a cliff ten to twelve feet high. The shore is strewn with large slabs, but weathered fossils do not appear as at Roberval. At Snake Island towards the south-west of the lake, characteristic fossils of the Hudson River group are said to have been obtained.

In a paper read in 1882 before the Royal Society of Canada, the Rev. Abbé Laflamme stated that he had found the Trenton limestone well developed upon the shore of the Saguenay River, from St. Anne to the upper side of the junction of the two discharges. He had also discovered some beds of the same south-east of the mouth of the Metabetchouan, reposing on the Laurentian, and showing signs of being the remains of larger deposits of which

the greater part had been removed by glaciation. He noticed that these limestones are rich in petroleum; this has been observed by others also, for in answer to enquiries recently made, I find that a gentleman of Buffalo has purchased land near Chambord with the intention of bringing the petroleum there into use.

Lake St. John is 300 feet above the level of the Gulf of St. Lawrence, it is not, except towards the centre, very deep, and having sandbanks in some parts, navigation near the shore is difficult. In shape it is almost circular. Its greatest diameter from the Metabetchouan to the Peribonca is twenty-eight miles, and from the grand discharge at the head of the Saguenay to the Ouiatchouanish twenty miles. It is the recipient of several rivers, large and small, draining a great extent of country. On the north it receives the Peribonca, said to be nearly 400 miles long, and navigable for nearly twenty miles. The Mistassini and the Ashuapmouchouan navigable for eight miles coming from the north-west. On the south of the lake are the Ouiatchouan, leaping over and down the mountain side in magnificent and beautiful falls, which give the name to the river, and which are 236 feet in height, and the Metabetchouan from Lake aux Rognons, a few miles south-east of Cedar Lake. This river is said to have a fair amount of good land, suitable for settlement on its borders.

As is well known, Lake St. John discharges its surplus waters by the Saguenay river into the St. Lawrence.

It would appear as if Lake St. John occupies a hollow formed by the elevation of the Laurentian hills in this part. That in the Palæozoic times it was, with the country around, covered by the Silurian seas. After these retired, this part of the country was not much disturbed by the various movements which occurred in many other regions. In the glacial period, it was with the rest of this part of the continent again submerged, and much of the limestone carried away. The bottom of the lake and parts of the country around have retained the covering of Silurian limestone and the decay of this, mixed with the disintegrated

constituents of the Laurentian rocks, forms the fertile soil which makes this district of so much importance to the province. About twenty years ago, one of the largest bush fires on record devastated the whole country on the south of the lake from the Descharge to Point Bleu. Many poor habitants lost their lives in this conflagration. The burnt country soon attracted fresh settlers, and being now more easily cleared, and possessing such good soil, this part is the most thickly populated. From the comfortable appearance of the people and their homes, the well-fenced fields and fine crops of wheat, oats, barley, potatoes, &c., it is evident that the praise bestowed on this region is no more than it deserves. There is said to be another flourishing settlement on the western side of the lake on Ashuapmouchuan. At the Indian reserve at Point Bleu there is a settlement of Montagnais Indians, pure Indians, veritable hunters. Houses have been erected for them, but they prefer living in their tents, using the houses as repositories for their various belongings. They go into the woods in the winter, seeking furs, and are said to endure great hardships being often in want of food when game is scarce. Indeed, it is said, many have died of starvation. The young people are, as a rule, healthy looking and round faced, but the older people carry signs of their hard life in their bent forms and hollow cheeks. It may be noticed that very few old men are seen among them.

As a consequence of the great fire, the trees on the south side of the lake are but small. On the north side and in the country around the Saguenay, lumbering operations have been for many years carried on by the Messrs. Price, Brothers, of Quebec, and most of the valuable timber taken out. The principal trees are spruce, balsam, white and yellow birch.

Leaving Lake St. John and turning southward, with the exception of some good land on the Metabetchouan river, there appears to be little to entice the settler till you approach St. Raymond. Other fertile spots may be found when the country is better known, but at present the

chief wealth of the district seems to be in its white and yellow birch, spruce and balsam, and in the more southern parts, elm and maple. Mills have been erected on some of the streams, and quite an extensive business is done by the railway in conveying the sawn lumber, as well as immense quantities of cordwood to Quebec.

There seems to be but little chance of minerals of any value being found there. It is said that copper and iron have been reported at Beaudet Station, and at Valcartier is a deposit of foraminiferous earth. I have before spoken of the petroleum at Lake St. John. The granite or gneiss in some parts, is fine in grain and hard. It makes a good polish, and is not affected by the weather. It is to be used for the monument to Jacques Cartier to be erected at Quebec.

Large animals are scarce throughout the whole of the district. Bears may sometimes be seen near settlements. The beaver, otter, musk rat, fisher and mink are found. It is the fish which make the country so interesting to the sportsman, and which is drawing the attention of our neighbours to this part of our province. In this region of mountain streams, lakes and rivers, there is scarcely a piece of water but abounds with fish. In Lake St. John is found the famous Ouinaniche or land-locked salmon, weighing from 4 to 14 lbs. It is a beautiful fish, fine eating, and said to give excellent sport to the angler. Other kinds of fish of good size are found here also. In other streams and lakes are the forked tail and speckled trout, the former weighing up to nearly 30 lbs., the latter to 7 or 8 lbs. Fine fish of 3 lbs. or 4 lbs. are quite common in Lake Edward. Other fish found there are bass, doré, whitefish, pike and perch.

On a New Genus of Siliceous Sponges from the Trenton Formation at Ottawa.

By George Jennings Hinde, Ph.D.

[Plate D.]

The Canadian Geological Survey, through Mr. J. F. Whiteaves, F.G.S., has lately forwarded to me, for examination and description, a small collection of fossil sponges which has been obtained by Mr. W. R. Billings from the Trenton Formation at Ottawa. The rarity of these organisms in this geological horizon renders a special interest to their study. The forms obtained are, for the most part, unattractive in outward aspect, showing little more than their cylindrical or compressed outlines; and their real characters, whether sponges or mere inorganic nodules, cannot in all cases be known until sections have been made. These show that the sponges are now completely filled up by the dark limestone matrix of the rocks in which they occur, which renders it very difficult to make out the direction of the canals which traversed their walls. Sometimes, however, transparent calcite has partially occupied the canals. The delicate spicular network of which the sponge-skeleton is composed, has also been largely destroyed in the fossilization, and the portions which remain have quite lost their original siliceous structure, and are now replaced by crystalline calcite. The effect of this change has been that the definite form of the individual spicules and their mode of union with each other, can no longer be recognized, and thus render their determination somewhat uncertain. In spite of these hindrances to a precise diagnosis, I venture to describe these forms as a new genus of Lithiotid sponges, for which I propose the name Steliella[1].

Steliella, *g. n.*

Generic characters.—Sponges simple, subcylindrical, compressed, club-shaped or occasionally funnel-shaped, appar-

[1] στηλη, an upright stone or post, dimin.

ently free. Walls thick, a cloacal depression at the summit, which may be extended downwards as an open tube. The outer surface of the wall with circular canal apertures disposed in longitudinal rows. There are two series of canals; a larger which traverses the walls in a generally vertical or oblique direction; and a smaller which extends from the surface in an arched direction to the interior of the sponge wall. The skeleton consists of a connected spicular meshwork, apparently of the Anomocladina type, in which there is a relatively small central node with a variable number of rays which connect with adjoining nodes. No distinctive dermal layer is present.

The spicular structure of this genus is nearest allied to that of *Astylospongia*, F. Roemer, but the nodes are less developed, and the network is much less regular. Owing to the manner in which the spicules are replaced, and their coalescence, it is impossible to make a close comparison with other sponges, and, in fact, it is difficult to state positively whether the spicules are uniformly of the Anomocladina type. The canal apertures of the surface, and the shape of the sponges as well, resemble some forms of *Calathium*, Bill., such as *C. Anstedi*[1] and *C. Fittoni*,[2] but the spicular structure in these latter is as yet unknown, and therefore they cannot properly be compared with *Steliella*.

STELIELLA BILLINGSI, sp. n., pl. Figs. 1–4.

Sponges subcylindrical or compressed so as to be nearly elliptical in transverse section, or club-shaped; the basal end obtusely rounded and apparently free. The specimens vary from 28 to 64 mm. in length, and from 14 to 34 mm. in thickness. The vertical rows of canal apertures are about 1 mm. apart, the apertures themselves, in the single specimen in which they are clearly shown, are circular or ovate and about 1 mm. in width. The larger canals, as shown in transverse sections, are from 0.5 to 1 mm. in width, those of the smaller series are from 0.2 to 0.3 mm.

[1] Pal. Fos., vol. 1. p. 210.
[2] Ib., p. 211.

wide. The skeleton of the sponges has the appearance in thin sections of a minute stellate network, the central nodes rounded or slightly elongate, from 0.11 to 0.17 mm. in thickness; the spicular rays are about 0.3 mm. in length and 0.03 in thickness; there are from three to six radiating from each node, but they cannot in all cases be traced to their union with the proximate nodes. In some cases the spicular rays radiate from a non-inflated centre and are thus of a tetracladine type; such forms however appear to be exceptional.

This species appears to be not uncommon. The specimens are all alike in their unfavourable condition of preservation. In several, the cloaca and main canals have been partly filled with microscopic crinoidal joints.

Distribution. Trenton Limestone, Ottawa. Collected by Mr. W. R. Billings, after whom the species is named.

STELIELLA CRASSA, sp. n., pl. Figs. 5–6.

The single specimen referred to this species is funnel-shaped, with an oblique summit and thick rounded margins. The basal extremity is obtusely rounded. The cloacal depression appears to be shallow. There are only a few traces of canal apertures on the outer surface, they are about 1 mm. in width, their arrangement cannot be ascertained. The specimen is 65 mm. in height, and 30 mm. in thickness. The large canals are about 1 mm. in width, those of the smaller series vary from 0·25 to 0.5 mm. wide. The spicular structure is of the same character as in the preceding species, but the rays of the spicules are decidedly larger, ranging up to 0.5 mm. in length, and the spicular mesh is thus of a more open character.

The specimen is in the same state of preservation as the forms described above.

Distribution. Trenton Formation, Ottawa. Collected by Mr. W. R. Billings.

REFERENCE TO FIGURES.

Figs. 1-4 *Steliella Billingsi.*

Fig. 1. Showing the form of the sponge and traces of the vertical ridges between the canal apertures.

Fig. 2. A transverse section from the centre of the same specimen showing the arrangement (in section) of the large canals. Natural size.

Fig. 3. The outer surface of another specimen showing the canal apertures. Natural size.

Fig. 4. A portion of the spicular mesh, as seen in a thin microscopic section. Enlarged sixty diametres.

Figs. 5-6. *Steliella crassa.*

Fig. 5. The sponge, natural size.

Fig. 6. A fragment of the spicular mesh, enlarged sixty diameters.

ON THE ACADIAN AND ST. LAWRENCE WATER-SHED.

BY L. W. BAILEY.

Read before the Nat. Hist. Society of New Brunswick, April, 1889.

The tract of land which constitutes the great divide between the basin of the St. Lawrence on the one hand, and shore of the upper St. John and Baie Chaleur on the other, is one of much interest for several reasons. Geographically it corresponds very nearly to the line separating the Provinces of New Brunswick and Quebec; politically, it has had great significance in connection with the various international and inter-provincial boundary disputes, as it still marks in a general way the line of separation between races of different language, customs and descent; physically, its character is such that, until a comparatively recent period, it has acted as a very serious barrier to inter-provincial communication; and finally, from a geological point of view, it is of interest as forming a portion of one of the great cordilleras of the continent, the eastern extremity of the great Appalachian mountain-system. It is proposed in the present paper, to give a brief summary of some of its characteristics, as viewed in the last two aspects.

Regarding the Gaspé peninsula and its direct extension westward, as properly marking the limits of the area under discussion, this may be said to have the general form of a broadly curving belt convex to the northward of which the sides are nearly parallel and at a distance from each other of about ninety miles, while its length from Cape Gaspé to the Little St. Francis river, is 250 miles. While on the northern side it forms the south shore of the St. Lawrence, and is of very regular outline, it is on the southern side less clearly defined by the valley of the St. John river above Edmunston, and farther east by that of the Restigouche river and the Bay Chaleur.

Though everywhere hilly, the district in question can only at comparatively few points be properly described as mountainous. Its true character is rather that of an elevated plateau, having in the Gaspé peninsula an average elevation of 1000 feet, but declining to the westward, upon which are held up, along certain lines, somewhat more prominent ridges, while the sides have been broken up and made hilly by the effects of deep and irregular erosion. Of the ridges referred to, the most considerable are those forming the Shickshock Mountains, included wholly within the Gaspé peninsula, and having a length of about sixty-five miles with a breadth of from two to six miles, at a distance of about twelve miles from the St. Lawrence. Their maximum elevation is from three to four thousand feet, and the district which they form is one of an exceedingly rugged but picturesque character. From the summit of Mount Albert, nearly 4000 feet high, not less than (158) one hundred and fifty-eight distinct peaks were observed and triangulated by Mr. A. P. Low, who also describes the intervening valleys as having often the character of deep cañons, traversed by narrow but deep streams with numerous rapids and falls. In addition to the main chain of the Shicksocks, a second range, of less elevation, but still including some lofty peaks, is found between the latter and the coast, while here and there, on either side of the axis, are isolated granite hills, such as Table Top Mountain, rising fully 2000 feet above

the general level of the surrounding country, and nearly bare of vegetation. Towards Lake Metapedia and the line of the Intercolonial Railway, the great ridges of the Gaspé peninsula become much less prominent, but a little to the westward of the lake, another range, that of the Notre Dame Hills, rises somewhat abruptly from the surrounding plateau, and stretches away in the direction of the head-waters of the Grand Metis and Patapedia rivers. It does not, however, quite reach these latter, and to the westward of these streams no ridges of a well defined or continuous character are to be met with.

The rivers which drain as well as owe their origin to the great belt of high land here described, present many interesting features. They are quite numerous, including, in the Gaspé peninsula proper, the St. Anne des Monts, the Dartmouth, York and St. John at the eastern end of the peninsula, with the Grand Pabos, Bonaventure, Big and Little Cascapedia, tributary to the Bay Chaleur. Farther west we have, on the north or St. Lawrence side, the Little and grand Metis, the Rimouski, the Trois Pistoles, Riviére Verte and Riviére du Loup; while on the southern side, besides the Metapedia, there are the Restigouche, with its tributaries the Patapedia and Quatawamkedgwick, the Madawaska, the St. Francis, the Big Black and Little Black rivers, with others of minor importance. As might be expected, the streams flowing northward into the St. Lawrence are, as a rule, much smaller than those flowing in the opposite direction, but if we include the entire distance of the latter to the sea, the contrast is in some instances quite remarkable. Thus while few of the streams tributary to the St. Lawrence show a greater length than thirty miles, the length of the Metapedia, including the lake, is nearly sixty miles, that of the Restigouche from the source of the Kedgewick nearly ninety miles, and the St. John, measured in the direct line from Temiscouata to the Bay of Fundy, 260 miles, or from the source of the St. Francis, over 300 miles. The streams on the north shore also differ in being usually more irregular in course, with more

numerous and larger falls and rapids, being sometimes inaccessible for considerable distances. A more curious and more interesting feature is the fact that many of the streams, on either side of the general water-shed seem to have been but little affected by the position of the latter, having their source upon one side of this and their discharge upon the other. Thus in the Gaspé peninsula, as described by Richardson and others, the Matane, the Ste. Anne des Monts and the Chatte all take their sources south of the general height of land, and have cut deep gorges through the latter on their way to the St. Lawrence, while one branch of the Matane, rising north of the axis, flows across the latter to its junction with the main stream, and thus has its waters twice intersect the principal range of elevations. On the other hand the St. Francis, rising in a lake of the same name, is only twelve miles distant from the St. Lawrence, and several miles north of the sources of the Trois Pistoles, and yet flows southward across the range to its junction with the St. John.

Another noticeable feature is the number, size and depth of the lakes connected with the streams draining the southern side of the water-shed. Of these, Lake Temiscouata is the largest, being about thirty miles in length, with a breadth varying from one to two miles, and a depth (which is nearly uniform through a large part of its length) of 220 feet, its elevation above the sea being 467 feet. Lake Metapedia has an area of twelve square miles, about half that of Temiscouata, and an elevation of 480 feet, but has much less depth. Near Temiscouata, and in connection with it, are the Squatook Lake and Cabano Lake, both remarkable for their depth, while farther west, on the line of the St. Francis, are Pohenagamook or Boundary Lake, Glazier's and Beau Lake. It is noticeable that most of these lakes occupy long narrow troughs having a nearly north and south course, or transverse to the trend of the hills in which they lie, and that this course is extended in nearly the same direction by the streams to which they give origin. The valleys of these streams, as in the case of the Metapedia

and the Madawaska, are now largely filled with drift, and there can be but little doubt that all of them mark old channels of sub-aerial erosion, the partial damming of which has originated the lake-basins which now characterize them.

The climatic features of the region under review may be readily inferred from its position and physical aspects. While its comparatively high latitude determines great inequality in the length of the seasons, a long winter and a very short summer, its altitude further tends to reduce the mean temperature of the latter. The temperature of the coastal waters, these being a part of the great southward flow from the Arctics, being also very low, leads to a further chilling in the air above them, and the effects of this are readily recognizable in the prevailing winds. Fogs are not uncommon, even over the higher portions of the district, and the rain and snow fall both excessive. Ice sometimes remains in Lake Metapedia as late as the 24th of May, and upon the adjacent hill tops, as well as in ravines and gullies, great banks of snow often linger far into June. Frosts come early in autumn, and may come, even with severity, at any time of the year. Long continued and excessive heats are of rare occurrence.

The climatic features of the region are reflected in its vegetation and animal life, although the former is also largely influenced by the character of the soils and drainage, as these in turn are by the nature and structure of the rocks beneath. The larger portion of the district is forest-clad, the clearings being for the most part confined to a narrow belt, five to fifteen miles wide, skirting the St. Lawrence, to isolated settlements around the shores of the Gaspé peninsula, to the immediate neighbourhood of the Temiscouata Portage Road, and to the more recently opened line of the Intercolonial Railway. The trees most commonly met with are spruce, fir, hackmatac and white birch, but in favorable situations and on lands of moderate elevation yellow birch and sugar-maple are also not uncommon, and along the river valleys, groves of black ash and poplar.

The immediate banks of streams are bordered by the ubiquitous alder, amid which in autumn glow the rich berries of the mountain ash. On the higher summits the vegation is of course more scanty, and in the Shickshocks, as already described, these are often quite bare of trees. Of herbaceous plants there is, of course, in the district as a whole, a considerable variety, but little has yet been done in working out the details of their distribution. Of those occurring in the vicinity of Lake Temiscouata a pretty full list has been published by Mr. J. J. Northrop (Bull. Torr. Bot. Club, Nov., 1887), and supplemented by another prepared by Mr. Ami of the Geological staff. With few exceptions the species named are the same as those found in the valley of the St. John river, but many forms, both of trees and herbs, common in the latter have not yet been noted in the hilly district to the north. The following list embraces a few forms observed by the author on the banks of the upper St. John, near Fort Kent, *Parnassia Caroliniana Tanacetum Huronense, Oxytropus Campestris, Veratrum viride Hedysarum boreale, Allium Shoenoprasum, Heracleum lanatum, Rosa blanda, Lilium Canadense, Potentilla fruticosa, Anemone Pennsylvanica, Thalictrum dioicum, Castilleia pallida, Silene inflata, Diervilla trifida, Lysimachia stricta, Brunella vulgaris, Pyrola secunda, P. elliptica.*

As to animal life, the same forms are found as occur in the less inhabited parts of our own province. Bears are very common, and red-deer and caribou but little less so, while moose are comparatively rare. Both birds and insects present considerable variety, but as yet have been but little studied. The remarkable clearness and coolness of the streams, and the depth of the lakes, are especially favorable for the development of fishes, and few regions in the world can excel in attractions for the sportsman, those afforded by the waters of the Restigouche and its tributaries, the Cascapedia, the Matane and the Grand Metis. In the larger lakes, in addition to trout, are found the white fish, the toque and the tuladi. Turtles, sometimes of large size, were often seen basking on the muddy banks of streams,

and at some points, specimens of cray-fish were also observed. The soils of the region under discussion can be best considered in connection with the geological formations which have determined them.

The oldest rocks of the Gaspé Peninsula proper, are, according to Mr. Ells, those which make up the mass of the Shickshock Mountains, and consist chiefly of epidosite, garnetiferous gneiss, horneblendic, chloritic and micaceous schists, together with large masses of serpentine, portions of which are distinctly stratified, while others suggest an eruptive origin. These rocks were described in the Geology of Canada, by Richardson and Logan, as being an altered portion of the Quebec group (Sillery), but are referred by Ells, chiefly upon lithological grounds, to the Pre-Cambrian. The only point where the belt of rocks so referred has been observed by the present writer is on the eastern shore of Lake Metapedia. They here consist of heavy masses of grey, greenish and purplish amygdaloid, holding considerable quantities of epidote, and bear some resemblance to the Huronian of southern New Brunswick, but not more than they also do to similar masses occurring in connection both with the Cambro-Silurian and Silurian formations. To the north of these volcanic rocks, upon the same lake, the rocks are chiefly hard massive sandstones of a greenish (or rarely purplish) color and distinctly bedded, but with these, at two points, are beds in which the sandstones, by the enclosure of limestone pebbles, become a coarse, gritty conglomerate. These rocks have also been referred to the Quebec group (Sillery) but they have as yet yielded no fossils, and further investigation of their relations is required. At the extreme northern end of the lake, the rocks are undoubtedly those of this latter group, and from near Sayabec Station on the Intercolonial Railway to St. Flavie, are exposed in a very remarkable and almost continuous section, showing repeated alternations of bright red, green, grey and black slates, with beds of massive grey or whitish sandstone. The former resemble the strata which at other points along the south shore of

the St. Lawrence have been described under the name of the Levis rocks, and the latter bear a similar resemblance to the so-called Sillery, but it may well be doubted how far these and the numerous other sub-divisions adopted by Richardson in his report on the geology of southeastern Quebec, are capable of being sustained by actual facts. A new and good opportunity for the study of these rocks has recently been furnished by the line of the newly opened Temiscouata railway, and was availed of by the writer and Mr. W. McInnes during the past summer; but with the result of showing that along this line at least no good reasons exist for the adoption of such sub-divisions. It has been supposed by Richardson that in addition to the several members of the Quebec group proper (Sillery, Lauzon and Levis) a portion of the sandstones found at St. Antoine and Frazerville (Riviére du Loup) are of Potsdam age, but it is impossible to see in what respects the rocks thus referred to differ either in character or relations, from those elsewhere referred to the Sillery sandstone. The topography of the country underlaid by these Quebec rocks is exceedingly broken and rugged, the repeated alternations of hard and soft strata, together with excessive folding, having been especially favorable to the formation of steep and bold ridges separated by narrow and deep valleys. The massive sandstones, from their peculiar whiteness and absence of vegetation, are especially conspicuous, but are exceeded in elevation, as well as in the craggy character of the scenery which they determine, by the hard and glossy slates which at various points rise from beneath them. Near the axis of the divide the land is, as has been stated, somewhat flatter, but here large tracts are so thickly strewed with blocks of the dark grey Sillery sandstones that little else is visible. In all parts, except where intervales occur, the soils are of the most meagre character, and the settlements, chiefly French, of the poorest description.

The transition from the Quebec or Cambro-Silurian rocks to those of the Silurian system, is everywhere well marked, being seen alike in the character and attitude of the beds.

The contrast in the latter respect is especially noticeable, for while the strata of the older series are everywhere highly inclined and sharply folded, those of the younger, along the line of contact, are very generally nearly flat. While, too, the former are largely made up of slates, often brilliantly or variously colored, and without conspicuous fossils, the latter are usually grey or dark grey in colour, consist largely of limestones, and abound in corals and other organic remains, often of large size. The contrast in many places has been made still more striking by the effects of erosion. Thus along a large part of its northern edge, the Silurian presents the appearance of a bold or even precipitous escarpment, separated only by a deep and narrow valley from the irregular and usually lower tract to the north occupied by the inferior group. This feature is very strongly marked between the Grand Métis river and the Rimouski, determining in part the eminence of Mount Commis and wholly that of the Bois Brulé, and though to the westward of the Rimouski it becomes less evident, it re-appears with special prominence at Temiscouata Lake, here originating the remarkable eminence known as Mount Wissick, Mount Lennox or the Big Mountain.

The order of succession and the equivalency of different members of the Silurian system in northern New Brunswick and adjacent portions of Quebec and Maine, have long been wrapped in much obscurity, the difficulty of their determination arising partly from the great sameness of the formation over large areas, the excessive folding and strong slaty cleavage by which it is generally characterized, and finally from the comparative paucity of fossils. An examination however of the section afforded by Lake Temiscouata and its vicinity has recently done much to remove this obscurity and to afford a key whereby the geology of the districts named may be more satisfactorily correlated not only with each other, but with more distant parts of the continent.

It will not be possible in this place to dwell at length on the details of this section (which will be fully described in

a forthcoming report, by the writer and Mr. Wm. McInnes, to the Director of the Geological Survey), but the following brief summary embodying the more important results, will probably be of interest.

The strata in question naturally fall into three groups. Of these, the first are those which directly constitute the eminence of Mount Wissick. At their base they exhibit a considerable thickness of a pure and nearly white highly vitreous sandstone, with thin beds of conglomerate, followed by a mass of shales partly grey and partly bright green and red, above which, forming the principal mass of the mountain, are thick beds of grey limestone, the whole having a thickness of about 600—1000 feet. Their dip is for the most part at a low angle and at the northern base of the mountain, where it rises precipitously from the lake, their unconformity to the Quebec group, consisting here of black and green slates which are highly disturbed and altered, may be readily witnessed. In the shales and limestones the fossils are abundant and large collections recently made show that with the possible exception of the sandstones at the base, the strata are newer than the Niagara formation, the lowest fossiliferous shales being about the equivalent of the Guelph formation of Ontario, above the Wenlock, but below the Ludlow group of England, while the higher range through this last named group to and possibly through the Lower Helderberg. A similar but less complete succession has been observed by the writer on the Rimouski river, in Bois Brulé Mountain at St. Blondine, in the valley of the Neigette, on Taché Road at St. Gabriel, on the Grand Metis, and finally on Lake Metapedia, and from each of these, fossils of similar character have been collected. On Lake Metapedia, the basal sandstones were also found to be fossiliferous, including among other forms that of *Pentamerus oblongus*, a *Murchisonia* and *Oriostoma*.

The second series of rocks shown in the Temiscouata section is separated from the last by an interval of about 800 yards without exposures, and differs greatly both in

character and attitude. The lowest beds are conglomerates of very coarse character, and attain a thickness of not less than 1000 feet, with a nearly uniform south-easterly dip of 50°. The pebbles in the conglomerates include many of limestone, and have apparently been derived from the disintegration of the slates and limestones of the Quebec group, but are not at present known to contain any fossils. Above the conglomerates is a considerable breadth of slates, also usually inclined southwards at high angles and including some beds of limestone, above which we finally have a great body of sandstone rock, peculiar, in addition to its hard and massive character, in being often of greenish or purplish color, with veins and blotches of epidote and bands of purple jasper. These rocks which form upon the lake the promontory of Point aux Trembles, and thence extend up the Tuladi river to Squatook Peak, which is composed of them, have been in earlier publications supposed to be younger than those of Mount Wissick and to be possibly Devonian. But collections of fossils recently made from both the slates and sandstones, and examined by Mr. Ami of the Geological Survey, would seem to show that they are really the older of the two, representing probably the lower part of the Niagara formation, and perhaps the Medina or Clinton group. From this it would also follow that we have here a great physical break in the Silurian system, its upper members being not only unconformable to the lower, but spreading beyond the limits of the latter, and thus made to rest directly upon the rocks of the inferior Quebec group.

The third and last group of rocks found at Temiscouata Lake consists of fine grained slates, with some sandstones of grey and dark grey colors, all of which are more or less calcareous, and are further noticeable for their repeated and complicated corrugations and the general presence of a very strong slaty cleavage. The direct contact of the slates with the sandstones of Point aux Trembles has not been observed, but from their general position in relation to the latter and from such fossils as have elsewhere been

obtained in them, it is conjectured that they are more recent than the latter. In this case they can not be far removed in age from the rocks of Mount Wissick, and are perhaps to be regarded as the equivalents of the latter, deposited under somewhat different conditions.

Applying now the key thus afforded, we find that the succession of rocks constituting the first of the above divisions, that of Mount Wissick, is but repeated, with eventually the same character and fossils, and with the same low dip all around the northern margin of the Silurian tract, from Rimouski to Lake Metapedia, and eastward into the interior of the Gaspé peninsula. So, similarly, to the southward of these strata, we find the country drained by the Restigouche and its tributaries, the Quatawamkedgewick, the Patapedia and the Metapedia, everywhere occupied by slates similar to those of the lower part of Lake Temiscouata and the Madawaska. At no point, however, distant from the lake, has anything been observed corresponding to any portion of the intermediate division, which must accordingly either be wholly wanting or concealed from view by the superposition of the higher and unconformable members of the system. In New Brunswick the slates are also predominant, being the prevailing rock through all the northern counties, though sometimes becoming so calcareous as to constitute true limestones, but with these, at a few points, are also found beds which appear to represent the inferior group. Thus on the Siegas River, in Victoria county, where the beds are nearly vertical, the slates are accompanied, first, by a coarse and very peculiar conglomerate (holding elongated, curved and disrupted pebbles of limestone, mingled with others of serpentine), and, secondly, by beds of sandstone not unlike those of Point aux Trembles, and carrying fossils indicative of a similar horizon. Again, on the Beccaguimec River in Carleton county, on the extreme southern edge of the Silurian tract, the succession of beds bears much resemblance to that observed near its northern edge, and again holds similar organic remains, while, finally, it is possible

that still another such area exists near the mouth of the Shiktehawk. In the State of Maine, the three groups of strata described are still more clearly represented, for while there, as in the province, the slates are the most commonly occurring rocks, comprising all the country drained by the upper St. John, as well as large areas about Presquile and Houlton, we have, in the Fish River Lakes, and again at Ashland, beds of limestone, abounding in fossils which are nearly parallel with those of Mount Wissick, while finally, in the valley of the Aroostook and covering large areas, are conglomerates and sandstones, which are the evident continuation of those of the Siegas River, presenting precisely similar characters and associations, and carrying the same fossils. In northern Maine, however, there are with these undoubted Silurian strata, great masses of volcanic rock, felsites, quartz-porphyries and amygdaloids, as well as fine silicious slates and purple micaceous and gneissic sandstones, the relations of which are not yet fully known. Beds of Devonian (Oriskany) age also occur, as they do both in New Brunswick and in the Gaspé peninsula, but are much less widely distributed than has been previously supposed. Finally, the slates are at a few points unconformably covered by bright red sandstones and conglomerates similar to those of the Tobique valley in New Brunswick, and the Bonaventure district of Quebec, which are referable to the Lower Carboniferous formation.

Thus the succession of events indicated by the rocks in the early history of the region under discussion would appear to be as follows. The great period of upheaval, mountain-making and metamorphism which brought Archaean time to a close, having served to determine and to some extent to limit the great St. Lawrence or Acadian basin, by lifting above the sea the ridges which still border it,—the Laurentides north of the St. Lawrence valley, ridges of similar rock along the New England coast, some of our own southern hills and similarly some of those of Nova Scotia, Cape Breton and Newfoundland—we find in the Cambrian and Cambro-Silurian periods which succeed,

that over the intervening seas were in process of accumulation a vast thickness of sedimentary beds, pebble, sand, mud and lime-beds, spread horizontally over the sea-floor, and receiving from time to time the more durable relics of the life,—Brachiopods, Crinoids, Graptolites, &c.,—with which those seas were filled. Another period of upheaval then ensued, and, through pressure brought to bear upon the same sea-floor, portions of its surface became crumpled up into folds and ridges, and its materials more or less altered in character. At the same time, along the south side of the St. Lawrence, where the foldings are most numerous and excessive, the ridges thus produced were thrust above the sea level, thus defining that great estuary upon the southern as well as on the northern side, and embracing the system of heights (the Notre Dame Mts., &c.) already described as extending through the Gaspé peninsula and forming the great divide between the St. Lawrence and the Bay Chaleur. Along the southern side of the Lower Silurian rocks thus folded, we have seen that the Upper Silurian rocks meet them unconformably, and from their northern edge, in some places not more than nine miles from the shores of the St. Lawrence, spread southward to the Bay Chaleurs and upper St. John, as well as farther, over all the northern portions of New Brunswick and Maine. From the absence, or slight representation, through most of the Gaspé peninsula, of the inferior portions of the system (Niagara group) we may infer that, for some time after the opening of the Silurian era, this district still remained too elevated to be reached by oceanic waters: but the occurrence of limestones of this age at Cape Gaspé, as well as on Anticosti, filled with marine organisms, shows that in these localities at least the great St. Lawrence Gulf was still in existence. At the same time, the occurrence of the heavy beds of conglomerate, fully 1000 feet in thickness, with the succeeding shales and sandstones, carrying Niagara fossils, on Lake Temiscouata, would seem to indicate that these waters of the Gulf spread westward, at least as far as that point, though of diminished

depth, and (to judge from the coarseness of many of the beds,) with currents of considerable power. Similar strata occurring on the Siegas River in New Brunswick, on the Beccaquimec River in the same province, and on the Aroostook River in Maine, indicate that these also were regions of similar shallow waters, with similar powerful and variable currents, and, as it would seem, subject at times to sub-marine volcanic ejections. Connected with these accumulations, and possibly in part determined by them, the floor of the gulf underwent frequent oscillations of level, and along certain tracts even more marked movements occurred, tilting (as at Burnt Point and Point aux Trembles) the heavy beds, and giving them their present steep inclination, while at others only gentle undulations were the result. Finally, over the irregular floor thus produced were deposited the later beds of the Silurian sea, mostly in the form of fine calcareous muds, now hardened into slates, but in places in the form of pure limestones (like those of Dalhousie, Mount Wissick, Square Lake, Ashland, &c.) now filled with the relics of their ancient populations. These too have since felt the force of the great earth movements which have in all ages operated so widely and so powerfully in the history of our globe, and their effects are readily witnessed in the tilted and crumpled character of many of the beds, more particularly about the Grand Falls of the St. John, but never since have they been submerged to anything like their former extent, the later beds of the Devonian and Lower Carboniferous being much more limited in this distribution, and as regards the latter at least, found in what must have been very shallow and isolated basins.

Of the still later chapters in the history of the region we have been discussing, two only can here be referred to, and these but briefly. Everywhere over the district are to be seen evidences of a former extensive glaciation in the smoothing, polishing and striation of rock surfaces, in the occurrence of travelled boulders, and in the existence of drift-dammed pond and lakes, kames, &c., some of which

are quite remarkable. The depth of some of the lakes like the Temiscouata, the Squatook and the Cabano, occupying as they do north and south depressions and with nearly flat bottoms, would seem to point to ice-movements as having been closely connected with their position and character. But what is of still greater interest is the evidence which the district everywhere affords, of a northern as well as a southern driftage at some time during the ice period, the great ridge becoming itself a centre or axis of ice distribution as it is now of the rivers which drain it. This fact is strikingly seen in the occurrence of great boulders of fossiliferous Silurian limestone strewed over the Quebec rocks at the upper end of Lake Temiscouata, and which have been derived from Mount Wissick to the south, again in the similar occurrence of such boulders at the northern end of Lake Metapedia, and finally their occurrence, in large numbers, along the St. Lawrence shore, as noticed about the Grand Métis river and Rimouski. Similar facts have elsewhere been observed by Mr. Chalmers, and are referred to in his reports on the Superficial Geology of the district.

Of the early human period, but few relics, so far as known to the writer, have yet been found in the region here considered. None were observed by us around the shores of Temiscouata Lake, but near the outlet of the First Tuladi Lake, are numerous fragments of chipped flint, together with a few sherds of pottery, indicating the former presence here of the early Pre-Historic races. So also we have failed to find any relics of this character on the St. John river above Edmunston, although below that point, and especially about Grand Falls and Aroostook Falls, they are not uncommon.

Notes on some Birds observed at Montreal.

By F. B. Caulfield.

The vicinity of a large and busy city like Montreal, with its well-travelled roads, noisy railway trains and steamboats, is not a favorable locality for studying bird life, yet, quite a number of species can be found within easy walking distance of the city; about 175 species of birds are now known to occur on the island of Montreal, and no doubt, continued research will extend the list. Our knowledge of the life history of many species is yet very limited, many interesting problems regarding their migration, nesting and distribution being yet unsolved.

I observed last summer, a remarkable instance, showing how birds of a naturally shy and retiring disposition, will, even under most adverse circumstances, cling to a place suited to their habits. Just east of the village of Côte St. Paul and close to the public road and the Lachine Canal, there is a large pond, partly surrounded by a thick fringe of water flags and other aquatic plants. During the summer months the rattle of carts and blowing of steamboat whistles is almost incessant upon one side, while on the other a gun club has its quarters, and on Saturdays at least, keeps up a constant fire, the shot frequently striking the water with a sharp splash.

Passing by this pond on the 24th of last May, I was surprised to see several red-winged black birds, *Agelaius phœniceus*, rise from the reeds and circle around, uttering cries of alarm. This habit of flying up from the cover when alarmed, probably prevented their raising a brood, as on visiting the place a little later in the season, none were observed. I was pleased to find here a bird I had not previously met with, the Long-billed marsh wren, *Cistothorus palustris*, numbers of which were singing in the reeds, their harsh, guttural notes making the place quite lively. Owing to their habit of hiding in the reeds, just above the surface of the water, only showing themselves for an instant, I failed to secure specimens, which I particularly wished to

do, as the species is not represented in our collections. Indeed I have not seen it on any Montreal list, although I believe it has been observed on Nun's Island by Mr. Dunlop. Quite a number of rails were heard and seen in the pond, one of which was secured and proved to be the Virginia Rail, *Rallus Virginianus*. As both these species frequented the pond until the summer was well advanced, they no doubt, reared at least one brood, their hiding habits enabling them to escape the dangers by which they were surrounded, while the blackbirds, not availing themselves of this protection, were, early in the season, either killed or driven away.

The important question of the food habits of birds, and their influence upon the insect world, has not yet received the attention which it deserves; and with the exception of the few who have investigated the matter, the general opinion is, I think, that birds are, with very few exceptions, highly beneficial, and that insects are, with equally few exceptions, exceedingly injurious, or in other words, that if the birds did not eat the insects and thus reduce their numbers, they would multiply to such an extent as to entirely destroy all vegetation.

While freely admitting the charm which the beauty and melody of the birds gives to the summer, and fully endorsing the laws enacted for their protection, I incline to the opinion that their practical value has been over-estimated.

It is obvious to any one who has given the subject a little attention that there are some kinds of insects that birds do not care to eat, for example, the hairy caterpillars, prominent amongst which are the Tent caterpillars, *Clisiocampa Americana*, and *C. Silvatica*. These troublesome insects are more or less common every summer, and during some years become excessively numerous. When first hatched they conceal themselves beneath a web, but when about half-grown, scatter over the trees, and may be seen resting in groups on the trunks and larger limbs. I have seen thousands thus exposed, but have never seen a bird eat one, or indeed notice them in any way. I have, however, on two

occasions observed a large species of ground beetle, *Calosoma frigidum*, killing them, seizing a caterpillar in its powerful jaws and shaking it just as a terrier does a rat. Professor Saunders, in his Presidential address to the Entomological Society of Ontario, for 1880, speaking on this subject, says: "When the cut worms were so common with us, this spring, that any bird, with very little effort, might have its fill of them, the contents of a number of stomachs were examined, especially those of the robin, and not a single specimen of this larvæ was found in any of them. It has been urged that some birds devour the larvæ of the plum curculio, by picking them out of the fallen fruit, but I have failed to find any confirmation of this statement, indeed never found a curculio larvæ in the stomach of any bird, excepting once in that of a robin, who had evidently swallowed it by accident when bolting a whole cherry.

As for the robin having any claims upon the sympathies of man for the good he does, I fear that but a very slight case can be made out in his favour. Of fruit he is a thief of the very worst kind, stealing early and late, from the time of strawberries until the last grapes are gathered, not content to eat entirely the fruit he attacks, but biting a piece out here and there from the finest specimens, and thus destroying a far greater quantity than would suffice to fill him to his utmost capacity. At the time of writing, flocks of the most pertinacious specimens are destroying the best of my grapes, while alongside is a patch of cabbages almost eaten up with the larvæ of the cabbage butterfly, nice, fat, smooth grubs, easily swallowed, but no such thing will Mr. Robin look at as long as good fruit can be had."

I have myself, during the past year and up to the present, so far as my opportunities would permit, examined the stomachs of birds, with the following results:—

1888.

May 14th—Baltimore Oriole. *Icterus galbula*. Ground beetles belonging to the genera *Platynus* and *Pterostichus*.

These are predacious insects, and are classed as beneficial.

Of three summer warblers obtained on the same date, the stomach of one contained specimens of *Syneta triplax*, a leaf-eating beetle, and although not sufficiently numerous to do much harm, is certainly to be classed as injurious. The second had been eating a species of *Paria*, also injurious. The third contained some triplax, same as first, also some of a species of *Aphodius*, a beetle living in cattle droppings, and may be set down as neutral.

May 19th—Scarlet Tanager, *Piranga erythromelas.* May beetle, *Lachnosterna fusca.*

This injurious insect was very abundant last season, many birds eating it.

May 21st—Baltimore Oriole, *Icterus galbula.* Predacious ground beetles, belonging to *Platynus* and *Pterostichus.*

May 22nd—Purple Grackle. *Quiscalus aeneus.* *Platynus*, *Pterostichus*, one Elater and *Lachnosterna fusca*, four species.

Two injurious, and two beneficial.

May 24th—Baltimore oriole, *Icterus galbula.* *Lachnosterna fusca.*

A second specimen had eaten an hymenopterous insect, but it was too much broken to be determined.

Red-eyed Fly-catcher. *Verio olivaceus.* Some species of bug, *Hemiptera.* Blue bird. *Sialis Sialis.* *Lachnosterna fusca*, swallowed entire, wing-cases, legs and all, an immense mouthful for a small bird.

Bobolink, *Dolichonyx orizivorus.* Wheat and a few small *Carabidae.*

May 25th—Cat-bird. *Galeoscoptes Carolinensis.* May beetle, *Lachnosterna fusca.*

May 28th—Purple Grackle. *Quiscalus aeneus.* May beetle, *Lachnosterna fusca.*

June 9th—Tyrant Fly-catcher. *Tyrannus Tyrannus. Aphodius* fossor. Ichneumon, too much broken for determination.

Some blue jays, *Cyanocitta cristata*, obtained in the fall, had been feeding on beech-mast, one specimen having swallowed no less than ten of these sharp-pointed nuts.

1889.

March 9th—Blue bird, *Sialis Sialis. Carabidæ*, and one Lepidopterous larvæ.

March 16th—Blue bird. *Sialis Sialis.* Sumach seed, an Orthopteron, *Tetigidea polymorpha*, and one *Lepidopterous* larvæ.

April 5th—White rumped Shrike. *Lanius ludovicianus excubitorides.* Caribidæ.

April 6th—Northern Shrike. *Lanius borealis.* Carabidæ.

April 19th—Cow-bunting. *Molothrus ater.* Dung beetles. *Aphodius.* Varied wood-pecker. *Sphyrapicus varius.* Small carabidæ.

Golden-winged wood-pecker. *Colaptes auratus, Ants. Formica.*

These notes, although by no means as full as I would wish, are sufficient, I think, to show that the birds did not confine themselves to any particular kind of insect, but took what they happened to meet with, and would, therefore, be as likely to destroy the useful species as those that are injurious, and this objection, I think, applies to all animals that eat insects, such as toads and frogs, and many of the smaller mammals. All of these take the good and bad together, and can only be useful in so far as they may be a check on the whole race of insects.

The true check upon injurious insects is the host of parasitic species with which the larvæ of nearly all butterflies and moths and many other noxious species are infested.

Let us take two well-known species as illustrations:

The Cabbage Butterfly, *Pieris Rapae*, was by some means brought to this country from Europe some twenty-five or thirty years ago, and as its principle food plant was plentiful, and the summer long and warm, it soon became excessively abundant.. Of late years, however, its numbers have been greatly reduced by a small hymenopterous insect, *Pteromalus puparum*. which, piercing the caterpillar with its ovipositor, deposits a number of eggs in its body. The caterpillar thus attacked, continues to feed, and in due time changes to a chrysalis, but never reaches the perfect or butterfly state. The parasites now finish their work, and transforming within the chrysalis, cut their way out, to destroy in their turn another brood of caterpillars.

The May beetle is another instance. The larva of this insect passes its preparatory stages in the earth where it feeds on the roots of grasses and other plants, never appearing above ground until it emerges as a beetle, but even this concealment does not save it from its enemy, a large black ichneumon fly, *Typhia inorata*, which, by some wonderful instinct finds it and deposits an egg in it, after which its death is only a question of time. The thoroughness of the work done by the parasitic insects is no doubt largely owing to the fact that as a rule they restrict their attacks to a single species, or to species belonging to the same genus. Moreover, the life of the perfect insect is generally brief and almost entirely occupied in providing for the continuance of the species, hence these parasitic insects are constantly occupied in searching for the particular kind of larvæ to which their instinct teaches them to commit their eggs. The bird might eat the caterpillar if it came in its way, the parasite must find and destroy it, or fail to accomplish the chief end of its existence. But the question may be asked, how is it that with this army of parasitic insects to help us, we are ever troubled by injurious species? Well, Nature's plan is not to exterminate any species, but to keep all within proper bounds, we, however, are continually violating her laws, covering acres of ground with wheat, cotton, or some other crop to the entire exclusion of all

others. Nature, protesting against this, multiplies the insects that feed upon it, and when these in their turn become too numerous, the parasitic species come. We cannot however always afford to wait until these get the mastery, as their work though sure, is often slow, and so we have to battle with the bugs for our potatoes, and with paris green murder both friend and foe.

In a circular on the protection of North American birds, issued by the American Ornithologists' Union, the following statement is made: "With the decrease of birds at any point, is noted an increase of insects, especially of kinds injurious to agriculture. The relation of birds to agriculture has been studied as yet but imperfectly, but results could be cited which go far to substantiate the above statement of their general utility."

I have seen similar statements in other publications, and also, some to the effect that when the birds were again allowed to increase, the insects decreased in a corresponding degree. These views may be perfectly correct, and are certainly very generally held. I have, however, so far failed to find anything showing that they are the result of careful investigation, and it is worthy of notice in this connection, that many kinds of insects do at times suddenly increase to an enormous extent, and just as quickly die off again, apart altogether from any unusual increase or decrease in the numbers of the birds. In 1884, the clover fields in the Ottawa district were seriously injured by a caterpillar which suddenly appeared in immense numbers, it proved to be the larvæ of *Agrotis fenica*, a moth which had previously been quite a rarity, and probably unknown, except to entomologists. When almost full-grown they were attacked by a fungoid disease which quickly destroyed them, but very few producing the moth, nor have they since occurred in such unusual numbers.

In 1881, the pasture fields of Northern New York were attacked by an immense army of caterpillars, entire fields being laid waste in ten or twelve days, and in some places they were so numerous that they could have been scooped

up by the handful. The insect, when it reached maturity, proved to be a small Grass moth, *Crambus vulgivagellus*, well known to entomologists, but had not before been observed to be at all injurious.

The same insect was quite common at Montreal during that season, but I have not since observed it.

A word in conclusion regarding the European sparrow *Passer domesticus*, introduced to America, I believe, with the expectation of its proving a check upon injurious insects. It is now conceded by almost all our leading American ornithologists that the experiment has been a failure, and the serious charge is made, that, owing to its noisy and quarrelsome habits, it drives away our native birds. Nothing that is eatable seems to come amiss to the sparrow, although its favourite food is grain of all kinds, as its robust form and strong beak indicate. In the town its principal food is the partially digested oats which it finds in the horse droppings, and this with the addition of crumbs and odd scraps is its only food during the winter months. During the summer it no doubt eats insects. These are, however, mostly the smaller dung-beetles, *Aphodii*, which it finds about cattle droppings and in the roads. It probably does eat a few caterpillars, but is just as likely to destroy a parasitized larva as a healthy specimen.

They are expert spider-catchers, hovering in front of the webs and picking them out with great dexterity, but I have no reason to think that they destroy many injurious insects. I have watched them scolding and fighting in a garden where that pest to the fruit-grower, the currant saw-fly, *Nematus ventricosus*, was to be seen in scores about the bushes, but so far as I could see, they did not take the slightest notice of them. Last summer, the conspicuous black and white caterpillars of the hickory Tussock moth, *Helesidota caryæ*, were very plentiful on Montreal mountain, but so far as I could learn were not touched by the sparrows.

Later in the season I saw a flock busily engaged in a field

of oats at Côte St. Paul, and judging by their numbers they must have done considerable damage.

Before the advent of the sparrow, the tree, or white-bellied swallow, *Tachycineta bicolor*, was common in the city, nesting in boxes put up for their benefit. Now, when they arrive in spring, they find the sparrows in possession of the boxes, and are forced to return to their original habit of nesting in holes in trees. A few years ago a large colony of cliff swallows, *Petrochelidon lunifrons*, nested beneath the eaves of a farmhouse at Côte St. Luc, but I learn that the sparrows have ejected these also, and they probably harass and annoy the yellow warblers and song sparrows, which certainly are not nearly so frequently heard within the city as in former years.

On a Species of Goniograptus from the Levis Formation, Levis, Quebec.[1]

By Henry M. Ami, M.A., F.G.S. (London and America).

In Vol. XVIII of the Annals and Magazine of Natural History, 1876, p. 128 *et seq.*, Prof. F. McCoy recorded the discovery of a "new Victorian graptolite" from "the black and red slates of the Llandeilo flags age of the Bendigo goldfield, Sandhurst, Victoria, Australia."

In this communication Prof. McCoy describes and figures this new graptolite under the name of *Didymograpsus Thureani* and concludes by proposing the genus "Goniograptus," which as he says: "might be suggested for such types as the present, in which the branches of the funicle (for which I would suggest the name stolons) are angularly bent at the points of budding into the celluliferous stems."

One year later, the same author described and figured more elaborately the same species in Decade V, of the "Geological Survey of Victoria"—Prodromus of the Palæontology of Victoria, pp. 39 and 40 where the species

[1] Published by permission of the Director of the Geological Survey of Canada.

is referred to *Graptotites* (*Didymograpsus*) *Thureani* (McCoy) with the same note and suggestion regarding the genus Goniograptus as given above.

In vol. III, section 5, of the Annals and Magazine of Natural History, Prof. Charles Lapworth recognises the validity of the genus *Goniograptus*, and refers the Victorian form to that genus, viz.: Goniograptus Thureani, McCoy; (see "the Geological distribution of the Rhabdophora" p. 80) in the table shewing the vertical range of British Rhabdophora.

The following is the description given of *Goniograptus Thureani*, by Prof. McCoy.

"DESCRIPTION.—Radicle conical, minute, in the middle of a short straight funicle, one and a half lines long, which bifurcates equally at each end, giving rise to four equal main branches or stolons of the complete polypidom; each branch about one inch long, bent regularly in zigzag angles of about 135° alternately giving off at intervals of about one line, on both sides from the salient angles, the regular, straight, simple stems, five or six in number on each side, and about one inch in length (more or less, as they are nearer the base or the apex), each with a row of broad acutely angular cell-denticles, seven in the space of three lines; the upper edge of each cell slightly convex, and nearly at right angles with the back; and rather longer than the undivided portion, the lower edge two-thirds uncovered by the next cell, and making an angle of about 45° with the back; from the point of one cell to the next about equal to the width from the same point to the back. The whole polypidom, of about forty stems forms a slightly quadrate circle or rounded square about two inches in diameter."

In 1886, Mr. T. C. Weston of the Canadian Geological Survey, obtained the first American example of the typical genus *Goniograptus* from the black graptolitic and linguliferous beds, in the cutting on the Intercolonial Railway, 1560 paces below the Lower Levis and Quebec Ferry, Levis, Quebec. This specimen measures about seven inches

diagonally across the flattened and expanded polypary from tip to tip, and is presented on a slab of shale nearly five inches square.

The affinity and close relationship of this Canadian *Goniograptus* to the Australian one was noticed at a glance, and as the individual was comparatively large, and presented other characters (the disc, &c.) not seen nor described in the Australian form, it was at first doubtfully referred to Prof. McCoy's species *Goniograptus Thureani* and probably new.

In 1887, Dr. Selwyn, accompanied by Messrs. Weston and Lambe of the Canadian Survey, examined numerous graptolitic and other fossiliferous localities along the south shore of the St. Lawrence, and in the collections made by the two last named gentlemen were found three additional specimens of the genus *Goniograptus* from the same locality.

All of these are evidently referable to the same genus and species, although three of them have a disc preserved which is developed around and clasps the funicle as well as the non-celluliferous branches or stolons, from the sicula or initial point of the polypary to the base of the last bifurcation of the last branch or stolon into the celluliferous stipe.

When compared with the admirable figures and description given by Prof. McCoy of its Australian congener, the American form is found to be so nearly identical and clearly co-specific that it is not deemed advisable to give it a new specific designation. The presence of a disc around the funicle and the pterate, or winged margin along both sides of the non-celluliferous branches, the large number of stipes originating at the goniate portion of the polypary are the main points of distinction, between these two geographically remote representatives of the species.

The disc and winged margin, however, are characters of generic importance, whilst the number of celluliferous branches originating at the angles of the non-celluliferous branches or extremity of the stolons are merely characters of age and size of specific value.

Both the Australian and the American specimens clearly belong to the family of the *Dichograptidæ*, which rank as the "earliest siculate graptotites" known. They belong to section "*b*" of Prof. Capworth's "Analytical table of the genera of graptotites" under "Fam. III" (see Geol. Mag. 1873, vol. X, table I), where the polypary is described as compound, and where the major extremity of the sicula gives origin to a funicle, falling under division "II," where the funicle is said to be "once divided giving origin to four main polypiferous branches which form the complete polypary." Then the genus *Goniograptus* naturally comes in this sub-division, from the manner in which its simple celluliferous branches are disposed, would fall under a new generic head between "I" and "II," or between genera Nos. 16 and 17 of the "table of genera, &c.," as the "four main polypiferous branches" "form the complete polypary" by giving off simple celluliferous branches from both margins, giving four generic heads under division II, as follows:—

I By continued dichosomous sub-divisions.

II By giving off simple branches from one margin only.

III By giving off simple branches from both margins at regular intervals.

IV By giving off compound branches from both margins.

The following are amongst the most salient characters: Dimensions are taken from the American form: Sp. No. 1—Collected by Mr. Weston in 1886 at Levis, Quebec.

Length of the *funicle*: .125 inch.

Diameter of *disc*, in the direction of the funicle: .125 inch.

Breadth of *margin of disc*, from extremity of the funicle to the outer edge or margin: .0625 inch.

Diameter of *disc*, in the direction at right angles to the funicle: .1 inch.

Disc with outer margin, concave and produced along the non-celluliferous branches or stolons, clasping them, forming a winged or alate margin which gradually diminishes in breadth from the disc proper, towards the distal extremity of the branches.

One other specimen is quite free from, or destitute of a disc—the stolons and funicle being quite naked. The *funicle* is straight and narrowly cylindrical, forked at each extremity, each fork making an angle of 135°—a right angle and a half. The *four* branches or stolons thus produced, give rise to the four zigzag or goniate arms of the polypary by a continued process of gemmation and bifurcation at regular intervals. The angles formed by the zigzag or goniate stolons become more obtuse as the distal extremity of the polypary is reached, where they form a nearly right line.

At each one of the re-entrant angles, there arises one simple celluliferous stipe of greater or less length, according to the size and age of the polypary, and according to the proximity to, or distance from the funicle. These fossiliferous stipes are disposed in alternating manner on each side of the arm, and making right angles one set with the other. In the specimen under examination, these celluliferous stipes vary from a little over *one* inch in length, at the distal extremity of the arm, to more than *three* inches near the proximal end of the same.

The *arm* itself is a little in excess of *two* inches in length, and all *four* are sub equal, disposed regularly and symmetrically so as to form a large + shaped figure, or cross with equal (sub-equal) arms, but bearing celluliferous stipes in such a manner that they form two similar series of parallel lines occupying two vertically or diagonally opposite areas.

The angles which these celluliferous stipes make with the general direction of the arm is generally 450°, but in most of the examples the angle diminishes gradually towards the distal extremity where they make an angle of 10° only. The most perfect arm contains *twenty-one* celluliferous stipes, *ten* on one side and *eleven* on the other side of the arm. The arm, diagonally opposite, exhibits *nine* celluliferous stipes on each side: *eighteen* in all.

The third arm whose apex is twisted and somewhat crushed holds *seventeen* arms; *eight* on one side and *nine* on the other. This arm is somewhat shorter than the two preceding, whilst these first three are complete.

The fourth and last arm is broken, and exhibits only six celluliferous stipes on one side, and five on the other.

The whole polypary, about seven inches across, thus consists of *sixty-seven* celluliferous stipes, as preserved, which number would no doubt have been increased to about *eighty*, had the polypary been perfect. This number is greatly in excess of that obtained in the Australian specimens, just double.

The *thecæ* are acutely pointed and triangular, and number from 30 to 32 in the space of one inch. They are inclined at an angle of from 30° to 50° to the axis of the stipe, this variation being probably due to the mode of preservation of the specimen. Only here and there is there a short row of thecæ visible in this fine specimen, the branches having been crushed in a direction opposite to and so as to hide the cell apertures and thecæ.

As in Prof. McCoy's species, the Canadian example "forms a slightly quadrate circle or rounded square" with a diameter of nearly seven inches (about eight inches when perfect).

The presence of a *disc* or membrane clasping the sicula, funicle, &c., also extending upwards and outwards along the arms has already been noted, which feature was not preserved in the Australian specimens, which absence is evidently due to the mode of preservation and fossilization rather than to the mode of growth of the polypary.

Of the disc-bearing graptolites known to the writer, we have the following:—*Loganograptus Logani*, Hall; *L. Kjrulfi*, Brögger; *Dichograptus octobrachiatus*, Hall; *Tetragraptus Headi*, Hall; *T. alatus*, Hall; *T. crucifer*, Hall; and *Climacograptus bicornis*, Hall. This disc which acted both as support and float in the genus *Goniograptus*, as well as in the other species just enumerated, would act also as a more or less rigid membrane in keeping the celluliferous stipes from entangling—causing them to lie more or less evenly in one place. On *Climacograptus bicornis*, this use of the disc is not so evident.

When compared together, the Australian and American

representatives of the genus Goniograptus appear to be very nearly co-specific, and so identical are they, especially in their early or young stage, that it is not thought that a new specific designation is required. Should later investigations and the finding of additional material, both in Australia and Canada yield new facts, separating these widely separated forms (geographically speaking), other than those noted above—then I would suggest the varietal or specific designation *Goniograptus Selwyni* to include such forms as are included in the above description of the forms, merely adding that I have much pleasure in coupling Dr. Selwyn's name with this interesting species, from the fact that to him "must be awarded the merit of finding the first graptotite (1856) which determined the age of the gold-reef-bearing slates of Victoria." (See preface of Decade II, Pal. Victoria, 1875, p. 5).

Locality and *Formation*: Fifteen hundred and sixty paces East of Lower Levis—Quebec ferry, in the black shales of the "Tetragraptus zone" met these in the I.C.R cutting, Levis, Quebec.

Levis Formation (Cambro-Silurian or Ordovician) Collectors: Messrs. J. C. Weston and L. M. Lambe, 1886 and 1887.

Note.—The affinities of this species with the forms described by Prof. Hall as *Graptolithus Richardsoni*, and *G. ramulus* are apparent, but the compound nature of the branching celluliferous stipes readily differentiate them.

The figures (figs. 4 and 4a) of Decade I, Pal. Victoria—appear to answer well to Hall's *G. ramulus* which would evidently fall under some new generic designation whilst Prof. Hall's specific name would include both forms. The remarkable identity of species occurring at localities so widely remote, geographically speaking, is pecularly noteworthy, Dr. Selwyn having collected many species precisely identical with Canadian forms.

On Fossil Sponges from Beds of the Quebec Group of Sir William Logan, at Little Metis.[1]

By Sir J. W. Dawson, LL,D., F.R.S.

(*Abstract.*)

The discovery of these sponges was made by Dr. B. J. Harrington in 1887, and as it was obviously of much interest, was followed up by further exploration in the beds containing the fossils.

A preliminary note on the specimens was published in the "Notes on Specimens" of the Peter Redpath Museum last winter, and in the past session more thorough exploration of the beds was made by the employment of labourers to open up the more fertile layers. In this way a large amount of additional material was obtained, which has been carefully studied, and the more important specimens submitted to Dr. G. J. Hinde, the author of the British Museum Catalogue of Fossil Sponges.

The present paper gives a detailed account of the containing beds, with a map and sections, and describes the species found, which are about eleven in number, all siliceous sponges, and most of them Hexactinelid. Of these six belong to the genus *Protospongia*, one to the genus *Cyathospongia*, and five others belong to new genera which are described in the paper. There are remains indicating other species, but too imperfect for certain determination. The whole of these forms occur in two layers of black and gray shale only a few inches in thickness, in beds for the most part destitute of fossils. The specimens are all flattened and the spicules are in most cases pyritised.

The beds appear to belong to the Levis division, and contain with the sponges a brachiopod of the genus *Linnarssonia* and of fucoid, *Buthotrephis pergracilis*. In beds of sandstone associated with shales are the Graptolites of the genus *Retiolites*, probably *Rensiformis* of Hall.

[1] Read before the Royal Society of Canada, May, 1889.

The occurrence of so many species of siliceous sponges in great abundance in these beds is a new and interesting fact, and indicates that at certain times the floor of the Siluro-cambrian sea has been amply stocked with organisms of this kind, scattered spicules of which abound in layers in which specimens retaining their form have not been found.

The paper will be illustrated with photographs and figures of the species.

New Fossil Plants from the North West.

By the same Author.

This paper is a continuation of those by the same author in previous volumes of the Transactions of the Society. It relates to an interesting collection made by Mr. R. C. McConnell, B. A., of the Geological Survey of Canada, on the McKenzie River, and to specimens obtained by Mr. T. C. Weston, of the same survey on the Bow River. The species all belong to the horizon of the Upper Laramie, and serve to show the similarity of the flora of this series in the McKenzie and Bow Districts with that of other parts of the N. W. Territories, of the western parts of the United States, of the Hebrides, of Alaska, Spitzbergen and Greenland. The paper notices more especially the previous publications of Heer, on the McKenzie flora, the additional species obtained by Mr. McConnell, the geographical distribution of these species, and their Lower Eocene facies.

Notes on Erian (Devonian) Plants.

By D. P. Penhallow.

(*Abstract.*)

The Paper read under the above title gives a continuation of Studies on *Nematophyton*, which were presented to the Royal Society at its meeting in 1888. The author gives a few additional observations upon the principal species (*N.*

Logani), all of which confirm his previous results. More special attention is given to *N. Hicksii* and to three other plants previously described under the name of *Nematoxyten crassum*, Dn., *Nemotoxyten tenne*, Dn., and *Cellutoxyten primævum*, Dn., but all of which are here referred to the genus *Nematophyton*, thus making the whole number of probable species belonging to this genus of ancient Algæ, five.

The facts stated with reference to *N. Hicksii* add nothing to what had been observed by others. The material is wholly in fragments and the structure is represented only by siliceous coats of the cells.

Nematoxyten crassum is shown to present the same general structural features—museptate, tubular cells branching into a secondary system of intercellular filaments, as the species of *Nematophyton* previously described. *Nematophyton tenne* shows cells of a tubular character, but of very alternated size, without any well marked intercellular filaments, and in its general structure approaching more nearly to the hyphal structure of *Nematophyton laxum*.

Cellutoxyten primævum is shown to be a highly altered form of *Nematophyton*, the alteration having been effected through crystallization of silica and consequent redistribution of the highly decayed organic matter; the result being the formation of an ill-defined cellular structure. Comparison is made with well authenticated specimens of *N. Logani*, in which the same section, embracing variously altered structure, shows in one part normal cells, and in another part a false cellular tissue precisely similar to that of *N. primævum*. This latter is therefore referred, on geographical grounds as well as of probable structure, to *N. crassum*.

The Paper is illustrated by several photo-micrographs, showing the structure of the various species described.

The author also drew attention to further examinations of the laminated fossil described in his communication of last year, and also to a certain resin-like material occurring abundantly in the Gaspé Sandstones and always associated with *Nematophyton*. That the laminated fossil represents

fragments of the fronds from *Nematophyton* is a view that has received much strength from the more recent investigations, although in the absence of definite data connecting the line, must be regarded as largely hypothetical. The resin-like substance occurs in thin flakes, and is shown to be in many cases composed of a substance which presents many of the peculiarities belonging to the laminated fossil, of which it may be a more highly altered form. Attention was drawn to the desirability of a more careful examination of the beds of Gaspé Basin, with a view to collecting more representative specimens of these fossils than have yet been submitted to examination.

Annual Field Day.

Saturday morning, June 8th, 1889, at 9.15, a special train left the Dalhousie depot, containing a large number of members and friends of the Natural History Society, who that day celebrated their annual picnic at St. Eustache. Among those who were present were: Sir J. W. Dawson, president; John S. Shearer, vice-president; Prof. Penhallow, Dr. Blackader, Messrs. J. H. R. Molson, Albert Holden, J. S. Brown, C. Gibb, Graham, Dunlop, Hollis Shorey, F. B. Benjamin, J. A. Robertson, W. D. Lighthall, Mrs. Molson, Miss Dawson, Miss Hill, Mrs. Holden, Miss Mercier, Mrs Garth, Misses Morgan, Miss Van Horne and others. The visit of the society's members had evidently been looked forward to with a great deal of pleasure by the inhabitants of St. Eustache. The village was decorated with flags and bunting, and huge streamers were stretched across the streets bearing the words: "Honour to Science," "Be they welcome," "Welcome Natural History Society," etc. On the arrival of the train the depot was crowded with villagers to welcome the visitors. Mayor Paquin and J. D. Daoust, M. P., made short speeches in which they expressed their pleasure at seeing so large a number of Montrealers paying their village a visit. Waggons and carriages were waiting to convey the visitors to the different points of interest. Three classes were

arranged as follows: Botany, in charge of Prof. Penhallow; Geology, Sir J. W. Dawson; Entomology, Mr. Caulfield. Each class was driven to its respective points of interest in the suburbs of the village, where they spent several hours in search of specimens of their various hobbies.

To those whose tastes are less scientific, St. Eustache is a very attractive place, as being the site of the old struggle for autonomy in 1837. And the Natural History Society has done well in inviting those societies which are interested in the history of Canada in its various phases to accompany them in their visit to such an historic place. The ancient church still bears signs of the fight of 1837, and like a veteran warrior, still shows the scars of combat. The old cemetery which formerly lay under the shadow of the church has been done away with, but otherwise the scene of the struggle has been little altered, and the twin towers to-day look down upon the excursionists as they did upon the fierce fight that raged there half a century ago. Inside, one sees the chancel window from which Dr. Chenier and his two companions jumped when the church was burning all over, and the only chance for life was to escape from the burning building. In the churchyard outside, Dr. Chenier died, gallantly fighting to the last, and from there his body was taken to Addison's Hotel, then known as the Bull, which still stands in all its original simplicity and which was then used as a hospital for the wounded. Among the participants in the fight was Captain Marryat, who achieved greater fame as a novelist than as a soldier, and who described the battle of St. Eustache for his English readers. The old seignioral mansion then owned by Mr. Dumont, now by the De Bellefeuille family, stands in very much the same condition as when Colonel Wetherall ordered the troops to clear it of the rebels who were using it as a fortress or rifle pit. The old Globensky House also still retains a good deal of its primitive simplicity. Almost opposite the station is a very old house, the date stone on its walls showing it to have weathered the storms of a century.

Although the village has some touch of interest in its past

history, it by no means depends upon its past to-day, but it is a live, thriving place, and on the point of cleanliness is a brilliant exception to the usual run of villages in this province. The streets are lined with trees, not branches ruthlessly stuck in for a temporary *fête* but actually planted to beautify the village. The old houses supply antiquity, but the smart brick stores offer a type of modern civilization, and business has been of such a satisfactory nature that until last winter there had not been a failure for about a dozen years.

About 2 o'clock those who, as Mr. J. S. Brown put it, were fortunate enough not to bring baskets, partook of an excellent dinner at Goulet's Hotel.

At four o'clock a meeting was held at the station, under the chairmanship of Mr. John S. Shearer. Addresses were delivered by Sir J. W. Dawson, Prof. Penhallow, and Mr. J. S. Brown.

Sir J. W. Dawson, on behalf of the "knights of the hammer," announced that the local formation is calciferous sandstone or lower silurian. It contains few fossils, the characteristic one being the Murchisonia Anna, so named by Billings, at Dr. Dawson's suggestion, because first found at our own St. Anne's, near Montreal. On the High street were two large stones of trap dyke. The inside of them having been softer than the outside, it had been so hollowed out by the weather as to form small drinking troughs. A large deposit of a variety of kaolin is found near St. Eustache. Attempts are being made to utilise it for paint, and this visit of the society to St. Eustache may result in its being used for pottery, as Dr. Dawson pronounces it "a most remarkable earth." The Botanical prize was awarded to Dr. E. Blackader, for a collection of 34 species of plants in blossom.

Votes of thanks were tendered to the Mayor, Mr. Daoust, and the villagers in general for their handsome treatment and entertainment of the visitors. In reply to this Mr. Daoust said that they needed no thanks. They were well repaid by the fact that the society had deigned to pay them

a visit, and he could only thank them and give them a hearty invitation to return. Cheers for the Village Council, the villagers and the Queen were given, and the train moved away from St. Eustache station arriving in Montreal at 6.30. The trip was a most enjoyable one and will be remembered with pleasure by those who attended.

Proceedings of the Natural History Society.

The seventh monthly meeting of the Society was held on the evening of Monday, April 29th, at 8 o'clock, Sir J. W. Dawson in the Chair.

After reading the minutes of the previous meeting, the Rev. Dr. Campbell was appointed a delegate to the meeting of the Royal Society of Canada. The Librarian reported the usual exchanges.

The following donations were received from Mr. F. B. Caulfield:

Two Prairie Horned Larks.
One Cedar Waxwing.
Two specimens of Spotted Proteus.

From Mr. J. H. R. Molson:

Two Stalactites from Bermuda.

The thanks of the Society were tendered the donors.

Dr. B. J. Harrington presented a paper entitled, "Notes on Bibliography of Canadian Mineralogy," and "On the Number of Mining Species known to occur in Canada."

Mr. F. B. Caulfield also presented a paper entitled, "Notes on some Birds observed at Montreal."

The thanks of the Society were tendered for the above papers, which were ordered to be printed.

Annual Meeting.

The annual meeting of the Society was held on Monday, May 27th, at 8 o'clock, the President, Sir J. W. Dawson, in the Chair. There were present:

Mr. J. S. Shearer, Mr. C. Gibb, Prof. Penhallow, Dr. T.

W. Mills, A. H. Holden, P. S. Ross, J. A. U. Beaudry, Dr. Campbell, J. S. Brown, E. T. Chambers, Geo. Sumner, H. T. Martin, Jas. Gardner, Dr. Stirling, Dr. Ruttan, J. H. R. Molson, J. H. Joseph, Rev. Dr. Campbell, F. B. Caulfield, Dr. J. B. Edwards.

The President's Address.

Gentlemen,—We have, I think, good reason to congratulate ourselves at the end of the session just closed that this oldest of Canadian scientific societies shows no sign of senility but rather of new life and energy. The improvements made in our building, museum and library, through the care and activity of the council, the house committee, the honorary curator, Mr. Stevenson Brown, and the librarian, Mr. Chambers, the additions to our list of members, the eminent specialists whose services were secured for the Sommerville course of lectures, the importance of that course with reference to the industrial interests of the province, the valuable papers read at our monthly meetings and published in our journal, the admirable excursions to Montebello and Abbotsford, so well planned and carried out through the kindness of our friends, Mr. Papineau and Mr. Gibb, the successful and brilliant Conversazione in which we were honored with the presence of their Excellencies Lord and Lady Stanley of Preston, are among the features of a most useful and prosperous year. They are noticed in other reports to be presented this evening, and it falls to me in this address rather to direct your attention to the more strictly scientific portions of our work, and more especially to the papers read before the Society and published in the *Record of Science*, and which may be considered, so far as they extend, as steps in advance in Canadian science. They were summarized by our delegate, the Rev. Dr. Campbell, at the recent meeting of the Royal Society in Ottawa, but they deserve a little more detailed notice here.

According to the list, kindly prepared for me by the Recording Secretary, Mr. Holden, twenty original papers

were read at our meetings and accepted for publication. Of these, the majority, thirteen in all, were on geological subjects, including mineralogy and palæontology, four were botanical and three on zoology and animal physiology. Of the geological papers, those by Dr. Harrington, Mr. Tyrrell and Mr. Adams related to rocks and minerals. By these gentlemen our attention was directed to the important and valuable coal deposits of the Northwest, embracing as we now know, all kinds of mineral fuel from anthracite to lignite, and to the curious and probably valuable deposits of gypsum recently discovered in the Northwest, as well as to the microscopic structure of some Canadian rocks. A new and interesting subject was also opened up by Dr. Harrington's notes on the Bibliography of Canadian mineralogy, which brings before us some of those pioneers of our geology, who at a time when many parts of our country were difficult of access, and when little interest was taken here in such subjects, laboriously laid the foundations of our present magnificent accumulation of geological facts. In reading the memoirs left by these men, one is struck not by the paucity of facts and the difficulty experienced in their explanation, but by the skill and penetration and unwearied industry of the men, and the magnitude and accuracy of their results in comparison with the then crude condition of geological science and the inadequacy of the means at their disposal. In the fossils of the older formations, Mr. Matthews was kind enough to lay before us, in a condensed and clear manner, some of his latest results in the study of those Cambrian rocks of New Brunswick which have yielded so many new discoveries to his skilful and painstaking researches, and I had the pleasure of bringing under your notice some new fossil plants, which seem to throw much light on ancient vegetable forms hitherto greatly disputed. A good piece of local geology relating to a little explored and interesting region, was given us in the paper of Mr. Chambers on the Lake St. John district. In more recent geology the curious modern concretions found by Rev. Prof. Kavanagh near Boucherville helped us to explain those

much larger and older cylindrical bodies of the Potsdam sandstone which have puzzled so many observers. The papers on *Balanus Hameri*, from River Beaudette, and on the varietal forms of the recent *Mya*, compared with those in the Pleistocene, were supplementary to papers formerly published on these subjects, and added to the mass of material furnished by the St. Lawrence Valley in reference to the life of the so-called "Glacial" period. The contribution of Mr. Chalmers I regard as much more important, and as illustrating by a large collection of facts the conclusion that we have to explain the Glacial phenomena of Western Canada not by an imaginary and physically impossible ice sheet, but by local glaciers, aided by floating ice. This view, which I have again and again endeavored to impress on geologists too much addicted in this matter to invoke the aid of portentous and improbable causes, has been amply vindicated by the careful observations of Mr. Chalmers in Eastern Quebec and New Brunswick. We may also place among papers relating to recent geology those of Professor Spencer on the St. Lawrence Basin and the Great Lakes, and of Mr. Drummond on the Lake Basins of the St. Lawrence. Mr. Spencer, one of our younger Canadian geologists, now transferred to an important professorship in the United States, has for many years pursued an elaborate series of observations and measurements on the former levels of the lakes, and more especially as to the evidence of unequal lifting of the lake terraces depending on the warping of the earth's crust in the elevation of the continent. These observations when complete will form very important contributions to the Physical geography as well as geology of North America. Our botanical papers we owe to Prof. Penhallow, Prof. Goodwin and Mr. Ami. That on ringed trees was a curious contribution to vegetable physiology. Another directed our attention to the edible qualities of a fruit not hitherto regarded with much favor, that of *Shepherdia Canadensis*, and the local flora of Montebello was connected with the excursions of the Society to that place, on the kind invitation of Mr. Papineau, and was an illustra-

tion of the varied assemblage of plants which characterizes the junction of the Laurentian and Palæozoic rocks, and the diverse kinds of soil and station which these afford. Our Zoological papers were few, but not unimportant. Dr. Wesley Mills gave us some interesting contributions from the physiological work which he has so successfully pursued, and the observations of Mr. Caulfield on birds observed at Montreal were of much interest, raising among other things the questions of the relations of the imported sparrow to our native birds, the services and misdeeds of the former, and the manner in which it is accommodating itself to the peculiar conditions of our climate. These questions were merely opened up by Mr. Caulfield, and I hope will be followed farther by him in the same earnest and observant manner. One fact to be noted in regard to the services of insectivorous birds, and which is often overlooked, is that the multiplication of certain species of insects which these birds do not relish or cannot easily destroy, is no proof that they do not deliver us from others which, but for their agency, would become equally abundant. Farther, we cannot expect birds to annihilate the species on which they feed, but only to keep down their numbers. The amount of original work implied in these papers may not be large, in comparison with that done by stronger societies abroad; but in so far as it goes, it is so much gained to science, so much of valuable fact and inference obtained and preserved for future use, and marking a perceptible advance in knowledge. On this we may well congratulate ourselves, and take courage for the future, and I would again say here that our friends should remember that any facts or specimens throwing any new light on the geology or natural history of this country will not be despised by us, but are always welcome at our meetings. Every genuine and accurately observed fact in natural history is a gain, often a much greater gain than that which results from mere speculation and generalization, however brilliant.

I have now, in resigning the position of president with which this Society has honored me for a number of times, to

ask that I may be permitted to see it transferred to younger and abler hands. I have arrived at a time of life when it has become necessary to husband my remaining powers, and there are so many unfinished departments of work in connection with the University and with the scientific studies which are dear to me, that I feel it necessary to retire from as many engagements as possible. I also feel that there is much to be done by your president for which I have not the time or strength, and that a new impulse might be given to our work by the selection of a younger man. I shall for my part be ready as formerly to contribute to the Society such results of my studies as may seem likely to be useful and acceptable, and shall be happy to do anything that I can as a private member to promote the interests of the Society. It will be a pleasure to me to lay down my official connection with it at a time when its condition and prospects are so good as at present, and when I hope it has entered on a new career of increasing prosperity and usefulness.

The following reports of Committees were submitted :

Report of the Council.

The Council beg to submit the following report :—

The session which this meeting brings to a close, has been one of much interest in every department.

There have been seven meetings of the Society, and thirteen of the Council, five of which were special, in connection with the Autumn "Field Day," and the "Conversazione."

Thirty-five ordinary and three associate members, have been added to the Society during the year, as against twelve last year.

The Library has received a good deal of attention from Mr. Chambers, the Chairman, and the other members of the Committee, but considerable work has yet to be done by the Committee to be appointed for the coming year.

The Society's building is now in better condition than for many years past. The Council authorized the Hon. Curator,

and the Chairman of the House Committee, to make some changes in the "Aquarium Room," re-arrange to some extent the "Museum," and generally to improve the interior of the building. They had to find the means with which to do this, and have to thank members of the Society, as well as a number of citizens, who kindly contributed to this end, but the work is far from being completed, they recommend their successors in office to follow up what they have begun until the "Museum," and the entire building, be put into first class condition.

We have received during the year for rent of Hall, Library, and Committee Rooms, about $1,200.00, being a large increase over any previous year.

In the Superintendent's report to the Chairman of the House Committee, there is the following memo. :—

Received from Visitors to "Museum," 1887-88.....		$27.00
Do " " " "	1888-89.....	76.90
Increase.....		$49.90

The yearly grant from the Provincial Government, Quebec, of $400.00 was duly received and handed to the treasurer, Mr. P. S. Ross.

The Editing Committee have done their work nobly. The thanks of the Society, are due and tendered to Prof. Penhallow, Dr. Harrington, and the other members.

The Annual "Field Day" was held at Montebello, on the grounds of the Hon. Mr. Papineau. The excursionists left Dalhousie Square Station punctually at 9 a.m. The morning was cloudy and looked like rain, but turned out fine. The train reached Montebello before noon, and was met at the station by a few scientists from Ottawa, amongst them were, Mr. J. F. Whiteaves, Mr. M. Ami, and others. The party proceeded at once to the residence of Mr. Papineau, and were received, and welcomed by him in a few well-chosen words. They were then conducted to his "Museum," full of objects of interest, which were appreciated and admired by all. The excursionists here divided into sections, bent on Geological, Botanical, and Entomological work, while quite a number enjoyed the beauties surrounding the residence of our host.

At 4.30 p.m., the party, by previous arrangement, met in front of the house, when Mr. J. H. R. Molson, proposed a hearty vote of thanks to Mr. Papineau, seconded by Prof. Bovey, to which Mr. Papineau responded, when cheers were given, and the excursionists said good-bye to their kind host, and his lovely grounds.

On arrival at the station, the first business was to decide who were the prize winners. Dr. Harrington, Mr. Whiteaves, and Mr. M. Ami examined the various collections, and named the successful workers in the three departments for named and unnamed specimens. Then bidding "good-bye" to their Ottawa friends, the party boarded the train for home, and found Mr. Burgess in charge of a car decorated with flags and evergreens, when an elegant lunch was provided for the excursionists with the usual kind forethought, and hospitality of the Canadian Pacific Railway. A rapid run brought the party to Dalhousie Square Station at 7 p.m. On the platform a vote of thanks and three rousing cheers were given to the officers of the C. P. R. for their kindness. Home was next in order, and the excursionists separated, all delighted with the day's outing.

Mr. Chas. Gibb, of Abbotsford, tendered an invitation to the Society, for an Autumn "Field Day," which was accepted for September 29th. Some one hundred and twenty (120) excursionists proceeded to Abbotsford by the Canadian Pacific Railway to enjoy Mr. Gibb's hospitality at his lovely residence, and all found a hearty welcome, a splendid lunch was prepared to which the party did ample justice. The large, and beautiful orchards were open for inspection, and enjoyment of the whole party. The trees were loaded with apples of every description, amongst them a variety of Russian apples. Mr. Gibb has also a plantation of ornamental and other trees from amongst which he is endeavouring to find out those best adapted to our Canadian climate. The excursionists divided up into parties, the most numerous led by Sir J. W. Dawson, went to the top of Yamaska Mountain, where a splendid view of the country (although a snow storm intervened) was obtained. Sir J. W. Dawson

delivered an admirable address on the mountain top, upon the Geological features of the vicinity. The Botanical party worked upon the mountain, under the direction of Professor Penhallow. The collections made were principally Geological, the Botanical specimens were not so numerous.

The excursionists met at the house at 3.30 p.m., when addresses were delivered by Sir Wm. Dawson, and Prof. Penhallow. A hearty vote of thanks was tendered to our host for this, another proof of his many kind acts to the "Natural History Society." The party left for the train when Mr. Gibb, with his kind thoughtfulness, had baskets full of his lovely apples waiting them. Good-bye was said and cheers given for Mr. Gibb, and the party started for the city, after a day of pleasure and profit.

The Society decided to hold a "Conversazione" on February the 28th, and invite Lord Stanley (the Patron of the Society) and Lady Stanley to be present. Committees were appointed for each department, and through our President, Sir Wm. Dawson, the Governor General Lord Stanley and Lady Stanley accepted the invitation. The excellent work done by the several committees, and the pressence of Lord and Lady Stanley made the "Conversazione" a complete success. The thanks of the Society are due and hereby tendered to the "Microscopic Society," to the ladies who kindly assisted in decorating the "Museum," and also to the following gentlemen, Mr. J. Stevenson Brown, Prof. Penhallow, Dr. Harrington, Dr. Girdwood, A. Holden, Geo. Sumner, Horace T. Martin, Dr. McConnel, and to Mr. Armstrong for his splendid exhibits from the North West.

The Sommerville course of lectures, six in number, delivered last winter were of a high order, and attracted good audiences. The subjects and names of the lecturers are as follows:—

Feb. 21st—"Agricultural Education." By Sir J. W. Dawson, C.M.G., F.R.S.

March 7th—"Forestry for Canada." By Hon. H. G. Joly De Lotbiniere.

March 14th—"Our Fruits, Past and Present." By CHARLES GIBB, Esq., B.A.

March 21st—"Economic Entomology as a Branch of Agriculture." By JAMES FLETCHER, Esq, F.R.S.C., Dominion Entomologist.

March 28th—"The Food of Plants." By Prof. D. P. PENHALLOW, B.Sc., F.R.S.C.

April 4th—"Sugar-producing Plants." By W T SKAIFE, B.A. Sc.

The Society beg to tender to these gentlemen their thanks for their kindness in coming forward so generously and assisting by delivering those interesting and instructive lectures.

An important feature during the year, was a resolution passed by the Council, to open the "Museum" of the Society, free to the colleges and schools of the city. A circular was issued placing the "Museum" at their disposal every Saturday, which has been duly acknowledged. A large number with their teachers have already taken advantage of the offer.

During the year 1868, this Society required money for a special purpose. A number of citizens came forward and subscribed very liberally, fully supplying the needed funds. Such an example would be well worth imitating at the present time, and would materially assist the Society in the good work it is doing for the Province of Quebec, and we might say for the whole Dominion. About $10,000 is required to put the Sommerville Course of Lectures upon a proper educational basis, and for enabling our scientific workers to prosecute their work thoroughly. This cannot possibly be done without adequate means, and it is to be hoped our citizens will come forward and subscribe liberally to this end.

We cannot close this report without mentioning the careful attention given to the building and its contents by the Superintendent, and the assistance he has rendered to the officers on all occasions.

The "Field Day," this year will be held at St. Eustache, on the 8th of June.

Respectfully submitted,

JOHN S. SHEARER.

Curator's Report, 1888–89.

During the past year numerous changes have been made in the Museum, but it must be understood that, in this *report, reference only is made to what has been* accomplished since the present Curator took office, in October last.

Owing to the insufficiency of light in the Aquarium Room since the building of the Victoria Rifles' Armoury, it was deemed advisable to remove the specimens and convert it into a neat and comfortable Hall to be rented for evening meetings, or to be used by the Society when required.

The fish case, which originally stood at the north end of this room, has been removed to the upper gallery, and its contents have been carefully dusted, cleaned and re-arranged, whilst the long case which stood at the east side has been taken away completely, part of the specimens have been placed in other parts of the Museum, and the balance has been carefully put away until such time as new cases can be provided.

The cabinet of reptiles which also stood in this room, but which had fallen into a state verging upon ruin, has been repaired, and now stands upon a suitable table at the head of the gallery stair.

A considerable amount of time was occupied in re-arranging this cabinet; the specimens, originally preserved in spirits and which had become dried up and useless, were culled out; the bottles and jars containing those yet good have been all washed and the stuffed specimens cleansed with turpentine and varnished where necessary.

The alligator, crocodile and whale have been re-varnished; a new stand has been provided for the old cannon, and the cases in the gallery have all been painted to correspond with those in other parts of the Museum.

Special reference must be made to the gallery of the Museum, which through neglect had been allowed to fall into a deplorable state of dilapidation. Many of the specimens nailed upon the walls were inaccurately named or described, and the majority were without labels, others

again had been seriously damaged through being attached to the walls by large and unsightly nails which, in many cases, had been driven right through the objects. A complete re-organization of this department was found necessary. The specimens were accordingly carefully removed from the walls and laid aside, while the slats upon which they should have hung were repaired, painted and varnished. Small brass hooks have been placed at intervals along these slats and the specimens attached thereto by means of fine copper wire. The specimens were first thoroughly cleaned, then classified according to locality, and afterwards hung in their respective groups. Fresh labels have been written in bold, clear characters and affixed to the various objects, so that each tells its own short history in few words. The work of re-arranging this department has been both irksome and laborious, and occupied very considerable time. In this connection your Curator wishes to testify to the very great assistance rendered him by Mr. Shearer, Mr. Holden, and Mr. Martin, who, at considerable personal sacrifice, devoted between twenty and thirty evenings to this work during the winter, working on several occasions till after midnight. Indeed, had it not been for the untiring energy of these gentlemen much that has been accomplished would remain undone, and the thanks of this Society is certainly due to them for their zeal in these matters.

A large collection of war implements, mats, and other objects of interest from Samoa, presented to the Society some time since, but which had never been unpacked, are now labeled and placed in appropriate positions.

There has been a large increase of visitors to the Museum this year as compared with last, as the following figures show: last year there were admitted 451; this year, 1192.

The expenditure in connection with the various alterations, improvements and repairs referred to in this report has been met from a special fund provided for the purpose by a few friends, and this is probably the first year in the history of the Society in which the Treasurer has not been

called upon to foot the Curator's bills. This fund, however, is now about exhausted, and there remains much work yet to be done. Surely it will not be discounting the future unduly to ask those who may be in charge of these matters in the ensuing year to continue the work already begun, in the hope that ere long some public-spirited citizen will come to their assistance in such a way as to enable them to make the Museum a credit to the Society as well as an honor to the city.

This report would be incomplete did it not specially refer to the assistance rendered by the Superintendent in re-arranging the specimens and in keeping the Museum clean and free from dust, to the civility and attention shown to visitors, and the general interest he has taken in matters connected with the Museum.

The following list comprises the donations to the Museum during the year:—

Coluber eximus (Milk Snake).
Balanus hameri, several specimens.
Astrophyton Agassizzii (Sea Basket).
Tamais striatus. Albino variety. (White Chipmunk.)
Several specimens of Coleoptera, Lepidoptera and Ambulatoria.
Two Stone Gouges and a specimen of Fossil Wood.
Woodland Caribou, mounted complete.
Stalactites, 2 specimens.
Octocoris alpestris praticola (Prairie Horned Larks), 2 specimens.
Ampelis cedrorum (Cedar Waxwing).
Manitoba Grouse, 2 specimens.
Menobranchus maculatus (Spotted Proteus).

Respectfully submitted,
J. STEVENSON BROWN, *Hon. Curator.*

To the President and Council, Natural History Society of Montreal:

GENTLEMEN,—In submitting the Annual Report of the Editing Committee, it is gratifying to be able to state that the past year has been one of general progress in all the work assigned to this Committee. The number of exchanges has steadily increased, and more than the usual number of requests for exchange have been made. As pointed out in previous reports, the RECORD OF SCIENCE is the most impor-

tant medium through which the work of this Society can be extended and made known, and it is felt that every effort should be made, not only to maintain the RECORD, but to promote its increased efficiency. With this end in view, we would submit the following recommendations:

There should be appointed an Editor who shall have direct charge of and be responsible for the proper publication of the RECORD, and four associate editors who will assist him in the proper selection of material and otherwise advise him.

The sum of one hundred dollars should be appropriated to the employment of an assistant, who shall read the proofs and otherwise act under the supervision of the Editor.

Provision should be made for increased illustration of articles where such is needed, and in the near future an increase in the size of the journal may be found desirable.

We would also recommend that in future all books, periodical publications and works received in exchange, be acknowledged by the Librarian, to whom such duty properly belongs.

Respectfully submitted,
On behalf of the Editing Committee,
D. P. PENHALLOW, *Chairman.*

To the President and Council of the Natural History Society:

The Library Committee have to report that the following works have been presented to the Library during the past year, for which in the name of the Society, they desire to thank the donors:

"The Geological History of Plants," by Sir Wm. Dawson.

"Notes on Specimens of Eozoon Canadense," by Sir Wm. Dawson.

"On Paleozoic Rocks of the Atlantic Coast," by Sir Wm. Dawson.

"Report of the Royal Society of Canada."

"Geology of Minnesota," from the Geological and Natural History Survey of Minnesota.

"The Fishery Industries of the United States," 4 vols., from the U. S. Fishery Commissioners.

"Report of the U. S. Geological Survey."

"Embryology of Insects, and Arachnids," by J. Bruce, from the Johns Hopkins University.

The parts (as far as published) of the "Prodomus of the Zoology of Victoria."

"Report of the Smithsonian Institution."

Besides these, many parts of the proceedings of Scientific Societies have been received in exchange for your RECORD OF SCIENCE. Several volumes of these need binding, as, in the event of any parts being lost, it is sometimes impossible to complete the set. Your Committee have not asked for any appropriation from the Council, except for the stand for the exchanges, but would suggest the necessity of a sum, **$50** at least, being placed annually in the hands of the Library Committee for binding these volumes, and preventing the large accumulation of unbound works, such as is now to be found on your shelves. Much time has been spent during the year in an endeavour to arrange these, and your Committee trust that this important work may be completed in the ensuing year.

The remainder of the books in the cases on the north side of the Library have been placed and noted in the Catalogue. Those in the cases on the south side will be placed as soon as arranged and classified.

Your Committee trust that their efforts will make your valuable Library more accessible to the members, and regret that in consequence of the large number of unbound parts that have had to be looked over, the work of arranging and placing them could not be completed within the past year.

Respectfully submitted,

On behalf of the Library Committee,

E. T. CHAMBERS, *Chairman.*

TREASURER'S REPORT.

STATEMENT NATURAL HISTORY SOCIETY.

Receipts.

Rents	$1,008 50
Subscriptions	569 00
Field Day Excursion, "Conversazione"	129 27
Special Donations	109 85
Government Grant	400 00
Entrance Fees	76 90
	$2,293 52

Disbursements.

Balance due Treasurer	$ 5 30	
Salaries and Commissions	392 76	
Soil Temperatures	67 70	
Sundry Expenses, Caretaker, &c	469 22	
Fuel and Light	376 55	
Repairs Buildings—Museum, &c	160 07	
Taxes	144 20	
"Record of Science"	293 93	
Lectures	115 53	
House Furnishing	28 50	
Interest	12 96	
House Improvements	210 00	
Balance on hand	16 80	
		$2,293 52

Balance on hand $16 80

The following officers were elected for the ensuing year:

NATURAL HISTORY SOCIETY OF MONTREAL,

Officers—Session 1889-90.

President—Sir William Dawson, LLD., F.R.S., F.R.S.C.

Vice-Presidents—B. J, Harrington, Ph. D., F.R.S.C, J. H. R. Molson, Sir Donald A. Smith, John S. Shearer, George Sumner, Edward Murphy, A. F. Gault, Rev. Robert Campbell, A.M., D. P. Penhallow, B. Sc., F.R.S.C.

Members of Council—J. A. U. Beaudry, Chairman; P. S. Ross, John W. Stirling, M.B., S. Finley, W. H. Rintoul, J. H. Joseph, Very Rev. Dean Carmichael, Rev. Canon Empson, R. F. Ruttan, B.A., M.D.

Honorary Recording Secretary—Albert Holden.

Honorary Corresponding Secretary—Horace T. Martin.

Honorary Curator—J. Stevenson Brown.

Honorary Treasurer—James Gardner.

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Library Committee—J. A. U. Beaudry, C.E., F. B. Caulfield, R. W. McLachlan, Joseph Fortier.

Lecture Committee—Dr. J. B. Harrington, P. S. Ross, Rev. Robert Campbell.

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Superintendent—Alfred Griffin.

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Molson, J. H. R.
Molson, J. T.
Molson, J. W.

Nivin, William

Sutherland, Louis
Sumner, George

Watt, D. A. P.
Winn, J. H.

Workman, Thomas.

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Campbell, Rev. Robert
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Costigan, W. T.
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Carter, G. H.

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Ewing, A. S.
Ewing, S. H.
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Euard, Wm.
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Selwyn, A. R. C., *Geological Survey, Ottawa, P.O.*

Whiteaves, J. F., *Geological Survey, Ottawa, P.O.*

ABSTRACT FOR THE MONTH OF APRIL, 1889.

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

DAY.	THERMOMETER.				BAROMETER.				† Mean pressure of vapour.	‡ Mean relative humidity.	Dew point.	WIND.		SKY CLOUDED IN TENTHS.			Per cent of 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	31.87	36 0	26 6	9.4	29.9243	29.984	29.854	.130	.1365	76.7	25.2	N.E.	13.7	7 5	10	0	79	....	....	....	1
2	31.28	34.8	27.6	7.2	29.7595	29.801	29.696	.105	.1543	87.7	28.0	N.E.	8.0	10.0	10	10	00	....	0.1	0 01	2
3	33.55	38.0	28.6	9.4	29.7618	29.838	29.697	.141	.1653	86.0	29.8		7.9	6.3	10	0	16	....	Inapp.	0.00	3
4	35.62	40.1	31.7	8.4	29.8928	29.960	29.789	.171	.1303	62.5	24.0	S.W.	13.8	6.5	10	0	18	....	....		4
5	32.78	40.0	27.3	12.7	30.0993	30.167	30.031	.136	.0997	53 7	18 0	N.E.	12 2	1.0	5	0	96	....	....	...	5
6	32.68	41.0	23 8	17.2	30.3353	30.407	30.219	.188	.0978	53.0	17.5	N.	13 0	0 3	1	0	96	....	....	...	6
SUNDAY. 7	.....	47.0	24 8	22.2	.....	.....	.....	....	....	....	....	S. E	1.6	....	..	..	96	....	....	....	7 ....SUNDAY
8	40 98	48.9	31.7	17.2	30.2753	30 412	30.077	.335	.1275	50.2	23.7	E.	3.3	2.5	10	0	97	....	.. .	....	8
9	41.52	52.0	34.3	17.7	29.8972	30.019	29.788	.231	.1647	62 0	29.3	S.W.	16 3	3.8	10	0	44	....	....	....	9
10	37.95	44.2	30.7	13 5	29.9345	29.983	29.909	.074	.1378	60.3	25.3	S.W.	16.8	1.3	5	0	96	....	....	....	10
11	47.40	58.0	36.2	21.8	29 7713	29.898	29 626	.272	.1693	53.0	30.2	S.W.	26 0	5.3	10	0	70	....	....	...	11
12	41.97	49.1	32 4	16 7	29.6357	29.702	29 595	.107	.2020	74 5	34.2	N.	12.3	7.3	10	0	12	0.09	....	0.09	12
13	33.65	39.3	26.8	12.5	29.8302	29.965	29 741	.224	.1175	61.2	21.8	N.W.	14.8	8.2	10	0	25	....	....	....	13
SUNDAY.....14	.....	47.1	31.8	15.3	.....	.....	.....	....	....	...	...	N.W.	13.6	....	..		71	....	....	...	14 .....SUNDAY
15	40.50	49.1	31.7	17.4	30 4110	30 459	30.340	.119	.0950	39.0	16 2	N.	11 5	0.0	0	0	95	....	....	...	15
16	47.10	59.4	34.6	24.8	30.3438	30 437	30.243	.194	.1448	46.8	26 7	E.	6.1	0 8	2	0	92	....	....	....	16
17	51.93	64.2	36.5	27.7	30.1102	30.227	30.015	.212	.1693	46 2	30.2	S.	12 9	0.8	2	0	95	....	....	....	17
18	53.53	66.1	38.3	27.8	30.0438	30.075	30.016	.059	.2262	56 2	37 5	N.	6.8	4.0	10	0	73	....	....	...	18
19	59.40	73.6	41.3	32.3	29.9535	30.096	29 813	.283	.2802	55 3	42.5	S.E.	14 7	3 5	10	0	89	0.02	....	0 02	19
20	62 58	69.8	57.5	12 3	29.9210	29 969	29 863	.106	.3160	56 5	45 3	S.W.	25 0	4.3	10	0	74	0.04	....	0.04	20
SUNDAY.....21	.....	67.9	32.6	35.3	.....	.....	.....	....	....	....	....	S.W.	28.2	...		..	74	0.02	....	0 02	21 .....SUNDAY
22	33.88	40.3	28.3	12.0	30 1747	30.313	30 031	.342	.0935	48.3	16.3	W.	24 0	4.8	10	0	48	....	....	...	22
23	38.02	46.2	26.6	19.6	30 3173	30.404	30.196	.208	.1312	56.7	23.5	S W.	8 2	7.2	10	0	53	....	....	....	23
24	51.68	63.0	36.5	26.5	29.9985	30.130	29 885	.265	.2575	67.2	40 7	S.E.	16.4	9 0	10	4	46	0 01	....	0.01	24
25	53 53	57.0	51.9	5.1	29.9047	29.918	29 895	.023	.3603	87.0	49 8	S.	14.3	10 0	10	10	00	0.34	....	0 34	25
26	51.12	55.5	45.5	10.0	29.8760	29.910	29.816	.094	.3583	95.2	49.7	N.E	8.6	10 0	10	10	00	0.51	....	0.51	26
27	49.92	61.0	42.7	18.3	29.5323	29.713	29.401	.312	.3323	92.2	47.7	N.E.	20.5	9.2	10	5	30	0.10	....	0.10	27
SUNDAY.....28	.....	62.2	45.6	16 6	.....	.....	.....	....	..	...	...	S. E.	17.3	....	..	..	06	0.58	....	0.58	28 .....SUNDAY
29	48.32	51.9	44.6	7.3	29.4657	29.570	29 377	.193	.2998	88.2	45.0	S.W.	21.7	10.0	10	10	00	0.43	....	0 43	29
30	44.12	50.8	40.5	10.3	29 6652	29 727	29 588	.139	.2148	74.2	36.2	W.	27.4	8.8	10	3	00	Inapp.	....	0.00	30
....Means	43.34	51.78	34.97	16.82	29.9554	.....	.....	.179	1916	65.0	31 32	S 72° W.	14.55	5.48	.	..	53.0	2.14	0 1	2 15	Sums .....
15 yrs. means for & including this mo.	39.58	47.6	31.7	15.9	29 9359	.....	.....	.199	.1693	67.1	....	....	....	5.90	..	..	¶52.7	1.58	6.7	2.25	15 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.....	1353	1472	367	507	1413	2674	2134	559	
Duration in hrs..	96	113	52	48	103	130	114	49	15
Mean velocity...	14.1	13 0	7.1	10.6	13.7	20.6	18.7	11.4	

Greatest mileage in one hour was 48 on the 21st.
Greatest velocity in gusts 66 miles per hour on the 21st.
Resultant mileage, 2,790.

Resultant direction, S 72° W.
Total mileage, 10,479.

*Barometer readings reduced to sea-level and temperature of 32° Fahr.
§ Observed.
† Pressure of vapour in inches of mercury.
‡ Humidity relative, saturation being 100.
¶ Eight years only.

The greatest heat was 73.6 on the 19th; the greatest cold was 23.8 on the 6th, giving a range of temperature of 49.8 degrees. Warmest day was the 20th. Coldest day was the 2nd. Highest barometer reading was 30.499 on the 7th; lowest barometer was 29.277 on the 28th, giving a rangeof 1.222 inches. Maximum relative humidity was 100 on the 25th. Minimum relative humidity was 15 on the 15th.

Rain fell on 11 days.
Snow fell on 2 days.
Rain or snow fell on 13 days.
Auroras were observed on three nights.
Solar halo on three days.
Lunar corona on two nights.
Fog on two days.
Thunderstorm on the 27th.

ABSTRACT FOR THE MONTH OF MAY, 1889.

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

DAY.	THERMOMETER.				BAROMETER.				† Mean pressure of vapour.	‡ Mean relative humidity.	Dew point.	WIND.		SKY CLOUDED IN TENTHS.			Per cent of 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 perhour	Mean.	Max.	Min.					
1	41.83	45.4	35.3	10.1	29.8348	29.919	29.757	.162	.1798	68.0	31.7	S.W.	24.1	9 7	10	8	24	0.01	....	0 01	1
2	44.77	49.6	39.6	10.0	29.8943	29.937	29.855	.082	.2020	68.3	34.8	S.W.	13.2	10.0	10	10	4	....	....	....	2
3	44.42	50.3	39.6	10.7	29.8447	29.869	29.816	.053	.2070	70.5	35.3	W.	11.0	8.2	10	0	10	0.03	....	0.03	3
4	50.33	59.2	37.5	21.7	29.8563	29.902	29.827	.075	.2295	63.2	37.8	S.W.	20.9	6 2	10	0	67	....	....	. .	4
SUNDAY..... 5	.....	72.1	48.2	23.9	.....	.....	.....	....	....	....	....	S.W.	30.4	....	..	..	94	....	....	....	5 .....SUNDAY
6	60.28	73.0	45.5	27.5	29.9842	30.042	29.946	.096	.2735	54.3	42.3	S.W.	15.2	7.7	10	0	54	....	....	.	6
7	68.75	80.9	52.4	28.5	29.9027	29.986	29 835	.151	.3403	50.0	48.3	S.W.	13.0	2 8	5	2	85	....	....	....	7
8	72.72	85.6	58.1	27.5	29.8472	29 866	29.811	.055	.4392	54.7	54 8	S.W.	21.0	0 0	6	0	91	....	....	....	8
9	74.63	86.2	65.1	21.1	29.7987	29.882	29.704	.178	.4768	56.3	57.7	S.W.	26.7	2.0	4	0	87	....	....	....	9
10	69.30	77.7	59.3	18.4	29.6282	29.697	29.567	.130	.4623	63.8	56 5	W.	20.9	3 3	9	0	62	0.10	....	0.10	10
11	56.42	65.0	48.4	16.6	29.7423	29.764	29.711	.053	.2725	60.2	42.5	N.	14.4	0.2	3	0	88	....	....	....	11
SUNDAY... . . 12	.....	70.0	44 5	25.5	.....	.....	.....	....	....	....	....	N.W.	9.2	...	..	..	96	....	....	...	12 .....SUNDAY
13	60.90	71.8	47.9	23.9	29.8480	29.959	29.732	.227	.2787	53.8	43 0	E.	10.4	5.5	10	0	55	....	....	....	13
14	57.87	64.9	52 9	12.0	29.7048	29.805	29 658	.147	.3880	80.8	51.8	S.	10.2	10 0	10	10	00	0.27	....	0.27	14
15	52.92	60.2	45.3	14 9	30.0135	30.059	29.906	.153	.2690	67.5	42.0	W.	8.0	6.7	10	1	75	...	....	....	15
16	47.60	52.1	43.6	9.5	30.0868	30.139	30.051	.088	.2932	89.3	44.3	N.	15.9	10 0	10	10	00	0.23	....	0 23	16
17	65.33	82.8	46.5	36.3	30 0663	30 134	30.002	.132	.4840	77.7	57.5	S. E.	13.9	4.7	10	0	70	Inapp.	....	0.00	17
18	77.82	88.0	70.1	17.9	30.1488	30.216	30.111	.105	.6488	68.0	66.2	S.	15.7	2 5	10	0	89	....	....	....	18
SUNDAY.....19	....	83.9	65.3	18.6	.....	.....	.....	...	....	....	....	S.	13.5	....	.	..	84	....	...	....	19 .....SUNDAY
20	63.77	68.0	60.3	7.7	29.9225	29.997	29.781	.216	.5417	91.7	61.2	S.	7.6	10.0	10	10	00	0.76	....	0.76	20
21	63 20	72.8	56.3	16.5	29.6150	29.723	29.531	.192	.4897	85.2	58.3	W.	7.7	10 0	10	10	33	0.91	....	0.91	21
22	52.43	57.0	48.5	8.5	29.6930	29.830	29.557	.273	.3013	76.5	45.2	S.W.	24.4	8.5	10	4	61	0.03	....	0.03	22
23	49 77	54.4	46.3	8.1	29.9165	29.966	29.868	.098	.2573	72.3	41.0	S.W.	12.0	8.5	10	1	21	....	....	....	23
24	52.28	58.1	47.2	10.9	29.7903	29.857	29.734	.123	.2938	75.2	44.2	S.W.	10.8	10.0	10	10	15	0.15	....	0.15	24
25	48 80	55.2	40 6	14.6	29.9612	30.009	29.868	.141	.1998	58.2	34.2	W.	13.7	0.5	3	0	98	0.06	....	0.06	25
SUNDAY.....26	.....	62.0	43.5	18.5	... .	.....	...	....	....	....	....	S.	8.4	....	..	..	77	....	....	....	26 .....SUNDAY
27	53.58	62.2	45.2	17 0	29.8702	29.997	29.691	.306	.2863	70.8	43.7	S.E.	14.6	7.5	10	0	45	0.10	....	0 10	27
28	47.22	51 5	41.5	10 0	29.6683	29.872	29.545	.327	.2597	79 0	40.8	S.	24.3	9.7	10	8	00	0.25	....	0.25	28
29	48.10	55.7	39.5	16.2	30.1127	30 169	29.955	.214	.2187	65.5	36.7	S.W.	15.3	6.2	10	1	86	Inapp.	....	0.00	29
30	47.58	54.5	44 5	10 0	30.1150	30.148	30.085	.063	.2743	83.3	42.7	N.E.	24.8	8.3	10	1	41	0.05	....	0.05	30
31	65 05	79 9	44 7	35.2	30 0003	30.063	29 959	.104	.4448	73.3	55.2	S. E.	17.2	7.3	10	2	64	0.02	....	0.02	31
....Means.	56.95	66.13	48.46	17.67	29.8839	.....	.....	.146	.3338	69.5	46.29	....	....	6.52	..	..	54.1	2.97	....	2.97	Sums .....
15 yrs. means for & including this mo.	54.78	63.96	45.79	18.17	29.9365	.....	.....	.161	.2864	65.2	....	....	....	6.29	..	..	¶52.5	2.86	0.1	2.87	15 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..	1188	539	274	591	2100	5415	1222	393	
Duration in hrs..	86	23	31	54	144	273	95	37	1
Mean velocity ...	13.8	23 4	8.8	10.9	14.6	19.8	12.9	10.6	

Greatest mileage in one hour was 42 on the 28th.
Resultant mileage, 6,195.

Resultant direction, S 43° W.
Total mileage, 11,722.

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

§ Observed.

† Pressure of vapour in inches of mercury.

‡ Humidity relative, saturation being 100.

¶ Eight years only.

The greatest heat was 88.0 on the 18th; the greatest cold was 35.3 on the 1st, giving a range of temperature of 52.7 degrees. Warmest day was the 18th. Coldest day was the 1st. Highest barometer reading was 30.216 on the 18th; lowest barometer was 29.531 on the 21st, giving a range of 0,685 inches. Maximum relative humidity was 98 on the 17th. Minimum relative humidity was 29 on the 7th and 12th.

Rain fell on 16 days.

Fog on two days.

Thunderstorm on the 10th and 21st.

Solar halo on the 29th.

NOTE.—The maximum temperature for the month (88.0°) is the greatest observed here in May during the 15 years over which the present series of observations extends.

ABSTRACT FOR THE MONTH OF JUNE, 1889.

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 vapour.	‡ Mean relative humidity.	Dew point.	WIND. General direction.	Mean velocity in miles perhour	SKY CLOUDED IN TENTHS. Mean.	Max.	Min.	Per cent of possible sunshine.	Rainfall in inches.	Snowfall in inches.	Rain and snow melted.	DAY.
1	63 08	71.6	53·5	18.1	29 9365	39.001	29.884	.117	.4777	82.7	57.3	S.W.	12.2	9.7	10	8	07	0 33	....	....	1
SUNDAY..... 2	.....	66.2	50.3	15·9	.....	.....	.....	....	....	....	....	W.	6.5	..	..		21	0 20	....		2 .....SUNDAY
3	60.95	68 0	55·4	12.6	29.9167	29.973	29.841	.132	.4053	76 7	53.0	S E	6 0	8.5	10	5	00	0 08	....	...	3
4	64 25	73·9	56.4	17·5	29 6657	29.808	29.565	.243	.4505	76 2	55 0	S E.	6.4	8.0	10	2	63	0 07	....		4
5	56.37	65 0	50.5	14·5	29.5152	29 534	29.489	.045	.3813	84.5	51.5	S.W.	12.4	6.7	10	0	32	0 43	....	....	5
6	51.87	58·9	47.4	11.5	29.5563	29.714	29.488	.226	.3097	80.0	45 7	W.	18 5	9 0	10	5	08	0 06	....	....	6
7	58.87	68.0	46 3	21·7	29.7322	29 823	29 658	.165	.3155	65.0	45.8	S.W.	13 8	5.5	10	0	74	0 11	....	....	7
8	56.22	61.9	52.2	9 7	29 7890	29.916	29.660	.256	.3748	83.0	51.0	.....	10.7	7 7	10	0	18	0.08	....	....	8
SUNDAY. 9	.....	57.4	50 3	7.1	.. .	.....	.....	...	...	....	...	N.E.	14.6	...	..		10	0.97	....	...	9 .....SUNDAY
10	66.73	78.0	54 5	23.5	29.9402	29 974	29.901	.073	.5548	84 0	61 7	S.W.	13.4	7.3	10	1	32	0 07	....	....	10
11	62.70	69 0	56 5	12.5	30.0097	30 089	29 956	.133	.4408	77.5	55 3	S.W.	18.9	8.5	10	3	19	Inapp.	....	....	11
12	64.72	74.0	55.4	18.0	29.9900	30.038	30.958	.080	.4153	69.0	53 8	S.W.	20.3	3.0	9	0	83	....	....	....	12
13	65.08	74.0	58.5	15·5	29 9332	30.051	29.866	.185	.4378	70.7	55 0	W.	20.8	5 2	10	0	49	0 06	....	....	13
14	60.62	69 0	49.6	19.4	30.1337	30.197	30.046	.151	.3300	62.7	47.3	N.W.	8.7	5.7	10	0	95	....	....	...	14
15	65.70	73.3	60.2	13.1	29 9137	29.992	29.829	.163	.5292	83.2	60.5	S.	12.7	10.0	10	10	10	0 73	....	...	15
SUNDAY.....16	. ..	74.0	57.3	16.7	.....	.....	.....	....	...	....	....	S.W.	8.7	....	..	..	65	0.07	....	....	16 .....SUNDAY
17	62.23	68 9	51.1	17·8	29.8495	30.018	29.726	.292	.3087	54.7	44 0	N.	18 0	3.8	10	0	91	....	....	....	17
18	56 77	66.0	45.1	20.9	30.0387	30.113	29.959	.154	.2575	57.0	40.8	N.	10 2	7.2	10	0	70	...		.....	18
19	64 58	72.8	55 4	17 4	29.7673	29.943	29.582	.361	.3740	62.5	50.8	E.	16.1	6.5	10	1	55	Inapp.	....		19
20	70 25	77 9	62.3	15 6	29.6943	29.815	29.525	.290	.4715	64.7	57.3	S.W	24.3	5.7	10	0	79	0 04	....	....	20
21	68 03	76.5	61.5	15.0	29 7493	29.867	29.602	.265	.5552	81.3	61.7	S.W.	13.8	8.8	10	3	23	0.20	..	....	21
22	60.82	67.3	52.4	14.9	29.7243	29.898	29.624	.274	.3887	70.5	51.5	S.W.	27.6	6.0	10	1	44	0 01	....	....	22
SUNDAY.. 23	.....	70.0	49 6	20.4	.....	.....	....	....	....	...	....	W.	21 4	....	..	..	72	....	....	....	23 .....SUNDAY
24	61.15	66.9	55.1	11.8	30 3822	30 411	30.304	.107	.3487	64.2	48.7	S.W.	16 1	9 5	10	7	00	....	....	....	24
25	63 03	72.0	52·3	19.7	30.3442	30.423	30.258	.165	.4095	71 5	53.3	S.W.	10.6	10 0	10	10	49	....	....	....	25
26	62.92	67.0	56.3	10.7	30 0977	30.224	29.939	.285	.5178	89.5	59 7	S.	12.1	9.5	10	7	00	0.86	....	...	26
27	70 85	77.2	63.3	13.9	30.0150	30.085	29.932	.153	.6233	83 3	65.2	S. W.	13.6	6.7	10	0	64	0 36	....	....	27
28	64.07	71 9	56.7	15.2	30.1623	30 200	30.137	.063	.4743	79.3	57.2	N. E.	9.8	6.3	10	0	57	...	....	....	28
29	70.92	79.0	59.3	19.7	30.1280	30 195	30.068	.127	.5622	74.8	62 2	S.W.	8.5	3 0	9	0	80	....	....	....	29
SUNDAY.....30	.....	84.9	63.2	21.7	.....	.....	.....	....	.....	....	....	S.W.	7.3	....	..	..	65	....	....	....	30 ....SUNDAY
....Means	62.91	70.68	54 60	16 09	29.9194	.....	.....	.180	.4286	73.9	53.8	....	....	7 11	.		45 5	4 73	....	..	Sums ....
15 yrs. means for & including this mo.	64 46	73.12	55.94	17.17	29.8970	.....	.....	.155	.4224	68.8	....	...	...	5.67	..	..	55 0	3 19	....	..	15 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..	857	501	424	647	1133	3498	2538	342	
Duration in hrs..	72	37	45	63	97	218	164	23	1
Mean velocity...	11.9	13 5	9 4	10.3	11.7	16.0	15·5	14 9	

Greatest mileage in one hour was 34 on the 22nd.

Resultant mileage, 4,795.

Resultant direction, S 57° W.

Total mileage, 9,940.

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

§ Observed.

† Pressure of vapour in inches of mercury.

‡ Humidity relative, saturation being 100.

¶ Eight years only.

The greatest heat was 84 9 on the 30th; the greatest cold was 45.1 on the 18th, giving a range of temperature of 39.8 degrees. Warmest day was the 30th. Coldest day was the 18th. Highest barometer reading was 30.423 on the 25th; lowest barometer was 29.488 on the 6th, giving a range of 0,935 inches. Maximum relative humidity was 99 on the 1st and 26th. Minimum relative humidity was 27 on the 17th.

Rain fell on 20 days.

Fog on 1 day.

Thunderstorm on the 4th, 9th and 13th.

NOTE.—The rainfall is nearly equal to the greatest in June (4,82 in 1879) during the past 15 years. The depth of rain in June 1882, was the same as this month. The number of days rain in June 1879, was 21, and in June 1882 rain fell on 2 days. The average number of wet days for June is 1·.