BULLETIN

OF THE

NATURAL HISTORY SOCIETY

OF

NEW BRUNSWICK.

No. XXVIII.

VOL. VI. PART III.

PUBLISHED BY THE SOCIETY.

ST. JOHN, N. B.,
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1910.

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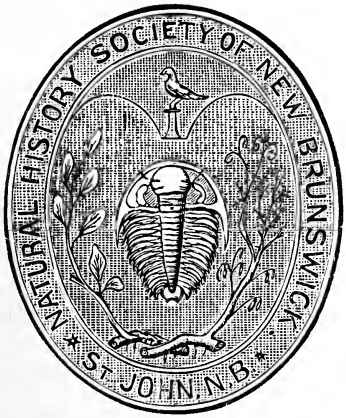

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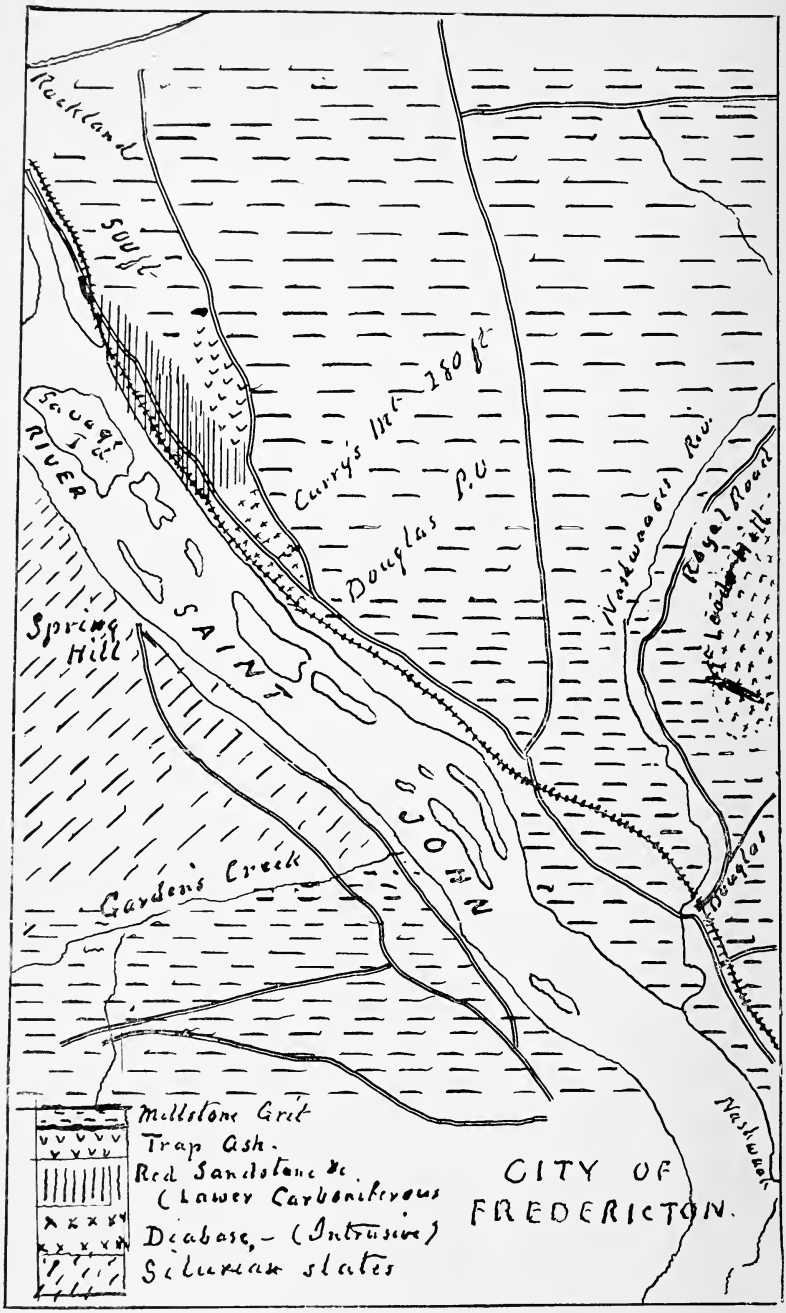

Rockland
500 ft
Currys Mt 180 ft
Douglas P.O
Nashwaaksis Riv.
Royal Road
Mt Lookout
Douglas
Spring Hill
SAINT
JOHN
RIVER
Gardens Creek
Millstone Grit
Trap Ash.
Red Sandstone &c
(Lower Carboniferous
Diabase, - (Intrusive)
Silurian slates
CITY OF
FREDERICTON.
Nashwaak

ARTICLE I.

THE HISTORY OF CURRIES MOUNTAIN—AN OLD NEW BRUNSWICK VOLCANO.

By L. W. Bailey, LL. D., F. R. S. C.

(Read by Title, May 4, 1909.)

Upon the left bank of the St. John river, about five miles above Fredericton, is the eminence formerly known as Clark's, and now as Curries Mountain. It has certainly no claim to the latter designation, its elevation being quite insignificant, only 280 feet, but rising somewhat steeply from the river's bank, and separated by a marked depression from the hills in the rear, it stands out with some degree of prominence, and is a conspicuous feature in the landscape, as from its sides or summit may be had a somewhat extensive view of the river valley, and of the city in the distance. Along its western slope, near the base, between it and the river, run the highway and the Woodstock branch of the Canadian Pacific Railway; and in the construction of these the structure of the mountain was to some extent revealed; while in the hills behind, traversed by what is known as the "Back Road," leading to Rockland, and which attain an an elevation (five hundred feet) somewhat exceeding that of the mountain itself, are other exposures from the study of which information as to the origin and history of the mountain may be had.

Curries Mountain is, in a sense, an old volcano. That is to say, it is of volcanic origin. It is true that it is not now possible to recognize about it anything of the nature of a crater and it may never have possessed one; but volcanic eruptions do not always lead to that result. They may determine outflows along extended cracks or fissures. Craters, even if originally present, may be obliterated by later flows, by sedimentary deposits or

by erosion. The molten rock from the earth's interior, though penetrating the crust, may fail to reach the surface, and subsequently be revealed by the removal of the surrounding beds, or this may come up along a narrow vent, forming a pipe or chimney, and, without forming a crater, overflow the region in its neighborhood. On the other hand the fact of the igneous origin of Curries Mountain is placed beyond question (1) by the study of its rocks as regards their nature and arrangement; and (2) by the relations of these to the other rocks with which they are associated.

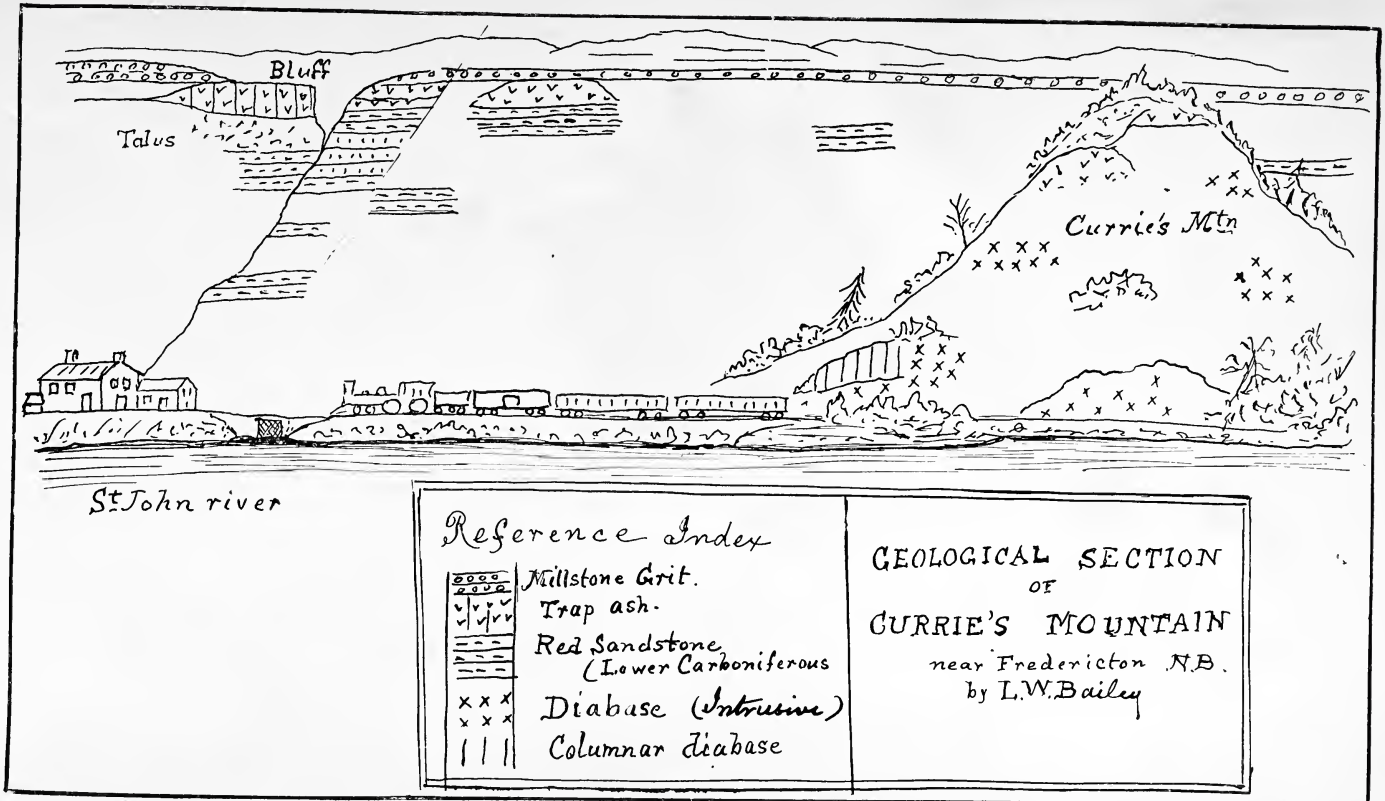
Volcanic Rocks.—The rocks which constitute the main mass of Curries Mountain are of a dark grey, almost black colour, quite hard, of uniform texture and breaking with a broad conchoidal fracture. Fresh surfaces glisten somewhat from the presence of minute crystals, and on the northwestern face of the hill are ledges showing a distinctly columnar structure, similar to that of Blomidon or the Giant's Causeway. Technically the rock is Diabase, a variety of "trap" consisting of an intimate admixture of felspar (labradorite or anorthite) and augite or pyroxene. To the latter, an iron-bearing mineral, the colour, hardness, toughness and weight of the rocks are due. It is an admirable material for road making, and considerable quantities of somewhat similar but inferior rock, derived from the outskirts of the hill or from boulders, have been used in macadamizing the streets of Fredericton, the main mass of the mountain, owing to the cost of removal, remaining still untouched.

No other rock than that last referred to is visible in the mountain itself; but along the crests of the hills which, as already stated, lie in the rear, and extend for several miles in the direction of Rockland, are numerous exposures of beds of related origin. These are of lighter colour than the diabase described above and are earthy rather than crystalline, though not unfrequently containing crystalline minerals. These latter are usually scattered through the rock in the form of blebs or nodules, and include quartz, calcite, heulandite and a variety of chlorite known as delessite. Thus the rock is a sort of volcanic

ash, which in places assumes the character of a coarse amygdaloid or toad-stone. No bedding is discernible in these rocks, but they may be seen to rest horizontally upon non-volcanic stratified rocks to be presently noticed, showing that they are either of the nature of flows or of showers of ashes. They may be well studied on either side of a ravine traversing the hillside about a mile and a half above Curries Mountain, where they form a conspicuous and vertical bluff, half-buried by a talus of detached fragments, and commanding a view probably unexcelled in beauty in the whole valley of the St. John.

Sedimentary Rocks.—The rocks of this character found associated with the volcanics consist of conglomerates, sandstones and shales, of which those below the volcanics are noticeable for their intensely red colour and calcareous nature, while those above are as uniformly grey and non-calcareous. The former are identical with those which in various other parts of the Province occupy a similar position and are referable to the Lower Carboniferous system, while the latter represent the Millstone Grit formation or Lower Division of the Coal Measures. The latter are remarkable as mainly made up of well-rounded white quartz pebbles. The red rocks may to some extent be seen along the Back Road where this makes its ascent to the hills behind Curries Mountain, but better in the ravine referred to above or along the steep hillsides leading to Rockland. From the height of the hills, the horizontal attitude of the beds, and the position of the exposures, it may be inferred that they have a thickness of at least five hundred feet. The grey beds are not seen in the immediate vicinity of the mountain, but come into view on either side, in one direction becoming continuous with the great Carboniferous tract of southern New Brunswick, in the other helping to mark the northern escarpment of that formation to and up the valley of the Keswick River. They are noticeable, in addition to their coarseness and silicious character, for the extent to which they have been planed and even polished by glacial action. Poorly preserved stems of plants are occasionally found in the red as well as in the grey beds.

Stratigraphical Relations.—These may be most readily understood by the accompanying sectional view of the mountain and its immediate surroundings. As has been stated, nothing else is revealed in the mountain itself but compact crypto-crystalline diabase or doleryte, exposed both near its base and on its sides and summit. It thus forms a somewhat conical mass arising from the level of the river and presumably extending beneath it to an unknown depth and rising to a height of nearly three hundred feet. Upon either side the structure is quite different. Thus, quite near the base of the mountain on its northwestern side, are beds of red conglomerate in nearly horizontal position, and which, if they do not underlie the whole mass of the mountain, as seems improbable, must have been penetrated by the volcanic rock in its efforts to reach the surface. This view is rendered almost certain by the fact that upon either side of the mountain similar red beds are exposed to within about sixty or seventy feet of the summits of the hills, being then capped by horizontal masses not of dolerite but of vesicular ash-rock and amygdaloid. Such open vesicular rocks are somewhat of the nature of a slag, their cavities being the result of the expansion of gases under diminished pressure, and they are believed to have been formed at or near the surface, while those of a more solid crystalline character, such as constitute the mountain, were formed at lower levels and under greater resistance. Thus the mountain proper represents a volcanic neck or chimney, penetrating the red sediments from an unknown depth, while the ash beds and amygdaloids are the lighter and more scoriaceous materials thrown off from the summit of the pipe, possibly under water, and spread over the surrounding deposits. These do not include the grey beds. At no point can the volcanic materials be found to rest upon the latter; but at no great distance to the north of the ravine the coarse grey beds of the Millstone Grit formation may be seen in a position which clearly indicates that they lie above the amygdaloids and ash-beds.


Bluff
Talus
Currie's Mtn
St John river
Reference Index
Millstone Grit.
Trap ash.
Red Sandstone (Lower Carboniferous
Diabase (Intrusive)
Columnar diabase
GEOLOGICAL SECTION
OF
CURRIE'S MOUNTAIN
near Fredericton N.B.
by L.W. Bailey

TIME OF ERUPTION.—From the facts above stated it is easy to determine the time of overflow of the Curries Mountain lavas. Resting upon the red sediments of the Lower Carboniferous system they could not have reached the surface until near the close of the Lower Carboniferous period, or altogether subsequently; while, covered as they are by the lowest beds of the Coal-period, they must have antedated the latter. The time of eruption was between the two.

CONTEMPORANEOUS NEW BRUNSWICK VOLCANOES.—New Brunswick has been the seat of volcanic activity at many periods during its history both before and since that of which Curries Mountain is a monument. Volcanic products are a very marked feature of the so-called Huronian age, and in parts of St. John and Kings counties, as about Loch Lomond, Kingston and the Nerepis region, cover large areas. They recur again in the Silurian, represented by many of the finer hills about the Bay des Chaleurs, Passamaquoddy Bay and the eminences, such as Mount Teneriffe, Mount Wightman, Sagaook Mountain, etc., at the sources of the Tobique and Nepisiquit; and in comparatively recent times there were the outflows now so conspicuously represented in the Bay of Fundy trough by Grand Manan and the North Mountains of Nova Scotia; but the Lower Carboniferous period is also remarkable for the extent to which volcanic operations were then carried on. One evidence of this is not very far removed from the locality which forms the subject of this paper. Upon what is known as the Royal Road, which runs in the rear or to the east of Curries Mountain at a distance of about five or six miles, is a conspicuous bluff known as McLeod's Hill. Like the bluff at the ravine described above, and like most of the beds of volcanic origin of the Lower Carboniferous system, it presents upon one side a bold front, perpendicular towards the top but covered below with broken fragments, while in the opposite direction it slopes off more gradually and is mostly covered by superficial deposits. This

corresponds to what in Scotland is known as the "Crag and Tail." The rock, like that at Curries Mountain, is a dolerite or diabase, but is more coasely amygdaloidal, containing not unfrequently considerable cavities lined with quartz crystals, or of calcite encrusted with quartz. This overflow may have been connected with that of Curries Mountain, but the connection, if existing, is now obscured by the overlying rocks of the Coal Measures which occupy all the intervening area. Other localities for these volcanic outbursts are: the Miramichi river, about six miles above Boiestown, where again they form conspicuous bluffs; the vicinity of Harvey Station where they include the eminence of Cranberry Hill, at the base of which passes the main line of the Canadian Pacific Railway, as well as Bald Mountain a few miles to the east; the west shore of the St. John river, near Long Island, in Queens County, where they spread over a large area and are associated with beds of limestone which by the heat accompanying their ejection have been converted into marbles; and yet again about the Emigrant Settlement north of Grand Lake in the same county; — in each of these instances exhibiting the same relations to the red and grey rocks, respectively beneath and above them, as are seen near Fredericton, and hence showing they all belong to the same great period of volcanic activity. The red beds and associated limestones contain in many places corals and other forms of marine life, showing the presence of the sea at the time of their formation; the grey beds on the other hand hold only the trunks and roots of trees and ferns, indicating their origin about fresh water streams and lakes.

History.—From the above data it is easy to summarize the probable history of Curries Mountain.

In the Lower Carboniferous period, antedating our own by some millions of years, the sea covered a large part of New Brunswick, including not only the great central triangular basin now occupied by large portions of York, Queens, Sunbury, Northumberland and Gloucester counties, but also a considerable

part of both the northern and southern Highlands. In the south they are found on the top of the Quaco Hills and Shepody Mountain, nearly one thousand feet above the present sea-level; in the north they form high hills on the Beccaquimic river and about the Blue Mountains on the Tobique, though it is not probable that they ever covered the summits of the latter range or the much higher hills about the sources of the Tobique and Nepisiquit rivers. In the central basin and in the depressions among the higher hills waves, tides and currents were at work, and by their action the hills were being levelled and the depressions filled with pebble, sand and mud beds, the conglomerates, sandstones and shales which now occupy them. Here and there, where the waters were pure enough, corals were growing and shells accumulating, the former indicating that the temperature of the waters was at least sub-tropical. In the same waters were numerous fish, but mainly of types related to the sturgeon and shark, and along the shores basked frogs and reptiles of gigantic size in comparison with their modern relatives. For untold centuries this condition of things prevailed, the sediments gradually becoming thicker and thicker until they had attained a maximum of some thousands of feet. This would only be possible upon a sinking floor, and with a sinking floor sooner or later fractures must come. In the production of these fractures the Lower Carboniferous period came to a close; through the vents thus made, sometimes perhaps in single pipes or chimneys, in other cases along extended fissures, came floods of molten material from the earth's interior; in the eminences which have been referred to as occurring in Curries Mountain and elsewhere we have, now open to our study, what has been left of these old ejections. For we can hardly suppose that the whole of the materials poured out have been left undisturbed, and some of the events in the later history of the country were well calculated to remove them. Yet it does not seem probable in the case of Curries Mountain that its height was ever considerable. Its present base is too small to justify such a belief, and the relations of the sedimentary to the igneous rocks also

points to a different conclusion. For had volcanic action continued into the Coal-era, or had there been then any considerable eminence subject to wear and waste, the products of such waste would be found in the Carboniferous strata, at least in the vicinity of the hill. None such have been observed, and considering the origin of the strata last mentioned, in fresh water swamps and estuaries, it would seem probable that the mountain, so called, was at this period not only quiescent but actually buried beneath many hundreds of feet of sedimentary rocks. Still the mountain must have been somewhat higher than now, for the ash beds derived therefrom are found nearly two hundred feet higher in position than the summit of the mountain, which must therefore have been cut down at least to that extent. Just when the overlying materials were removed or when the old pipe or chimney, by becoming exposed, was thus made liable to loss, we know not. It may have remained buried through all the vast lapse of time represented by the formations, Triassic, Jurassic, Cretaceous and Tertiary, which followed the Carboniferous, but of which the region affords no record; but it is hardly possible that the Ice age, with its powerful instruments of erosion, could have passed without materially affecting the region, as it did all others subject to its influence. And the wonderful exhibition of planed and polished rocks to be seen, not far away, upon the Rockland hills, leaves little doubt upon this point. They show beyond question the presence of ice in such quantity, and moving under such pressure, that the pebbles of conglomerates several inches in diameter and composed of pure quartz, have been cut through or planed down as though they had offered no resistance whatever to the abrading agent. For a time, no doubt, and possibly for a long time, this mantle of ice and snow believed by many to have been some thousands of feet thick, would have still farther buried the seat of the old volcanic fires as it did the beautiful valley of the St. John near by; but with the return of less rigorous climatic conditions, and as the result of the floods following the melting of the ice, the mass now forming the mountain had its load removed, and the

surroundings were made to assume somewhat nearly their present aspects.

Only a few more words are necessary. The view which the hill commands—one of the most beautiful, as has been said, which the river affords—includes two very large islands, Sugar and Indian islands, lying between the main river and the mouth of the Keswick. As indicated by its name, one of these was formerly a favorite camping-place of the Indians, and tradition tells of severe conflicts here between the native tribes and the invading Iroquois from the west. Stone axes and other implements of like nature are not of uncommon occurrence, and in connection with the excavations made at the base of Curries Mountain for the construction of the railway, human skeletons wrapped in bark and accompanied by beads and ornaments, were exhumed and destroyed by the navvies engaged in the work. But we have no reason to believe that the mountain or its surroundings were materially different then from what they are now, except as regards the removal of the forests and the changes incidental to the advent of civilization. So we have no reason to anticipate any serious change in the future. The volcano, if we are right in so terming it, is dead, and has been so for many millions of years. Volcanic activity has been transferred to other regions of the earth, and Curries Mountain and its associated hills are now chiefly interesting as helping to determine a beautiful landscape or as affording to the geologist opportunity for the study of some problems of the remote past.

ECONOMIC MOLLUSCA OF ACADIA.

By W. F. Ganong.

Some years ago Professor W. F. Ganong prepared for this society an account of the "Economic Mollusca of Acadia," which is a mine of information for those who wish to investigate the history, habits and economic value of our native shell-fish. The book is of 116 pages, well furnished with wood-cuts of the several molluscs described, and with these and the descriptions given, those interested should have no difficulty in identifying the several species of shell-fish described.

One excellent feature of this work is that the uses and the quantity that enters commercially into consumption, are given; this is under the head of *"Economics,"* for each species, other headings of information applying to the several species are *"Distribution"* and *Habit.* So that from this little book one may learn much about each of the kinds of shell-fish treated of. Thirty different kinds of molluscs, having economic value are treated of in this volume of which two are Cephalopod ("Squids"), seven Gasteropod (Univalves), and the remainder Lamellibranchs (Bivalves).

Professor Ganong has gone to much painstaking research in connection with this subject, and the result is a little volume full of educational value and a useful *vade mecum* to the wanderer on the seashore.

Bound copies of this book may be had from the Curator of the Natural History Society of New Brunswick, at the price of fifty cents each.

ARTICLE II.

NOTES ON THE NATURAL HISTORY AND PHYSIOGRAPHY OF NEW BRUNSWICK.

By W. F. Ganong.

117.—On the Physical Geography of the Muniac Stream.

Read by Title, Nov. 3, 1908.

Some ten miles below the Tobique, there falls into the Saint John from the east the little river called Muniac. Last summer, in a search for the pre-glacial outlet of the Tobique, I descended this stream along the highway road which follows it closely from source to mouth; and I made the following observations.*

Below the mouth of the Tobique, that river and the Saint John are separated by a great ridge, one of the parallel pair which confine and give direction to the Saint John in this part of its course. Southward this ridge swings around to the east and joins the central highlands which run northeast from Moose Mountain. Just in this turn, very close over to the Tobique side, interlocking with branches of the Tobique and the Munquart

*The name is Maliseet Indian, but of uncertain meaning. A map of 1785 names is *Muineck or Bear River*, evidently connecting it with *Moo-in*, bear, and the locative *ek;* and the local explanation of the word is to the same effect. But I incline to think that this is simply a surveyor's etymology, for two of the best-informed Maliseet Indians have told me independently that the word is really *Am-wee-neck* or *Am-oo-een-ek*, which one of them said he could not interpret at all, while the other said it meant "very gnarly" (?) whatever that may mean to an Indian. An interpretation which I believe to be correct has been sent me by Rev. Father Ryan of Andover, who has consulted the best informed Indians on my behalf; they say it means "Gorge-like, or a stream running between two great hills or mountains," which perfectly fits the place. The word probably involves the root of the word "to cut", which is given in Father Rasle's Abnaki Dictionary as *nouek:* that is the valley is a cut or gash in the hills. The name is no doubt allied also to *mool-a-kesk*, the Maliseet name for Sullivans Creek, to which they give the meaning, "it runs deep."

The river was not laid down upon any map until after 1872, in which year it was mapped in connection with surveys made for the settlement of Scotch immigrants, who arrived the next year and founded the thriving settlements of Stonehaven and Kintore upon the highlands above the river.

and some 500 to 600 feet above the Saint John, rises the Muniac. Its extreme source spring I did not see, but it appears to lie in a great wild ravine-like basin, or circ, with towering wooded walls, a strikingly wild and impressive place such as one sees but rarely in this province. Then the little stream falls rapidly as a very clear and beautiful mountain torrent in the bottom of a deep and charmingly-wooded valley. A mile or two down, where it receives the first large branch from the west, the valley opens out into a little basin with terraces and settled intervales, through which the stream, rapidly-enlarging but ever cosey, cheerful and companionable, flows more gently over gravel and cobbles. Thus it continues, receiving many small branches full as clear as itself, down to the first large branch from the east. Below this it narrows again, becoming once more almost a ravine, the walls rising steeply and the stream falling rapidly. And here, at a place on the west of the road, is a feature I was charmed to see,—namely, great ledges of granite; for their presence is another confirmation of my belief that all of the great north-and-south ridges which control the topography of this part of New Brunswick possess intrusive cores, where they are not composed wholly of intrusive rock. Below, the valley again opens out, is settled somewhat, and receives the Inman Branch from the east out of another great ravine-valley. Then, below the Kincardine Road, the valley narrows again and becomes steep-walled, this part, like all of the narrow parts, being unsettled and incapable of settlement; while the clear and fast-growing waters pour down over a rocky bed. The valley opens out a little at the grist-mill, half a mile from the Saint John, then closes in more narrowly than ever; here the stream winds with much fall and is cutting into slate ledges in the bottom of a V-shaped valley, so narrow that the mill-dam at its mouth holds the water against walls of ledge rock. Then suddenly, after a course of about ten miles from its source, it pours its waters, sullied now by the refuse of the mill, through a narrow gap into the Saint John.*

*Certain minor points of interest concerning the river have been communicated to me by Mr. Benjamin Kilburn, a prominent resident of Kilburn settlement at its mouth. He says

Thus the Muniac, though pre-glacial in its origin, is a new river still in the torrent stage, and now cutting its valley directly into the rock. Indeed, it is, I believe, the most perfect example in New Brunswick of a new river of homogeneous development. And of course it cannot have been an old outlet of the Tobique. Scenically it is one of the most beautiful of New Brunswick streams, combining a perfection of the purest running water, with the wildest of mountain valleys clad in the finest of woods. It has a companion stream, similar in every feature except size, in the brook at Perth followed by the road to Tobique. It is very likely, also, that the present outlet to Tobique, which was once continuous, I believe, with Little River, was similar. The heading of these streams so close to the Tobique valley illustrates very clearly a stage in the formation of cross-connections between distinct river systems.

118.—On the Physiographic Characteristics of Cains River.

Read Nov. 2, 1909.

Of the several rivers which follow the slope of the Carboniferous basin of Eastern New Brunswick, the longest which lies wholly within that formation is Cains River. For this reason it could be expected to illustrate with particular clearness the physiographic evolution of the simpler rivers of the Northumbrian system. Accordingly, after long and eagerly looking forward to its study, it was with particular pleasure that I was able, in late August and early September last, under good conditions of weather and exceptionally good conditions of water, to descend this river in a canoe from near its source, and observe its physiographic features.*

there is a high fall on the Inman Branch, and a cave somewhere near Cox Brook. Traces of gold have been found in the stream; and many attempts have been made to obtain gold in another way by digging, about half a mile up the river on the north side, for money supposed to have been buried by the French. The stream is a wonderful trout river, and visited throughout the summer by local sportsmen from far and near.

*I was accompanied by Mr. S. A. R. MacDonald of Fredericton. We were portaged over the usual road from Taymouth (or Zionville) to "The Meadows," a mile below the upper Forks. I visited it again, to study the old Indian portage, in July, 1910, with Mr. William Laskey of Fredericton. We were taken in by the old Grand Lake road, went down stream on foot to the portage, crossed to the Gaspereau, and came down that river to the settlements.

The history of the development of our knowledge of the river is of considerable interest, so that I shall here treat the matter in some detail. The river makes its first appearance in records on the remarkable De Meulles-Franquelin map of 1686 (published in the *Transactions of the Royal Society of Canada*, III, 1897, ii, 364, though with some errors corrected in a photographic copy which I now possess) where it is laid down with an accuracy wholly surprising and indicative of a personal visit by the map maker. It is there named *Ouelamoukt*, which is obviously identical with the name *Wel-a-mook-took* by which the Micmacs call it to this day. Happily the meaning of the word is perfectly clear, for the Indians themselves say it means "handsome river" or "fine river," and Rand's *Micmac-English Dictionary* (169) gives *Welamook* as meaning "beautiful," "kind." The word is etymologically identical with Oromocto, which is a corruption of Welamooktook, while the Maliseets call Cains River *Mic-ma-we-wel-a-mook-took*, that is "Micmac's Oromocto." The name "handsome," or "beautiful," I believe, does not apply to the scenery so much as to its characteristics as an easy canoe river, an idea confirmed by Rand's meaning "kind," and by the character of the river itself. The same valuable map also applies the Micmac names to three branches, *Minooisak* to Muzroll's Brook, *Namamgamkikac* (or something very like, for the original map is injured at this place) to Sabbies River, and *Kepchkigoe* to a branch which appears to be Lower Otter Brook. These names I have not yet been able to interpret. It is said, by the way, that the Indians had favorite camping-places at the mouths of Six-Mile and Muzroll Brooks, and Sabbies River; and, as I know from observation, all of these places offered exceptionally favorable and pleasant sites. The name *Cains* is without question a corruption of *Etiennes*, (the name of an Indian Chief), for all of the intermediate stages in the evolution of the word are known, as traced in the *Transactions*, above cited, II, 1896, ii, 223. Of great interest are the names of its principal branches, Muzrolls and Sabbies. Upon the origin of these, local tradition is not clear except that they were given for persons, but I have no question that they are the

French family names Muzroll and Savoy, two of the commonest names in the French settlements at the mouth of the Miramichi. This is confirmed by the fact that Sabbies is simply a corruption of Savoys, the form which appears, as I have recently found, in the earliest records. I have no question that these names are a survival of the actual residence at the mouths of those branches of French families of those names. They probably settled there at the time when the French were being driven from the accessible parts of the Province by the English, in the same way that they settled at, and gave names to, the French Lakes on the St. John. Their settlement here would be natural for the reason that this river was the great route of travel from the Miramichi to the St. John via the portage to the Gaspereau, a route which was used not only in early Indian and French times but even after the arrival of the Loyalists. The exact route of this portage I have been able to work out on the ground, and the matter is of so much antiquarian interest that I have treated it with some detail in a supplement to this Note. As to the other names of places along the river, they are mostly of an obvious descriptive sort, given no doubt by the earliest lumbermen.*

The first survey of the river, from the mouth nearly to Muzrolls Brook, was made by W. Harley in 1826; this part was later surveyed also by B. R. Jouett. The headwaters were sketched in connection with timber-line surveys as far down as Bantelorum Brook, by Kilpatrick in 1835, while all the intermediate portion was surveyed by Fairweather in 1836. Some surveys in connection with proposed roads, (never built) to Gaspereau and Grand Lake were made by J. A. Beckwith in 1850. All of the plans of these surveys are in the Crown Land Office, and have been used, along with new information and

*Except the curious name *Bantelorum*, which I have not been able to interpret. Local explanations vary much,—from an origin in recollection of a stream of that name elsewhere, to a slang expression for a drunken revel by some early lumberman. The word first appears, and in this form, upon Kilpatrick's survey plan of 1835. Wilkinson, 1859, gives it the form *Bartholomew*, perhaps under the supposition that it is a corruption of that word, which was a family name among the Micmacs; though such an origin seems unlikely. The word certainly has, however, much the appearance of a somewhat jocose corruption of some Indian word. Six-mile Brook is perhaps so called because its southern branch is crossed by the Indian Portage about six miles from Cains River.

observations, in compiling the accompanying map. Settlers, partly English but mostly of Irish descent, began to extend up the river as an expansion from the growing Miramichi settlements about 1818, and more rapidly after the great fire of 1825; and they continued to increase until about 1870 when they reached up beyond the old Indian Portage, and included some forty or fifty families.* A considerable village had also grown up, some time after 1825, around some large mills at Sabbies River, where the foundations and abandoned gardens are still to be seen. In recent years, however, owing partly to the destruction of most of the timber by fire, with a consequent failure of a market for the farm produce, and partly to the universal movement of the young people to the more attractive life of the towns, the settlements have been steadily contracting, until now the river is abandoned by all but a dozen families, and the former large farms are rapidly reverting to wilderness. This phenomenon of the contraction of settlement in a time of prosperity, a striking fact in the history of the settlement of New Brunswick, is characteristic of the other North Shore Rivers as well, but nowhere is so conspicuous as on Cains River. Some day these rivers will all be settled again, and then the settlement will be permanent.

The greater part of the country along the river has been burnt and is now barren and worthless, though it is said locally that the great Miramichi Fire did not touch this valley. In addition to a considerable amount of lumbering which has been done on the river, it is a favorite resort of trout fishermen and

*The general place of the river in the history of New Brunswick is briefly discussed, with references, in the *Transactions of the Royal Society of Canada*, X, 1904, *ii*, 120. The locations of all of the families on the river in 1876, at the time its settlement was most thriving, are shown upon Roe and Colby's *Map of Northumberland County*, published at Saint John in that year, while other facts are contained in the grant plans of the Crown Land Office. In addition I have been so fortunate as to obtain very full information as to the nationality etc. of the early settlers,—too much in fact to publish in the present paper as I originally intended. For this information, and much more besides, I am greatly indebted to Mr. Alexander Arbo, himself an almost life-long resident on the river, who has answered my many troublesome inquiries with the greatest readiness and courtesy, and to Mr. J. J. MacKinnon, long a school teacher in the settlement. The information they have given me I expect later to publish in full in another connection.

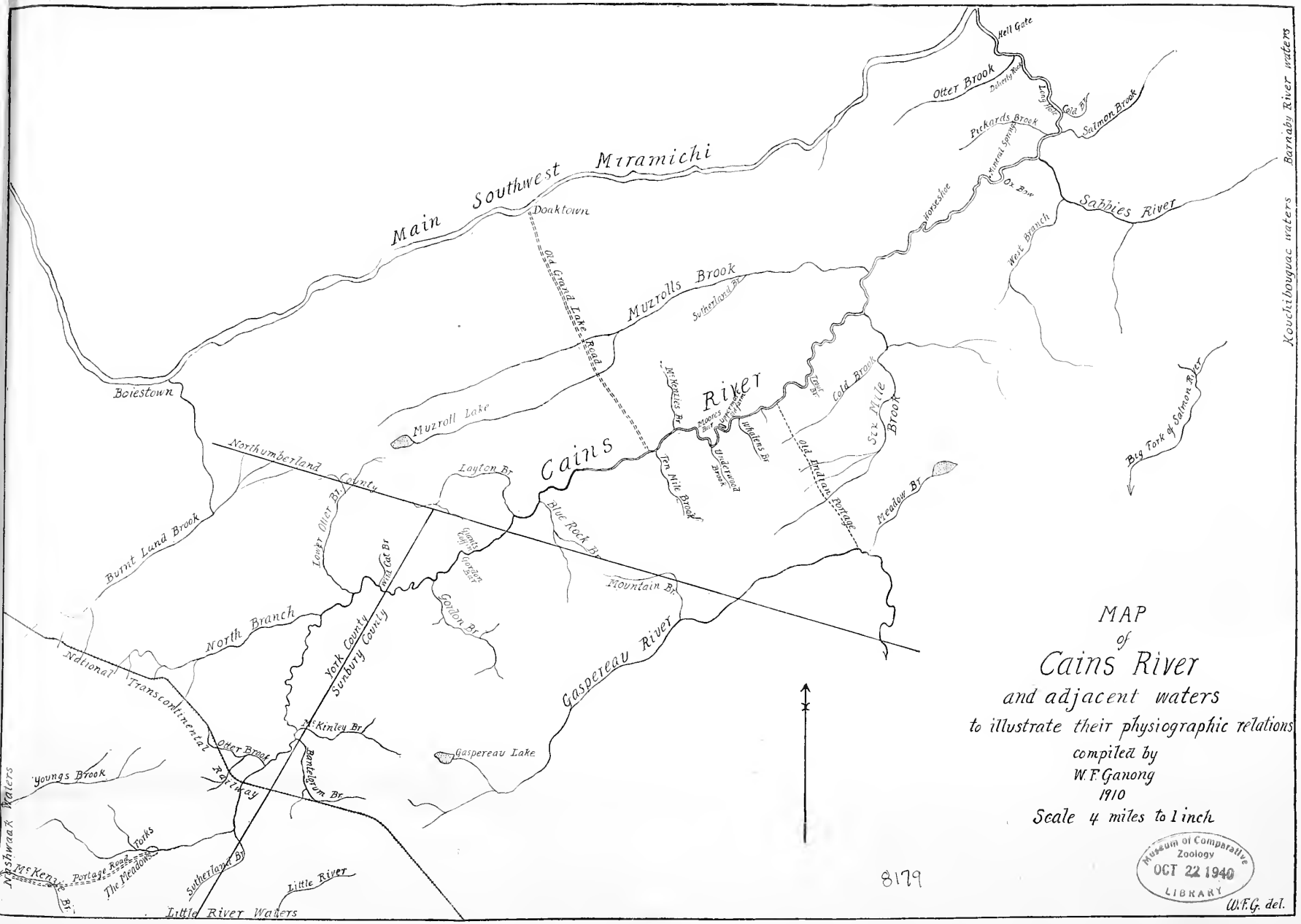
other sportsmen,* and two or three sporting camps, reached by roads from the Miramichi, now stand in good places along the stream. While a remarkably good trout river, especially in its upper course, it has never been, according to local report, good for salmon, those fish not being partial to such dark waters as it possesses. Only a single mention of the river occurs in the *Reports* of the Geological Survey, and that a brief mention of glacial striae by Chalmers in his Report for 1895, M, 60, though there is considerable additional information, which must have been added by him as result of a visit, upon the Surface Geology map. The structural geology is correctly laid down, as Carboniferous sandstones throughout the entire course and watershed of the river, upon the geological map. though apparently no geologist had previously visited it. Finally, the latest point of interest in its history is the construction across it, near its head, of the new Transcontinental Railway, now nearing completion.

So much for the history of Cains River so far as man is concerned. We turn now to an account of its geographical evolution. The river rises on the Carboniferous plateau interlocking with branches of the Nashwaak, as shown by the map. At the pleasant low upland bank, (The Meadows), where the Zionville portage reaches it, the stream comes winding out of an extensive meadow lying in a large basin in a very open country. This basin is not, however, on the very surface of the plateau, since one descends a good deal from the Nashwaak watershed to reach it. Cains River is here a small narrow dark stream, easily navigable for canoes in high water such as we had, though in ordinary low summer water it is too shallow for such navigation. It runs northeast as a pleasing little stream, though long still-waters broken by short reaches of quickwater or gentle ripples between pretty banks of intervale, meadow and low upland

*There is a brief mention of a hunting trip to the river by Dashwood, in his very interesting book *Chiploquorgan* (page 119). An account of a trip by a fishing party down the river is in *Forest and Stream*, May 3, 1902, 345; a narrative of a hunting trip to Muzroll Lake ("Maswell Pond") is in the same journal for October 7, 1905, 293. Another account is in the *National Sportsman*, XII,, 1904, 314, and another in more detail, is said to be promised for an early number,

occupied by mixed woods in a country showing no hills or elevations of any kind. This character continues down to near the crossing of the railroad, when the stream become swifter and a little broken, with a wide bed and stony bottom which would give the canoeman much annoyance at low water. At the railroad, where the bed of the stream is 410 feet elevation by spirit level, the river has evidently begun to cut down into the plateau, for the banks here rise steeply some 30 feet which is the height of the railway bridge. Below, it continues of much the same character, though with some long quiet pretty pools, down to Upper Otter Brook, where, as so often along this river, is a charming open camp ground.

Below Otter Brook, the river continues a series of quick-waters, with intermediate stillwaters, broken by occasional small rips, between banks usually of meadow but sometimes of low upland, though gradually some banks of sandstone in the form of low cliffs appear. Below McKinley Brook, the river is evidently cutting more deeply into the plateau, for the valley walls, at first low, gradually grow higher, and in places show marked cliffs. In this part the river seems to be cutting across a ridge, for below the North Branch the country falls off and continues lower to beyond Lower Otter Brook. In this part, the river is a very charming canoe stream, smooth and ever swift though with little fall. Here and there the bed of the river is composed of flat sand stone ledges, apparently indicating that this river is now cutting into its rock bed, and has not a bed of drift. Below Lower Otter Brook, the river becomes gradually shallower and more rocky and would give trouble to the canoeman at low water. Here the valley walls soon rise steeply, and the great burnt country is entered which extends for most of the distance to the mouth of the river, though the new growth is developed enough to give the country a rather pleasing park-like aspect in many places. The river now runs for some miles in a deep valley of steep walls, evidently a plateau cut 50 or 60 feet at least deep; and from the bare knolls an appearance can be seen as if this deeper and newer valley were cut below a more ancient and shallow trough valley, but of this



I could not be sure. The river meantime becomes very quiet, and runs between its high walls and occasional cliffs in a series of great stillwaters and gently moving quickwaters, with only occasional little rips between. This part of the river is not post glacial, for there is much intervale and glacial material, but it has an appearance in places almost of "interglacial" origin. At Layton and Blue Rock Brooks the country falls off and is lower and more open, but soon rises again, while the river for a distance becomes shoaler and swifter. Below Ten Mile Brook the valley becomes narrower and the valley walls steeper and higher with many fine cliffs, this part appearing almost "interglacial" in age, and cut 100 feet or more into the plateau, while the river is narrower and deeper. But soon it again opens out, and develops some fine slopes and low terraces, which have been cleared and farmed, though now once more reverting to wilderness. Thus the river continues down to Arbo's, now the uppermost house (though abandoned) on the river, and thus it continues also, a series of fine long stillwater reaches through high valley walls, but with occasional fine low terraces, a very pleasing country, down to Six Mile Brook, where now stands the uppermost occupied house on the river.

Below Six Mile Brook the valley is wider, though it rises on one side or the other into a high wall, sometimes in abrupt cliffs, but there is room for wide terraces and intervales.* These are more or less cleared and settled, but in many places are abandoned and growing up in park-like and attractive manner, providing innumerable pleasing camp-grounds. Meanwhile the river bed remains mostly quiet and deep, forming a canoe stream of the easiest and quietest character, explaining very fully why this route to the St. John was such a favorite in early days. The low terraces afford at many places, and especially at Muzrolls Brook, and Sabbies River, camp grounds of the most pleasing character, which I have no doubt were great favorites in Indian and French times. Below Salmon Brook the river turns abruptly

*At one place, at the Oxbow, are some mineral springs which we examined. They come out of a high rock bank, and stain the rocks a rusty red, but have no very marked taste.

northward to the Miramichi and runs in a deep, rather narrow, course in an almost unsettled valley which is somewhat, though not very different in character from the part above; but the river bed continues deep and still all the distance with the exception of one small rapid at Hell Gate, almost the only rapid worthy of the name on the entire river. The plateau here is higher, apparently, than anywhere above, and the river is evidently cutting across a considerable ridge. Finally Cains River flows quietly into the Miramichi.

We summarize now the physiographic evolution of the river. Inspection of a general map will show that the flat country in which it rises lies nearly in a continuation of the upper part of the Nashwaak valley. The whole appearance of the topography of that region, as I have seen it from different directions, together with the analogy of the direction of the parallel Taxes-Miramichi valley to the northward, makes it seem wholly probable that the upper Nashwaak, above Cross Creek, formerly continued its course right along the direction where now lie McCallums and Youngs Brooks to the present source of the river, and thence, probably by the North Branch, (the part above McKinley Brook belonging to the Gaspereau), along the present course of Cains River as far as Salmon Brook. This combined Nashwaak-Cains River valley was subsequently bisected by the working back of the present lower Nashwaak, leaving the Cains River part as a shallow valley cut but little below the general surface of the Carboniferous plateau. In the course of time this stream has cut its valley deep down below the old valley, resulting in the typical case of a "rejuvenated" valley such as Cains River really presents.

The remarkable parallelism of all the streams of this region, and their striking continuity of direction with other rivers to the eastward, has already been discussed in earlier notes (Nos. 50 and 93); the facts seem to make it certain that both Cains River and Gaspereau formerly continued their main courses north-eastward to the sea through some of the smaller North Shore rivers, and received the right-angled turns of their lower courses by subsequent changes. Thus, Cains River probably

followed the present course of Salmon Brook across to Barnabys River while the Gaspereau probably had a course into the Kouchibouguacsis, as I shall discuss more fully, with new evidence, in a note upon that river. In a country of such flat relief as this possesses, the evidence for such former connections must be chiefly cartographical, but everything I have seen able to observe upon the ground is strictly in harmony therewith.

The alignments of the streams shown within the limits of the accompanying map suggest one or two other possibilities. Thus it seems plain that the upper part of Burnt Land Brook must have emptied through Muzrolls Brook, but was turned into the Southwest Miramichi by a process exactly identical with that which turned Cains river itself into the Miramichi. Again, the alignment of the upper Gaspereau with the upper part of Six-Mile Brook suggests a possible old course by this route and the west branch of Sabbies River, though this is much less likely than the other course for the Gaspereau already mentioned. One can also fancy an alignment between Cains River above Trout Brook, and the course of Sabbies River through to the Kouchibouguac, leaving Muzrolls Brook as the head of the river through Salmon Brook, a view which I suggested in the discussion of these rivers in Note No. 93, but which I now regard as less probable than the arrangement suggested above.

There is an interesting fact about the easterly sloping plateau through which Cains River flows. It is by no means a uniform slope, but on the contrary seems to present a series of low crests and troughs across the course of the river. Possibly these have only been formed by erosion, but there is a possibility that they are tectonic. Thus, there is a crest below McKinley Brook, while Lower Otter Brook lies in a trough, one which can, I think be traced along the lower course of Burnt Land Brook and a part of the southwest Miramichi itself. Below is another crest, and then a trough at Blue Rock and Layton Brooks, and I am told that this low country extends through to Gaspereau by Mountain Brook, while Muzroll Lake seems to lie therein to the northwest, and it is possible that Big Hole Brook and Dungarvon

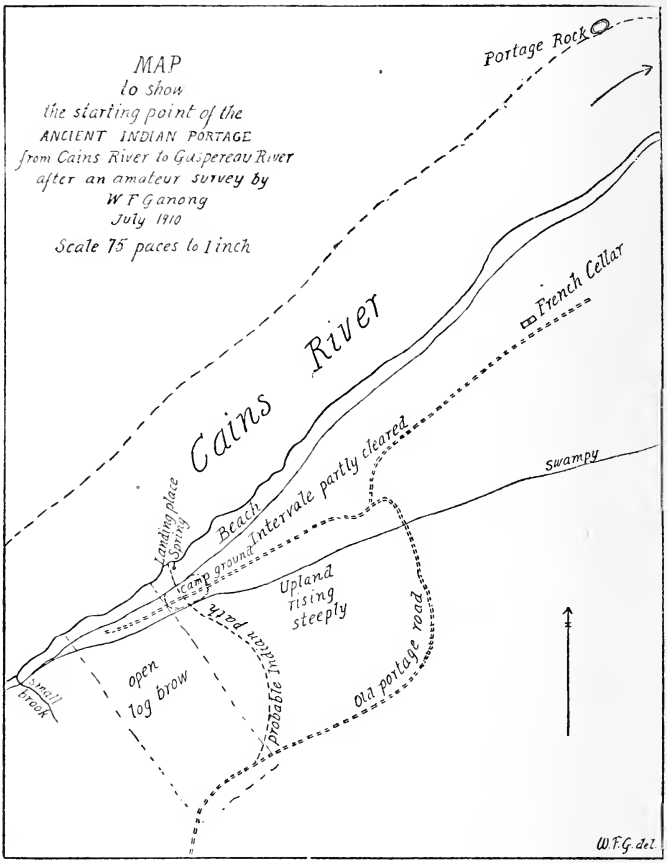
Lake lie in the extension northward. Another crest comes below Blue Rock Brook, and a trough at Six Mile Brook, of which the valley of Big Fork of Salmon River may be an extension. Then follows another crest, with another trough at Sabbies River and the lower course of Cains River, a trough which is continuous with that of the northwest Miramichi, after which comes another crest. If these troughs and crests actually exist they are probably minor synclines and anticlines parallel with those larger ones which have given the north coast of New Brunswick its form, and have made the Straits of Northumberland and Prince Edward Island.

Supplement to Note 118.—The Ancient Indian Portage from Cains River to the Gaspereau.

One of the most interesting of the features of Cains River, and one which will remain of interest to the people of New Brunswick as long as they care for their history at all, is the ancient portage route which connected this river with the Gaspereau, as a link in the most important aboriginal route of travel from the Miramichi to the St. John waters. Its importance is witnessed by the references which occur in our early records, (all of which are summarized in the *Transactions of the Royal Society of Canada*, V, 1899, ii, 251 and XII, 1906, ii, 93,) and also by physiographic or geographical probabilities,—since this route is by far the easiest of travel, and most practicable at all seasons, between the St. John and Miramichi systems. It was used, no doubt, by the Indians from the time of their earliest migration into this part of America; it was surely the principal route of the French when they had to move back and forth through Acadia in the troubled times of the expulsion, and it was even used as a regular route of travel by the English after the foundation of the Province. But although thus historically important, it has, by one of those freaks of historical fortune which are sufficiently common, escaped exact description in maps or records, and, having been now for over a half century out of use and having therefore become overgrown by the forest, it has been only by a combination of the fragmentary historical records, the recollection of certain old people who knew it when still in use, and a minute examination of the country itself that I have been able to recover its location with certainty.

The portage left Cains River, as shown by the accompanying map, about twenty one miles from its mouth. Up to this point both Cains River and Miramichi are extremely easy for canoe navigation at all stages of water, being comparatively deep, quiet, and free from rapids, the few of these which occur being of insignificant difficulty. To one ascending the river, the approach to the portage is marked, in one of the very prettiest parts of the whole stream, by the presence, on the north side of the river, of an immense and conspicuous solitary sandstone boulder, a flat fragment of ledge which has slipped down from the low cliffs above and now rests slanting against the bank. This rock is known universally to all who use the river as *Portage* Rock. On its flat surface, by the way, can be traced a crude suggestion of a human face, and no doubt the Indians had some interesting legend, now forever lost, to explain this noticeable feature. Some 200 to 300 yards further up river, on the south side, started the portage, as all evidence agrees. Thus far the matter is plain, and it is only when we try to locate the exact spot at which the path left the river that we meet with any uncertainty. There is in the Crown Land Office an important plan of the timber lands on Cains River made by Fairweather in 1836, and exactly at the crossing of a timber-line of his in this vicinity there is written in pencil, faintly but unmistakeably, *old portage leading from Cains River to Gaspero*, and there is also a plan of lots on the river which refers to this line as *Deputy Fairweather's line at the old portage.* These references appear to show that the line started exactly at the portage, which could thus be located if the line could now be found. All trace of it in this vicinity has, however, vanished, though it could perhaps be recovered by a skilled surveyor; and its location is not known exactly even by the one man who would be likely to know it best, viz., Mr. Alexander Arbo, who formerly lived on a farm, now abandoned, a half mile above the portage, and who has known the river intimately since early boyhood. Mr. Arbo has been so kind as to give me a great deal of information about the river and the portage, both by letter and by word of mouth; for I had the great good fortune to meet him almost on this very spot during my visit in July last. Mr. Arbo remembers that the line came down to the river in the near vicinity of the camping ground marked on the map, but he cannot remember exactly where. He himself does not remember the actual Indian path, but he does remember that the old wood road, marked as ascending the hill upon the map, and which was early cut out and used for travel through to the Gaspereau, has always been

said to follow the old Indian path. This, for the most part, it no doubt did, as I shall presently note, but in this vicinity the road is evidently and naturally so placed as to give an easy slope for teaming up the steep wall of the valley to the higher



ground, which forms a plateau nearly one hundred feet above the river level, though it is to be noted that it is not at all necessary that the path should have taken such a course. No direct evidence being thus available for the exact location of the path, we must turn to probabilities indicated by the nature of the locality; and fortunately these speak in no uncertain

tone. Considering that the Gaspereau lies directly to the south, the path would naturally have left Cains River at the most southerly point, which is a little to the westward of the limits of the accompanying detailed map. But this most southerly bend lies against an inaccessibly steep wall of the valley, and the nearest point at which this valley wall becomes accessible at all is at or just east of the log brow shown upon the map. If, now, one views the shore of the river all along this part of its course, he finds one spot, clearly indicated upon the map, marked out by characteristics which strongly point to its probable use as the starting point of the path. In the first place, there is here a piece of firm flat shore of gravel and clay forming a kind of natural platform alongside of which canoes can be brought very conveniently, while there is no other spot just above, and none for a long distance downward, (where the immediate shore is mostly low and soft) so convenient for the purpose. Of course the place must have been altered somewhat in the course of time and especially through the action of the waters carrying lumber in recent years; but the whole tendency of the log-laden floods of spring is to wash away and not build up such places, whence I infer that this platform is not new, but rather a remnant of one which was formerly larger. Close beside and below it there gushes out from the bank a very clear cold little spring, the best by far for a long distance up or down this shore, and up the bank a few feet is a fine dry level flat, now an attractive shady glade. This flat forms one of the very finest of camping places, much the best for a long way up and down the shore, and one which has evidently been much occupied, as witnessed by its long-used fireplace. We have ourselves camped upon it with a deep feeling of satisfaction in the belief that we had this bond in common with a very long and ancient line of worthy voyageurs, with whom we have no little pride in being numbered. Close behind the flat the valley wall rises steeply, but not too steeply for ascent, as is shown by the fact that old paths, evidently used by the same lumbermen who made the log brow just above, wind easily up it. All probabilities appear to me to unite in connecting the old Indian path with these places, and I believe there is no doubt that the Indians used the gravel platform as their canoe landing, camped on the dry flat, drew their water from the spring on the shore, and climbed the valley wall by a winding path just behind, somewhat along the course shown by the map.

It is of interest, incidentally, to note that on the extensive intervale, formerly cleared and now half open and half grown

up to bushes, eastward of the camping place, there exists a conspicuous old cellar, in a curious double or triple form. Mr. Arbo tells me that the first settlers found here the ruins of a house, which contained two fireplaces, surrounded by about two acres of cleared land, while in the vicinity have been found some relics,—pottery, stone and iron axes, a stone pipe, etc., showing extensive early use by French and Indians. Furthermore, there is a tradition on the river that this was a French "station," and that another existed at the mouth of Muzrolls Brook, and a French settlement also at the Long Hole. The French origin is wholly probable, and it is no doubt a relic of the time when the Acadians had to settle temporarily in retired places beyond reach of their English enemies who were trying to expel them wholly from the Province; and it is quite probable that it really was a post or station for travellers by the portage.

We turn now to the route of the portage south to the Gaspereau, a distance of about seven miles across the plateau country. According to Mr. Arbo its course is coincident with an old road which, though much overgrown, can still be followed as far south as Cold Brook. This road swings up the hill by an easy route as shown on the map, crosses the head of the log brow, and then turns southward, which course it originally kept to Cold Brook; but later a deviation was made westward along an old road now following the river, in order to avoid a great blow-down caused by the Saxby Gale. With the exception of the part where it ascends the bank, and the deviation above mentioned, I have no doubt that the road and the old path are practically coincident It is wholly probable that the makers of the road, in crossing this very level country directly southward, would follow the route already clearly marked out for them by the portage path; and moreover, as Mr. Arbo tells me, at the point where the road crosses Cold Brook an old kettle has been found, turned over various utensils, etc., all of which no doubt were abandoned by the French in some hasty portage, showing a coincidence of road and portage at that point. Beyond this place, according to Mr. Arbo, the old road crossed the western end of an immense open barren. This my companion and I missed, for after following the road to the brook we took a wrong route and held too much to the westward. Thence, partly along timber roads and partly steering by compass, we held to the magnetic south, and crossed a level and undulating country, no doubt substantially like that crossed by the path, through some open barren, some burnt upland, and some swamps

and bog, intersected by some five different brooks all running to the eastward, and reached the Gaspereau a half mile above the portage.

The Gaspereau end of the portage has proven equally difficult to locate exactly. No known map marks it in any but the crudest manner, even the plan by Beckwith, earlier mentioned, which professes to show it, being obviously only a sketch. But from Mr. Arbo, and especially from Mr. P. H. Welch, one of the most valued of my correspondents, who speaks not only from his own long and extensive knowledge of that region, but after consultation with other old residents, I have learned that the path left the Gaspereau above Portage Island, which is half a mile above Meadow Brook. This place I have examined and mapped with care, but I withhold the map, partly because it belongs properly with my note upon the Gaspereau which I hope later to publish, and partly because I wish before publishing it to re-examine the locality. Portage Island lies in the extreme northerly bend of the river. It is an insignificant island, lying close to the northern bank, flat, treeless and little more than a weed-covered gravel bar; but it is unmistakeable, for it is the only island for a long distance up and down the river. To the eastward a bogan separates if from high rocky land leading up to a line of sandstone cliffs, while north and west of it lie the "Portage Island Flats," a low open intervale, almost a marsh, covered with coarse grass. In our visit I was under the impression that the portage path left the river east of the island, at a place where a clear little brook falls into the river, paralleled by an old lumber road along its western side. Here we detected and surveyed a very old path, west of the road, leading up by a very easy ascent to the plateau one hundred feet over the river, and this we thought was probably the Indian path. But Mr. Welch tells me that the path left the river nearly a quarter of a mile above Portage Island, and above the intervale flats, and that it led up through a ravine or gap in the cliffs which afforded the only route to the plateau at this place. Later a lumber road was cut along the same route, though now it is quite obliterated. Where the path left the river, on the western side, was formerly a camping place, now overgrown; and a few years ago the washing away of the bank about a hundred yards farther down stream brought to light a large store of bullets, doubtless buried for safety and never reclaimed. Additional details I hope to give with the map in the later note.

Below the Portage the Gaspereau is a swifter and shallower stream than Cains River, but yet is comparatively an easy canoe

route, and must have been ever better in earlier times before lumbering operations had widened and shoaled its bed.

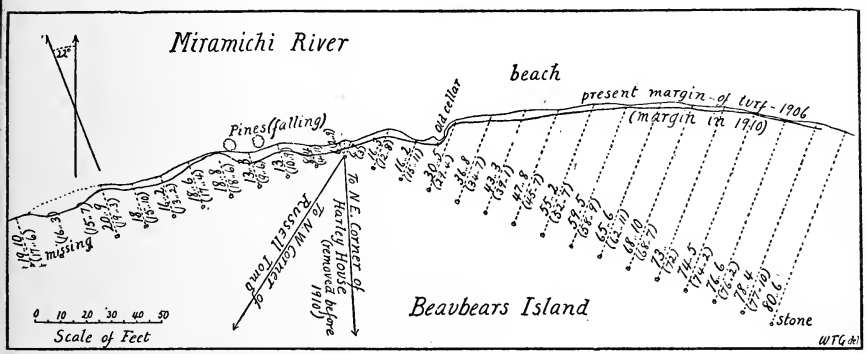
Some day, the important historical sites of the Province will be marked in suitable and permanent fashion by our Historical Societies, and among the first to be fixed in this manner should be the ends of the Cains River-Gaspereau portage.

119.—An Absolute Measure of the Rate of Recession of the New Brunswick Coast Line.

It is a fact familiar to all concerned with our physiography that New Brunswick is slowly sinking beneath the sea, thus allowing the waves of the ocean to encroach upon the land and wear it away. Naturally, it is a matter of much interest to measure this rate of sinking and the correlated recession of the coast. In an earlier note of this series (No. 83) I called attention to a very favorable opportunity for a measurement of the latter phenomenon. It is based, in brief, upon the fact that in the open level field which forms the northern and exposed end of Beaubears Island there happens to stand a line of old fence posts, cut so close to the ground that they are likely to remain indefinitely undisturbed, and so situated that offsets at right angles to the line can easily be measured to the seaward edge of the field, which is being undermined and washed away by the sea. It should therefore be possible to use the posts as a basis for measurements at considerable intervals, which would permit a somewhat exact determination of the rate of recession. My first measurement was made in August, 1904, and is recorded in the aforementioned note, with a suitable diagram. In August of the present year, after an interval of exactly six years, I was able to measure the offsets by aid of the same methods, the same companion and even the same tape measure (or one exactly similar, since I possess two alike), In order that the measurements should not be influenced by any pre-conceptions upon my own part, I carefully refrained from reading my former figures until after all of the new ones were made and recorded. The results are shown on the accompanying diagram where the

change in the coast line is shown on a true scale, and the figures are added in parentheses upon the very copy from which the cut was made to illustrate the earlier note.

The testimony of the figures is unmistakeable. In the very short space of six years, the sea has eaten horizontally into this coast for a distance averaging one foot eleven inches, which means almost four inches a year, and thirty-three feet in a century. There is no reason which I can imagine why this particular locality should be subject to a faster erosion than the North Shore in general, but on the contrary the comparative shelter given



by the position of the island within the Miramichi would tend to make the action of the waves much less rapid than at many places on the more exposed coasts. Hence these figures are probably conservative for the coast as a whole. This rapid removal of the flat coast is a fact which must be taken into account not only in physiographic but also in archaeological studies.

I found that the posts had decayed considerably since my last visit, and in order to make their positions secure for future measurements, I gathered small boulders, of cobblestone size, from the beach, selecting always some kind other than the sandstone of the island; and I forced one of these into the decaying center of each of the posts, driving them just below the level of the ground. If should be possible to locate these

boulders for a long time in the future, since, although they will become more or less buried, the compass directions of the lines, (as shown on the diagram), and the regular distances apart of the posts, (somewhat under fourteen feet from center to center), will permit the positions of all to be determined when any one of them is once found. It should, however, be remembered that while my measurements were taken from the nearest edges of the posts to the shore, the stones are in the centres of the posts, which will make a difference of a few inches when the stones are used. While thus marking the posts I was able to locate the position of those designated "missing" on the earlier diagram, and accordingly they are added upon that accompanying this note.

ARTICLE III.

THE MARINE AND ESTUARINE DIATOMS OF THE NEW BRUNSWICK COASTS.

By L. W. Bailey, LL. D., F. R. S. C.

Read December 6, 1910.

Introduction.

The land flora of New Brunswick has been the subject of study by many observers, and a fairly complete though not exhaustive list of the terrestrial plants of the Province has been made. But there is one group of low but very beautiful forms to which almost no attention has been paid. This is the group of the Diatoms, a family of microscopic Algae of the Class *Chlorophyceae,* abounding everywhere, but, owing to their minuteness, beyond the reach of ordinary observation. A list of those occurring at Harris's (or Matthew's) Cove, on the Kennebecasis, was published by the writer in the Bulletin of the Natural History Society for 1863, and subseqently short lists of forms observed about Chatham were published in the Proceedings of the Miramichi Natural History Society, by Dr. J. McG. Baxter, but, with these exceptions, there is absolutely no reference to these interesting forms in the botanical literature of the Province.

It having been the writer's good fortune to spend several weeks in the summer of 1909, at the Biological Station at St. Andrews, and a considerably longer period in 1910, his interest in the study of the Diatoms was, after nearly fifty years neglect, renewed, and the opportunities afforded for their more careful study were eagerly embraced. These opportunities included not only the examination of collections made by members of the staff in the immediate vicinity of the Station, including the

viscera of fishes, Molluscs and Echinoderms, but soundings, dredgings and plankton gatherings from all parts of Passamaquoddy Bay, about the Western Isles and Grand Manan. Many gatherings were also made from the bottom and shores of the lower St. John and Kennebecasis rivers, from the wharves in St. John Harbour and Courtenay Bay, and finally about St. Martins. To these were added interesting collections, made by Dr. Baxter, from buoys in Miramichi Bay. So that, taken together, we have in them a very fair representation of the characteristic forms of the New Brunswick seaboard, especially in its southern portions.

It is the hope of the writer that by presenting in this and subsequent articles the results of his studies of these lowly organisms he may not only add an interesting chapter to our knowledge of the flora of the Province, but also lead other observers to take up a study which, besides being of economic importance, never fails to fascinate those who, with proper equipment, enter upon it. He proposes, therefore, in addition to giving lists of the species observed, to represent by figures the more common and typical species of the different genera, with brief descriptions of their character and distribution. Later this may be followed by similar articles upon the fresh-water Diatoms and those which, under the names of Tripolite and Infusorial Earth, are often found constituting the bottom of lakes and ponds.

To make the subject intelligible to beginners a few words are necessary as to the structure and life history of Diatoms.

If the reader will take the trouble to glance at the accompanying plates he will get a good idea of their general appearance. They exhibit great variety of form, including shapes which are linear, bacillar, ovoid, circular, triangular, quadrangular, sigmoid, crescentic, boat-like, wedge-like and others. As a rule they are remarkable for their beauty of outline and also for their perfect symmetry. In addition to their exquisite shapes, which often suggest artistic patterns, their beauty is greatly enhanced by the marvellous details of their

surface, upon which are to be seen vast numbers of minute lines or *striae,* variously arranged and sometimes separated into distinct areas by smooth bars or empty spaces. Though usually free and independent they are often connected together in chains, sometimes side by side or end to end, in other instances by their alternate corners, thus forming either ribbands or zig-zag chains. Each individual, whether independent or connected with others, has a complete wall enclosing a cavity and is therefore a true cell, and the Diatoms belong to the group of the Unicellular Algae. Within the cell there is, of course, more or less protoplasm, the source of its vital activities, and with this various other substances, including coloring matters, but while the other chlorosperms, as their name indicates, contain much chlorophyll and are of a bright green tint, the Diatoms have relatively little of this substance and their color, instead of being green, is brownish yellow. But the most remarkable feature possessed by all the members of the group, is the power of secreting silica from the waters in which they dwell and depositing this in their tissues. Other plants, like certain grasses, do indeed separate silica and deposit it in their cells, thus acquiring increased strength, but in the Diatoms not only is the quantity comparatively much larger but it is so disposed as not only to give to the individual permanency of form and a considerable power of resistance but also to determine the wonderful and often very elaborate patterns with which the exterior of the cell is decorated. When we remember that the Diatoms stand very nearly at the base of the scale of vegetable life, it is truly wonderful to find them manifesting a constructive activity and a variety of architectural conceptions such as an accomplished artist might well emulate. It is the formation of these siliceous skeletons, as transparent as crystal, which gives to Diatoms, as will be presently explained, their economic and geological importance.

But what perhaps is still more wonderful is the power of independent movement possessed by many of the Diatoms, and which in some instances is truly marvellous. They may often be observed swimming across the field of view of the microscope

with a somewhat rapid motion (though this is in reality magnified as well as the objects themselves) encountering or retiring from obstacles, and with every appearance of spontaneity. How it is done is a puzzle not yet satisfactorily settled, but is doubtless connected with the internal activities of the cell and the work of that wonderful substance, Protoplasm. It was this property, no doubt, which led the earlier observers to regard the Diatoms as animals and to rank them with the group of the Infusoria as they are still often called. But no trace of organs of locomotion, such as are found in the latter, have yet been observed even with the most powerful microscopes.

In order to get an idea of the structure of the Diatom cell it is well to compare the latter with one or two familiar objects. The first comparison is with an ordinary pill-box. This consists of a circular collar, with a fixed base and a moveable cover. If the base be also made moveable the resemblance to a Diatom, especially one of the circular forms (such as Coscinodiscus, Fig 15) is very marked. The Diatom also has two covers, termed "valves," and between these a collar or "connecting membrane," all easily separating from each other, and it is from this easy separation that the name of Diatom (dividing into two) is derived. Similarly, when compared with a watch, the valves correspond to the two lids of the latter while the "connecting membrane" finds it counterpart in the circular band upon which the lids are fastened. In this case the comparison may be carried further, for the sculpturing on the valves of the Diatom correspond to the artistic designs with which the watch lids are usually ornamented, and in the case of certain circular forms the resemblance to an ordinary engine-turned watch is very striking. Even when the forms are not circular, the structure is essentially the same. All Diatoms, whatever their shape, consist, so far as the cell wall is concerned, of three parts, the two "valves" and the "connecting membrane." It is well to add that when viewing a Diatom the part turned towards the observer, if it be that of a valve, is regarded as constituting the "lateral" or "valvular" view, while if both valves are

visible together with the "connecting membrane," this is known as the "front" or "zonal" view.

The multiplication of Diatoms is by one or other of two processes, both common to all the lower forms of vegetation. The first of these is "by division," the second "by conjugation." When a Diatom is about to multiply by "division" two new valves, are formed within the old one, applied back to back, and each united with one of the old valves by a new "connecting membrane," and as this grows and elongates, the old "connecting membrane" is ruptured and falls off, leaving two new individuals where previously there was only one. The new individuals thus formed may remain adherent to each other, wholly or partly, or may become entirely free as already described. In some instances they remain embedded in a sort of gelatinous envelope or enclosed in gelatinous tubes. The process takes place simultaneously in many cells (or frustules as they are technically termed) and with comparative rapidity, thus accounting for the vast number of individuals usually found associated together. "Conjugation" on the other hand is a comparatively rare process and has actually been observed only in a relatively small number of species. In this case, much as in Spirogyra, a common water plant, often known as Pond Scum, two cells or frustules, lying side by side, mingle their contents (*endochrome*) to form one or two reproductive bodies, known as *sporangia*, usually much larger than the two cells from which they are derived, and which will eventually by "division" form new frustules similar to those from which they were derived. This process, however, is but very imperfectly understood. Single individuals of adjacent chains may be "conjugating" while the others are multiplying by ordinary "division." So rapid is this latter process that it has been estimated that one thousand millions of new individuals may be produced in a single month.

The Diatoms are essentially aquatic, and are to be found in all waters, fresh or salt, to which light has access. They are, however, most abundant and most varied in sea water, while estuaries, like the Kennebecasis, and marshes and creeks to

which the sea has access, usually also afford large numbers of species. They make up a very considerable proportion of the so-called "plankton" or assemblage of free swimming microscope organisms which abound everywhere near the surface of the sea, whence they may be obtained by the use of "plankton nets," constructed of the finest silk gauze, and which are drawn through the waters by row boats or motor boats. Many are attached to sea-weeds, others to buoys or to the piers of wharves, still others, though usually in a dead condition, are found in the products of sounding and dredging. Finally, the stomachs of fishes and various marine invertebrates often afford a rich harvest.

The Diatoms are of considerable economic interest both when living and when dead. It has been stated that they exist in countless numbers in all waters, fresh or salt, and hence it is not to be wondered at that they play a part of the first importance in connection with the food supply of the animal life tenanting the same waters. This is directly proved, as just stated, by finding them so abundantly in the stomachs of these animals; but it has been further observed, in connection with the cultivation of oysters and clams, that these thrive best where Diatom life is most abundant, and that the development of Diatoms by artificial fertilizers in artificial oyster beds leads to a great increase in the number of the oysters, besides improving their quality. Indeed so important is the part taken by Diatoms as purveyors of food to marine animals that one writer has made the remark that "All fish are Diatoms," in the same sense, of course, that we also say that "All flesh is grass." In other words they are, to a great extent, the basis of the food supply of the entire animal life of the ocean, even to the highest forms, and we cannot attach too much importance to a knowledge of everything which concerns their life history and distribution.

But again, Diatoms are not lost by death. Possessed of indestructible silicious skeletons, preserving all their more prominent characteristics and still capable of easy identification, they simply fall after death to the bottom of rivers, ponds, lakes

or the ocean, and notwithstanding their minuteness, may give rise in time to silicious deposits of vast extent. The material thus formed is known as Tripolite or Infusorial Earth, and several very interesting beds of it occur in New Brunswick, which will be treated of in a later article. But it is in the ocean that the results of Diatom growth and accumulation are most remarkable, it having been ascertained through the explorations of the Challenger and other expeditions, that large portions of the ocean's bed are made up of little else. Sir Joseph Hooker, during the expedition of the Erebus and Terror to the Antarctic seas, found a bank of Diatoms 400 miles long and 120 miles broad, in latitude 60° S., and the later investigations of the Challenger indicated that what is probably the same bank, really has a length of not less than 1,700 miles. The naturalists of the latter exploration were also led to believe that a great zone of Diatoms, or rather of Diatom-ooze, surrounds the South Polar regions between the Antarctic circle and the latitude of 40° S., which is estimated to cover nearly 11,000,000 square miles, while a smaller patch in the North Pacific covers about 40,000 square miles.

Considering the indestructibility of the skeletons of Diatoms, it is not to be wondered at that these should also occur in a fossil condition. As a matter of fact they are found in various formations as far back as the Cambrian era, but are most abundant in the Mesozoic and Tertiary periods, then forming deposits comparable with those of the existing oceans. The beds of Tripolite, already referred to as occurring in New Brunswick, are of this nature, and though doubtless still in process of formation, may have begun their growth in the Pleistocene or even in earlier periods. But of these we propose to speak more fully on a later occasion.

I must now close this introduction by a few remarks upon the collection, preservation and study of Diatoms.

I have already indicated the places in which Diatoms are to be sought. It is a good plan to carry a number of small collecting bottles, which, by closing with the finger and inversion,

may be placed in or over the material sought, which will, by suction when the finger is withdrawn, pass up into the bottle, to be there tightly corked. Or a quantity of pond scum may be directly dipped up by the hand or a cup and introduced into the bottle. If this is to be kept for any considerable length of time it is well to add a few drops of a weak solution of formaline to prevent putrefaction. Mud from river, pond or lake bottoms may be obtained when the waters are not too deep, by cups or scoops attached to poles of suitable length, while submerged objects of almost all kinds are covered with a scum, often richly diatomaceous, which may be readily scraped off with the edge of a knife. For plankton collections, as already stated, very fine silken nets are required. The collection having been made, it may be necessary to remove impurities. If these consist of sand or mud, a separation may be made by mere decantation, the Diatoms being usually much lighter than ordinary mineral matters. If the collection is from sea water, the salt must be gotten rid of, as otherwise it will crystallize upon the glass slides, but the removal is easy as the result of the addition of fresh water and decantation until all traces of salt is removed. Finally, if there be much organic matter either in or with the Diatoms, it will be well to place the material in a test tube and boil for some minutes with strong nitric acid, subsequently removing this as before by dilution and decantation.

A good microscope is required for all work with Diatoms and high powers are needed for satisfactory results. A one-quarter inch or a one-sixth inch objective, such as made by Leitz, Zeiss, or Bausch and Lomb, answers well for ordinary observations, but for the smaller and finer forms a one-twelfth oil immersion will be needed. Some means of exact measurement, in other words some form of micrometer, will also be required for specific determinations.

The material having been cleaned, as above described, is ready for mounting. This is done on ground glass slides which may be obtained, with thin glass covers, from dealers in microscopic supplies. (Lyman & Co., Montreal). A small

quantity is placed in the centre of the slide and on this is placed a single small drop of Canada balsam. The cover glass is next put on, and the slide being gently warmed, the balsam spreads beneath the cover, carrying any air bubbles with it, while by gentle pressure the former is made to take its final position. The exposed edges soon dry, and the slide is ready to be labelled and used.

For the determination of Diatoms certain literature is required. It is hoped that the present series of articles, with the accompanying plates, will enable students in New Brunswick to recognize at least the genera of the more common and typical forms met with in the Province, and lists of all species so far observed will also be given, but to identify all of these it will be necessary to have access to standard works. The most generally useful of these, on account of the number and accuracy of its figures, is "Smith's British Diatomaceae," which includes a great number of forms found also in America, but if to this the student can add copies of "Van Heurck's Diatoms of Belgium," "Castracane's Diatoms of France," and "Wolle's Diatoms of North America," he will be well equipped for work. Numerous more special articles are to be found in the Smithsonian Contributions, in the London Microscopical Journal and in the Reports of various exploring expeditions. Type specimens may also be obtained from dealers but are expensive.

I shall now proceed to give a tabulated list of all the marine and estuarine Diatoms so far observed about the coasts of New Brunswick, leaving the fresh water and fossil forms for later consideration. A figure representing at least one species of each genus will be given in the accompanying plates. For the more exact determination of a considerable number of the species indicated I am indebted to Dr. A. H. MacKay, of Halifax.

EXPLANATION OF TERMS.

Frustule, one complete diatom cell. *Front view*, the aspect looking at the connecting membrane. *Side view*, looking at a valve. *Valve*, one side of cell, connected with its fellow by the connecting membrane. *Striæ*, lines of dots. *Costæ*, ribs. *Nodules*, swellings at centre or extremities. *Median line*, central longitudinal space, destitute of striæ. *Stauros*, a lateral expansion of median line to form a *cross*. *Stipe*, a stalk or pedicel, found in attached species. *Keel*, a line of prominences or projections. *Awns*, long and sharp processes. *Plankton* free, floating microscopic forms of life, plant or animal. *Bacillar*, rod like. *Arcuate*, bowed. *Flabellate*, in fan-like clusters. *Cuneate*, wedge-like. *Sigmoid*. like the letter S. *Annulate*, ringed. *Septa*, partitions. *Calyptriform*, like a cap,

ACNANTHES.

Acnanthes. Frustules bent, the upper surface convex, the lower concave. Solitary or aggregate, attached to a stipe, which may be long or short. Valves striate, unsymmetrical, the lower with a longitudinal or transverse line. Central and terminal nodules.

A. longipes Ag. Very abundant in Miramichi Bay, Passamaquoddy Bay and Grand Manan (rare). (Plate 1, Fig. 1.)

A. brevipes Ag.

A. subsessilis K. Kennebecasis. Rare.

Actinoptychus. Frustules free or adherent, discíform. Valves plane or slightly convex, cellular, undulated, with conspicuous central nodule and radiating lines, dividing the surface into triangular segments.

A. undulatus Kütz. Common about Passamaquoddy Bay, St. John and St. Martins. Typically marine. (Plate 1, Fig. 2.)

AMPHIPRORA.

Amphiprora. Frustules, free, simple, in front view constricted in the middle; valves convex, with a longitudinal wing or keel, and central or terminal nodules. Striae, when present, transverse.

A. alata Kütz. Rothesay, St. Martins, Passamaquoddy.

AMPHORA.

Amphora. Frustules free, or adherent. Valves cymbiform; lateral view lunate or arcuate, with central marginal nodule.

A. ovalis. (Plate 1. Fig. 3.)

AMPHIPLEURA.

Amphipleura. Frustules free. linear or sigmoid. Valves with longitudinal ridges.

A. sigmoidea W. Sm. Rothesay, St. Martins.

BACILLARIA.

Bacillaria. Frustules linear, straight, united into a short band, moving on each other by a sliding motion, without separation. Valves with a longitudinal punctate keel.

B. paradoxa Gmel. Near wharves at Indiantown, Rothesay. In plankton gatherings from lower part of St. John river. Readily recognized by its singular movements. (Plate I, Fig. 6.)

BIDDULPHIA.

Biddulphia. Frustules compressed. Quadrilateral. More less perfectly united into a continuous or zig-zag filament. Valves convex, elliptical, cellulate, with or without spines. Angles equal, elongated into tooth-like or horn-like projections. Cellules circular.

B. aurita Lyngb (Plate I, Fig. 7). Passamaquoddy, Kennebecasis, Miramichi, Grand Manan, Le Tete, L'Etang.

B. pulchella? Gray. Passamaquoddy.

B. baileyi. See Zygoceros.

CAMPYLODISCUS.

Campylodiscus. Frustules free, solitary, saddle shaped. Valves equidistant, tortuous or saddle shaped, with radiating costae.

C. cribrosus Kennebecasis. (Plate I, Fig. 8.)

CHAETOCEROS.

Chaetoceros. Frustules, smooth, without striae, usually united to adjacent ones by means of awns, thus forming a filament. The awns proceed either from the frustules or from a band between the latter, and are often, at maturity, extravagantly long. A very peculiar and characteristic plankton genus, the long awns adapting the forms to flotation. It is still only imperfectly known, but the following species have been recognized in the plankton of Passamaquoddy Bay and adjacent waters.

Ch. decipiens. (Plate I, Fig. 10.)

Ch. boreale Bail.

Ch. dicladia ?

Ch. chriophyllum Cast. (Plate I, Fig. 9.)

Ch. (dicladia) Capreolus. (Plate I, Fig. 11.)

COCCONEIS.

Cocconeis. Frustules generally small, adherent to larger algæ. Valves elliptical or orbicular, with a median line and central nodule.

C. scutellum Ehr. Passamaquoddy Bay, common. Miramichi Bay. (Plate I, Figs. 12 and 13.)

C. pediculus. Mouth of Nerepis.

C. placentula ? Harding's Pt., St. John river, Passamaquoddy, Kennebecasis.

COCCONEMA.

Cocconema. Frustules stipitate. Cymbiform. Lateral surface lunate, striae divided unequally by a longitudinal line with median and terminal nodules.

C. lanceolatum. Kennebecasis, estuarine. (Plate I, Fig. 16.)

COSCINODISCUS.

Coscinodiscus. Frustules often large, simple, discoid, free or adherent. Valves or discs flat or convex, cellulate, the cells, which may be large or small, closely or loosely aggregated, being arranged either radiately or in curving lines, sometimes with a central rosette.

C. radiatus. (Plate I, Fig. 15.) **C. Liniatus. C. Americana. C. Eccentricus. C. pellucida. C. griseus. C. marginatus.**

C. oculus iridis.

The first seven of the above species are from Harris's or Matthew's Cove on the Kennebecasis. **C. radiatus** and **C. oculus iridis** are common in the waters of Passamaquoddy Bay and abound in the plankton of the Bay of Fundy.

CYCLOTELLA.

Cyclotella. Frustules free or adherent, disciform, simple or binately conjoined. Valves plane or slightly convex. Striated, striae rayed.

C. Kutzingiana Thw. Kennebecasis, St. John, (Plate 1, Fig. 14.)

C. meneghiniana. Kennebecasis.

C. compta Grun. Passamaquoddy. Kennebecasis.

CYMATOPLEURA.

Cymatopleura. Frustules free, oblong or elliptical. Valves undulated.

Cy. scutellum Rothesay. (Plate I, Fig. 14A.)

CYMBELLA.

Cymbella. Free, cymbiform. Valves lunate, striated, with a longitudinal line and central and terminal nodules.

C. ehrenbergii, Kennebecasis.

C. gastroides, Kennebecasis. (Plate I, Fig. 17.)

C. lanceolata. Kennebecasis.

DIATOMA.

Diatoma. Frustules oblong. Quadrangular. Cohering by their opposite or more generally by their alternate angles into zig-zag chains. Valves elliptical or linear. (Plate I, Fig. 18.)

D. tenue Ag. Kennebecasis.

D. hyemale Lgng. Kennebecasis.

ENCYONEMA.

Encyonema. Frustules cymbiform, arranged in longitudinal series within submembranous tubular filaments producing a frond. Valves divided unequally by median line and nodules. Striae moniliform. (Plate I. Fig. 19.)

E. caespitosum Kutz. Kennebecasis.

E. ventricosum K. Kennebecasis.

EPITHEMIA.

Epithemia. Frustules quadrilateral, lunately curved, with transverse ribs. Strongly marked transverse lines.

E. turgida Ehr. Kennebecasis. (Plate I, Fig. 20.)

E. gibba Kutz. Kennebecasis.

E. zebra Ehr. Kennebecasis. (Plate I, Fig. 21.)

E. musculus Ktz. Kennebecasis. Passamaquoddy.

EUNOTIA.

Eunotia. Frustules free, oblong. Valves arcuate, with terminal nodules and convergent striae.

E. monodon Ehr. Kennebecasis.

E. diodon Ehr. Kennebecasis. (Plate I, Fig. 22.)

E. major. Kennebecasis.

E. pectinalis. Kennebecasis.

E. lunaria. Kennebecasis.

FRAGILLARIA.

Fragillaria. Frustules linear, straight. United into a filament, free or attached. Valves linear or elliptical, smooth or finely striated. (Plate I, Fig. 33.)

F. Sp? Passamaquoddy.

F. pacifica? Grun. Kennebecasis.

F. construens? Grun. Kennebecasis.

F. mutabilis? Grun. Kennebecasis.

GOMPHONEMA.

Gomphonema. Frustules stipitate, wedge-form. Valves variable in outline. striated, with median line and central nodule.

G. acuminatum Ehr. Kennebecasis.

G. angustatun. Kennebecasis.

G. exiguum K. Kennebecasis.

G. marinum. Passamaquoddy, Grand Manan.

G. geminatun A. Kennebecasis. (Plate I, Fig. 24.)

GRAMMATOPHORA.

Grammatophora. Frustules oblong, adhering by opposite or alternate angles in a zig-zag chain. Valves linear or elliptical, marked by conspicuous opposite septa which are usually more or less curved.

G. serpentina E. (Plate I, Fig. 25.) Kennebecasis, La Tete, Grand Manan.

G. marina Lyn. (Plate I, Fig. 26). Kennebecasis, La Tete, Grand Manan.

HOMOCLADIA.

Homocladia. (Plate I, Fig. 27). Frustules bacillar, usually somewhat fascicular, enclosed within submembranaceous branched filaments, forming a frond.

H. filiformis W. Sm. Kennebecasis.

HYALODISCUS.

Hyalodiscus. Frustules simple, disc-like. The central or umbilical portion more or less granulated, and separated from the delicately striated marginal portion by a distinct suture.

H. Sp? Passamaquoddy Bay. (Plate I, Fig. 28.)

ISTHMIA.

Isthmia. Frustules large, compressed, trapezoidal, conspicuously cellular, cohering by short neck like processes to each other or to higher algæ. Frustules always more or less oblique. Cellules more or less hexagonal.

I. nervosa Kutz. Passamaquoddy, La Tete.

I. enervis Ehr. Passamaquoddy. (Plate I, Fig. 29.)

LICMOPHORA.

Licmophora. Frustules wedge-like, arranged in fan-like clusters on thick irregularly branched stipes. Valves convex, elongated, inflected at larger extremity and traversed by a longitudinal median line.

L. Lyngbei Grun. (Plate I, Fig. 30.)

L nov Sp. Kennebecasis.

MASTOGLOIA.

Mastogloia. Frustules oblong, boat-like, annulate, enclosed in a gelatinous cushion or frond. (Plate I, Fig. 31.)

M. Smithii Thw. Kennebecasis.

M. elliptica. Kennebecasis.

MELOSIRA.

Melosira. Frustules cylindrical, disciform or globose, connected into cylindrical conferva-like filaments, usually embracing many individuals. Valves hemispherical or sub-cylindrical, more or less convex.

M. varians. Kennebecasis, Nerepis, The Wolves.
M. Borerii. Kennebecasis, Passamaquoddy, Miramichi.
M. octagona. Kennebecasis.
M. granu.lata. Kennebecasis.
M. crenulata. Kennebecasis.
M. sulcata. Kennebecasis.
M. nummuloides. Indiantown, Miramichi, Passamaquoddy, St. Martins. (Plate I, Fig. 32.)
M. marina. Passamaquoddy, St. Martins.
M. subflexilis. Harding's Pt., St. John River and harbor.
M. Jurgensii Ag. Biological Station, St. Andrews.
M. orichalcea Ken. (Plate I, Fig. 33.)

MERIDION.

Meridion. Frustules cuneate, united in a spiral filament, attached or free Valves elongate, cuneate, with transverse costæ. Striated.
M. intermedium. Harris's Cove, Ken. (Plate I, Fig. 34.)

NAVICULA.

Navicula. Frustules free, oblong, lanceolate or boat like. Valves convex, with similar ends, divided by a median line, with nodules at centre or extremities, sometimes constricted in the middle or near the ends, or with apices produced or beaked.

N. nobilis Ehr. Kennebecasis, (Plate II, Fig. 1.)
N. major Ktz. Kennebecasis.
N. viridis Ktz. Kennebecasis.
N. peregrina Ktz. Kennebecasis, Passamaquoddy.
N. Smithii C Ag. **var. ovalis.** Kennebecasis, Passamaquoddy.
N. elliptica Kennebecasis. (Plate II, Fig. 4.)
N. marina Ralfs. Kennebecasis, Passamaquoddy.
N. maculata Bail. Kennebecasis. (Plate II, Fig. 3.)
N. permagna Bail Kennebecasis.
N. roteana ? Grun. Kennebecasis.
N. minuscula. Kennebecasis, Passamaquoddy.
N. crabro or didyma. Passamaquoddy.
N. distans. Passamaquoddy. (Plate II, Fig. 2.)

NITSCHIA.

Nitschia. Frustules free, elongated, compressed. Valves linear, keeled, with one or more longitudinal lines of puncta. Keel frequently eccentric.

N. scalaris E Sm. Passamaquoddy, Kennebecasis. (Plate II, Fig. 8).
N. sigmoidea Ehr. Passamaquoddy, Kennebecasis. (Plate II, Fig. 5.)
N. sigma W Sm. Passamaquoddy, Kennebecasis, (Plate II, Fig. 6.)
N. bilobata. Passamaquoddy, Kennebecasis, (Plate II, Fig. 7.)
N. closterium. Passamaquoddy, (Plate II, Fig. 9.)
N. punctata Sm. Kennebecasis.
N. Tryblionella H. Kennebecasis.
N. circumsuta Bail. Kennebecasis.
N. thermalis Ktz. Kennebecasis.
N. angularis W S. Kennebecasis.
N. longissima Ralfs. Kennebecasis.
N. granulata Grun. Kennebecasis.
N. paradoxa? Grun. Kennebecasis.
N. constricta? Grun. Kennebecasis.
N. littoralis Grun. Kennebecasis.
N. levidensis Ant. Kennebecasis.

ODONTIDIUM.

Odontidium. Frustules quadrangular, united into a filament. Valves elliptical or cruciform, with conspicuous costæ.

O. mutatile S. Kennebecasis. (Plate II, Fig. 37.)

PLEUROSIGMA.

Pleurosigma. Frustules simple, free, elongated, more or less boat-like. Valves sigmoid, with a central longitudinal line, which is also sigmoid,, and nodules at centre and extremities. Striæ numerous and delicate arranged longitudinally, transversely or obliquely, and with very high powers resolvable into dots, which are frequently hexagonal. A very beautiful genus, embracing many species.

Pl. angulatun S. Passamaquoddy. (Plate II, Fig 13.)
Pl. balticum W S. Passamaquoddy. (Plate II, Fig. 11.)
Pl. strigilis S. Passamaquoddy.
Pl. fasciola E. Passamaquoddy. (Plate II, Fig. 12.)
Pl. strigosum S. Passamaquoddy.
Pl. aestuarii? Breb. Passamaquoddy.
Pl. formosum. Passamaquoddy.
Pl. Spenceri Grun. Passamaquoddy.

RHABDONEMA.

Rhabdonema. Frustules united in elongated filaments, attached or stipitate, annulate. Annulae plane, cellulate on their circumference, forming internal septa. Valves elliptical, striate, with a median line. Striæ bead-like, and giving a latticed appearance. (Plate II, Fig. 14.)

A. arcuatum Lyn. Common in Passamaquoddy region.

RAPHONEIS.

Raphoneis (Doryphora). Frustules free, simple or shortly stipitate. Front view narrowly linear. Valves much broader, with transverse dotted striæ and a median longitudinal line.

R. amphiceros Ehr. Kennebecasis. Common.

R. (Doryphora) Boeckii. Kennebecasis, Passamaquoddy. (Plate II, Fig. 15.)

RHIPIDOPHORA.

Rhipidophora. Frustules stipitate, on front view cuneate, in lateral view obovate lanceolate, Inflected at larger extremity and traversed by a median line. (Plate II, Fig. 16.)

R. sp? Bocabec. Passamaquoddy, Miramichi.

RHIZOSOLENIA.

Rhizosolenia (Filamentous). Frustules sub-cylindrical, greatly elongated, silicious, annulate. Annulae broadly cuneate. Surface striated, extremities calyptriform, pointed with a bristle.

R. setigera? Passamaquoddy Bay, in plankton gatherings. (Plate II, Fig. 18.)

R. ? Several forms not determined. (Plate II, Figs. 17-19.)

SKELETONEMA.

Skeletonema. This is a very rare genus of Diatoms not described in many standard works. Frustules cylindrical and resembling Melosira, like the latter united in chains of many individuals, but with considerable intervening spaces crossed by groups of fine hair-like processes. The form represented in Plate was obtained from plankton gatherings in Chamcook Harbor.

Sk. Sp undetermined. (Plate II, Fig. 20.)

SCHIZONEMA.

Schizonema. Frustules naviculoid (boat-like) arranged confusedly or in a single file, within a capillary, sub-membranaceous single tubed, more or less branched frond, of nearly equal diameter throughout.

S. crucigerum W Sm. Passamaquoddy Bay. (Plate II, Fig. 21.)

SCOLIOPLEURA.

Scoliopleura. A single species of this genus (Sc. tumida) was observed by Dr. A. A. Mackay in collections from Passamaquoddy Bay, but is unknown to the writer.

STAURONEIS.

Stauroneis. Frustules free, oblong or lanceolate. Valves convex, striated, with a median line and terminal nodules. Central nodule dilated into a band (Stauros) free from striæ. General appearance like that of navicula, but easily distinguished by the "stauros" or cross.

S. phoenicenteron Ehr. Kennebecasis. (Plate II, Fig. 22.)

S. obliqua Passamaquoddy. (Plate II, Fig. 23.)

S. anceps Ehr.

S. spicula. Kennebecasis.

STRIATELLA

Striatella. Frustules united to form short filaments, attached by a long stipe. Individuals longitudinally striated, lateraly lanceolate, with a median line. Imperfectly silicious. (Plate II, Fig. 24.)

S. unipunctata Ag. Kennebecasis, Passamaquoddy.

SURIRELLA.

Surirella. Frustules simple, free, ovate or elliptical. Valves with a longitudinal central line and margins produced into wings (alæ). Canaliculi distinct, usually parallel.

S. splendida Kutz. Kennebecasis. (Plate II, Fig. 26.)

S. ovata Kutz. Kennebecasis, Harding's Pt.

S. ovalis Breb. Kennebecasis. (Plate II, Fig. 25.)

S. Mollerianum Grun. Kennebecasis. (Plate II, Fig. 27).

S. biseriata W Sm. Kennebecasis.

S. constricta. Kennebecasis, St. Martins.

S. gemma. (Plate II, Fig. 28). Passamaquoddy.

S. striatula. Salt marsh, St. Martins.

Surirella sp? Kennebecasis. (Plate II, Fig. 29.)

SYNEDRA.

Synedra. Frustules elongated, rectangular, attached at one end. Valves linear or lanceolate, plane or convex. Often grouped in fan-like radiating clusters. Lateral view traversed by a smooth median longitudinal line.

S. pulchella Ktz. Kennebecasis, Passamaquoddy.

S. acus Ktz. Kennebecasis.

S. Ulna Ehr. Kennebecasis, Passamaquoddy. (Plate II, Figs. 30, 31, 32.)

S. radians. Milkish, St. John river, Passamaquoddy, Grand Manan.

S. salina. Miramichi, Campobello.

S. sigma. Indiantown and Courtney Bay.

TABELLARIA.

Tabellaria. Frustules quadrangular, united into a filament or cohering in a zig-zag chain. Septa equal, alternate, straight. Lateral surfaces inflated at ends and middle.

T. fenestrata. Kennebecasis. (Plate II, Fig. 33.)

TRICERATIUM.

Triceratium. Frustules free, simple, with lateral view (in N. B. species) markedly triangular. Surface of valves divided into cellular spaces, wanting at the angles which are somewhat produced.

Tr. alternans Bail. Rare, but several specimens obtained from Harris Cove, Kennebecasis, and from a salt marsh at St. Martins. (Plate II, Fig. 34.)

TRYBLIONELLA.

Tryblionella. Frustules simple, free, elliptical or linear. Valve plain. Alæ or wings submarginal or obsolete. Canaliculi inconspicuous, Parallel, small. (Plate II, Fig. 35.)

T. scutellum Sm. **Surirella circumsuta** Bailey. Kennebecasis.

T. gracilis? Kennebecasis.

ZYGOCEROS.

Zygoceros. This genus in general appearance closely resembles Biddulphia' with which it is united by many authors. It differs in being much larger than the ordinary forms of the latter, not forming long chains.

Zygoceros Mobilensis Bail. (**Biddulphia Baileyi** Sm.) Several individuals of this species were observed in the plankton of Passamaquoddy Bay and the Western Isles. (Plate II, Fig. 36.)

EXPLANATION OF PLATES.

The following figures are only rough sketches, drawn in most instances from the objects themselves, without any attempt to represent, except in a general way, their relative proportions. Owing also to their small size, it has been impossible to represent upon them their finer markings. As, however, only generic differences are aimed at, the want of these particulars is less important. For more accurate delineations, and figures drawn to scale, the student is referred to the standard authorities mentioned in the text.

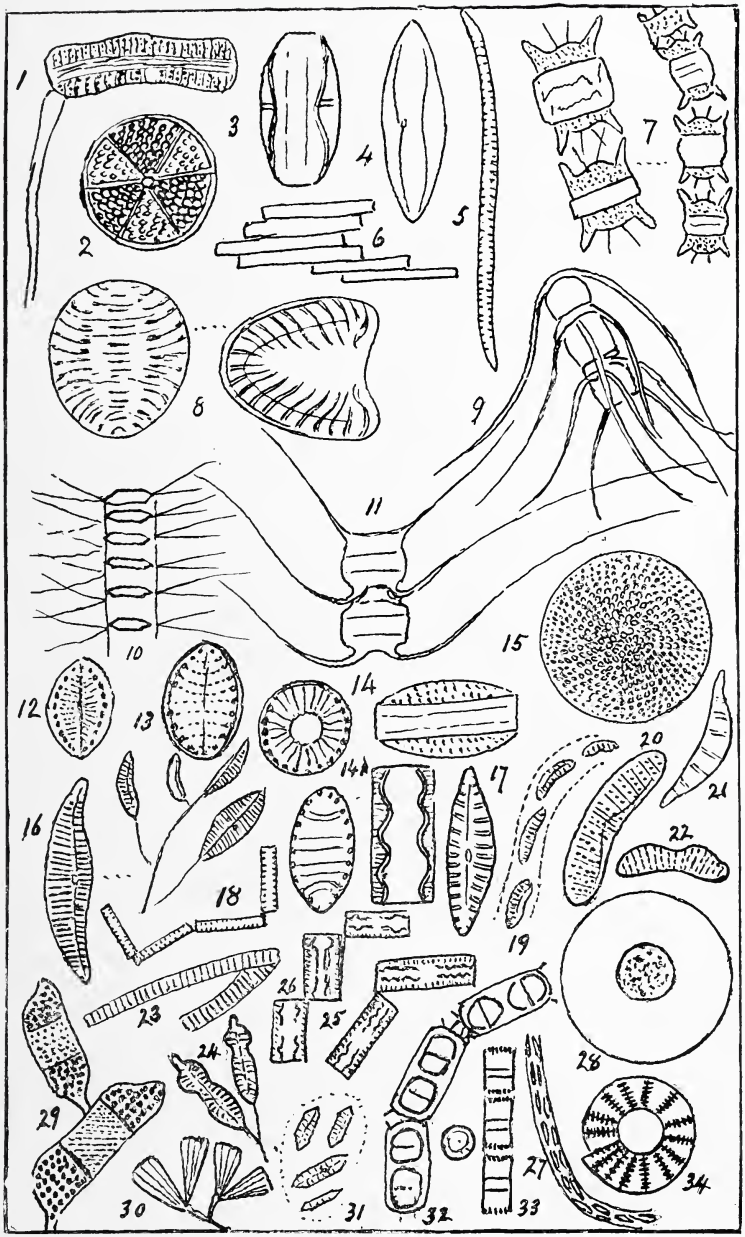
PLATE I.

Fig. 1. **Acnanthes longipes** Ag.
2. **Actinoptychus undulatus** Kutz.
3. **Amphora.**
4. **Amphiprora.**
5. **Amphipleura**
6. **Bacillaria paradoxa** Gmel.
7. **Biddulphia aurita** Lyn.
8. **Campylodiscus** Lyn.
9. **Chaetoceros chriophyllum** Cast
10. **Chaetoceros decipiens.**
11. **Chaetoceros.**
12. **Cocconeis scutellum.**
13. **Cocconeis scutellum.**
14. **Cyclotella.**
14A. **Cymatopleura.**
15. **Coscinodiscus.**
16. **Cocconema lanceolatum.**
17. **Cymbella gastroides.**
18. **Diatoma.**
19. **Encyonema.**
20. **Epithemia turgida.**
21. **Epithemia zebra.**
22. **Eunotia diodon.**
23. **Fragillaria.**
24. **Gomphonema geminatum** A.
25. **Grammatophora serpentina.**
26. **Grammatophora marina.**
27. **Homoecladia filiformis.**
28. **Hyalodiscus.**
29. **Isthmia.**
30. **Licmophora.**
31. **Mastogloia.**
32. **Melosira nummuloides.**
33. **Melosira orichalcea.**
34. **Meridion.**

PLATE II.

Fig. 1. **Navicula (Pinnularia) nobilis** Ehr.
2. **Navacula distans.**
3. **Navicula maculata** Bail.
4. **Navicula Smithii** Ag.
5. **Nitschia sigmoidia** Ehr.
6. **Nitschia sigma** W. S.
7. **Nitschia bilobata.**
19. **Rhizosolenia**
Fig. 20. **Skeletonema.**
21. **Schizonema crucigerum.**
22. **Stauroneis Phœnicenteron Eh**
23. **Stauroneis obliqua.**
24. **Striatella unipunctata.**
25. **Surirella ovalis** Breb.
26. **Surirella splendida** Kutz.

PLATE I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8. **Nitschia scalaris** E Sm.
9. **Nitschia closterium.**
10. **Pleurosigma.**
11. **Pleurosigma Balticum.**
12. **Pleurosigma fasciola** E.
13. **Pleurosigma angulatum.**
14. **Rhabdonema.**
15. **Raphoneis (Doryphora)** Boeckii
16. **Rhipidophora.**
17. **Rhizosolenia.**
18. **Rhizosolenia setigera.**
27. **Surirella Mollerianum.**ü
28. **Surirella sp?**
29. **Surirella sp?**
30. **Synedra radians,** side view.
31. **Synedra ulna,** side view.
32. **Synedra radians,** front view.
33. **Tabellaria.**
34. **Triceratium alternans** Bail.
35. **Tryb ionella scutellum?**
36. **Zygoceros (Biddulphia) Mobilensis** Bail.
37. **Odontidium.**

ADDITIONAL NOTES ON DIATOMS.

By L. W. Bailey, LL. D.

In the preceding article reference has been made to the diatomaceous forms found in Plankton collections in and about Passamaquoddy Bay. A few words may be added as to the forms associated with the latter, their relative abundance and mode of treatment.

These collections are made by means of plankton nets drawn through the water at some distance behind slowly moving motor boats. When allowed to stand the contents of the collecting bottles were found to settle very slowly, assuming at the surface of the deposit the appearance of a flocculent precipate, disturbed by the slightest movement.

Examined in this condition, the collection is found to consist mainly of vast numbers of Copepods and related Crustaceans, mingled with great numbers of the Diatom *Coscinodiscus,* the whole forming a somewhat sticky mass, which soon begins to decompose, emitting a disagreeable odor. Reduced by evaporation nearly to dryness, and thoroughly washed, the residue is of a dark brown color, but still very soft and light.

Examined in this condition, the Copepods, etc., will be found to have been largely or completely removed, the mass now consisting mainly of large *Coscinodiscus* (see preceding Plate I), the characteristic deep brown endochrome, which in the untreated frustules largely conceals their sculpture, having entirely disappeared, while great numbers of marginal rings or hoops, derived from the same Diatom are seen. *Coscinodiscus oculus-iridis* is probably the most common form, but with this are specimens of *C. radiatus* and *C. centralis.* Another noticeable feature is the abundance of forms of the genius *Chaetoceros,* which, by its awns, often of extravagant length, are admirably adapted for flotation. There are many species, several of which are figured in the preceding plates.

It is proposed to treat of all these forms more fully in a later article.

ARTICLE IV.

THE OLDEST SILURIAN FLORA.

By G. F. Matthews, D. Sc., F. R. S. C.

(Read 7th November, 1910.)

Much interest centres in the early Palæozoic floras, with their strange forms of vegetation, so different from modern plants, yet (if evolutional theories are to be accepted) these old plants are the channel through which modern species are descended. If the Neo-Palæozoic plants are worthy of special study, how much more interest attaches to the investigation of the Eopalæozoic forms, those of the three earlier ages, Silurian, Ordovician and Cambrian.

Two floras of the first of these Ages, the remains of which have been found near St. John, N. B., have been the subject of investigation by several leading palæo-phytologists, and have been found to be mostly of deltaic habit, like the majority of those of the Coal measures. In following the formation that carries these plant remains of St. John westward along the shore of the Bay of Fundy, one can see how the emerged beds of the delta with their plant remains gradually pass into submerged deposits in which such plants are rarely found, but in which, eventually, remains of marine animals appear. This terrain is shown, by the occurrence of these marine remains, to be of Silurian age.

But a further step backward in the history of the Silurian Flora is taken when we discover that there are still earlier plant remains in this district in its Silurian rocks than those of the deltaic flora above mentioned, remains which are quite different both in genera and species, from those of this flora. Beds with these older plants were discovered a year ago in

Charlotte county, and in the past summer collections of the plant remains were made, and are now undergoing examination and study. We propose to give here a brief notice of the mode of occurrence of these plants, and to state in a general way, what they appear to teach.

The plants occur in beds along a shore line on the eastern side of Beaver Harbor. On the western side of the harbor south of the village there is an exposure of the characteristic black silicious slates of No. 2 of the Mascareen phase of the Silurian series; above these are sandstones which further west carry a Niagara fauna; hence, (and for other reasons) these black slates are regarded as of Clinton age. The black silicious slates do not appear on the eastern side of Beaver Harbor, but their place would be to the south of and above the plant beds and associated strata on that side of the harbour. The composition of the measures here, and the fact that the base of the Silurian system is seen on this shore, leads us to regard these plant beds as of Medina age.

A section of these rocks is presented herewith, and the contact of the Silurian with an older unconformable series of sediments is shown. The older set of beds show a core of massive gray quartzites, in a ridge, covered on each side by masses of red volcanic ash rocks (grits and felsites), fragments of both members of this series being plentiful as boulders and pebbles in the overlying Silurian conglomerates. The section shows a blank in the middle where there is a gravelly beach, which probably is underlain in part by dark gray shales, such rocks being found at this horizon, on the north end of the village beach at Beaver Harbor, and in the keyhole pond at this north end of the harbor. Thus it will be seen that the plant beds, from which the fossils were taken, are not at the bottom of the Medina division (No. 1 of the Mascareen section), but towards its top.

The plants of this flora do not show much variety of species, but the uniformity in this respect enables one to speak with greater confidence of the characteristics of the species that do occur. One plant, of a new genus allied to Psilophyton, is

shales, sandstones and conglomerates in which no plant remains have been found. At some points almost the whole group appears to be represented by volcanic effusives.

Upon this group rests the strata of No. 2 of the Mascareen series, represented in the eastern exposures mostly by the Dadoxylon sandstone. The latter, however, is the littoral or fluvial phase, for when followed to the west and south these sandstones are replaced by hardened black silicious shales, which give characteristic black sands at certain points along the coast of the Bay of Fundy; a beach of these sands is seen at Black Beach, in Musquash Harbor, and another at the village shore, in Beaver Harbor.

The Dadoxylon phase is largely composed of river-sands, in which were buried rafts and single trunks of trees, swept down from the uplands of a Silurian interior country; hence these trees, including *Dadoxylon Ouangondianum* of Dawson, and other trees undescribed, are the only sure representatives that we possess of an *upland* flora of Silurian age.

Associated in the sand beds with these trees are other, more perishable plants, mostly of the Equisetaceæ, that flourished and grew in the sands themselves.

Finally there was a third group of plants also contained in the sandstone deposit, but in finer shaly beds, which represent to us the more delicate of the Equisetales, and still another type, plants of higher grade that lived on the higher parts adjoining the pools among the river sands. Many of these plants fall in the group Pteridophyta and Pteridosperma of the accompanying list. This, then, was the nature of the fauna of the second column presented in the list.

A much richer fauna, that described by the late Sir William Dawson, the late Professor C. F. Hartt, and others, is found in the overlying group (Lower Cordaite shales, at St. John, No. 3 of the Mascareen series, Silurian, in Charlotte county). This fauna is contained in alternations of clay and sand and marks the advent of true deltaic conditions; previously in the time marked by the Dadoxylon sandstones the Silurian basin had

comparatively deep waters in the center, and sands at its margin and in the river channel; the deposits in the outer parts of the basin being black silicious mud, but in this later time, *i. e.,* that of the Cordaite shales the silting up of the basin (or elevation of its bottom) choked the outlets of the river and led to the formation of a deltaic deposit, covering the whole basin; here were entombed in the shallow pools of its surface the remains of numerous species of plants, remarkable for their high phytological standing, and for the delicacy of their foliage. These plants (of the third column of the list) were twice as numerous in species as those of the Dadoxylon sandstone; and it will be noted that while a large number of the group Equisetales are present, the species here classed as Pteridophyta and Pteridosperma largely preponderate.

The geological history is thus a record of a long quiescent period, extending from the Medina to the end of the Niagara and in some parts of New Brunswick probably through the Upper Helderberg Time. During this time southern New Brunswick was the border of a large oceanic island, shut off from the rest of America by sounds of the sea crossing New Brunswick and Maine, and having a land flora and fauna, so far peculiarly its own, but prophetic of that of the Coal Measures. An exception to the university of this telluric calm in Acadia in the Silurian time is seen in Charlotte county and further west in the State of Maine, where volcanic effusives appear at the top of the terrane which accumulated there in Silurian Time.

LIST OF SILURIAN PLANTS OF SOUTHERN NEW BRUNSWICK, showing the species of the several floras, and their horizons.

N. B.—In the following list "Dn" = Dawson, "Brngt" = Brongniart, "Schl" = Schlotheim, "Matt" = Matthew,	First Flora.	Second Flora.	Third Flora.
THALLOPHYTA.			
Rhizomorphia lichenoides Matt.	.....	.....	*
Gyromyces Eriensis Dn. sp.	.....	.....	*
EQUISETALES.			
Arthrostigma sp.	*	.....	.....
Astrocalamites scrobiculoides Matt.	.....	*	*
Calamites Suckovii Brngt.	.....	*	*
C. cannæformis Schl.	.....	.....	*
C. Cistii Brngt. mut. Matt.	.....	*	*
C. geniculosus Matt.	.....	.....	*
Lepidocalamus scutiger Dn. sp.	.....	*	.....
Ramicalamus dumosus Matt.	.....	*	.....
Calamodendron antiquius Dn.	.....	*	.....
C. tenuistriatum Dn.	.....	*	.....
Astrophyllites parvulus Dn.	.....	*	.....
A. parvulus var. Matt.	.....	.....	*
A. fasciculatus Matt.	.....	.....	*
A. lentus Dn.	.....	.....	*
?**A. fissus** Matt.	.....	.....	*
Annularia latifolia Dn. sp.	.....	.....	*
A. latifolia mut. minor. Matt.	.....	*	.....
A. acicularis Dn. sp.	.....	*	*
?**A. lenta** Dn. sp.	.....	.....	*
A. recurva Matt.	.....	.....	*
?**A. ligata** Matt.	.....	.....	*
Pinnularia dispalans Dn.	.....	*	*
P. elongata Dn.	.....	*	*
P. nodosa Dn.	.....	*	.....
SPHENOPHYLLALES.			
Sphenophyllum antiquum Dn.	.....	*	.....
S. gemma Matt.	.....	*	.....
S. latum et var. minus Matt.	.....	.....	*
S. innocens Matt.	.....	.....	*

LIST OF SILURIAN PLANTS. — Continued.

	First Flora.	Second Flora.	Third Flora.
LYCOPODIALES			
Sigillaria palpebra Dn.	.....	*	.....
Stigmaria perlata Dn.	.....	*	.....
Lycopodites Matthewi Dn.	.....	.....	*
PTERIDOPHYTA ET PTERIDOSPERMA			
Psilophyton elegans Dn.	.....	.....	*
?P. glabrum Dn.	.....	.....	*
New genus allied to Psilophyton	*	.....	.....
Eremopteris sp.	*	*	.....
Aneimites sp.	*	*	.....
Aneimites obtusa Dn.	.....	.....	*
A. (Triphyllopteris) valida Dn.	.....	.....	*
Ginkgophyton Leavitti Matt.	.....	*	.....
Pseudobaiera McIntoshi Matt.	.....	*	.....
P. McIntoshi mut flabellata Matt.	.....	.....	*
Sphenopteris marginata Dn.	.....	.....	*
S. Harttii Dn.	.....	.....	*
S. splendens Dn.	.....	.....	*
S. (Hymenophyllites) curtilobus Dn.	.....	.....	*
S. subfurcatus Dn.	.....	.....	*
?S. Gersdorfii Goepp.	.....	.....	*
S. obtusilobus Goepp.	.....	.....	*
Alethopteris ingens Dn.	.....	.....	*
A. Perleyi Hartt.	.....	.....	*
Johannophyton discrepans Dn. sp.	.....	.....	*
J. discrepans var.	.....	*	.....
Neuropteris polymorpha Dn.	.....	.....	*
N. retorquata Dn.	.....	.....	*
N. crassa Dn.	.....	.....	*
N. Selwyni Dn.	.....	.....	*
Nephropteris (Odontopteris) varia Dn.	.....	.....	*
N. problematica Dn.	.....	.....	*
?Odontopteris squamosa Dn.	.....	.....	*
Megalopteris Dawsoni Hartt sp.	.....	.....	*
?Cardiopteris Eriana Dn.	.....	.....	*
?Callipteris pilosa Dn.	.....	.....	*
Pecopteris (Aspidites?) serrulata Hartt.	.....	.....	*
P. (A?) pretiosa Hartt.	.....	.....	*

LIST OF SILURIAN PLANTS. — Continued.

	First Flora.	Second Flora.	Third Flora.
P. (Cyathites?) densifolia Dn.	.....	.....	*
Whittleseya Dawsoniana D. White.	.....	.....	*
W. concinna & var's. Matt.	.....	.....	*
Trigonocarpon racemosum Dn.	.....	.....	*
T. perantiquum Dn.	.....	.....	*
GYMNOSPERMA			
Dadoxylon Ouangondianum Dn.	.....	*	.....
Cordaites Robbii Dn.	.....	.....	*
C. Robbii narrow var. Dn.	.....	*	.....
Cardiocarpon cornutum Dn.	.....	.....	*
C. cornutum var.	.....	*	.....
C. Baileyi Dn.	.....	.....	*
C. Crampii Hartt.	.....	.....	*
C. ovale Dn.	.....	.....	*
C obliquum Dn.	.....	.....	*
Carpolithes compactus Dn.	.....	.....	*
Antholithes Devonicus Dn.	.....	.....	*
A. floridus Dn.	.....	.....	*

SUPPLEMENTARY NOTE ON LOCALIZED FLORAS.

Herr Gothan in one of the German scientific journals, presents evidence of dry- and of moist-climate areas in Europe during the Carboniferous time. He eliminates from consideration the cosmopolitan species of the Coal flora, which are very numerous, and turns his attention to certain characteristic species of local distribution; he thus establishes the range of a series of coal basins in a region that had a moist climate, ranging from Great Britain to Belgium, the Lower Rhine, and thence to Upper Silesia. To the south of this range of coal basins there were basins, as those in the valleys of the Saar and Zwickau and in the mountains of Saxony and Bohemia, which had a dry climate, as is shown in the floras of their coal basins.

One of the plants mentioned as indicating a wet climate is the filicoid genus *Lonchopteris,* which differs from *Alethopteris* in having a reticulate in place of a forked venation in the leaves; while on the other hand one which marks a dry climate is the net-veined Neuropteroid form *Linopteris;* he mentions three other forms that are especially characteristic of a dry climate

A parallel condition to this is that of the flora in the group of strata that underlies the Lower Carboniferous limestone in southern New Brunswick. At Perry, in Maine, it has a flora which has been pronounced Upper Devonian by Sir William Dawson and Mr. David White, in the Kenebecasis valley the flora is that of the "Lower coal measures" of Sir Wm. Dawson, which Messrs. Ells and Fletcher found to be in Upper Devonian rocks. But on the shores of the Bay of Fundy the same formation contains abundant *Calamites,* and the genus *Neuropteris,* showing the existence of moist conditions of climate that encouraged the growth of water-loving plants. On the opposite slope of the ridge in the Kenebecasis valley, ten miles away, flourished Lepidodendraceæ in great numbers, with the fern-like *Aneimites,* while the Equisetaceæ are rare and Neuropteris fern-like forms wanting.

ARTICLE V.

AVERAGE OPENING OF FLOWERS.

By G. U. Hay.

The records that have been made by the writer and published in the Bulletins during the last nine years, (with unpublished notes for the season of 1910) of the opening of flowers at Ingleside, and incidentally a glance at weather conditions, have, it is hoped, not been without interest to plant students. As far as possible the same plants under the same conditions of situation and temperature have been observed. This is an important feature in taking such observations. It is well known that flowers bloom and reach maturity much earlier in scanty soil in sunny situations secluded from cold winds. It is obvious that observations made in such chosen spots should not be compared with those made in more exposed places where the rays of sunlight have less chance of concentration and where the soil is deeper. For instance, it is noted that plants bloom earlier on the sunny south-eastern slopes of Rockwood Park, St. John, than they do in the open places at Ingleside, although the latter, situated about nine or ten miles, "as the crow flies," from the city, as well as places further inland, are much earlier than in bleak exposed situations along the north side of the Bay of Fundy.

One of the earliest plants to come into bloom about St. John is the coltsfoot (*Tussilago farfara*), an introduced plant. The writer saw it in bloom one year in a sheltered nook as early as the 27th of March. The first native flowers to bloom are the mayflower (*Epigaea repens*) and the hepatica or liverleaf (*Hepatica triloba*), if we except those earlier inconspicuous flowers of certain trees and shrubs that are in haste to scatter their pollen before the leaves appear.

Our spring-comings are uncertain, as may be gathered from an examination of the earliest and latest openings of flowers in

the summary that follows. The spring that promises well in February and March is tolerably certain to be delayed into the latter part of May or even June. This, with the prevalent cold east winds that continue into late spring, account for the late average opening of plants in southern New Brunswick in comparison with the more western sections of Canada, remote from the polar currents of the ocean and from prevalent east winds.

No attempt has been made to average the time of opening of the leaves on our deciduous trees or shrubs. Generally speaking, the leaves of the fetid or skunk currant are among the first to unfold, followed closely by the small native mountain fly honeysuckle (*Lonicera canadensis*). The birches, maples, amelanchier, cherries, put forth their leaves nearly together, the white birch leading; the poplars and elm are a little later; then the oaks and the ashes, the latter the most tardy except the acacia. This, with the black ash, retains its leaves longer than the others in autumn.

Among ferns the little woodsias are the first to unfold their fronds, followed by the bladder fern and other smaller species, whose habitat is usually on rocks, more or less exposed to the sun. The tender fronds of the cinnamon fern are very susceptible to early frosts. On the night of June 6, 1905, a severe frost quite destroyed all the young fronds of this fern.

In the following list the name of the plant is followed by the *average date* of its opening. The dates that come after are the *earliest* and *latest* of its appearance. One flower was not in general deemed sufficient to make a date, but several are included in those first seen.

The spring of 1902, which leads all others in the "earliest" opening of flowers followed a remarkably open winter. The St. John river that year was clear of ice on the 27th of March—the earliest on record. The spring of 1907, which marks the greatest number of "latest" openings, was very backward with frequent snowstorms in March and April ,and wet cold weather through May and June.

Average Dates for the Flowering of Plants for the Past Ten Years.

	Average.	Earliest.	Latest.
1. *Coltsfoot (Tussilago farfara),	April 24	April 8, 1902	May 2, 1908
2. Mayflower (Epigaea repens)	April 26	April 5, 1902	May 10, 1907
3. Liverleaf (Hepatica triloba)	May 4	May 1, 1902	May 10, 1907
4. Sweet White Violet (Viola blanda)	May 7	May 1, 1901	May 15, 1907
5. Red Maple (Acer rubrum)	May 2	April 25, 1902	May 7, 1907
6. Strawberry (Fragaria virginiana)	May 8	April 25, 1902	May 14, 1907
7. Yellow Adders'-tongue (Erythronium americanum)	May 9	May 1, 1902	May 15, 1907
8. Bloodroot (Sanguinaria canadensis)	May 10	May 1, 1902	May 18, 1907
9. Blue Violet (Viola cucullata?)	May 13	May 1, 1902	May 19, 1907
10. Mt. Fly Honeysuckle (Lonicera canadensis)	May 12	May 1, 1902	May 20, 1907
11. Goldthread (Coptis trifolia)	May 16	May 10, 1902	May 20, 1907
12. Wood Anemone (Anemone quinquefolia)	May 16	May 10, 1902	May 19, 1907
13. Painted Trillium (Trillium undulatum)	May 17	May 1, 1902	May 24, 1907
14. Purple Trillium (Trillium erectum)	May 18	May 12, 1902	May 27, 1906
15. Dandelion (Taraxacum officinale).	May 18	May 12, 1901	May 22, 1905
16. Marsh Marigold (Caltha palustris)	May 16	May 10, 1901	May 22, 1907
17. Bluets (Houstonia caerulea)	May 18	May 10, 1901	May 24, 1907
18. Bellwort (Oakesia sessilifolia)	May 18	May 10, 1901	May 22, 1905
19. Shad Bush (Amelanchier canadensis)	May 20	May 16, 1902	June 1, 1907
20. Rhodora (Rhododendron canadense)	May 23	May 17, 1901	June 12, 1907
21. Blueberry (Vaccinium canadense)	May 27	May 20, 1901	June 16, 1907
22. Buckbean (Menyanthes trifoliata)	May 28	May 25, 1901	June 6, 1905
23. Clintonia (Clintonia borealis)	May 28	May 25, 1901	May 30, 1909
24. Stemless Lady's Slipper (Cypripedium acaule)	June 9,	June 4, 1902	June 16, 1907

*This record is for St. John. Those following for Ingleside.

BOTANIZING IN NEW BRUNSWICK.

Professors M. L. Fernald and K. M. Wiegand make the following interesting notes in *Rhodora,* of June, 1910: On August 6th we reached Ingleside, on the St. John in the parish of Westfield, about four miles below the mouth of the Nerepis. We were very obviously in the St. John Valley, for in the rich alluvium of the river were many plants familiar from above St. Francis to Woodstock. A fine specimen was found of *Acer rubrum* L., var. *tridens* Wood (previously unknown north of Auburndale, Massachusetts), and in short walks in the neighborhood other notable plants were seen—*Panicum tennesseense* Ashe, *P. implicatum* Scribner, *Glyceria laxa* Scribner and *Lycopodium sabinaefolium* Willd.

One afternoon and evening were given to a sail up the lower reaches of the St. John and the quiet winding channel of the Nerepis River. The meadows along this stream were luxuriant to a degree and we longed for more time than was available to explore them. Shoulder-high stood a dense thicket of *Scirpus pedicellaris* Fernald, *S. cyperinus* (L.) Kunth, var. *pelius* Fernald, *Zizania aquatica* L., *Sparganium eurycarpum* Engelm, and other marsh plants not generally known from so far east; and in deep water, forming broad dense islands nearly covered at high tide but rising at low tide, a meter above the surface, stood acres of clumps of *Scripus fluviatilis* (Torr.) Gray, a stately bulrush once reported as growing at Perry, Maine, but heretofore unverified from east of the lower Merrimac. About Passamaquoddy Bay we had grown callous to the attractions of *Potentilla palustris* (L.) Scop., var. *villosa* (Pers.) Lehm., but at twilight a beautiful silvery variation of the species was found on the Nerepis marshes and a single specimen taken in the dim light "for locality," under the impression that it was var. *villosa.* Later, however, too late to return for more, it proved to be var. *subsericea* Becker (the first station known to us in America) a very beautiful plant, worthy a place among cultivated semi-aquatics.

ARTICLE VI.

NOTES ON NEW BRUNSWICK WEATHER FOR 1909.

By D. Leavitt Hutchinson.

January.—Weather changes were very rapid during the first half of the month. Mild thawing weather from 4th to 6th. followed by an immediate return to colder conditions, temperatures below zero being general on the 8th. Then moderately cold until the 13th. Between this date and the 19th, decidedly cold weather prevailed, excepting the 18th, when a change of remarkable rapidity occurred, with a range of temperature of 52 degrees in twenty-four hours. Milder the 22nd, and then moderately cold until the end of the month. In most parts of Southern New Brunswick the ground was bare of snow, or nearly so, up to the 12th, but at the end of the month the covering in Southern New Brunswick ranged from six to twenty-eight inches. A phenomenally heavy and record rainfall for January on the 5th and 6th, was the distinctive feature, causing much damage, freshets in rivers and streams, flooding of low lands. and unusual delay to railway and other traffic. This storm was attended by heavy thunder and lightning, and a southeast to southwest gale, with maximum velocity of eighty-four miles per hour in the Bay of Fundy. The highest temperature was fifty-six at Sussex, on the 6th; lowest, minus twenty-five, at Dalhousie, on the 17th.

February.—Very low temperatures were general on the first four days, followed by alternating periods of mild, thawing and moderately cold weather. Fine and bright on fourteen days, snow on seven, rain on three, and rain and snow on three days. Six gales occurred during the month, the heaviest being from the southeast and southwest, that on the 10th was accompanied by snow, sleet and rain, and one from the southeast on the 24th with snow, turning to rain in southern parts of the Province. More than half the total snowfall fell between the 15th and 17th.

The snow covering varied from one inch at St. John, to twenty-four inches at Dalhousie, with good roads throughout the month. The highest temperature was fifty-nine, at Grand Manan, on the 14th; the lowest, minus twenty-eight at St. Stephen, on the 4th.

March.—Generally moderate weather conditions prevailed throughout March, though in some localities zero temperatures were reported early in the month. One of the heaviest snowstorms of the season occurred locally on the 17th and 18th. otherwise in southern New Brunswick the snowfall was light. Fresh easterly gales on the 26th and 28th, the latter being accompanied by an exceptionally heavy rainfall. Towards the close of the month there was much open water in the river beween St. John and Fredericton. The ground was mostly bare of snow. and wild geese were passing northward . The highest temperature was fifty-four, at Grand Manan, on the 26th; lowest, minus eight, at Fredericton, on the 2nd.

April.—A cold, dull, wet and backward month, with precipitation much above the average. There was a marked deficiency of warm, spring-like days. Rain fell on eleven days; heavy snow fell on the 4th, 17th and 25th. Thunderstorm on the 19th; moderate northwest gale on the 4th; fresh southwest to northwest gale on the 8th. Considerable snow remained in the woods of the interior and in northern New Brunswick. Navigation on the St. John River opened on the 17th. Owing to cold weather, freshets in rivers and streams were not up to the usual height at the close of the month. The highest temperature was sixty-three, at Fredericton and St. Stephen, on the 13th; lowest, minus six, at Dalhousie, on the 12th.

May.—The month was cool and wet with excessive cloudiness and high winds; rain fell on seventeen days, but excepting the 11th, the amounts were exceptionally small, varying from .01 to 0.3 inch; vegetation was generally backward and greatly in need of bright sunshine; northwest gales occurred on the 12th and 13th. The highest temperature was seventy-nine, at St. Stephen, on the 27th; lowest, twenty-three, at Dalhousie, on the 1st.

June.—A remarkably fine, warm and dry month, the first ten days being absolutely without rain at most places. During this period forest fires were very destructive. The rainfall, which was abnormally light fell chiefly in showers and varied greatly with localities. Frosts were general on the 2nd, but did little damage: coast fogs were exceptionally infrequent, but smoke from forest fires was, at times, quite thick. Owing to the warmth and timely showers of the last ten days, crops made remarkable progress. The highest temperature was ninety, at Moncton, on the 25th; lowest, twenty-five, at Dalhousie and St. Stephen, on the 2nd.

July.—The weather for the greater part was fine and warm, with frequent light showers and no heavy rainfalls. Thunderstorms were numerous, but not severe, and coast fogs were much below the average. The highest temperature was eighty-eight, at Fredericton, on the 28th; the lowest, thirty-nine, at Dalhousie, on the 6th.

August.—A month of fine and exceptionally warm weather, with a marked deficiency of fogs near the coast. Rainfall varied with locality, some places being below and others much above the average. Moncton reported the heaviest rainfall for any month during the past thirteen years. Frosts were reported from the river counties on last days of the month. On the night of the 10th a local northeast gale of unseasonable severity was the cause of some damage to small pleasure crafts on the lower portion of the St. John River. In this district it was accompanied by the heaviest rainfall of the month. The highest temperature was ninety-three. at St. Stephen, on the 8th; lowest, thirty-one, at St. Stephen, on the 31st.

September.—Exceping the 1st and 6th, when rain fell heavily, the weather was generally fine and seasonable up to the 23rd, when a period of comparatively high temperatures and excessive rainfall set in and continued until the close of the month. Rivers and springs were swollen to spring freshet level; interval lands were under water with serious damage to crops in some places. Travel by rail and highway was interrupted by washouts and flooding. This was the heaviest autumn rainfall and freshet since October.

1900. During the first half of the month local frosts were reported at intervals, with freezing temperatures in some places. A southeast gale, with velocity of fifty miles an hour at Point Lepreaux. occurred on the morning of the 27th. Highest temperature, seventy-nine, at Moncton, on the 24th; lowest, thirty-two, at Dalhousie, on the 12th.

October.—During the first ten days, bright, dry and almost summer-like conditions prevailed, while with a few exceptions the weather of the remainder of the month was mild, dull, wet and windy. Freezing temperatures were locally recorded on the 20th and 21st, and generally on the 30th and 31st. The water in lakes, rivers and streams was unseasonably high. There was a southwest gale on the 17th, and a northwest gale on the 26th, the latter being the heavier, with an hourly velocity of forty miles at St. John, and forty-four at Point Lepreaux. The highest temperature was eighty, at St. Stephen, on the 9th; lowest, twenty-two, at St. Stephen, on the 21st and 31st.

November.—Extremely mild and unsettled conditions prevailed throughout the month; fair and foul days being about equally divided, with temperature much above the average; the St. John River and its tributaries were absolutely free of ice, and greatly above the seasonal level; in southern New Brunswick, the snowfall was abnormally light, and at the close of the month the ground was everywhere bare of snow; there were northwest gales on the 18th, southwest on the 23rd, and southeast on the 25th; more than half the total precipitation occurred during the period covered by the last two gales. The highest temperature was sixty-seven, at Moncton, on the 3rd; lowest, thirteen, at Dalhousie, on the 4th and 16th.

December.—Phenomenally mild weather in all localities prevailed till the 27th, when a change to decidedly colder conditions occurred. The St. John River closed on the 12th, a remarkably late date, and the Miramichi on the 26th, making one of the longest periods of navigation on record. Near the coast line the ground was practically bare of snow until the 26th, while on the north shore, and in the interior, sleighing was good during the last half

of the month. Lumbering operations in northern New Brunswick were delayed by mild conditions and lack of snow. There was a moderate southeast gale on the 8th, heavy southeast on the 14th, moderate northwest on the 27th and 30th. At the close of the month the snow covering ranged from two inches near the coast to two feet in Northumberland County. The highest temperature was fifty-one, at Grand Manan, on the 6th; lowest, minus twenty, at Sussex, on the 29th.

METEOROLOGICAL ABSTRACT FOR 1909.

ST. JOHN OBSERVATORY.

METEOROLOGICAL SERVIDE OF CANADA.

Latitude, 45° 16′ 4.50″ N. Longitude, 66° 3′ 51″ W.

MONTHS 1909.	BAROMETER.			THERMOMETER.			*Cloudiness*: 0 = Clear, 10 = Wholly Clouded.	*Precipitation*: Rain & Melted Snow.	Thunder Storms.	Fogs.
	Mean	Highest	Lowest	Mean	Highest	Lowest				
January.....	30.098	30.882	29.047	21.5	53.3	- 9.6	5.6	6.53	0	2
February.....	29.872	30.628	28.708	21.8	48.0	- 7.3	5.9	5.30	0	0
March.....	29.696	30.163	29.127	30.4	46.7	7.0	5.87	4.71	0	0
April.....	30.016	30.645	29.296	37.4	53.5	18.5	6.0	5.58	1	3
May.....	29.919	30.375	29.448	49.0	69.0	32.7	6.1	2.15	0	4
June.....	29.907	30.223	29.571	57.7	79.5	38.7	5.2	1.75	3	4
July.....	29.866	30.251	29.326	60.8	80.2	48.7	5.5	2.61	5	11
August.....	29.966	30.361	29.451	63.0	81.8	45.7	4.5	2.86	2	7
September.....	30.112	30.511	29.594	57.0	67.0	43.3	6.2	7.43	0	4
October.....	29.891	30.397	29.275	49.3	72.9	28.7	5.4	4.37	0	2
November.fl...	30.106	30.699	29.364	40.3	57.8	21.0	6.6	5.58	0	2
December.....	29.729	30.639	28.992	25.5	42.5	3.5	7.0	2.60	0	0

Mean height of barometer for year was 29.931, the highest reading 30.882 on January 16th, and the lowest 28.708 on the 20th February. The mean temperature for the year was 42.8 which was 1.8 above the average for the past 37 years. Maximum temperature 81.8 occurred on the 2nd of August and minimum—9.6 on the 17th of January. Total precipitation was 51.47 which was 5.03 above the average. The first frost was recorded on October 20th and the last on June 2nd.

D. LEAVITT HUTCHINSON,
Director St. John Observatory.

ST. JOHN OBSERVATORY.

WIND DIRECTION AND VELOCITY FOR 1909

1909	N.		N. E.		E.		S. E.		S.		S. W.		W.		N. W.			
MONTHS.	Hours	Miles	Hours	Miles	Hours	Miles	Hours	Miles	Hours	Miles	Hours	Miles	Hours	Miles	Hours	Miles	Hrs. Calm	Total Miles
January	133	1,742	166	2,091	28	249	50	736	51	791	76	1,263	30	262	209	3,678	1	10,812
February	64	633	100	1,048	21	206	58	1,167	32	624	86	1,572	51	662	260	5,007	..	10,919
March	118	1,220	118	1,463	73	1,351	61	810	32	475	69	950	52	637	219	3,553	2	10,459
April	106	1,415	76	929	35	252	85	867	103	778	106	1,893	20	412	175	3,290	14	9,836
May	45	467	172	2,114	45	374	88	992	164	1,443	92	1,352	14	120	118	1,955	6	8,817
June	48	398	48	562	15	64	102	800	242	1,839	142	2,014	18	109	86	937	19	6,723
July	19	162	46	337	22	177	85	740	315	2,350	130	1,715	46	414	78	1,043	3	6,938
August	60	483	78	914	33	204	103	690	224	1,364	105	842	32	205	93	1,245	16	5,947
September	56	631	84	788	35	247	130	1,963	160	1,228	167	1,844	39	264	42	717	7	7,682
October	57	626	73	768	41	208	67	812	82	915	101	1,459	91	1,025	221	3,788	11	9,601
November	102	1,229	08	1,217	9	141	49	948	93	1,211	95	1,487	42	421	221	3,806	1	10,460
December	99	1,070	85	1,157	4	24	37	724	3	13	15	109	115	1,058	379	5,717	7	9,872
TOTALS	907	10,076	1,154	13,388	361	3,497	915	11,249	1,501	13,031	1,184	16,500	550	5,589	2,101	34,736	87	109,066

APPENDIX.

FORTY-EIGHTH ANNUAL REPORT

OF THE

COUNCIL OF THE NATURAL HISTORY SOCIETY

OF

NEW BRUNSWICK.

The past year has been a most successful one for the Society. The membership still continues to increase. There has been nearly double the number of visitors to the Museum. The educational work is growing. The specimens which the Curator lends to the schools are in continual demand. The lecture courses have all been well attended and the Museum is becoming better known and appreciated.

The Society suffered a loss in the death of one of its most valued members, Mrs. Catherine Murdoch. Mrs. Murdoch was always very generous to us, and at her death bequeathed the Society a handsome sum which will make it possible to pay off the mortgages, and thus be the means of adding Dr. Matthews' valuable Paleontological collection, which he offered to the Society when the mortgages shall have been paid.

The Society has also suffered a serious loss in the death of Mr. S. W. Kain, who was for many years one of its most valued and useful members. Mr. Kain did excellent work in the Archæological branch of the Society, of which it may be said, he and Dr. Matthews were the founders. As a member of the Council, his intelligent and active interest was always manifested in advancing the welfare of the Society.

Mr. McIntosh, the energetic Curator, has made many improvements in the arrangements of the different departments of the Museum, and the plans for its further extension will provide for a more modern equipment, such as will give to the Society and citizens an institution of which they may be proud.

The Ladies' Association has been active as usual, and also reports a successful year. They have given the Society a beautiful quartered oak desk with a brass tablet, in memorial of the late Mrs. Catherine Murdoch. They have also decided that they will present the Society with a piano, a gift that will be greatly appreciated.

The Society wishes to thank all those who have helped to make this year so successful.

Membership.

The membership of the Society has increased during the year. The enrollment is as follows:

Honorary	3
Life	20
Corresponding	15
Regular	173
Associate	360
Junior	35
Junior Associate	.24
Total	630

Financial.

Treasurer's Statement for Year Ending September 30, th 1910.

Income—

Balance from 1908-9		$716.91
Regular Fees	$325.00	
Associate Fees	330.00	
Junior Fees	23.00	
Junior Associate Fees	12.00	
		690.00
Rent of Barn		100.00
Rent of Reflectoscope		4.00
Donation, Jas. E. White		10.00
Grant from N. B. Government		400.00
Grant from City of St. John		250.00
From Executor Estate Catherine Murdock		3,500 00
Carried forward		$5,670 91

Brought forward		$5,670 91
Expenditure—		
Improvements to Building	140.83	
Cleaning Building	23 95	
Fuel	137 10	
Stationery and Printing	62 85	
Postage and Expressage	33 79	
Lighting	73 82	
Maintenance of Museum	33 55	
Sundries	13 35	
Insurance	83 00	
Indian Relics Purchased	5 00	
Bulletin XXVII	263 85	
Interest on Mortgages	170 00	
Water Rates	28 00	
Library, Books and Binding	2 00	
Commission, Collection of Fees	59 00	
Expenses re Lectures	29 80	
Telephone	19 42	
Salaries	575 00	
Wiring, Main Building $18.63, Barn $19.85	38 48	
Deposit, Special Account Bank of N. B	3,500 00	
Balance in Bank of New Brunswick	378 12	
		$5,670 91

Audited and found correct.

TIMOTHY O'BRIEN,
T. H. BELYEA, } *Auditors.*

Our liabilities consist of two mortgages, amounting to $3,500, and a few unsettled bills amounting to probably $75; say $3,575 in all; and the amount to our creditt in special account in Bank of New Brunswick, $3,561,01, will practically pay them off.

The building is insured for $8,000, and the collection for $3,500.

All funds are in the Bank of New Brunswick, Reg. account, $378.12; special account, $3,561.01.

A. GORDON LEAVITT, *Treasurer.*

P. S.—Since closing the above statement, I have been handed the sum of one hundred and fifty dollars by Miss G. W. Leavitt, Treasurer of the Ladies Association. A. G. L.

Curator's Report (Wm. McIntosh).

As Curator of the Museum of the Natural History Society of New Brunswick, I have the honor to submit the following report for the year ended 30th September, 1910.

During this period the principal work done on the collection has been in improving the method of installation. Further progress can not be made in the Museum until new cases are obtained and some changes made in the building to give additional space for exhibition purposes.

The following is a detailed report of the work done in the various departments during the year:

Zoology.—The mammals formerly spread about the building are now grouped in the centre of the zoological room.

The interior of the bird cases has been repainted, the collection re-arranged and new labels made for each specimen. Many of the stands have been repainted. This has improved the appearance of the collection very much. Our bird collection is an excellent one, but a few common species are lacking, and it is important that these should be added.

Some minor changes have been made tending to the improvement of the collections. Some fine shells have been donated and a number of invertebrate specimens collected.

Botany.—The most important work in this department has been the collection of material for an exhibit of economic botany. Specimens have been obtained to complete the New Brunswick wood collection and a few rare plants obtained for the herbarium.

Minerals and Rocks.—A collection of Canadian minerals and rocks presented by the Department of Mines of Canada, has been placed on exhibition in the Zoological hall. A group of beautiful minerals has been placed in this department, and attracts much attention.

A very interesting collection of New Brunswick minerals and rocks is available, but cannot be shown until new cases are obtained.

The study collection of minerals is now ready for use, and will, no doubt, be found very useful by teachers and students generally. During the year much valuable material has been donated and collected for this department.

PALEONTOLOGY.—Little change has been made in this department. A few hundred specimens of local fossils have been collected and added to the material for study and exchange.

ARCHAEOLOGY AND ETHNOLOGY.—This department was entirely re-arranged last year, but so much material has been acquired recently it was found necessary to again re-arrange the specimens.

During the past two years the Archæological collection has been more than doubled. Much of the new material being different in type from anything previously collected. It has been found necessary to store a number of interesting French and early colonial relics, as no cases were available for showing them.

The educational work of the Museum has outgrown our time and means. This is regrettable, for this is at the present time considered the most important department of modern Museum work. I refer more particularly to

(1) *Loaning collections to schools.* During the past year we have loaned birds, insects, minerals, ores, rocks, woods, plant-fibres, grains petroleum and its products, osteological specimens, archaeological specimens, etc. In a number of cases teachers wishing to obtain the same collection had to wait over two months before getting it.

(2) *Giving information.* Teachers, students, farmers, citizens are coming in constantly increasing numbers seeking information on subjects with which they think we are familiar. In the majority of cases the enquirer is satisfactorily answered.

(3) *Children's Work.* During the winter a series of young people's lectures was given. They were open to the public and were well attended. In May we began a series of outings for our young people, at these we learned much of outdoor life and gave simple lessons in emergency surgery.

In July the junior members spent twelve days camping. After the summer vacation the outings were commenced again, and will be continued until November.

Geology (G. F. Matthew, *Chairman.*)

The Committee reports that a visit was made to the plant beds, discovered last year by Dr. Matthew at Beaver Harbor. He and Wm. McIntosh spent two days there studying the relation of the beds and collecting from them. Only a few species of plants were found, but they are of special interest to the palæontologist and botanist, on account of their great antiquity.

Mr. W. J. Wilson, of the Canadian Geological Survey, has also been engaged in New Brunswick, in studying the coal mines at Minto, and collecting the varied and interesting fossil plants that are found with the coal. Dr. R. W. Ells, also of this survey, has visited the eastern counties in connection with the exploitation of the oil shales that occur there.

Dr. L. W. Bailey has been making a study of the living Diatomaceæ and other minute organisms that occur in the Kennebecasis and St. John rivers, and of the fossil Infusoria found at the bottom of these waters. The Drummond company that are opening up the iron ores of Gloucester County have extended their railway connections to the Miramichi, near Chatham, where they will ship their ore from large pockets erected there. The ore is a magnetite from the Ordovician slates of Gloucester County.

Botany (G. U. Hay, *Chairman.*)

The following are additions of new and rare species of New Brunswick Plants, discovered during the past two seasons. The list is the result of investigations made by Professors M. L. Fernald, K. M. Wiegand and by G. U. Hay, were not otherwise specified.

(The names of species and varieties in italics have not hitherto been reported from N. B.)

Acer rubrum L. var. *tridens* Wood. Ingleside. A tree of wide-spreading habit. Leaves, small, the middle lobe broadly triangular. Not hitherto found north of Auburndale, Mass.

Potentilla palustris (L.) Scop. var. *subsericea* Becker. Nerepis River. The first station known to us in America.—Fernald.

Betula alba L. var. *cordifolia* (Regel) Fernald. A doubtful variety in our woods.

Thalictrum confine Fernald. Ingleside. (All N. B. plants reported hitherto as T. dioicum and T. occidentale belong here.—Fernald.)

Scirpus *fluviatilis* (Torr.) Gray. Nerepis River.

Neslia paniculata (L.) Desv. Fairville and Ingleside. A bad weed.

Artemisia *ludoviciana* Nutt. Fairville.

Artemisia *frigida* Wild. Fairville.

Achillea Ptarmica L. Ingleside. Apparently naturalized.

Senecio Robbinsii Oakes. Near Harvey Station.

Solidago *racemosa* Greene. Aroostook Falls. (Erroneously called S. humilis in previous lists.—Fernald.

Salix *pellita* Anders. Ingleside and Nerepis. A beautiful shrub.

Salix nigra Marsh. Ingleside.

Populus balsamifera. Ingleside. Aroostook River.

Potamogeton *filiformis* Pers. Ingleside.

Potamogeton *Vaseyi* Robbins. Ingleside. The first station, apparently, east of Penobscot River.—Fernald.

Sporobolus *uniflorus* (Muhl.) Scrib & Merr. Ingleside.

Setaria viridis (L.) var. *Weinmanii* (R. & S.) Brand. Ingleside.

Apocynum *medium* Greene. Ingleside.

Euphorbia *glyptosperma* Engelm. Hartland.

Euphorbia *hirsuta* (Torr.) Wiegand. Aroostook Jct.

Vaccinium caespitosum Mich. Aroostook Falls.

Amelanchier *spicata* (Lam.) C. Koch. Aroostook Falls.

Agastache Foeniculum (Pursh) Ktze. Moore's camp, near Fisk's Mill, St. James, Charlotte Co., Apparently introduced; but well established under trees at the edge of the clearing and beginning to spread.—J. V.

Lysimachia quadrifolia L. Mouth Nerepis.

Adiantum pedatum L. Shogomoc Falls. F. W. Holt, C. E., Albert, Albert Co., Miss Mildred Murray.

Ornithology (A. Gordon Leavitt, *Chairman*).

Very little outside work has been done in this department, but the collections have received some careful consideration by the Curator, who, having observed that the small branch-birds, such as the warblers and finches, appeared to appeal more strongly to the visitors (students or others), re-arranged these forms, doing away with the old stands on which they were mounted, and giving them a position where they could be most easily examined or admired.

A glance at these collections will convince one that the change has made a great improvement and, when the rest of the material is similarly arranged, the Birds will continue to be one of the most attractive features of our collections.

Finances (A. Gordon Leavitt, *Chairman*).

After a glance at the treasurer's statement, the members of this Society will surely feel pleased at the present financial position.

The darkest cloud is said to have a silver lining, and, although the Society had the misfortune to lose a member, Mrs. Catherine Murdoch, a lady who took a keen interest in its welfare, and who, from time to time, gave to it both financial assistance and articles of value for its museum, we have been so well and kindly remembered in the will of this lady that we have now on hand funds sufficient for the paying off of our entire mortgage indebtedness, and place us in that ever enviable position—free from debt.

It is a great pleasure to be able to state that although the mortgages have yet some time to run, arrangements have been made whereby we will be permitted to pay them both off on the next date on which interest is due, namely, December 12th, and without having to pay one cent of additional interest, which is a usual requirement when mortgages are taken up before they are due.

Although relieved of the mortgage burden, our members must remember that much remains to be done in order that the Society may accomplish what it has in view, namely—a collection of local or Provincial antiquities, Minerals and their products, Mammals, Birds, Fish Shells, Wild Plants, Fruits and Grains, which will possess a highly interesting and educative value, to our citizens and visitors from abroad, regarding the history and natural resources of our Province.

For the accomplishment of the above, more material must be secured, cases provided and changes made in the building, all of which will call for expenditure, and, as we have a high ideal, and are working for the good of all, any demands we make should meet with a hearty response by our members, and the public generally.

The majority of present-day museums are up-to-date, and also have sufficient funds for the carrying out of the desires of those in charge, but, as we have not as yet arrived at that happy stage, constant efforts are necessary if we are to accomplish the great work which naturally falls to our lot, and which will be done if we receive the necessary financial support.

Building Committee (T. H. Estabrooks, *Chairman*).

There have only been the most trifling expenditures made during the past year by this Committee. The building is in good repair and no alterations or improvements will be required during the next few months, but if we have the money to spare, there are some important changes in the main building that should be undertaken after the close of the winter's lecture course.

Lectures (G. U. Hay, *Chairman*).

Eight lectures were given in the regular course of 1909-10, the subjects referring chiefly to the Natural History of New Brunswick, which our Society does well in keeping always before its members and the public.

1909.

October 5. Tides of the Bay of Fundy.— G. F. Matthew, D. Sc.

October 19. Annual Meeting. Reports. Election of Officers.

October 26. Conversazione.

November 2. The Interpretation of Natural Scenery,— L. W. Bailey, LL.D.

December 7. The Mammals of New Brunswick.— Mr. W. H. Moore.

1910

January 4. The Physiographic Characteristics of Cain's River.— Prof. W. F. Ganong, Ph.D., followed by Discussion on Some Results of Dr. Ganong's Work in New Brunswick.

February 1. Insect Enemies. (Illustrated).— Mr. Wm. McIntosh.

March 1. Our Native Trees.— G. U. Hay, D. Sc.

April 5. Benefactors in Feathers.— Mr. A. Gordon Leavitt.

May 3. Nature Study in the Public Schools.— J. Vroom, A. M.

June 7. The History of Rockwood Bog.— Dr. G. F. Matthew. Summer Field Work Outlined.

A course of popular lectures was given during the winter on Tuesday evenings not occupied by the regular meetings of the Society, These were free to members and their friends.

1910.

January 11. The Waterways of Canada. A Lecture for Teachers. The Bickmore Course, McGill University.

January 18. Swiss Lakes.— Mr. J. B. Clawson.

January 25. Photography, with illustrations, The Photographic Section of the Natural History Society.

February 8. A Quarter of a Century After.— Silas Alward, D. C. L., K. C.

February 15. The Drug Collector at Work.— Mr. W. H. Mowatt.

February 22. Evolution in the Light of Human History.— Geo. G. Melvin, M. D.

March 8. An Evening in Tennyson's Land.— Mr. W. F. Burdett.

March 15. Hampton Court and other Noted Places.— Rev. W. H. Cassup, B. A.

March 22. The Drug Collector at Work.— W. H. Mowatt.

March 29. A Promenade.— J. McG. Baxter, M. D.

The course for Junior members embraced talks on easy scientific subjects, travels in other countries and our own, and on subjects in the museum.

Field Meetings.

Four very pleasant Field Meetings were held by the members of the Society during the past summer at places not hitherto visited on such occasions.

The first was held July 9th, at Woodman's Point, on the beautifully situated grounds of Mrs. M. A. Woodman, the leader being Mr. W. F. Burditt.

It was a perfect summer day, and though the heat of the mid-day sun may have felt a little oppressive to some of the members while walking from Lingley Station across the long Nerepis bridge to Woodman's Point, the delightful shade of the tall spruce and pine trees in Mrs. Woodman's grove soon brought ease and refreshment. On account of the historical associations of the locality, the attention of the gathering was taken up rather with matters relating to history and genealogy, than with natural science. After a brief rest in the welcome shade of Mrs. Woodman's noble trees, a party, led by the rector of the parish, the Rev. Mr. Belliss, repaired to the nearby burial ground to view the tomb of General Coffin, and there gleaned from the Rector, Mrs. Woodman and others, many interesting facts with regard to the pioneers of civilization on the St. John River. Dr. Hay then took charge of the party and led the way to the river shore, along which a delightful ramble was enjoyed until the Point itself was reached. Dr. Hay, as usual, discoursing by the way and imparting information about the trees and plants met with en route, explaining their distinguishing characteristics, how the

uninitiated might know and recognize them again, and, more difficult still, how their names might be remembered. On the return journey a visit was paid to the site of General Coffin's home—the site of the original homestead, destroyed by fire many years ago, and additional reminiscences were called forth.

Near this place, in an oak grove, was discovered the four-leaved loose strife (*Lysimachia quadrifolia L.*), a plant that has not yet been found elsewhere in New Brunswick.

On the return to Mrs. Woodman's grounds, the usual refreshments were enjoyed, followed by an intellectual dessert. As the party gathered around the front porch of Mrs. Woodman's hospitable home, while the slanting rays of the evening sun lit up with a warm glow the wooded hillsides and receding headlands of the noble river outstretched before them, the scene and the occasion was felt by all to be one that would long linger in the memory with pleasurable recollection.

Dr. Matthew, being unable to be present, contributed a short paper upon the geological aspects of the locality, which was read by Mr. Burditt. Dr. Hay also making some references to the subject, and the discussion was further contributed to by Mrs. Woodman and the Rev. Mr. Belliss. It was, on the whole, a most enjoyable and instructive meeting, and the only regret experienced was that it was not more largely attended.

The meeting at Kennebeccasis Island, on the 21st of July, was well attended and the weather delightful. The headquarters for the day was at Mrs. Grannan's house, from which a fine view is had of the Milkish passage and the lower reach of the Kennebeccasis River. The leader for the day was Dr. G. F. Matthew, who described very interestingly, the geology of the Island, in which there is much diversity. A party went out to investigate the conglomerates, slates and trap-rocks at the ferry landing, and the exposures of the rocky ledges along the road west of the house. Meanwhile, the botanists, led by Mr. McIntosh, found entertainment in the numerous wild flowers, intermingled with introduced species that were found in the neighboring fields and along the road. The return was by steam ferryboat and stages

from Millidgeville to the city. The visitors will preserve many pleasant recollections of the day and of the kindness and hospitality of Mrs. Grannan and her friends.

The third meeting on the programme for August 4, to Ray's Lake, by invitation of Mr. Henry L. Everett, had to be cancelled on account of the wet weather.

The fourth meeting, which was under the charge of Dr. G. U. Hay, was held at Land's End, Kings County, August 20th, on the heights overlooking the St. John and Kennebecasis rivers. The invitation from Mrs. (Dr.) Skinner, Miss White and Miss Carrie M. Skinner had been cordially accepted, and the reception given by the kind hostesses to members of the Society, as they climbed the steep hill from the river, or came by way of Millidgeville and Bayswater, was especially cordial.

The day was perfect, the river smooth and the view from the picturesque spot far extending, embracing the waters and hills of the lower St. John in all their grandeur and loveliness. Mrs. and Miss Skinner and Miss White made charming hostesses.

After all had partaken of afternoon tea on the lawn provided by the hostesses, Dr. Bailey and Professor Klugh, of the biological station at St. Andrews, who are making a survey of the lower St. John, spoke of some results of their work. Dr. Bailey said the surface water of the St. John at Westfield is almost fresh owing partly to the volume of the St. John and the Nerepis. A stratum of salt water lies below this.

Professor Klugh gave some interesting facts about the large leaved aster and referred to the dozen or more kinds of asters and golden rods now found in bloom in various places in the Province.

A walk was then taken over "Ouangondy" path which overlooks the St. John, giving a series of picturesque views—none more lovely than that of Sunset Rock—onward to the "Amphitheatre," formerly the site of a house whose grass grown cellar is still visible, up to which from the cliff overlooking the river, rises a series of gentle knolls bordered with noble pines and cedars of rare beauty in shape and outline. The walk was enlivened

with talks on the trees, on the virtues of some edible mushrooms, on the habits and ghostly appearance of the "Indian Pipe," on the beauty of the paths and retreats which gird this region of simple pleasures and untroubled quiet, which the owners, the hosts of the day, have appropriately named Arcadia.

As the sun neared the horizon, a warning that every delightful day must have an end, luncheon was enjoyed. Senator Ellis, the president, in a few well chosen words, expressed to the hostesses the acknowledgements of the members of the Society for the delightful hours which had been spent, which W. F. Hatheway, T. H. Estabrooks, W. S. Fisher and others supplemented by a more formal vote of thanks. Miss White presented to each guest on departure a beautiful souvenir containing a text or verse appropriate to the occasion. As the hours of twilight drew on Dr. Matthew gave a sketch of conditions before the St. John River came into existence and Simon W. Hatheway entertained the company from his exhaustless fund of character sketches and anecdote.

The fifth and last outing was held on the grounds of Jas. Manchester, Esq., at Lancaster Beach, and the guests will remember the occasion from the many attentions shown them by Mr. and Mrs. Manchester. The leader was Dr. W. L. Ellis, and Dr. Bailey and Dr. Matthew contributed valuable addresses on the physical features of the district.

Photographic Section (C. P. Clarke, *Chairman*).

The Committee of this Section has little to report. Members generally have not taken up work earnestly or with the energy that might have been expected. On one occasion, during last winter, a most interesting paper written by F. H. J. Ruel was read by Mr. Ernest Fairweather, and was very favorably received and commented on. At the same time lantern slides illustrating various points of Mr. Ruel's paper were shown with the reflectoscope. They appeared to be much enjoyed by those present. It is hoped that the coming year will be productive of better results in this fascinating branch of study and recreation.

Microsocopic Section (W. H. Mowatt, *Chairman.*)

The Microscopic Committee reports that they conducted one meeting in the popular course of lectures. No other work of importance has been done during the year.

Press Committee (G. U. Hay, *Chairman*).

Your Committee desires to acknowledge the courtesy extended towards the Society by the daily press of St. John in publishing notices of our meetings and reports of our lectures prepared by the Secretary and members of the Press Committee.

Ladies' Association (Mrs. K. M. Matthew, *President*).

The Ladies' Association of the Natural History Society has pleasure in reporting another year of successful work. Our course of six afternoon lectures, beginning Octber 28th, was entitled "Episodes in the History of New France," illustrated with tableaux. They dealt with the following subjects:

Coming of the French.
The French in New Brunswick.
The Jesuit Missions.
The French in Quebec.
The French in Louisiana.
The French Habitant..

The proceeds of these lectures, amounting to $113.50, were devoted as usual to paying the salary of our valued Assistant Librarian.

The second course of afternoon lectures, which were free, began in January, nine lectures were given, all of exceptional interest. We are happy to welcome two or three new lecturers in this course. In the programme of children's lectures, given on Friday afternoons, two or three ladies gave very excellent talks on subjects of general interest.

I may say that I think St. John should be proud of the fact that there were twenty ladies able to give such excellent lectures as we heard last year, and I feel sure that ther are many more of our members who need only to make the effort to give us more new lectures of equal value.

The three social evenings held last winter in January, February and March respectively, proved an unqualified success. All the members of both sexes were invited and were able to inspect the varied treasures of the Museum, new and old. After a short literary programme, refreshments were served.

The ladies also took their part as usual at the annual conversazione in the fall and at the four very pleasant field meetings held by the Society during the summer.

This coming year promises to be no less interesting and valuable. Good courses of lectures are planned for the fall and winter, and we hope the social part of our work will not be less useful.

We have at present three hundred and seventy-three associate members and twenty junior associates, which branch includes girls from ten to twenty-one. The latter Class of the Society. though young, shows signs of vigorous growth, and we hope that when the ranks of our association may be depleted by death or removal, we may still fill up all vacancies from our junior members.

We are still, I trust, living up to our motto: "Progress is the law of life."

Junior Associates (E. MacKinnon, *Secretary*).

The Junior Associate members of the Natural History Society of New Brunswick report a most favorable year. There are about thirty members who were organized in April and have since had five business meetings and a number of outings to points of interest near the city which were well attended.

The members wish to express their appreciation to Mr. and Mrs. McIntosh and Mr Leavitt, for making these outings both interesting and instructive.

Treasurer's Report Ladies' Association.

(Grace W. Leavitt, *Treasurer.*)

Receipts—

1909	Balance	$36 70
	Course Ticket Receipts	113 50
	Donation from Miss Mary Jardine, Boston	10 00
	Sale of "Erica"	1 10
	Memorial Desk Receipts	15 25
	Withdrawn from Bank of Nova Scotia	40 05
		$216 60

Expenditure—

Printing Course Tickets	$ 3 50	
Printing Lecture Tickets	50	
Coaching	60	
Cost of Memorial Desk	50 00	
Brass Memorial Shield	12 00	
Miss Hoyt, Corresponding Secretary, Salary	150 00	
		$216 60

October 8th, 1910.

Donations.

Archæology and Ethnology.

Allison, Mrs. L. C.—Iroquois Indian Work.
Balmain, David—Seventy-six stone age relics.
Campbell, Chas.— Indian war club.
Coster, Miss Constance—Stone Age relics.
Estabrooks, Chas. D.—Stone spear head.
Ganong, Dr. W. F.—Indian stone pipe.
Gunter, Harry—Collection of Stone Age relics.
Gunter, John—Collection of Stone Age relics.
Gunter, Mrs. Isaac, Grand Lake—Two old Malecite Indian baskets.
Hamilton, Mrs. Geo. A.—Hupa squaw cap, ornaments, Hopi bread baskets, plaque, Hopi pottery, image of rain god, bow and arrows and other articles.
Hamilton, Miss Alice—Mic mac river canoe.
Hamilton, Mrs. Jas.—Fans from Fiji Islands, comb, caps, snuff box, opium pipe.
Hoyt, Mrs. J. A.—Iroquois Indian beadwork from Ontario.
Harding, Geo., Nerepis, N. B.—Indian sinker or pendant.
Irvin, K. C., John, Bridgetown, N. S.—An Old Acadian Padlock.
Jones, F. C.—African pipe.
Kee, Miss Edith M.—Indian stone implements, and pottery.
Leavitt, A. Gordon—Indian stone implements and pottery.
Leavitt, R. F.—Indian arrow head.
McIntosh, Mrs. Wm.—Indian relics.
McIntosh, Wm.—N. B. Stone Age relics.
McKinnon, Miss Elizabeth—Stone Age relics.
McSorley, Chas., Gibson, N. B.—Iron spear head (French).
Nakane, N., Moosejaw, Can.—Indian baskets.
Smith, Merritt C.—Indian arrow heads.
Smith, Chesley C.—Stone Age relics.
Smith, J. Austin—French and Indian relics.
Smith, Vance E.—Indian relics.
Sturdee, H. Russell—Boomerang, Australia.

Zoology.

Anonymous—Two mounted specimens of deer.
Armstrong, Capt. Beverley—Paper Nautilus.
Banks, Jas.—Cocoon of large moth.
Daley, Mrs. Harry—Mounted specimen yellow shafted flicker.

DUFFY, MARTIN G.—Object from stomach of moose.
FLEWELLING, C. H.—Collection of tropical birds.
GRANT, C. W. HOPE—Sponge on scallop shell.
HALL, C. T., Fredericton—Collection of local birds' eggs.
HAMILTON, MRS. GEO. A.—Nest of trap door spider.
HAMILTON, MRS. JAS.—Osteological specimens.
HENDERSON, M. G. B.—Mastodon tooth from Yukon.
KNIGHT, MISS—Egg cases of whelk.
KNIGHT, MRS. JOSHUA—Shell work, case of.
LEWIS, S. D.—Skeleton of crucifixion fish, Dutch Guiana.
LEAVITT, A. GORDON—Sponge.
MCCALLUM, WILLIAM, Amherst,—Frog skin from Africa.
MCLAREN, J. S.—Large lobster, (mounted.)
MCMANN, FRANK—Specimen of giant water bug.
SCOTT, GEO.—Collection of shells and marine specimens.
SHORT, MISS AGNES—Mounted specimen of duckling and polyphemus moth.
TAYLOR, MRS. JOHN K.—Rattlesnake skin and horned toad.
VROOM, JOHN P., Waneta, B. C.—Sand swallow nest from the Columbia river.

BOTANY.

FRENCH, MISS MABEL P.—Twenty-five botanical specimens local wild flowers.
HAMILTON, MRS. GEO. A.—Sugar pine cone, blue gum, century plants, nuts and fruits from California.
HAMILTON, MRS. JAS.—Fruits and nuts, also a large number of local botanical specimens.
HEGAN, GEO. B.—Botanical specimens from the most northerly Arctic settlement, brought from the north by Capt. Bartlett of the Peary expedition who presented them to Miss Hegan, a nurse in the Grenfell hospital, who sent them to her brother, the donor.
HOLT, F. W.—Specimen maiden hair fern.
LEAVITT, A. G.—Seaweed.
LEAVITT, R. T.—Sugar cane from West Indies.
MOWATT, WM.—Collection of drugs.
PENDER, JAMES—Specimen of sensitive plant from Fiji.
POTTS, MRS. WALTER—Seed pod of Martynia.
STANLEY, MRS. A.—Large specimen of polyporus (tree fungus).
TENNANT, MRS. W. B.—Woman's tongue bean.

PALAEONTOLOGY.

CLAYTON, J. P.—Leda clay containing fossil mussels.
LEAVITT, A. G.—Ripple marked stone, St. John.
LAWRENCE, MRS. J. M.—Trilobite from Gaspe.
MCLEAN, WM.—Shark's tooth (fossil) from South Carolina.
SCOTT, GEO.—Carboniferous fossil.

Minerals.

Bailey, Dr. L. W. — Antimony ore and galena, also specimens of freestone.
Daley, Mrs. Harry S.—Cryolite from Greenland, and antimony ore.
Department of Mines, Canada—150 mineral specimens.
Graves, Chas.—Tripolite.
Hunt, Miss Arianna—Sandstone with concentric bands.
Hamilton, Mrs. Jas.—Minerals and ores.
Hamilton, Mrs. Geo. A.—Minerals and ores from California.
Hillsborough Manf. Co.—Specimen of gypsum and plaster.
Lawrence, Mrs. J. M.—Specimens of rock from Gaspe.
Maritime Oilfields, Ltd.—Crude petroleum, oil shale and sandstone.
Sackville Freestone Co.—Samples of freestone.
Vroom, W. E.—Specimens of albertite.

Coins and Medals.

Armstrong, Morrison & Co., Vancouver, B. C.—Two medals issued on the opening of the Granville street bridge, Vancouver, B. C.
Dykeman, Kenneth—One cent (Lincoln) United States.
Gunter, Ivan—One cent (Lincoln) United States.
Ritchie, Miss Mary E.—Medal, Rt. Hon. Geo. Canning, M. P.
Warlock, Mrs. B.—Collection of silver and copper coins.

Library.

Allison, Mrs. L. C.—Wood's Natural History.
Alward, Dr. Silas.—Copies of two lectures delivered by Dr. Alward.
Anonymous—Four vols. U. S. Geol. Survey.
Blizard, Mrs. S. G.—Two old music books 1824, 1835.
Carman, Chas.—Books from the library of late Chas. H. Carman.
Emerson, R. B.—Two old volumes of work on geography, London, 1773.
Ganong, Dr. W. F.—Science, Vol. 27,
Le Clerq New Relation of Gaspesia, translated and edited by W. F. Ganong, Ph.D.
Hamilton, Mrs. Jas.—Six volumes on a variety of subjects.
Hay, Dr. G. U.—Eight volumes of Natural Science Handbooks.
Educational Review, Vol. XXII.
Kerr, John—Auditor's reports City and County of St. John, and several volumes on Natural Science.
Leavitt, A. Gordon—Smithsonian Reports 1859, 62-64, 66, 69-72.
Reed, Miss Ellen T.—Five copies N. H. S. of N. B. Bulletins.
Scott, Geo.—Old work on Theology, A. D. 1654.

GENERAL.

GODFERY, E. V.—Old shoemaker's knife found in the centre of a tree cut down in King Square.

HAMILTON, MRS. JAS.—Photographs, old silk mittens, and several interesting relics.

HAYWARD, MRS. H. P.—Portion of cloth from the first piece off the looms of Sir Robt. Peel's works.

JONES, PERCY.—Cannon ball found in Princess street, St. John.

KERR, JOHN—Microscopical instruments.

KINGSTON, WM.—Portion of first piece of paper made in Newfoundland.

TOWLE, MRS. G. BACON, New York City—Microscope.

Officers and Committees for 1911.

Officers,

President—Hon. J. V. Ellis, LL. D.
Vice-Presidents—G. F. Matthrew, LL. D., D. Sc., G. U. Hay, D. Sc.
Treasurer—A. Gordon Leavitt.
Corresponding Secretary and Curator—William McIntosh.
Recording Secretary—J. G. MacKinnon.
Librarian—W. L. McDiarmid.
Additional Members of Council—H. G. Addy, M. D., T. H. Estabrooks, Jas. A. Estey, W. F. Burditt, J. Roy Campbell.

Standing Committees.

Archæology—Wm. McIntosh, Rev. J. J. McCaskill, A. Gordon Leavitt, Dr. G. F. Matthew, John MacKinnon, Duncan London.
Botany—Dr. G. U. Hay, Dr. W. F. Ganong, J. Vroom, M. A., W. L. McDiarmid, J. G. MacKinnon, H. G. Perry, W. J. S. Myles.
Invertebrates—Wm. McIntosh, A. G. Leavitt, W. H. Mowatt, Miss S. B. Ganong, Miss G. Frink.
Ornithology—A. G. Leavitt, Jas. W. Banks, Thos. Stothart, Mrs. G. U. Hay, Mrs. J. W. Lawrence.
Astronomy and Meteorology—W. F. Burditt, D. L. Hutchison, Dr. G. U. Hay, Joshua Clawson, Mrs. Geo. Lee, Mrs. G. U. Hay.
Geology—Dr. G. F. Matthew, Dr. L. W. Bailey, Jas. A. Estey, Rev. David Hutchison, A. G. Leavitt.
Microscopes—W. H. Mowatt, Dr. G. G. Melvin, Dr. T. D. Walker, Dr. W. L. Ellis, Dr. Wm. Warwick.
Photography—G. Ernest Fairweather, C. P. Clarke, Geo. A. Henderson, T. Percy Bourne, Henry Town.
Library—W. L. McDiarmid, J. G. MacKinnon, W. H. Mowatt.
Lectures—Dr. G. U. Hay, Dr. H. G. Addy, Wm. Brodie, W. S. Fisher, Dr. McInerney.
Building—T. H. Estabrooks, A. G. Leavitt, Dr. Geo. F. Matthew, W. F. Burditt, Dr. H. G. Addy.
Press—Dr. G. U. Hay, A. G. Leavitt, Dr. G. F. Matthew, J. C. MacKinnon, Chas. A. Macdonald.
Publications—Dr. G. F. Matthew, Dr. G. U. Hay, A. G. Leavitt, Chas. A. Macdonald.
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Vice-President—Mrs. G. U. Hay, Mrs. Geo. F. Smith, Mrs. J. V. Ellis.
Treasurer—Miss Grace W. Leavitt.
Recording Secretary—Mrs. F. B. Cowgill.
Corresponding Secretary—Miss F. A. Hoyt.

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Press Committee—Mrs, F. B. Cowgill, Miss R. Waterman.

List of Members.

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Ganong, Prof. W. F., Ph. D.....Smith College, Northampton, Mass.
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Barker, L. W.
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Baxter, J. B. M.
Belding, A. M.
Bell, Thomas
Belyea, J. Fred
Belyea, T. H.
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Bourne, H. C.
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Bruckoff, Wm.
Burditt, W. F.
Bustin, Stephen B.
Bullock, T. H.

Campbell, G. Wilford
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