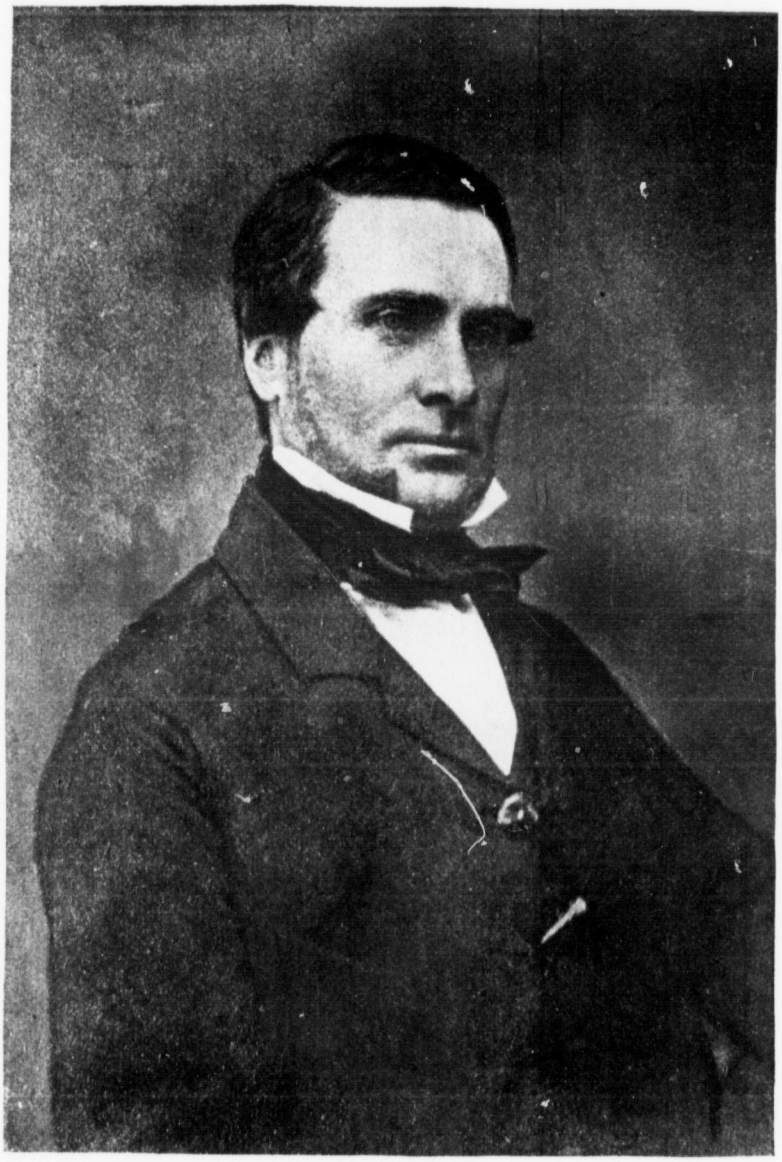

JAMES ROBB, M. D.

BULLETIN

OF THE

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OF

NEW BRUNSWICK.

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ARTICLE I.

DR. JAMES ROBB.

First Professor of Chemistry and Natural History in King's College, Fredericton—A Sketch of His Life and Labours,

By L. W. Bailey, LL. D.

Read April 5, 1898.

In the course of the development of knowledge as regards the structure, history and natural resources of a country, it is usually the case that distinct steps of progress may be recognized, and that with each of such steps the life and labours of some one individual are prominently associated. The names of such men as Aristotle, Linnæus, Cuvier, Agassiz and Gray, make such steps of progress for the world at large, but even within the comparatively narrow limits of a single state or community a like process of development by successive, well marked stages is usually recognizable, and New Brunswick is no exception.

The first period in all such cases is usually that in which some one individual, as a result either of a more intense sympathy with nature or circumstances especially favorable for her study, devotes his whole energy to such work, and thus, by gathering and comparing the isolated and disconnected observations of many observers, begins to give to the latter a definite direction and definite methods. To us who have to labour in fields already pre-occupied by so many workers, and where the discovery of even one new fact or species is a rare occurrence, in

some departments indeed well-nigh an impossibility, a glance backward into the territories investigated by the early pioneers cannot but awaken a feeling of envy. On whichever side they turned something entirely novel was almost sure to meet their gaze. They had only to stretch out their hands and a veritable Klondyke of rich rewards awaited their grasp. No wonder that their imaginations were aroused to the highest pitch, and that conclusions and anticipations should be indulged in, which would require time and the crucible of criticism, and more exact observation to reduce to their proper value. In New Brunswick the period of pioneer exploration, and of enthusiastic but not always well justified prophecy, is identified with the name of Dr. Abraham Gesner, a sketch of whose life and labours has been published by the Society in its No. XV. Bulletin. That of the beginning of more exact observation and of critical analysis is similarly associated with the subject of the present sketch, Dr. James Robb.

Dr. Robb was born in the city of Stirling, Scotland, in the year 1815. Of his early life and education I have been unable to obtain any particulars, but, from letters written at the time, I find that he entered upon a course of medical study in Edinburgh University in the year 1831. He could hardly have ever entered seriously upon the practice of his profession, for in August of the year 1835 we find him travelling, while still a student, on the continent of Europe, and in September, 1837, he had already come to New Brunswick to accept the position of Lecturer in Chemistry and Natural History in King's College (now the University of New Brunswick), in which as Professor he continued to work until the time of his death, in 1861.

It is very evident that, even at the time of his European journey, which lasted for several months, he had already acquired a fondness for scientific, as distinguished from merely medical or professional, work, for he himself says, in writing to his mother, that the trip "was more for science than for pleasure," and resulted in the "collection of vast numbers of plants and shells and minerals." He must also have already gained for himself an enviable reputation as a naturalist, for he was accompanied by Dr. Van Beneden, already well known in the scientific world, and carried with him letters to many distinguished savants, making, as he says, the entire journey a "*voyage d' agrément.*" Switzerland would seem to have had special attractions for him, though Nice, Milan, Genoa and Sardinia were also visited. The journey was made *on foot*, and in the passage of the Juras was not unattended with danger, the party being on one occasion storm-bound for three days in

a hut on the Auberge, from which they only escaped with difficulty, and where, to use his own words, "had they been much longer confined, they would have had to eat each other, like the Kilkenny cats, because there was nothing else to eat." He grows quite enthusiastic over their reception at the University of Pavia, where, despite their clothing, much the worse for travel, "the Professors of that time-honored seat of learning vied with each other in attentions and affability, one giving us objects of natural history, another presenting us with his works, and a third giving us iced sherbets and chocolate." He would never, he says, "think of his visit to Pavia but with feelings of the highest gratification." He adds that not at Pavia only, but throughout the journey, every moment was not only pleasurable, but of inestimable value to him. He was constantly in an atmosphere of science, and as the collections then made were undoubtedly those which subsequently became the nucleus of the cabinet now in the University in Fredericton, the writer of this notice, to whom these facts have only recently become known, can now the more readily understand, as he has always been surprised at, their extent and value.

The special circumstances which led to Dr. Robb's coming to New Brunswick are not definitely known; but as about the same time at least one other Professor from Scotland came to the Provinces for a similar purpose, it is probable that enquiries or advertisements had been instituted there with a view to the obtaining of properly qualified instructors. However this may have been, it is certain that Dr. Robb had not long been here before his influence began to be felt in the community. Accustomed to cultured society, fond of music, well read in the literature of the day, and, though not practising medicine, recognized universally as one thoroughly competent to advise, and, in the case of the poor, ever ready to give advice without compensation, he could not fail to be an acquisition to any community, and especially to such a one as then existed in Fredericton. Proofs of the estimation in which he was held are not wanting. Old residents of the city, and among all classes, speak of him even now in terms of the highest regard. His opinion was sought upon many subjects outside the line of his ordinary professional work. He was the first President and the most active spirit in the Fredericton Athenæum, a society or club for the promotion of literary and scientific research; he was nominated, in 1849, and chosen a member of the first Council of his adopted city, and again in 1850, in this latter case declining to serve that he might be the more free to give his attention to what he conceived to be a

still more important duty—the promotion of the agricultural interests of the Province. He enjoyed in an eminent degree the confidence of the then Lieutenant-Governor of New Brunswick, Sir Wm. Colebrook, as also that of the Bishop, the Chief Justice, the Master of the Rolls, and the other chief officials of the colony. As a teacher he was loved as well as respected by his pupils, seeking always for accuracy and clearness of statement rather than for a show of words, and endeavoring, as far as his very isolated position and remoteness from books and fellow-laborers would allow, to keep himself acquainted with the latest results of scientific thought and experiment. In December, 1840, he married Miss Ellen Coster, daughter of the Archdeacon of New Brunswick, and from that time his residence in the College building was a centre from which he continued to influence for good a constantly widening circle of individuals and of interests.

We, as naturalists, are chiefly concerned with his scientific labours. As might be expected, the natural products of a country quite new to him were quick to attract his attention, and the dates attached to specimens in the college herbarium show how soon after his arrival he entered upon the study of the botany of the Province. Practically he was our first botanist, for though others had made a few scattered observations on the occurrence of particular species, he seems to have been the first to attempt anything like a systematic collection. This collection is now in the museum of the University of New Brunswick, and embraces several hundred species, some of them forms of very rare occurrence, and some species re-discovered long afterwards by other observers. It was, of course, arranged on the old Linnæan system, but both in its extent and in the accuracy of its determinations shows clearly the labour expended upon its preparation. It is to be regretted that in this, as in so many other instances, the results of his work were never printed, so that little besides the collections which he made remains to indicate the extent of his services. He must, however, have maintained correspondence and exchanged specimens with naturalists abroad, as along with his own collection are many specimens sent from the herbaria of Messrs. Hooker and Balfour. He must also have continued to enjoy an enviable reputation among the botanists of the motherland, as his letters indicate the interesting fact of his having been suggested as a possible successor to Sir W. Hooker in the botanical chair in Glasgow, a position which, however, he says that he could not, in view of his engagements here, honourably accept.

A study of the wild plants of the Province was accompanied by an interest in the cultivated forms and in the conditions of their production. In April, 1850, having refused to be elected to the Fredericton City Council, he took hold of a Provincial Society for Encouragement of Agriculture, which, he says, "gave him more to do than the Council." He was elected its president, and soon after wrote a paper on the subject of Manures, which, with others, was afterwards printed, though no copies, so far as known to the writer, are now extant. Practically, he became Secretary of Agriculture for the Province, an office not actually established until a much later period, retaining the position until his death, and in that capacity visiting many parts of the Province, giving frequent lectures on agricultural subjects, and correlating the statistical returns submitted to him by his many correspondents. I have before me his lecture, "On Agricultural Progress in New Brunswick," and find it to be a model of terse statement, extended observation, careful criticism of existing methods, and sound judgment in the direction of possible improvement. The government of to-day could not do better than to have this lecture reprinted and widely circulated among the class for whom it was chiefly intended.

Such a man as Dr. Robb would of course naturally understand the intimate relationship between the nature of soils and that of the rocks from which they are derived. His interest in geology had, moreover, already been aroused by his European tour, the fruits of which were before him, and no doubt employed in the illustration of his daily lectures. We may be sure, therefore, that it was with no indifferent eye that he scanned the results of the geological survey begun by Dr. Gesner in 1837, and continued during the four following years.

In the commencement of this sketch it was stated that Dr. Robb represents the second period in the history of scientific progress in New Brunswick. Strictly speaking, he and Dr. Gesner were contemporaries, but the first published observations of Dr. Robb, of a geological nature, are subsequent to those of Dr. Gesner, and are largely in the direction of criticism of the latter,—criticisms, however, based on his own personal observations and evidently having no other object than that of reaching more reliable conclusions. These criticisms are mostly contained in the report of Prof. J. W. F. Johnston on the Agricultural Capabilities of New Brunswick. Dr. Robb here especially objects to the enthusiastic and in many instances grossly exaggerated

statements of Dr. Gesner, relative to the occurrence of coal, and shows, by reference to all known outcrops, that the coal field of New Brunswick, instead of being one of the largest discovered on the globe, as stated by Gesner, was really small as compared with those of Illinois and Pennsylvania, and that the coal supply, instead of being "inexhaustible" and "of the highest importance not only to New Brunswick but to Great Britain and the United States," was really very small, the only workable seam known, and that of limited extent (the Grand Lake seam), not exceeding eighteen or twenty inches.

Another point in which Dr. Robb took issue with Dr. Gesner, of less economic significance, but still involving important consequences, was that of the true stratigraphical position of the red saliferous and gypsiferous rocks which cover such large areas in southern and some parts of northern New Brunswick. These, on account of their lithological resemblances to the rocks of the New Red Sandstone formation of England, with which he was familiar, were asserted by Dr. Gesner to be newer than the Coal formation, whereas Dr. Robb, following the view of Sir Charles Lyell, maintained, and correctly, that the greater part of them are really older than the coal measures.

But the most important contribution in this direction made by Dr. Robb is that of a Geological Map, contributed to Prof. Johnston's Report, in which, taking Dr. Gesner's incomplete maps as a basis, but modifying them as influenced by his own observations, as well as by those of Jackson, Logan and Lyell, he makes a distinct advance in the representation of the geological structure of the Province. With characteristic modesty, however, he observes that the map, made at Prof. Johnston's request, is unsatisfactory to himself, and is offered with very great diffidence.

In a sketch of the scientific work of Dr. Gesner, prepared by Dr. G. F. Matthew, and published in a Bulletin of this Society (No. XV, 1897), a very full discussion of the former's view is given, together with a representation of his map reduced from the map in the hands of the Natural History Society of New Brunswick, showing the result of his first three years' survey, and the more complete one in the possession of the Crown Lands Department at Fredericton, which shows also the work of his fourth year. Unfortunately we are without any record of Dr. Robb's observations and conclusions, excepting the very brief observations embraced in the letter to Prof. Johnston accompanying his own map. We are therefore limited to a

mere statement of the differences presented by the latter, as compared with the earlier map of Gesner, on which it is avowedly based.

The first feature to attract attention in such comparison is the larger area embraced in the map of Dr. Robb, the latter including the whole Province, while that of Gesner did not extend, except along the St. John river, north of a line connecting Woodstock and Chatham. Gesner's map, however, represents the results of his first four season's work only, while in the following year he made explorations of the northern counties sufficient to indicate their general character, and it is upon these, no doubt, that the completion of the work by Dr. Robb is based.

In his representation of the distribution of the granites which are so conspicuous a feature in the geology of New Brunswick, Dr. Robb's map—at least as regards the southern part of the Province—is less fortunate than that of Dr. Gesner, the more recent explorations embodied in the maps of the Geological Survey showing, especially in Charlotte County and Western Kings, a much closer approximation to the outlines as given by the latter than to those of the former. Gesner also indicates the existence of an axis of such rock extending from the Kennebeccasis River, near Hampton, to Eastern Albert, which in the map of Dr. Robb is represented by a corresponding band of "Trap, Syenite, Felspar Rock and Porphyry." As a matter of fact, this ridge includes but little true granite.

The northern granite belt, represented in Gesner's map only between the St. Croix River and the St. John, in that of Dr. Robb is extended across the Province to Bathurst. The granitic area of the Serpentine is also indicated.

The including of so many different rocks under a common colour, irrespective of age or origin, as in the case of the Trap, etc., referred to above, is, in the maps of both authors under review, an unfortunate feature, but is far more conspicuous in that of Dr. Robb than in that of his predecessor, the former being in almost all parts, not occupied by the coal-formation or red sandstones, blotched with small patches represented as occupied by one or other of these rocks, and which include intrusives of every age from the Laurentian to the Trias.

As regards the earlier Palæozoic rocks, the two maps differ widely, the Cambrian system being made, in that of Dr. Robb, to include large portions of Charlotte and Kings Counties, which in that of Dr. Gesner are represented as granitic or trappean, while the great band of slates and quartzites north of the York County granites, and includ-

ing the area about Woodstock, represented by Gesner simply as clay slate or argillites, and differently marked from that of the similar belt south of the granite, is by Robb, and correctly, made of the same age as the latter. It is probable that in referring both of these great belts, which are more or less metalliferous, to the Cambrian system, Gesner and Robb were, upon the whole, more correct than the officers of the Geological Survey so many years later.

In Gesner's map a considerable belt of rock skirting the southern seaboard from Passamaquoddy Bay to Chignecto Bay, and now known to be Pre-Cambrian (Laurentian and Huronian), is referred to the Lower Silurian, or its supposed equivalent, the Graywacke System. This, undoubtedly the oldest group of rocks in the Province, and a part of the Acadian protaxis, is by Robb made still younger, or Upper Silurian, possibly through the knowledge of the occurrence of Upper Silurian shells in some of the areas, such as Passamaquoddy Bay, where they are to some extent associated with and overlie the beds of the older system; or, the fact that such Upper Silurian rocks had been shown by Jackson to occupy large areas along the coast of Maine, rendered it probable that the apparent extension of these in New Brunswick should be referable to the same horizon. The Upper Silurian rocks of Northern New Brunswick, not indicated in the incomplete map of Dr. Gesner, are by Dr. Robb clearly distinguished, the lines representing its southern margin showing a somewhat close approximation to their true position as determined by later investigation. On the north the border is made to exclude Temiscouata Lake, of which the greater part is really bordered by Silurian strata.

In this connection the following extract from a letter of Sir Wm. Dawson to Mr. S. W. Kain, in answer to certain enquiries of the latter, will be read with interest:

As stated in Acadian Geology, p. 502, the first fossil plant seen by me from the Devonian of southern New Brunswick was a Calamite (C. *radiatus* Brongt. *C. transitionis* Goept.), afterward illustrated by many specimens from the vicinity of St. John. This specimen Dr. Robb brought to Montreal, I think, at the time of the meeting of the American Association here in 1857. At the time these rocks near St. John were supposed to be Lower Silurian, and the Calamite showed that there must be newer beds there, though it was a species not found in the coal formation. I suggested at the time to Dr. Robb that on his return he should endeavour to ascertain if other fossil plants were present, and what portion of the slates and sandstone rocks near St. John contained them. This he proposed to do, but did not live to carry out his intentions, and the work fell into the hands of Messrs. Matthew and Hartt, by whom it was so successfully carried out. I did not know if Dr. Robb had any conference with

these gentlemen on the matter; but after his death I know I encouraged them to collect, though I had no idea of the rich results that were to reward their researches, and especially those of Mr. Matthew.

Sir William goes on to say: "I regarded Dr. Robb as an accomplished geologist, though I often regretted that the pressure of educational and other work, and perhaps his own quiet and retiring disposition, prevented him from cultivating more extensively the field for original research presented to him in New Brunswick."

In this connection it is gratifying to know that one of the largest and most abundant of the fossil plants found in the Fern Ledges at Carleton is a *Cordaites*, bearing the specific designation of *C. Robbii*.

No Devonian rocks, as such, are distinguished in the map of Dr. Robb, those of the vicinity of St. John and Lepreau being included in the supposed Upper Silurian area, while those of Passamaquoddy Bay (St. Andrews' peninsula) are, not unnaturally, associated with the red rocks of Kings and Westmorland and Albert, under the lithological designation of "Red Sandstones," etc. These, as already stated, were by Gesner regarded as newer than the coal formation, while by Robb they were looked upon as being beneath the latter, and "of the age of the mountain limestone, or perhaps of the Devonian strata. As it is now known that these "red sandstones," etc., include not only the equivalents of the mountain limestone and other lower carboniferous strata, but the Devonian plant-bearing beds of Perry, Maine, and those which, on the Bay Chaleur, hold remains of *Coccosteus*, *Pterichthys*, and other fishes of the old red sandstone type, it will be seen that Dr. Robb's anticipations in this respect have been fully confirmed. It is to be noticed, also, that the area assigned to these red rocks in Albert and Westmorland Counties is greatly reduced in the map of Dr. Robb, the districts thus represented being referred, though not with strict accuracy as to limits, to the coal formation.

The Lower Carboniferous outlier of the Tobique Valley is correctly indicated, though not definitely referred to this formation.

With the exception above referred to, the tracts assigned to the coal formation, as outlined by Dr. Robb, agree with those of Dr. Gesner and with the results of later observations. In their estimate, however, of the productive capacity of the coal field, the views of the two authors differ widely, those of Dr. Robb being far more moderate, and, as now believed, much nearer the truth.

It has been already stated that the red sandstones, etc., regarded by Dr. Gesner as "New Red," were by Dr. Robb referred to a Lower

Carboniferous or Devonian horizon. The existence of true Triassic beds, occupying as they do extremely limited areas on the coast, and not readily distinguished from associated Carboniferous strata, do not appear to have been known to him. The accompanying traps, with those of Grand Manan, are not, in the maps of either author, distinguished from other eruptives or assigned to any definite period.

Upon the whole, the map of Dr. Robb, though confessedly based upon that of Dr. Gesner, shows the results of extensive original observation and reflection, and though in some instances, as stated, less correct in its representations than the former, shows a decided advance in the direction of sound views and more exact limitations. It was the first published geological map of New Brunswick, and, so far as this Province was concerned, was reproduced, without essential change, in that accompanying the first edition of the "Acadian Geology" of Sir William Dawson.

Another, among the comparatively few instances in which Dr. Robb gave public expression to his views upon geological subjects, was in connection with the celebrated controversy as to the nature and origin of the mineral *Albertite*. The question having arisen as to whether this was to be regarded as coal or asphalt, or a variety of either, a question involving, in connection with the then existing mining laws, the ownership of a property of enormous value, experts were brought forward, in several instances from considerable distances, the consideration of whose testimony made the trial a very lengthy one, at the same time that it tended to extend very greatly the knowledge of the class of substances of which Albertite may be regarded as the type. On the one hand Dr. Chas. T. Jackson, of Boston, and his associates, maintained that the mineral was a true coal, while Prof. Richard C. Taylor, in association with Dr. Robb, asserted that it was either asphalt or a variety of asphalt. The published deposition of Prof. Taylor, on behalf of Dr. Gesner, the claimant, contains many interesting observations on the geology of the vicinity of Hillsborough, as well as regards the peculiarities of the Albertite deposit, all of which he states were made in company with Dr. Robb.

The final decision of the jury hinged, by the direction of the judge, simply upon the question whether Albertite was a *mineral* or not, and, there being no real doubt upon this point, was given in favor of the defendants. It is, however, interesting to observe that, as regards the real nature and origin of the material, the views of Taylor and

Robb have in every particular been confirmed by the results of later investigation. The very recent discovery of Albertite veins penetrating the pure white gypsum or alabaster deposits of Hillsborough, is a singular commentary upon the views that the mineral in question is a *coal*.

It has been said that Dr. Robb's published observations are but few. But important as these are, we should form a very inadequate idea of the man and of his work if we restricted our estimate to these only. In reality his researches took many different directions, and, had his manuscript notes, after his death, not unfortunately gone astray, their publication would have been a source of much valuable information. This is especially true of researches made by him in regard to the early occupation of the country by the French, as well as regards the language and traditions of the still earlier Indian tribes.

In referring to these manuscripts Rev. W. O. Raymond, in whose keeping they now are, says in a letter to the writer:

After the attempt by Peter Fisher in 1825, of Alex. Wedderburn in 1836 Moses Perley in 1841, Calvin Hatheway in 1846, and Abraham Gesner in 1847, to give something of the history of the Province, Dr. Robb seems to have formed the design of writing a history of a more elaborate kind, embracing the Acadian period as well as the history of the Pre-Loyalist English settlements and the later history. To this end he compiled, from time to time, such materials as he could glean from Champlain, Charlevoix and other French writers, and also from certain documentary materials in Halifax and Massachusetts. The manuscript books in which the result of his researches are to be found are interesting. They contain many corrections, interliniations, and on the pages opposite to the ink-written narrative, many supplementary notes in pencil, and observations which go to show that the work was regarded by him as of a tentative nature.

There is also among the Robb papers a lot of Indian words with observations on the same, and rude attempts at classification. In nearly all the papers one is struck with the industry that Dr. Robb displayed, and although he did not live to complete his historical work sufficiently for publication, he was following the right path, and really, with the time and opportunities afforded, he accomplished a good deal. Modern students of provincial history have fuller and better sources of information than had he, and I do not know that his manuscript contains much that is *original*, which is to be regretted.

The museum which Dr. Robb founded in connection with King's College (now the University of New Brunswick) is well worthy of notice. It has been already said that during his European tour Dr. Robb embraced every opportunity to make collections of minerals, rocks, fossils and plants. From the nature of the collections now in

the college, it is quite evident that the larger part of this material was brought with him across the Atlantic, though it may possibly have been supplemented by orders subsequently given. In particular may be mentioned a collection of European fossils, several hundred in number, all duly named and classified, similar collections of minerals and rocks, partly from the continent and partly from Scotland, examples of slags and furnace products, models of iron and soda furnaces, specimens of moulds and utensils employed in the manufacture of china and porcelain, Sopwith's geological models, glass models of crystals, etc., etc. In the botanical department, besides numerous flowering plants, are many specimens of mosses, lichens, ferns and seaweeds, also identified and classified.

Dr. G. F. Matthew tells me that he remembers Dr. Robb very well, and when the former began to study mineralogy he received much assistance and advice from Dr. Robb. This could only be on the rare occasions when Dr. Matthew visited Fredericton and had time to go up to the college. Dr. Robb took great pleasure in showing and explaining the collections in the museum, among which were specimens from the copper mines of Lake Superior, including an example of quartz crystals containing native copper, which Dr. Robb exhibited as a remarkable inclusion, not easily explained. It was from him that Dr. Matthew learned that Rogers had found "Lingulæ" in the slates at St. John, and that there were obscure remains of plants at the Barrack Shore in St. John city.

A somewhat curious specimen is that of a Malay child, which is partly double, having only one face, but four arms and four legs, obtained from a sea-captain, and which so interested its possessor that he sent all the way to Paris for standard works on the subject of monstrosities. It is accompanied by a number of carefully executed drawings, which indicate not only his interest in the subject, but also his skill in the use of pencil and brush. This latter faculty is also evidenced by the large number of pictures, some in pencil, but many in water colours or oils, and embracing views of volcanoes, coral atolls, coal plants, fossil fishes, etc., besides numerous geological sections, which are still in the possession of the university, and which were evidently made by Dr. Robb for the illustration of his lectures.

A circumstance which must have greatly embarrassed him, as it has his successor, was the want of access to libraries or books of reference. This want he endeavoured to remove, as far as in his power, by additions to the college library, and a review of the works

of a scientific character possessed by the latter at the time of Dr. Robb's decease, shows with what judgment his selections were made. The extent of this collection would have been much larger had it not been for the unfortunate shipwreck, on Sable Island, of a steamer containing a large number of books, among them the publications of the Ray Society, destined for him, besides a large quantity of furniture, crockery, etc. He must also have had an extended correspondence, one proof of which is of personal interest to the writer. Soon after assuming the duties laid down by Dr. Robb, he had occasion to make a detailed inventory of the apparatus and specimens in the chemical laboratory and museum of the college, and quite early in the search was at once surprised and gratified by finding a considerable number of packages, the written labels of which were recognized as being in the handwriting of the writer's father, the late Prof. J. W. Bailey, of West Point, N. Y. They contained samples of the so-called *Fossil Infusoria*, and, as the gentleman last referred to was at that time the principal authority in America on these microscopic organisms, he had evidently been written to by Dr. Robb that the latter might thereby be the better able to identify any similar forms which he might meet with here.

Dr. Robb's choice of apparatus, like that of books, was most judicious. Nothing but the best would satisfy him, an dhis chemical laboratory, though small, was a model of convenient arrangement, and, for the time and place, of ample equipment. The necessities of the case made him also his own mechanic, and in one of his letters he refers to his having been required to polish and repair a lot of instruments injured in, but recovered from, the Sable Island disaster, and which he describes as a "shocking wreck." His laboratory was fully supplied with carpenter's tools, and there is no doubt that he knew how to use them. He was a good analyst, and many specimens of ores now in the university collection are accompanied by labels bearing the results of his quantitative determinations.

His association with the Fredericton Athenæum has already been referred to. In this connection he prepared and published an almanac, of which he says, in a letter to his mother, "I can tell you it cost me a good deal of work." It was issued in 1849, is a volume of 142 pages, of which the object, as avowed on the preface, was neither profit nor remuneration, but the "furnishing of a compendium of information, useful for the time and place." He adds, "In a colony like this, where as yet food for the mind is but scantily supplied, care ought to

be taken that the quality of it is good, and that the poor settler, who often has no other library than his Bible and his almanac, should find in the latter something more nourishing than the chaff of Astrology, Alchemy and Divination." With this purpose in view, there is given a vast quantity of information, including, besides the usual monthly tables and accompanying tidal and lunar changes, a most interesting synopsis of provincial chronology, revised lists of provincial latitudes and longitudes, a register of the executive and legislative departments of the government, the judicial department, the roll of barristers and attorneys, a list of clergy of all denominations, banks, public institutions, etc., etc. It contained, also, tables of exports and imports, rates of duties, abstracts of revenue returns, tables of temperature, times of the opening and closing of navigation for successive years, tables of roads and distances in New Brunswick, and rules for the calculation of interest. It was, in fact, a sort of universal gazetteer, which, in the breadth and accuracy of its information, would compare favorably with much more recent and more pretentious volumes.

It will appear, from what has now been stated, that the life of Dr. Robb, though it has left but few records in the form of published contributions to knowledge, was a very busy one, and exerted a very extended influence upon the progress of intellectual and scientific development in New Brunswick. In estimating the results of his labours we must, as with Gesner, bear in mind the fact that science in that day was, in many of its branches, and especially in geology, in its early infancy. Dr. Robb's isolated position, as has been said, also made it difficult for him to know what was being done in the way of investigation elsewhere. And, finally, the facilities for travel in the Province were far inferior to such as exist at present. Of railways there was only one, that of St. Andrews, and, speaking of the proposed construction of another, he remarks, "There is great talk of railways at present (this was in 1847), but I am doubtful. Unless there be a federal union of the provinces, I doubt whether the great line from Halifax to Quebec would pay."

Dr. Robb was a member, and in 1849 and succeeding years President, of the Fredericton Society of St. Andrews, as also member of the Church Society of New Brunswick, and in both capacities is remembered as a zealous and energetic worker.

The removal at an early age of a man of such great and varied capacity, occupying so many different positions in the community, and at the same time ever ready to give advice, professional or otherwise,

to those who needed it, irrespective of their rank in society, could hardly fail to be deeply and universally deplored. That it was so is sufficiently indicated from the following announcement of his death in the Fredericton Reporter of April, 1861 :

> The sudden death of Dr. Robb, occasioned by a violent pulmonary attack, which took place on Tuesday afternoon, is an event which, while it will awaken feelings of the deepest regret in this community, will also be regarded as a public loss all over the Province. His earnest and constant devotion to the duties of his profession, his zealous attachment to the agricultural interests of the country, his high qualifications as a scholar, and his kind and affable manners as a man, have for many years been recognized and duly acknowledged by all who either had the pleasure of his personal acquaintance or who knew him only through the medium of the familiar, yet learned and useful essays with which he so frequently favored the public. It is, however, now that he has gone, that the full impression of the loss we have sustained becomes painfully evident. Every one bewails his loss; and every one, in this city especially, has good reason for unaffected sorrow."

Any one of whom the above could be written, as voicing the feeling of the community in which he lived and labored, needs no other eulogy.

The following is a list of the published writings of Dr. Robb, derived partly from Bulletin 127 (1896) of the U. S. A. Geological Survey, and in part from other sources :

1. Remarks upon certain geological features of the River St. John, in New Brunswick, with an account of the Falls upwards from the sea, which occur near its embouchure in the Bay of Fundy.
   Brit. Assoc. Rep., Vol. 10, Trans. of Sections pp. 115–118 (1841).
   Abs. Amer. Journ. of Science, Vol. 41. Pp. 55–56. 1841.
2. Encœnia oration. King's College, Fredericton. Pp. 16.
3. Report on the Agricultural Capabilities of the Province of New Brunswick. By Prof. J. W. F. Johnston. Fredericton, 1850. [This work contains a letter by Dr. Robb on the geological structure of the Province, with an accompanying geological map.]
4. Report of the New Brunswick Society for the Encouragement of Agriculture, Home Manufactures and Commerce. Fredericton, 1851.
5. Deposition of Richard C. Taylor, respecting the Asphaltum mine at Hillsborough, Albert County, N. B. Philadelphia, 1851. [This contains a joint report on the same subject by Messrs. Taylor and Robb.]
6. Notice of Observations on Drift Striæ in New Brunswick. Am. Assoc. Adv. Sci. Proc. Vol. 4, pp. 349-351. 1851.

ARTICLE II.

LIST OF RECORDED EARTHQUAKES IN NEW BRUNSWICK.

Compiled from Published Works and from Private Information.

By Samuel W. Kain.

Read March 1st, 1898.

In recent times much attention has been given to the study of earthquakes. In the historic period a number of shocks have been felt in this Province. Information in regard to them, however, is scattered and not easily accessible. Some of the shocks have been noted only in the newspapers, and a few of the more recent, in Grand Manan, have been drawn to my attention by one of our corresponding members resident there.

The following list has been compiled for the convenience of students, both in New Brunswick and abroad, and will be found complete for all shocks recorded. The time given (unless otherwise stated) is local time. To reduce St. John local time to 75th meridian time, deduct 35 mins. 44 sec.

1663. February 5; 5.30 p. m., 8 p. m.

This earthquake was of considerable violence, and was felt throughout the St. Lawrence Valley, Acadia and New England. (*Can. Nat.*, Oct., 1860).

1755. November.

Three or four shocks are recorded as having been felt in New England and Nova Scotia (then including New Brunswick). Sir William Dawson states (*Can. Nat.*, October, 1860) that two of these shocks were violent.

1764. September 30; about noon.

In the *Halifax Gazette* (Nova Scotia), December 13, 1764, occurs the following news item: "We hear from St. John's, in this Province, that on the 30th of September last, about 12 o'clock at noon, that a very severe shock of an earthquake was felt there."

1817. May 22; 3.31 a. m.

Felt in all parts of New Brunswick. The following account is from the *Courier*: "A heavy shock of earthquake was felt in St. John on the 22nd,

31 minutes past three o'clock, a. m. It was preceded by a noise as if a gale of wind sprang up, after which the earth began to shake violently, rumbling as if heavy carriages were passing. The trembling continued 15 seconds. The air was clear, with not a breath of wind. A minute after the shock moanings were heard from the southward. The earthquake was felt at Fredericton, fully as violent as at this place. At St. Andrews the shock was severely felt; the alarm was so great as to occasion the soldiers to leave their barracks. The shock at Fredericton occurred at 3.25 a. m.; tremulous motion lasted 25 seconds; profound calm; atmosphere heavy."

The same journal has also an account of the shock as felt at Grand Manan, which is of interest: "The earthquake of 22nd May was felt at Grand Manan; occurred just before daybreak, commencing with a loud sound, at the same time a violent shaking of houses. The shaking did not continue, but the sound lasted from 30 to 45 seconds. All agree in describing the motion as violent and the sound very loud. Weather fine and serene; light wind from northward; previous day uncommonly hot."

Peter Fisher, in his *History of New Brunswick* (1825), refers to this shock in the following paragraph: "New Brunswick appears to be but little liable to the great convulsions of nature, such as earthquakes, hurricanes, tornadoes, etc. There has been but one shock of an earthquake experienced by the present inhabitants since they settled in this country (*i. e.*, 1783–1825). This shock happened on the 22nd May, 1817, at 25 minutes past 3 o'clock in the morning. The duration of the shock was about 45 seconds. It was attended with the usual rumbling noise, without thunder, the weather being serene and pleasant. The appearances, however, usually indicating earthquakes, such as fiery meteors, the uncommon brilliancy of the aurora borealis, etc., had been frequent the winter preceding."

In the journal* of Azor Hoyt, 1813–1855 (of Lower Norton, Kings Co., N. B.), the following entry occurs: "May 22nd (1817) a shock of an earthquake." This shock was felt all through the Maritime Provinces.

1824. July 9.

Severe shock felt all over the Province.—(*Can. Nat.*, October, 1860).

1855. February 8; 6.30 a. m.

Felt all over the Province; also in Nova Scotia and in parts of the State of Maine. Moderate.

Dr. P. R. Inches has placed in my hands the following note made by him at the time:

"Saint John, February 8th, 1855.

This morning at half past six o'clock several shocks of an earthquake were felt here. I was lying in bed at the time, not quite awake, when I was startled by hearing a roaring and rumbling noise as of a chimney on fire, but much louder, followed by a violent shaking of the house and bed. I at once started out of bed to see what was the matter, but could find no cause for the noise. I could not imagine what was causing it unless it was an earthquake. I got into bed and shortly after, I think in about five or

* Manuscript: in possession of Rev. W. O. Raymond, St. John.

six minutes, felt another shock, but so very slight as to be just perceptible and no more. Again a few seconds after this second shock I thought I felt another, but I was not positive. The first shock lasted forty or fifty seconds, the second about the same time. It has, I believe, been felt at Chatham, Fredericton, Dorchester, and in the State of Maine. It appears to have been felt at Dorchester more than anywhere else. Some windows in the house of the Hon. E. B. Chandler of that place were broken."

Speaking of this shock in *Acadian Geology*, pp. 39–40, Sir Wm. Dawson says: "Its point of greatest intensity appears to have been at the bend of the Petitcodiac (Moncton). At this place there were several shocks, one of them sufficiently severe to damage a brick building."

In the Journal of Azor Hoyt, the following entry occurs: "February 8th, (1855). Three shocks of an earthquake — felt all through the Province." This is the last entry in the Journal.

1860 October 17; 6.25 a. m.

Felt over a large area of Eastern Canada and the New England States. Also felt in this Province. Moderate in New Brunswick, but severe in Quebec and Ontario.

The *Morning News* of October 19th, 1860, says: "A vibration of the earth from twenty to thirty seconds in duration occurred about twenty-five minutes past six o'clock on Wednesday morning along the western side of the harbour, causing the houses to shake quite perceptibly, and in several cases awakening people from their slumbers. We do not know what distance it extended or whether it was perceived in St. John or not; but parties residing in the vicinity of Negrotown Point felt it very distinctly, as did persons living near the Asylum."

1869. October 22; 5.48 a. m.

This earthquake was of considerable violence, and was felt all through the Maritime Provinces, St. Lawrence Valley and the New England States. The reports published in our city papers describe it as the most violent shock ever felt here. It was preceded by a rumbling rushing noise like the noise of distant thunder, and then came the vibrations, or series of them, which seemed to pass away in the distance as though a wave like motion had been imparted to the crust of the earth. These vibrations appeared to be travelling nearly east and west. Houses were shaken, dishes rattled, and bells rang, and in some cases flower pots, etc., where rolled over. The shock lasted about fifteen seconds. The papers of that date (October 25th, 1869) state that the waters of lakes and streams were discoloured by the shock, and it is noticed in particular that the water of the stream at Penobsquis, which supplied the paper mill at that place, turned chalky and had not regained its clearness on the following day. It is worthy of remark that at Fredericton, in Mr. Babbit's shop, the clocks facing north-west were stopped, while those at right angles to that direction were not affected.

W. Watson Allen has given me the following note about this shock: "At Derby (Miramichi), at the Mill Pond, known as Wilson's Mills, a spring on

the west bank of the pond, before the earthquake, boiled out of the ground, rising to a height of about a foot. After the earthquake, the fountain part of the spring disappeared, although the spring itself is still there, but diminished. Mr. William Wilson, who had lived there many years, always claimed that the pond had increased in volume of water to a large extent.

"At the forks (the confluence of Cain's River and S. W. Miramichi), Mr. Jacob Layton, who had resided there continuously for a number of years, states that in the bed of the main Miramichi River, near the shore where the water was quite shallow, and on a spot of ground that he knew very well, after the earthquake there appeared a spring of boiling water, sufficient to make a commotion upon the surface. There never had been any indications of it before the earthquake."

1870. March 17; 6 to 8 a. m.

Felt at St. John and Fredericton. Light. It was at this time that a landslide occurred at Sand Point, carrying the end of the Point out into the deeper water of the harbour. Sand Point is a gravel deposit formed by the meeting of the harbour tides and the river, and is underlaid by clay. This clay had probably been eroded by the action of water, and a heavy storm the day before had hastened a condition of instability which, even without a slight earth movement, would soon have caused the landslide.

1870. October 20; 11.40 a. m.

Felt all over the Province. In the lower part of the St. Lawrence Valley it was much more violent than in New Brunswick.

Dr. Jack, of the Provincial University, at Fredericton, in a despatch to the St. John *Daily Telegraph* (October 21st, 1870), thus describes it: "It was at seventeen minutes before noon that the first shock was felt here. This lasted perhaps two seconds, and was shortly followed by another of about the same severity, which may have been the return stroke, as the interval between was not over half a minute. The motion was vibratory, and seemed to be from south to north. It was not as strong as the earthquake of last year. There was violent wind all of Tuesday afternoon and night, and this afternoon we have a heavy rain and lowering darkness." The time at St. John was accurately noted to be 11.40; at Fredericton it was 11.43.

1882. December 31; 9.56 p. m.

St. John, Rothesay, Sussex and Fredericton. Light. Two shocks felt. The following is from the St. John *Daily Sun* (January 2nd, 1883): "At four minutes to 10 on Sunday night a slight shock of earthquake was felt. In one residence on Charlotte street a vase was thrown from its stand to the floor and broken; in another house, in an opposite part of the city, all the ornaments on a Christmas tree were set swinging vigorously. The shock was also distinctly felt in Indiantown and on the other side of the harbour. It was also felt at Sussex, Fredericton, and very markedly at Rothesay."

1884. January 26.

At Rothesay. Three light shocks. Reported in *Daily Telegraph* of January 29th.

1885. June; 10 a. m.

Rothesay, Seal Cove and Southern Head, Grand Manan. Light at Rothesay, but severe at Southern Head, where several tons of rock fell from the cliffs near the lighthouse.

1896. March 22; 7.56 p. m.

This shock was felt in Charlotte and York Counties, New Brunswick, and in Washington County, Maine. The area disturbed has a diameter of about 100 miles, and lies adjacent to the shores of the Bay of Fundy and the Gulf of Maine.

By correspondence with observers at different points, I have been able to secure some notes on this disturbance.

EASTPORT, Maine.—The shock took place here March 22nd, at 7.56 (75th meridian time), and lasted four or five seconds. This office is located in the new government building, built of granite, and on a solid ledge. Still the tremor was distinctly felt throughout the building, and more so by those living in wooden houses, The shock had no perceptible effect on our barograph. It had been rising steadily since noon, and I failed to see the least deviation in the trace.

D. C. MURPHY,
U. S. Meteorological Observer.

BEAVER HARBOR, N. B.—Shock slightly felt here on 22nd March at 8.45 p. m. Jar enough in some buildings to make glass rattle.

FLAGG'S COVE, Grand Manan, N. B.—A slight earthquake shock was felt here on Sunday, March 22nd. The noise was very distinct, but only lasted a few moments. It was felt all over the island at the same time as at this station.

CLARA C. SEELY,
Dominion Meteorological Observer.

ST. ANDREWS, N. B.—The shock was markedly felt at St. Andrews. A well known gentleman resident there wrote me as follows: "The noise at first was very sharp and was succeeded by a gradually lessening sound, and was all over in three seconds. It occurred at 8.45 p. m."

In addition to the above places the shock was felt in all the West Isles, on the mainland northward to McAdam, some distance along the line between McAdam and Woodstock, and at St. Stephen and Pennfield.

The shock was not felt at St. John, Fredericton, or Yarmouth, N. S.

1896. May 15th; 11.00 p. m.

A light shock was felt on this date at Fredericton, along the Nashwaak Valley, at Andover, and up the Tobique Valley as far as Three Brooks. A gentleman at Fredericton, in a letter to me, described it as "one momentary concussion." Dr. Welling, writing from Andover, says: "Two

shocks from an earthquake were felt here on the night of 15th of May about 11 o'clock. I was in bed at the time and felt the bed shake and tremble. One gentleman was about retiring when he heard what he thought were horses running around the house, but when he reached the door the noise was repeated and he saw at once that it was the shock of an earthquake. It was heard at Three Brooks on the Tobique River some twenty miles distant about the same hour."

1897. January 26; in the morning.

Felt at Campobello and Deer Island. Light.

1897. January 28; 9 p. m.

A sharp shock felt at Southern Head, Grand Manan. Duration about two seconds. Mr. W. B. McLaughlan, the light-keeper, in writing, says: "It shook us up so violently that it set my dogs barking and the horse and cattle in the stable tried to break loose. I made a record of it in my journal."

1897. February 14; 9 p. m.

Mr. McLaughlan goes on to say: "On the evening of the 14th inst., about the same hour, we felt another sharp shock, but not so violent as that of January 28th.

"I am of the opinion that these shocks are of frequent occurrence in the Bay of Fundy, and are generally thought to be the reports of cannon. I recollect that about twelve years ago the middle of next June, at 10 o'clock a. m., we felt a violent shock at this station and at Seal Cove, but the only place on the mainland that I noticed it reported was at Rothesay, Kings Co. That shock was so violent that several tons of rock fell from the cliff near the lighthouse."

1897. September 25; 1.30 p. m.

Parts of Charlotte and York counties in this Province, and in some parts of Eastern Maine. Light. Felt distinctly at Canterbury, McAdam and St. Stephen. At St. Stephen it rattled dishes, etc., and at McAdam the earth trembled as from the passing of a heavy railway train. It lasted fifteen seconds.

Not felt at St. Andrews, Eastport, or Woodstock.

1897. October 12; 10.35 p. m.

South West Head, Grand Manan. Light. "Duration about five seconds. Wind due south, strong gale and hazy weather, about two hours to high tide. Shock from southeast with a roar like a waggon over a frozen road. It shook the buildings sufficiently to alarm my watch dog." (Letter from W. B. McLaughlan).

1898. January 11; 2 a. m.

At South West Head, Grand Manan.

"We felt a sharp shock of earthquake at this place on Tuesday, the 11th inst., at 2 a. m. It sounded like a heavy explosion, Wind northeast, light, high water, clear cold weather." (Letter from W. B. McLaughlan).

The greater frequency of earthquakes at Grand Manan than at any other place in the Province is worthy of note, and it is possible that further observations may show some connection between the so-called "gun reports" (see Bulletin XIV, pp. 40–44, 1896,) and these light earth movements.

In the discussion which followed, Dr. Geo. F. Matthew said: "This part of the Bay of Fundy it remarkable for its great depth and precipitous shores. Off Brier Island the bottom descends to a depth of 100 fathoms in a distance of three miles from the outermost ledge; it is almost equally abrupt on the Grand Manan slope; the trough between is deeper than the bottom of the Gulf of Maine outside adjoining. This is the only part of the Bay of Fundy where there have been heavy outflows of trap of Triassic age on *both* sides of the bay, and the abyss between may be complementary to these ejections of lava. The weakness of the earth's crust here in Triassic times, as shown by the volcanic eruptions of that age, may not even yet be altogether removed; but the greater tendency to earthquake movements in this district may be the dying throes of the old Triassic disturbances."

ARTICLE III.

LIST OF MOSSES OF NEW BRUNSWICK.

COMPILED BY JOHN MOSER AND EDITED BY G. U. HAY.

Read October 2, 1894.

[Containing 15 new species, but several also reported by Prof. Macoun and others.]

1. SPHAGNUM fimbriatum, Wils., Gravet. Bogs and swamps, Kent County, (F's C.)[1]
2. S. strictum, Lindb. New Mills, Restigouche, (Hay). Peat bog, Kingston, Kent Co. (F's C.) Canaan Forks,[2] Queens Co. (Moser). Herb.
3. S. fuscum, Schimp. Grand Lake. (F's C.)
   Var. fuscescens. Swamps, Bass River,[3] Kent Co. (F's C.)
4. S. acutifolium. Common. Herb.
   Var. rubrum. Common. Herb.
   Var. versicolor. (F's C.)
5. S. rubellum, Wils. Peat bogs, Kingston, Kent Co. (F's C.)
6. S. recurvum, Russ. Swamps, (Moser). Herb.
   Var. mucronatum. Grand Lake. (F's C.)
   Var. amblyphyllum. (F's C.)
   Var. parvifolium. Indian Harbour, Halifax Co., N. S. Swamp, Canaan Road, Kings Co. (Moser). Herb.
7. S. cuspidatum, Ehrh. Nashwaaksis, York Co. (Moser). Herb.
8. S. squarrosum, Pers. Tay, York Co. (Moser). Herb.
   Var. spectabile. Grand Lake. (F's C.)
   Var. semi-squarrosum. (F's C.)
9. S. wolfianum, Girg. (Moser). Herb.
10. S. rigidum, Schimp. Var. squarrosum. Peat bogs, Kingston. (F's C.) (Moser). Herb.
11. S. subsecundum, Nees. (F's C.) Wet woods. (Moser). Herb.
12. S. imbricatum, Hornsch. Var. affine. Bogs (Moser). Herb.
13. S. papillosum, Lindb. Bog, Salem, Kings Co. (Moser). Herb. Lily Lake, St. John. (F's C.)
14. S. cymbifolium, Ehrh. Common. Herb.
    Var. laeve. (Moser). Herb.
15. S. tenellum, Ehrh. Peat bog, Kingston, Kent Co. (F's C.)

1. F's C. (Fowler's Catalogue) published in 1878. Herb. (Herbarium of Natural History Society of New Brunswick.)
2. As most of Mr. Moser's plants were collected at Canaan Forks, Q. Co., the name of this locality is omitted before "Moser" throughout this list.
3. As most of Prof. Fowler's mosses were collected at Bass River, Kent County, the name of this locality is omitted before F's C. throughout this list.

16. S. medium, Limpr. Var. laeve, forma purpurascens. (F's C.)
Var. roseum. Grand Lake. (F's C.)
17. Wesia viridula, Brid. Shelf of rock, Tay, York Co. (Moser). Herb.
18. Dicranodontium pellucidum. Wet bank, Tay, York Connty. (Moser). Herb.
19. Trematodon ambiguum, James. Tay and Nevers' Rapids, Queens Co. (Moser). (F's C.) Herb.
20. Dicranella crispa, Schimp. Common. (Moser). Herb.
21. D. squarrosa, Schimp. Shore of Washadamoak, Queens Co. (Moser). Herb.
22. D. cerviculata, Schimp. Damp earth, Carleton Co. Rotten wood, St. John. (F's C.) Gravelly bank near spring, Tay, York Co. (Moser). Herb.
23. D. varia, Schimp. Face of cliff. (Moser). Herb.
24. D. rufescens, Schimp. (F's C.) Road-sides. (Moser). Herb.
25. D. subulata, Schimp. Kouchibouguac. (F's C.) Red Bank, Tay. (Moser). Herb.
26. D. heteromalla, Schimp. Road-side, banks, common. Herb.
27. Dicranum montanum, Hedw. Rotten wood, common. Herb.
28. D. fulvum, Hooker. Boulders, damp woods. (Moser). Herb.
29. D. viride, Schimp. On old trees, common, but always barren. Herb.
30. D. flagellare, Hedw. On rotten wood, common. Herb.
31. D. scoparium, Hedw. Common. Herb.
Var. nigrescens. (Moser). Herb.
32. D. fuscescens, Turn. Common on old logs. Herb.
33. D. undulatum, Turn. Grand Lake, Q. Co. (F's C.) Madawaska and Tobique. (Hay). (Moser). Herb.
34. D. Bergeri. Wet woods, Kent Co. (F's C.)
35. Dicranodontium longirostre, Bruch and Schimp. On boulders, Tay. (Moser). Herb.
36. Fissidens adiantoides, Hedw. On rocks, St. John. (F's C.)
37. F. osmundoides, Hedw. Rough Waters, near Bathurst. (F's C.)
38. Leucobryum vulgare, Hampe. (Moser). Herb.
39. Ceratodon purpurens, Brid. Very common. Herb.
40. Distichium capillaceum, Bruch and Schimp. Tete-a-Gouche Falls. (F's C.) Wet cliff, Long Rapids, Washadamoak Lake. (Moser). Herb.
41. Blindia acuta, Bruch and Schimp. Washadamoak, Q. Co. (Moser). Herb.
42. Didymodon rubellus, Bruch and Schimp. On rocks and earth, Tobique River. (Hay). (Moser). Herb.
43. Leptotrichum tortile, Muell. On old roots, Washadamoak. (Moser). Herb. (F's C.)
44. L. vaginans, Lesq. and James. Road-side, Kent Co. (F's C.)
45. Barbula tortuosa, Web. and Mohr. (F's C.) On rocks, Tobique River. (Hay). (Moser). Herb.
46. B. unguiculata, Hedw. Common on earth. (F's C.) (Moser). Herb.
47. Grimmea conferta, Funck. (Moser). Herb.
48. G. apocarpa, Hedw. On rocks, St. John Co. (F's C.) (Moser). Herb.
49. G. rivularis. Fredericton. (F's C.) (Moser). Herb.
50. G. gracilis. Dry rocks. (Moser). Herb.

51. RACOMITRIUM fasciculare. On rocks, McDonald's Brook, Forks Stream and Tay. (Moser). Herb.
52. R. microcarpum, Hedw. Rocks, Forks Stream. (Moser). Herb.
53. HEDWIGIA ciliata, Ehrh. On rocks, common. Herb.
54. AMPHORIDIUM Lapponicum, Schimp. Long Rapids, Q. Co. (Moser). Herb.
55. ULOTA Ludwigii, Brid. On old trees, common. (F's C.) (Moser). (Hay). Herb.
56. U. crispa, Brid. On trees, common. Herb.
57. U. crispula, Brid. On birch trees. (F's C.) On trees. (Moser). Herb.
58. ORTHOTRICUM speciosum, Nees. On trees. (F's C.) (Moser). Herb.
59. O. sordidum, Sulliv. and Lesq. On trees. (F's C.) (Moser). Herb.
60. O. Ohioense, Sulliv. and Lesq. On trees. (F's C.) (Moser). Herb.
61. O. strangulatum, Beauv. On trees. (F's C.)
62. O. obtusifolium, Drumm. On poplar trees. (F's C.) (Moser). Herb.
63. ENCALYPTA Macounii, Aust. On ledges. (Moser). Herb. Crevices of rocks, Tobique. (Hay).
64. TETRAPHIS pellucida, Hedw. On rotten stumps, common. Herb.
65. TAYLORII tenuis, Schimp. Barrens. (Moser). Herb.
66. TETRAPLODON angustatus, Bruch and Schimp. Madawaska (Brittain). Near Lily Lake, St. John (Hay).
67. T. mnioides, Bruch and Schimp. Highland Park, St. John, and Tobique. (Hay).
68. SPLACHNUM ampullaceum, Linn. On earth, Fredericton Junction (F's C.) Swamps, Bocabec and St. John (Hay). On earth (Moser). Herb.
69. S. rubrum, Linn. (F's C.) Lancaster (Hay). Hunter's Home, Queens Co. (Moser). Herb.
70. BARTRAMIA œderiana, Swartz. On rocks, Tete-a-Gouche Falls, Gloucester (F's C.) Near St. John (Hay).
71. B. pomiformis, Hedw. On ledges and banks, along streams, common. Herb.
72. PHILONOTIS fontana, Brid. About springs, common. Herb.
73. P. glabriuscula, Kindberg. (New species).

"Tufts radiculose below, 4 cm. high. Stem slender. Leaves small, green, distant, spreading and straight when moist, twisted when dry, indistinctly decurrent, short ovate lanceolate, short acuminate, acute, slightly papillose, pellucid, plane at the margins, not plicate, minutely serulate, principally above. Cells oblong, hexagonal, the lower narrower, less chlorophillose. Costa subcurrent. Habit of Webera albicans." (From "Canadian Musci.")

It varies to a delicate floating form, as also does P. fontana.

Spring, in Owl Bridge Gully, Q. Co., but principally across the Washadamoak (south) in a spring in the woods east of Martin's farm; also at Hunter's Home and at Elmwood, Kings Co. Always barren (Moser). Herb.

74. AMBLYODON dealbatus, Beauv. Brooklets. Herb. "One summer there was abundance in a spring brooklet, the next summer there was not any, nor since." (Moser).
75. LEPTOBRYUM pyriforme, Schimp. On recently burnt soil, common. Herb.
76. WEBERA acuminata, Schimp. On rocks, also in Restigouche Co. (F's C.)
77. W. nutans, Hedw. Common. Herb.

78. W. Lescuriana, Lesq. and James. On the ground by roadsides. (F's C.) Sandy bank, Tay, Glen Margaret, Halifax Co., N. S. (Moser). Herb.
79. W. cruda, Schimp. (F's C.) Crevices of rocks, Hunter's Home, Q. Co. (Moser). Herb.
80. W. albicans, Schimp. On banks. (Moser). Herb.
81. Bryum pendulum, Schimp. On rotten wood. (F's C.)
82. B. uliginosum, Bruch and Schimp. Tay. (Moser). Herb.
83. B. intermedium, Brid. Rocky places. (Moser). Herb.
84. B. cirrhatum, Hoppe and Hornsch. (Moser). Herb.
85. B. bemum, Schreb. Borders of swamps. (F's C.) Wet woods, Forks. Boggy places, Elmwood, Kings Co. (Moser). Herb.
86. B. pallescens, Schleich. On earth. (Moser). Herb.
87. B. subrotundum, Brid. (Moser). Herb.
88. B. alpinum, Linn. Hunter's Home. (Moser). Herb.
89. B. caespiticium, Linn. On dry ground. (F's C.) Common at Canaan, Q. Co. (Moser). Herb.
90. B. pseudo-triquetrum, Schwaegr. Wet rocks. (F's C.) On earth. (Moser). Herb.
91. B. roseum, Schreb. Shady woods. (F's C.)
92. B. Ontarioense. (Moser). Herb.
93. Mnium medium, Bruch and Schimp. Deep shady ravines. (F's C.)
94. M. cuspidatum, Neck. Common. Herb.
95. M. Drummondii, Bruch and Schimp. In large patches on the ground in shady places. (F's C.) Tay. (Moser). Herb.
96. M. affine, Bland. Damp shaded bank of brook. (F's C.); also at Fredericton. Tay. (Moser). Herb. Common St. John Co. (Hay).
97. M. hornum, Linn. St. John Co. (west) abundant. (Moser). Herb.
98. M. orthorrhyncum, Bruch and Schimp. Grand Falls, Nepisiquit. (F's C.) (Moser). Herb.
99. M. pseudo-lycopodioides. In damp shaded ravines (F's C.); also at Fredericton. (Moser). Herb.
100. M. spinulosum, Bruch and Schimp. Damp shaded places. (F's C.) (Moser). Herb.
101. M. stellare, Reichard. Carleton. (F's C.) (Moser.
102. M. punctatum. Damp shady ravines (F's C.); also at Fredericton. Swamps, Tobique River, (Hay). (Moser). Herb.
103. Aulocomnium palustre, Schwaegr. Common. Herb.
104. Atrichum undulatum, Beauv. On the ground. (F's C.) (Moser). Herb.
105. A. angustatum, Bruch and Schimp. On the ground. (F's C.) (Moser). Herb.
106. Pogonatum brevicaule, Beauv. On clayey soil. (F's C.) (Moser). Herb.
107. P. urnigerum, Drumm. Dry turf on a ledge. (Moser). Herb.
108. P. alpinum, Roehl. Wet rocks, Tobique, (Hay). (Moser). Herb.
109. Polytrichum piliferum, Schreb. Gravelly knolls (F's C). Dry ground on rocks, Forks Stream. (Moser). Herb.
110. P. juniperinum, Willd. Gravelly knolls, common. Herb.
111. P. strictum, Banks. In swamps. (Moser). Herb.

112. P. commune, Linn. Common on wet barren ground. (Moser). Herb.
113. FONTINALIS antipyretica, Linn. In brooks, common.
Var. gigantea, Sulliv. Shallow streams, Tobique, (Hay . (Moser). Herb.
114. F. Dalecarlica, Bruch and Schimp. In brooks. (Moser). Herb.
115. DICHELYMA capillaceum, Bruch and Schimp. Grand Lake and Newcastle (F's C.) On sticks and roots skirting swamps, Forks. (Moser). Herb.
116. D. palliscens, Bruch and Schimp. On roots of alders, Hunter's Home. (Moser). Herb.
117. D. obtusulum. Fredericton. (F's C.)
118. NECKERA pennata, Hedw. On trees, common. Herb.
119. HOMALIA Macounii. C. M. and Kindberg. (New species).
H. trichomanoides, Lesq. and James. "Mosses of North America." (Drummond, Waghorn and Macoun). On rocks, Forks Stream and Tay, York Co. (Moser). Herb.
120. LEUCODON sciuroides, Schwaegr. On bark of trees, common. Herb.
121. PTERIGINANDRUM filiforme, Hedw. (F's C.)
122. THELIA compacta. On trees. (Moser . Herb.
123. MYURELLA julacea, Bruch and Schimp. On damp rocks. (Moser). Herb.
124. M. Careyana, Sulliv. On rocks, St. John. (F's C.) Crevices of rocks, Queens Co. (Moser . Herb.
125. LESKEA polycarpa, Ehrh. On trunks of trees, Nashwaaksis, York Co (Moser). Tobique, (Hay). Herb.
126. L. nervosa, Sulliv. On trees, Fredericton, (F's C.) Tay, (Moser). Herb.
127. L. denticulata, Sulliv. On roots of trees. (Moser). Herb.
128. ANOMODON rostratus, Schimp. Fredericton, (F's C.) On the sides of wet cliffs and on wet roots. (Moser). Herb.
129. A. attenuatus, Hueben. Bases of old trees and stumps. Moser). Herb.
130. A. obtusifolius, Bruch and Schimp. Old stumps, Tay. (Moser). Herb.
131. A. veticulosus, Hook. and Tayl. Ledge of rocks, Butternut Ridge, Kings Co. (Moser). Herb.
132. PLATYGIRIUM repens. Bruch and Schimp. On dead wood. (Moser). Herb.
133. PYLASIA polyantha, Bruch and Schimp. On the bases of trees, common. Herb.
134. P. intricata, Bruch and Schimp. On trees, Fredericton, (F's C.) Tobique, (Hay).
135. P. velutina. On trees F's C.) Tay. (Moser). Herb.
136. ENTODON cladorrhizans. On logs, Tay. (Moser). Herb.
137. E. brevisetum. On old logs and rocks. (Moser). Herb.
138. CLIMACIUM dendroides, Web. and Mohr. On the ground in dense shade, Molus River, Kent Co. (F's C.)
139. C. Americanum, Brid. Wet places (F's C.) (Moser). Herb.
140. HETEROCLADIUM dimorphum, Bruch and Schimp. On a wet bank, Tay, York Co. Scarce. (Moser.) Herb.

141. H. frullaniopsis, C. M. and Kindberg. (New species). Base of poplar trees, Hunter's Home, Queen's Co. (Moser). Herb.
This species differs very much from allied species principally in the uniform leaves, the absence of paraphyllia and the not cordate leaf base. Dioecious.
142. THUIDIUM scitum, Aust. On trees, Fredericton. (F's C.)
143. T. minutulum, Bruch and Schimp. (F's C.)
144. T. recognitum, Lindb. (Moser). Herb.
145. T. gracile, Bruch and Schimp. (Moser). Herb.
146. T. delicatulum, Bruch and Schimp. Common. (Moser). Herb.
147. T. abietinum, Bruch and Schimp. On rocks and ground, Restigouche. (F's C.)
148. T. Blandonii, Bruch and Schimp. Bogs. (Moser). Herb.
149. CAMPTOTHECIUM nitens. Schimp. Swamp, Hunter's Home. Not common. (Moser). Herb.
150. BRACHYTHECIUM laetum, Bruch and Schimp. On rocks, ground and roots of trees, common. (F's C.) (Moser). Herb.
151. B. digastrum, C. M. and Kindb. (New species). On rocks, Ottawa, Ont., Oct. 12th, 1889 (Macoun). On rocks, Canaan Forks, Queens Co., 1889 (Moser).
152. B. acuminatum. Bases of trees. (Moser). Herb.
153. B. salebrosum, Bruch and Schimp. On earth, common about the Tay. (F's C.) (Moser). Herb.
154. B. albicans, Bruch and Schimp. (F's C.)
155. B. harpidioides, C. M. and Kindb. (New species). On old logs in woods. Columbia River, May 6th, 1890. (Macoun). 1889. (Moser).
156. B. pseudo-collinum, Kindb. Queens Co. (New species). Under platform of a well. (Moser).
157. B. velutinum, Bruch and Schimp. (F's C.)
158. B. Starkii, Bruch and Schimp. (F's C.)
159. B. oedipodium. Under shade on light ground. (Moser.) Abundant. Herb.
160. B. curtum. On earth in woods. (Moser.)
161. B. reflexum, Bruch and Schimp. On rocks, Queens Co. (Moser.) Herb.
162. B. rutabulum, Bruch and Schimp. (F's C.)
163. B. leucoglaucum, C. M. and Kindb. (New species). On loose earth, Queens Co., and at Elmwood, Kings Co. September 10th, 1888. (Moser). Herb.
Intermediate between B. rutabulum and B. curtum.
164. B. mirabundum, C. M. and Kindb. (New species). On old logs in woods, Canaan and Elmwood. July, 1888. (Moser). Herb.
165. B. campestre, Bruch and Schimp. On the ground. (F's C.) On rocks and logs. (Moser). Herb.
166. B. rivulare, Bruch and Schimp. (F's C.) Also at Fredericton. On wet ground and stones in brooks. (Moser.) Herb.
Var. obtusifolium, Kindb. Also named Novæ Brunsviciæ. On wet rocks, Fredericton. (F's C.) Ontario and British Columbia. (Macoun). Near springs. (Moser). Herb.

167. B. populeum, Bruch and Schimp. (F's C.) On granite boulder in brook. (Moser). Herb.
168. B. plumosum, Bruch and Schimp. (F's C.) Also at Fredericton, Elmwood. (Moser). Herb.
169. SCLEROPODIUM illecebrum, Bruch and Schimp. On damp rocks. (Moser). Herb.
170. EURHYNCHIUM strigosum, Bruch and Schimp. (F's C.) (Moser). Herb.
171. E. piliferum, Bruch and Schimp. Rare. (Moser).
172. E. prælongum, Bruch and Schimp. Tay. (Moser). Herb.
173. E. Sullivantii. On rocks. (Moser). Herb.
174. E. hians. (Moser).
175. E. crassinerve, Schimp. Var. laxorite, Kindb. New var. On rocks in woods. (Moser).

    Differs in the leaves being nearly entire or faintly denticulate above, shorter, acuminate, and the cells larger. Only male flowers found. Allied to E. colpophillum.

176. RAPHIDOSTEGIUM recurvans. Kent Co. (F's C.) Common. (Moser). Herb.
177. R. demissum. On stones, rare. (Moser). Herb.
178. R. cylindrocarpum. On decayed logs. (Moser).
179. R. Jamesii. (Moser).
180. RHYNCOSTEGIUM serrulatum. (Moser). On rotten wood. (F's C). Herb.
181. R. rusciforme, Bruch and Schimp. On rocks, St. John River (F's C). Tobique River. (Hay). (Moser). Herb.
182. PLAGIOTHECIUM pulchellum, Bruch and Schimp. On rotten wood, Nashwaaksis, and Canaan. (Moser.) Herb.
183. P. turfaceum, Lindb. Common. Herb.
184. P. Muehlenbeckii, Bruch and Schimp. On old logs. (F's C.) Tobique and Norton. (Hay.)
185. P. denticulatum, Bruch and Schimp. (F's C.) Highland Park, St. John. (Hay). Common. (Moser.) Herb.
186. P. sylvaticum, Bruch and Schimp. Fredericton. (F's C., and Moser.) Herb.
187. P. Sullivantiæ, Schimp. On earth, Elmwood and St. John. (Moser). Herb.
188. P. aciculari-pungens, C. M. and Kindb. (New species.) On earth, 1889. (Moser.)

    This species is nearly allied to Plagiothecium sylvaticum, but the leaves are larger, the tufts more compact.

189. AMBLYSTEGIUM speirophillum, Kindb. (New species.) On face of wet stones, York Co. (Moser). Herb.
190. A. confervoides, Bruch and Schimp. On stones in woods. (Moser.) Herb.
191. A. serpens, Bruch and Schimp. (F's C.) (Moser.) Herb.
192. A. porphyrrhizum, —— Fredericton. (F's C.) On damp earth. (Hay and Moser.) Herb.

193. A. varium, Hedw., Lindb. Near Fredericton. (F's C.) On roots of trees. (Moser). Herb.
194. A. orthocladon. (F's C.)
195. A. fluviatile, Bruch and Schimp. On rocks, St. John River. (F's C.) (Moser.) Herb.
196. A. adnatum. On stones in woods. (Moser). Herb.
197. A. compactum. On the bases of trees. (Moser.) Herb.
198. A. riparium, Bruch and Schimp. On stones in brooks, Molus River. (F's C.) Kennebecasis Island, (Hay). Tay, (Moser). Herb.
199. HYPNUM hi pidulum, Brid. Bass River and Little Branch, Miramichi. (F's C.) On bases of trees. (Moser). Also at Elmwood. Herb.
200. H. Sommerfeltii. On old logs. (Moser). Salmon River, Kent Co. (F's C.) Herb.
201. H. chrysophillum, Brid. On logs, Tobique River. (Hay). (Moser). Herb.
202. H. unicostatum, C. M. and Kindb. (New species). (Moser). Near Ottawa, October 4th, 1890. (Macoun). Near Kingston, Ont., May 23rd, 1884. (Prof. Fowler).
203. H. polygamum, Wils. Base of trees. (Moser). Herb.
204. H. Kneiffii, Schimp. In swamps, Queens Co.. (Moser). Herb.
205. H. sendtneri, Schimp. In bogs. (Moser). Herb.
206. H. fluitans, Linn. In bogs, Coldbrook. (Hay). Herb.
207. H. exannulatum, Guemb. In boggy places. (F's C). Queens Co. and Elmwood, Kings Co. Common. (Moser). Herb.
208. H. uncinatum, Hedw. Common. (F's C.) (Moser). Herb.
209. H. Moseri, Kindb. (New species).

Differing from H. uncinatum in the leaves not being striate, but sometimes recurved at the base; costa faint, often failing; differing from all the other Harpidia in the stem, being densely radiculate.

On the bases and trunks of poplar trees, Dec. 30th, 1889 (Moser). Newfoundland (Rev. A. Waghorne). Herb.

210. H. filicinum, Linn. Near springs, Tobique River. (Hay). Forks (Moser). Herb.
211. H. chloropterum, C. M. and Kindb. (New species).

Resembles H. Novae-Angliae in habit, but differs considerably in the distinctly papillose, looser and patent, wider areolate leaves and the monoecious inflorescence, and in other respects.

On rocks, New Harbour, Newfoundland. (Rev. A. Waghorne). Near a spring, Owl Bridge Gully, Forks, and on wet ground, in shade, at Elmwood, K. C. (Moser). Herb.

212. H. Novae-Angliae, Sulliv. and Lesq. In large patches, Bass River. (F's C.) (Moser.) Herb.
213. H. commutatum, Hedw. On earth in a swamp. (Moser). Herb.
214. H. crista-castrensis, Linn. On old logs. (Moser). Herb. Bass River. (F's C.) Tobique River (Hay).
215. H. molluscum, Hedw. On logs, Tobique. (Hay). (Moser.) Herb.
216. H. reptile, Michx. On stones and bases of trees, common. Herb.
217. H. pallescens, Beauv. Fredericton and Grand Lake. (F's C.) (Moser).
218. H. callichroum. (Moser). Herb.
219. H. fertile, Sendt. (F's C.) (Moser). Tobique. (Hay).

220. H. imponens, James. Old logs. (Moser). Herb.
221. H. subimponens, Lesq. Old logs. (Moser). Herb.
222. H. complexum, Lesq. and James. On rocks. (Moser). Herb.
223. H. Lindbergii, Mitt. (H. arcuatum, Lindb.) On rocks. (Moser.) Also at Elmwood. Herb.
224. H. Renauldii, Kindb. (New species). On damp earth in shade; abundant. (Moser). Herb. Reported by Macoun and Rev. A. Waghorne.
225. H. curvifolium, Muell. Common along wet banks and in brooks. (Fowler, Hay and Moser). Herb.
226. H. pratense, Koch. On earth. (Moser).
227. H. Haldanianum, Grev. On old logs, common. (F's C., and Moser). Herb.
228. H. nemorosum, Koch. On decayed wood. (Moser).
229. H. flaccum, C. M. and Kindb. (New species). On logs and rocks. (Moser). Owen Sound, Ont. (Macoun). Herb.
230. H. palustre, Hedw. On rocks in brooks. (Moser). Herb.
231. H. circutifolium, C. M. and Kindb. (H. molle, Lesq. and James). Nearly allied to H. dilatatum, Wils. On rocks in brooklet emptying into Tay. (Moser). Herb.
232. H. engyrium, Schimp. On stones. (F's C.)
233. H. ochraceum, Turn. On stones in brooks, Nashwaaksis and Canaan. (Moser). Kent County and Fredericton (F's C.) Herb.
234. H. stramineum, Dicks. Among sphagnum. (F's C.) Tay (Moser). Herb.
235. H. cordifolium, Drumm. In wet, sandy places; common. Herb.
236. H. giganteum, Schimp. Springs and swamps (Moser). Herb.
237. H. sarmentosum, Wahl. Bogs. (Moser). Herb.
238. H. cuspidatum, Linn. Shore of Washadamoak. (Moser). Herb.
239. H. Schreberi, Willd. Common everywhere. Herb.
240. H. splendens, Hedw. In dense mats on damp rocks, or on the ground but at Nashwaaksis, in the woods, it is gregarious. (F's C.) (Moser). (Hay). Herb.
241. H. umbratum, Ehrh. (F's C.) (Moser). Common by brooklets. Have not found it in fruit. Herb.
242. H. brevirostre, Ehrh. In dense mats on granite boulders in the shade; no fruit, Halifax Co., N. S. Herb. (Moser).
243. H. squarrosum, Linn. In grassy, shady slopes. Have not found it in fruit. (Moser). Herb.
244. H. triquetrum, Linn. Common. (Moser). (F's C.) Herb.
245. H. pyrenaicum, Spruu. (H. Oakesii, Lesq. and James). On old logs and stones. (Moser). Herb.

ARTICLE IV.

RECENT DISCOVERIES IN THE ST. JOHN GROUP, No. 2.

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

(Read January 5, 1897.)

(See also Bull. IV., p. 97; Bull. V., p. 25; Bull. X., p. 34, x. and xi.; Bull. XI., p. 11; Bull. XIII., p. 94.)

Since the description was given in Bulletin X., page 34, of the genus Protolenus, and its place in the Cambrian succession, and of Trematobolus, in Bulletin XIII., p. 94, no record has been presented to the Society of the progress made in the study of the Acadian Cambrian faunas. It seems desirable, therefore, to add here a few words on this subject.

The Protolenus Fauna.—The chief work done of late in this direction has been the elaboration of the Protolenus Fauna*, which appeared in the Transactions of the New York Academy of Science (Vol. XIV., p. 101 to 153, Pl. 1 to 11, and Fig. 1).

Any fauna which can be found in the sediments of the earth's crust older than those which contain the Primordeal Fauna of Barrande is of interest to naturalists and geologists, because Barrande named this fauna as being the oldest, as he thought, except traces of worms that had existed on the earth. But beside the peculiar fossils of the Laurentian and other pre-Cambrian rocks, several faunas of greater antiquity have since been described by Linnarsson in Sweden, by Kjerulf in Norway, by Schmidt in Russia, and by Hicks in Wales; but these European faunas agree in having only a few species of trilobites. A fuller representation of pre-Primordeal trilobites is that discovered by C. D. Walcott in Newfoundland; but even this does not reach, in variety of trilobites, the number shown in the Protolenus Fauna. From this cause and others, a brighter light is thrown on various zoological problems by the facies of this fauna than by that of any of the others.

* This fauna is contained in Division 1, Band *b*, or the Zone of Protolenus (Bergeronia articephalus (formerly *Agraulos articephalus*). See Bull. X., p. 12.

In studying the development of the Primordeal trilobites by means of their young, we find certain features in the latter which are lost in the adult. But among the trilobites of the more ancient Protolenus Fauna these features are to be found subsisting in the full-grown trilobite.

One of these features is a long, cylindrical glabella (or middle lobe of the head-shield). This in many of the larval trilobites is enlarged in front, and so we find it in the adult of the genera Micmacca and Ellipsocephalus of this fauna, showing how primitive these forms are. Many of the trilobites have cylindrical glabellas (Avalonia and Protolenus), which cylindrical shape is the second phase shown in the glabella of the larval trilobites. Moreover *none* of the trilobites of the Protolenus Fauna have contracted their glabellas to the short, conical form prevalent in the trilobites of the Primordeal Fauna (Ptychoparia, Conocephalites, Conocoryphe, Ctenocephalus, etc.)

Another feature in the trilobites of the Protolenus Fauna is the prevalence of a continuous eyelobe. The eyelobe is a protective ridge extending along a portion of the seam between the middle piece of the head-shield and the movable cheek. In many Cambrian trilobites this lobe is quite short, but in others, while it is short in the adult, it is longer in the larval stages; this is notably the case in Paradoxides, which in the earliest species, and in the young of all the species studied, has continuous eyelobes—that is, eyelobes extending to the posterior furrow of the head-shield. Now this character of a continuous eyelobe marks *all* the trilobites of the Protolenus Fauna in which this part of the headshield has been preserved.

A narrow, movable cheek is apt to be associated with a continuous eyelobe, and such movable cheek is the only kind so far found with the trilobites of the Protolenus Fauna; sometimes with, sometimes without a genal spine. Such a cheek exists in the early larval examples of Pytchoparia and allied genera of the Primordeal Fauna, but disappears in the adult, in which the area of the cheek is often quite wide, owing to the withdrawal of the eye from the margin of the headshield during growth.

A fourth primitive character of the trilobites of the Protolenus Fauna is the shortness of the pleuræ, or lateral extensions of the thoracic rings. This may be observed as a characteristic of many trilobites in the larval state, but disappears as the species comes to maturity. Ellipsocephalus and several Agrauli preserve this character in the adult condition, but in the majority of Primordeal trilobites

(*See page 36*).

Some Types of the Protolenus Fauna.

Brachiopod.

Trematobolus insignis.—*a.* Interior of the ventral valve. *b.* Interior of the dorsal valve. *c.* Dorsal valve seen from behind. *d.* Inside of beak of ventral valve. *Notation of the muscles, etc. p. a.* Posterior adductor. *a. d.* Adjuster muscles. *l. m.* Lateral muscles. *a. p.* Anterior depression. *c. p.* Cardinal pit. *c.* Cardinal process. *s.* Hinge socket. *t.* Dentiform process of the ventral valve. *f.* Foramen. From Assize 2, Band *b*, Div. 1, St. John Group at Hanford Brook, St. John County, N. B.

Trilobites.

Protolenus elegans, W. D. Matthew (second group on left side).—The upper figure represents the head shield. The detached piece to the right is the movable cheek. The middle figure shows a joint of the thorax. The third figure is a side view of the head-shield.

Protolenus paradoxoides (second group on right side).—This represents the head-shield, with the movable cheek to the right, a little separated from the middle piece.

N. B.—All the above are figured of the natural size.

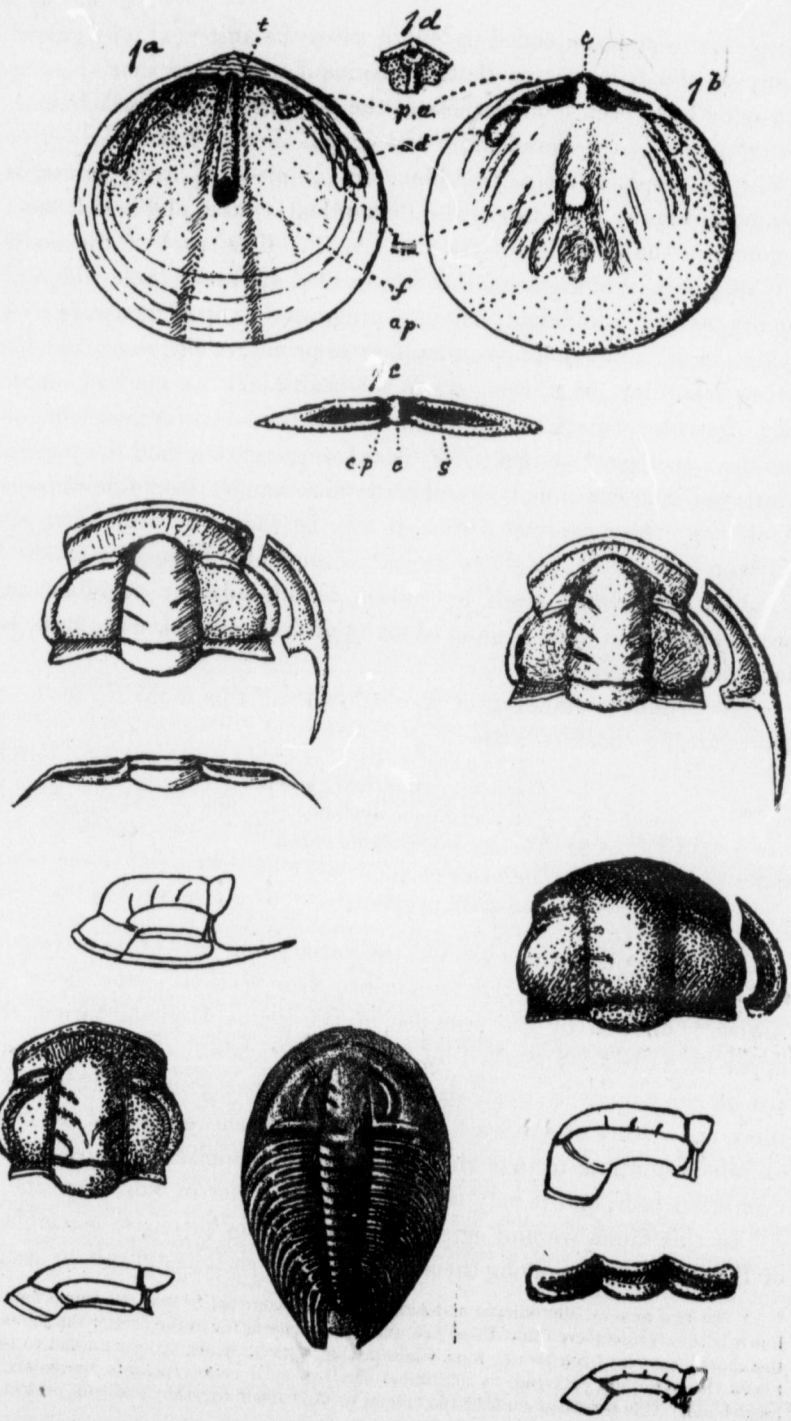
Protolenus articephalus (third group on left side).—The upper figure represents the middle piece of the head-shield. The second figure shows this part viewed from the side.

Ellipsocephalus galeatus (third group on right side).—The upper figure represents the head-shield, with the movable cheek somewhat separated. The second figure is a side view of the same. The third figure represents a segment of the thorax. The fourth figure is a side view of the middle piece of the head-shield, of the variety or mutation agrauloides.

N. B.—All the figures of the third groups, right and left sides, are magnified two diameters.

Olenus Zoppii, Menigh.—A complete trilobite, supposed to be a later derivation from the same stock as Protolenus. From the Cambrian of Sardinia, Italy. Introduced to show an entire trilobite of this family, and the relation of the different parts of the test of a trilobite to each other. The other figures of trilobites here given show parts of the test only.

The following genera compose the Protolenus Fauna: Foraminifera, Orbulina 4 sp., Globigerina 4 sp. Spongida, Monadites, Protospongia, Astrocladia? Brachiopoda, Lingulella 2 sp., Lingulella? 2 sp., Obolus, Botsfordia, Trematobolus, Protosiphon, Obolella, Linnarssonia, Acrotreta 2 sp., Acrothele. Mollusca, Hyolithellus? Coleoides? Orthotheca, Hyolithes 5 sp., Diplotheca 2 sp, Pelagiella, Volborthella. Ostracoda, Hipponicharion 3 sp., Beyrichona 6 sp., Aparchites 2 sp., Primitia 4 sp., Schmidtella, Leperditia 4 sp., Beyrichia. Phyllopoda, Lepiditta. Trilobita, Protagraulos, Ellipsocephalus 3 sp., Micmacca 4 sp., Avalonia, Protolenus 2 sp., subgen. Bergeronia 2 sp.


1a
t
1d
p.a.
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the pleuræ become extended in length when the animal is fully grown. Many of the trilobites of the Protolenus Fauna have short pleuræ, and none have been found to possess the prolonged pleuræ which mark many species of the Paradoxides and Olenus Zones (Primordeal).

The development of a pygidium, or tail-piece of many joints, is common in many trilobites of the Primordeal Fauna, and is still more common in the Ordovician system above it. This part of the body-covering is built of segments that were added gradually in the different moults as the individual trilobite progressed toward maturity. A pygidium of a few joints is therefore a primitive character, and the entire subordination of this part to the headshield is a mark of simplicity of structure; it is so throughout the Cambrian system*, but in the next geological system (Ordovician) we sometimes find the pygidia preserved in greater numbers and perfection than the head-shields (*e. g.*, Asaphus). As a contrast to this, it may be said that while there are thirteen species of trilobites in the Protolenus Fauna, of which a hundred or more of heads have been found, only one pygidium has been recognized. The pygidia of many of these species must, then, be small and insignificant.

The primitive standing of the trilobites of this fauna is shown by the following characteristics:

1. The long, cylindrical glabella.
2. The continuous eyelobe.
3. The narrow movable cheek.
4. The short pleura.
5. The small pygidium.

This fauna is remarkable for the variety and size of its ostracods, and they differentiate the fauna into two sections — the lower in Assize 1 marked by the presence of the genus Hipponicharion, the upper in Assizes 2-4 marked by that of Beyrichona. These ostracods are of comparatively large size, and, with other genera of this order, there are a score of species. We seem to find this section of the crustaceans beginning to take the place of the trilobites in those oldest Cambrian beds, and it may be the dominant order in older deposits.

In this fauna we find ourselves among a very primitive assemblage of Brachiopods, for among them are forms which it is difficult to assign

* The two genera, Microdiscus and Agnostus, may seem not to bear out this principle, but it is to be remembered that these are abnormal genera, for in the former the joints of the thorax may be from two to four, while in the latter they are strictly limited to two; hence the pygidium enlarged, by additional somites, as a counterpoise to the enlarging headshield. This provision enabled the animal to fold itself together and thus protect its soft under parts.

to any known genus; many are small, some are minute, and the larger forms belong to the Obolidæ and Siphonotretidæ. One of the latter is remarkable as being of the inarticulate order, yet having a distinct articulation at the hinge (Trematobolus). Another is notable in beginning life as one genus (Schizambon) and closing it as another (Siphonotreta), this being shown by the larval stages through which it passed.

A remarkable occurrence in this fauna is that of Foramenifera, of which several genera are present. The most notable are Orbulina and Globigerina, which at present are inhabitants of the open sea, on whose bottom they have left in modern times deposits of vast extent and thickness. Foramenifera abound in some of the Carboniferous deposits, but they have not been reported, so far as I know, from older geological systems; they will, however, probably be found in the intermediate deposits.

From the preceding remarks it will be seen that the exploitation of the Protolenus Fauna has resulted in a useful addition to the knowledge of early Cambrian geology.

The Geological Map of part of Kennebecasis Valley. (*See next page*). —This map, originally prepared to show the distribution of the Cambrian rocks of Kennebecasis valley, is useful also to exhibit other points in the geology of this interesting basin. The index to the formations is divided and placed in the lower corners, that part to the right shows the Pre-Cambrian rocks, that to the left the Cambrian and later terranes.

The foundation of the whole geological structure is the portion indicated by vertical bars. These are very ancient sedimentary masses classed with the Laurentian system of Canada. These old stratified rocks have been broken through by igneous intrusions (quartz-diorites, etc.,) of great age, which form a belt across the map, interrupted at points by the waters of Kennebecasis Bay.

Next in age come the great mass of igneous rocks of effusive or volcanic origin which form the principal part of the parish of Kingston, these occupy the upper side of the map. A parallel arrangement may be seen to hold for these three belts; this is due to the presence of ancient and profound faults or breaks in the earth's crust of very ancient date that run in an E. N. E. direction; along these fault lines the rocks have moved up and down more or less during the ages.

Black areas are those occupied by Cambrian rocks which now form

THE
CAMBRIAN SYSTEM
IN THE
KENNEBECASIS VALLEY
Scale, 1½ miles to an inch
KENNEBECASIS BAY
NORTH PASSAGE
LONG ISLAND
MILKISH
PASSAGE
Kennebecasis R.
Barlow's Bluff
Sandy Pt.
Hastings C.
Drury's C.
Torry Burn C.
COLONIAL
RAILWAY
Rothesay
Grey } Lower Carboniferous
Red } Series
St. John Group
Effusive Pre-Cambrian rocks
Intrusive Granite, Diorite & Syenite
Laurentian gneiss & Limestone

narrow strips or wedge-shaped belts of small extent, which it will be seen, are always closely connected with the older rocks.

Lastly, the Lower Carboniferous rocks form basins of sediments, filling in the hollows of the Cambrian and the older rocks and spreading in the valleys. They are the youngest rocks visible in this area, except the loose aggregations of Post-pleiocene gravel, sand and clay which are not represented in this map. The Lower Carboniferous shows two principal divisions—one reddish and of marine origin, the other of grey color and containing scanty remains of land plants rare in this part of the valley, but more abundant farther eastward. The relative antiquity of these two parts of the formation has not been determined. The grey beds are seen at Hasting's Cove, on the south side of Kennebecasis valley, and in Milkish passage on the north side.

A great accumulation of boulder beds in the red division of this system is well exposed on Long Island, where it comes out on the river at the "Minister's" Face, a bold bluff extending from the outcrop of Cambrian rocks half-way to the eastern end of the island.

The Cambrian Rocks of the Kennebecasis Valley.—It will be remembered that in the annual report of the Society for 1897 allusion was made to work carried on on the Cambrian rocks of the Kennebecasis valley. We are now able to present some of the results of this work.

Sedimentation.—The sedimentation of the Cambrian in this valley was found to show important differences from that of the valleys to the north and south.

All through the Etcheminian period, which preceded the true Cambrian, this valley, with the surrounding territory north, south and west, was elevated above the sea, and was apparently an island having recently ejected volcanic rocks to the north-west and south-east of the present Cambrian valleys. This island and the volcanic ridges furnished sediment to the Etcheminian sea.

When the Cambrian time arrived changes of level in the land took place, so that while the Kennebecasis valley sank beneath the sea, the ridges on either side of it, consisting, on one side of volcanic rocks, and on the other of old Laurentian sedimentaries, remained above the sea. Thus was the Cambrian sea in this district divided into three areas of deposition, which to some extent were independent of each other, but not so far as to make any very material difference in the faunas.

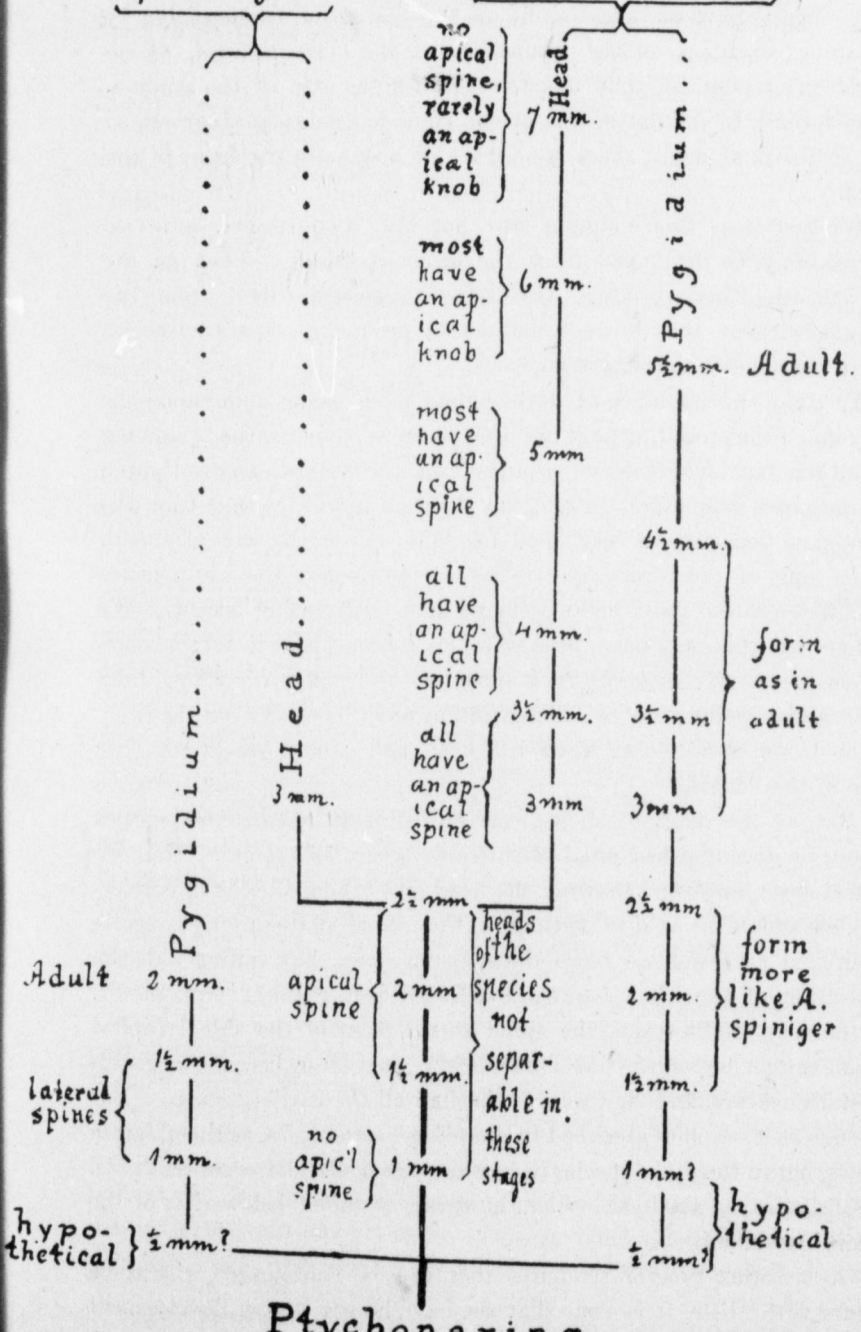
It is evident that the deposits in the middle basin (Kennebecasis valley) were much thinner than those of the southern (St. John) basin. This is shown by the small narrow strips of sediments of which the Cambrian here is composed, and by the absence of the upper division (Bretonian), which, being of fine soft shale, would be easily removed by denudation. The middle division (Johannian), which in the southern basin shows a thickness of 1,000 feet, is here so reduced as to show only a tithe of this thickness. The Paradoxides beds, though not well exposed, also seem much thinner than in the southern basin, and only the Protolenus beds, by their volume and texture, fully bear out the aspect of their counterpart in the southern basin.

It would appear, then, that while a great part of the Cambrian series is present in this valley, it is very much reduced in thickness; from this it may be inferred that the floor of the Cambrian sea was sinking in the area of the southern basin much more rapidly than in the middle basin, and for most of the time was being filled up with sedimentary deposits as fast as it sank.

Faunas.—An interesting discovery in the Kennebecasis valley was that of the fauna of Hasting's Cove, which is a sub-fauna of the Paradoxides beds. Hitherto we had not found in the Acadian Cambrian rocks anything to correspond to the Upper Paradoxides beds of Sweden, the sub-faunas found in the southern (St. John) basin being such as are paralleled by the Lower Paradoxides beds of that country. At Hasting's Cove, however, we came across some genera not before found in this region, and which recalled the facies of the Swedish Upper Paradoxides beds, these were Anomocare and Dolichometopus; and associated with them was the easily recognized genus Dorypyge, found in the Middle Cambrian of western America and of China. By this sub-fauna we can link the upper part of our Paradoxides beds with the corresponding rocks in Sweden, West America and China.

Another interesting discovery made in this valley was finding of a type of trilobite in company with *Agnostus pisiformis*, L., which showed peculiar phases of development. In this type were contained two species which, so far as the headshields are concerned, could not in the earliest stages be distinguished from each other. They first become separable by their pygidia, which in one species takes the form of Olenus and in the other that of Anomocare. It would thus appear that from the one phylum or stem-form two genera were developed. (*See the opposite page.*)

Development of Acantholenus spiniger & Anomocare stenotoides



The distinction of the headshields of the two species come at a later period of growth. Both, in the younger stages (though not in the youngest) have an apical spine on the margin of the headshield; this spine continues on the headshield of the Oleniod form, whose growth is arrested, so that it never reaches the size of the Anomocaroid form. In this latter the apical spine is gradually absorbed, so that in the final moult there is no trace of a spine in the front of the shield.

We see from this example how not only two species, but two genera, may be developed from the same rootstock. That is, the differentiation may produce two separate genera direct from the phylum, without the indirect method of producing separate species before the generic characters appear.

To make this instance of development more easily understood the diagram on the preceding page has been prepared, showing the branching of the trilobite *Acantholenus spiniger* from the stock which eventuated in *Anomocare stenotoides*. From this diagram it will be seen that the divergence occurred in very small heads, for even the caudal shield, 1 mm. long, of the former species has all the rings of the adult, hence the differentiation must have occurred in a still earlier moult. We assume that this may have been the ½mm. size. But if so the companion species *A. stenotoides* must have had an equally small pygidium as a starting point; so the differentiation must have occurred as early as the 1 mm. moult (*i. e.*, when the head and caudal shield together were of this length).

But, as the diagram shows, the head-shields of the two species cannot be distinguished until they reach a size of 2½mm. Had we perfect tests, however, showing the head and caudal shields in connection, we should be able to distinguish the two trilobites by the pygidia when this part was no more than 1½mm. long, but failing this the separation of the head cannot be effected before the 2½mm. moult. In the very smallest size the spine at the front of the shield (apical spine) cannot be found, but immediately thereafter becomes a distinguishing feature, and continues so through all the earlier moults. But by degrees it becomes absorbed in *Anomocare stenotoides*, as the diagram shows, but in the other species it continues as a distinct ornament until the full size is attained, which, however, is much below that of the species last named.

As no other type of trilobites that can be confounded with them occurs with these, it is clear that we have here a case of development

from a common stock which at once pass to different genera, one somewhat closely like an Olenus, the other diverging from a Pychoparian ancestor into the resembling genus Anomocare.

Other points of less moment have been noted in reference to the Cambrian faunas of the Kennebecasis valley; thus two of the thirteen species of trilobites of the Protolenus Fauna were found in olive-grey sandstones in this valley, and two new Ostracods were also obtained from the same beds. A very interesting Brachiopod from these sandstones was that which is referred to on an earlier page as passing during its growth from the condition of a Schizambon to that of a Siphonotreta.

Though since their deposition the Cambrian beds of this valley have suffered great disturbance and enormous denudation, and what remains of them are now to a great extent covered by the lake-like expansion of the Kennebecasis River, or concealed by sediments of Lower Carboniferous age, enough remains exposed to throw considerable light on their sedimentation and palæontology.

Upturnings and Dislocations of the Cambrian Beds.—The sharp folds into which the strata of the St. John basin were thrown have been described in Volume VIII of the Transactions of the Royal Society of Canada, pages 125 to 128, and displacements along faults of a high hade, of hundreds of feet. Horizontal displacement has also been shown by the result of well borings in the city of St. John and its neighborhood; the most remarkable are those that have come to light through borings in the upper (Bretonian) division. At Jones' Brewery on Union Street, a boring was put down to a depth of 385 feet, in what appeared to be a deep narrow trough of black shales, having an overturned dip of about 70 degrees. Theoretically, this bore should have been continuously in the black shales of this division, but at the depth of 317 feet the flag-stones of Division 2 were struck; these flags at the surface are about 300 feet to the N. W., hence there would appear to be a horizontal overthrust of the black slates on the flagstones to the extent of about 280 feet.

Similarly on the eastern side of Courtney Bay at the Almshouse, hard grey flags were encountered in a well sunk in the black slates at a depth of 700 feet and penetrated for 55 feet. Here the dip of the beds is about the same as in the city and the grey flags of Division 2 (Johnannian) appear at the surface about 500 feet to the N. N. W.; hence there would appear to be an overthrust here of about 460 feet.

A force operating from the same direction as that which produces these old conditions of overthrust strata, is in operation on a milder scale at the present day, for by reference to No. 12 of this Bulletin, page 34, it will be seen that since the Glacial Epoch there has been dislocation of the strata of the St. John Group whose phenomena show thrusting from a S. E. direction. The old displacements, however, are on a gigantic scale compared with these.

ARTICLE V.

NOTES ON THE NATURAL HISTORY AND PHYSIOGRAPHY OF NEW BRUNSWICK.

By W. F. Ganong.

4.—On the Color of the Water in New Brunswick Rivers.

Read March 2nd, 1897; re-written April, 1898.

New Brunswick is a land of splendid rivers. I have looked on the maps in vain for an equal extent of country elsewhere which can show so fine a series. For it might the words have been written: "A good land, a land of brooks of water, of fountains and depths that spring out of valleys and hills."

Everyone who has been much with rivers must have felt that they possess distinct characters or individualities. This character is a subtle aggregate, but a leading physical component of it is the purity and color of the water. The characters of our rivers I shall try elsewhere to express; I ask the Society now to consider the physical problem involved in their colors.

It is possible to find in the province every gradation between the sluggish, heavily sedimented, almost black streams of the peaty districts of Kent, Gloucester, and parts of Charlotte, and the rippling, limpid streams of the central and northern watershed. The causes of the color and opaqueness of the former are plain enough; they leach out the dark coloring matters of swamp and bog, together with much of the flocculent organic matter. But the clear northern rivers, when low in their stony beds, carry little sediment, and that not organic; but they show curious differences in color, for some of them are green and others are brown. In thus speaking of color, I do not refer to glint from their surfaces, nor the hue in rapids and waterfalls, but to that which one sees at low water, when he looks through a still surface, nearly vertically, into a deep pool with gravel or boulder bottom. Seen thus, the Restigouche is light green, and the Metapedia light brown; and where these two come together, one may run a canoe for three hundred yards on a boundary so sharp that on the right all is clear

green and on the left all equally clear brown. One may see the same contrast where Green River enters the St. John, but with a result less striking, for the greater river, though brown, is less clear. Indeed, the St. John water is of mixed color and texture—one might call it a golden brown—as would be expected from its receiving so great a mixture of streams. Another striking contrast of color is to be seen in the two branches of Charlo River. Where they cross the highway road, a quarter of a mile apart, the western is clear green, the eastern clear brown. The upper branches of the Restigouche are green; Nepisiguit is, I believe, brown; but I have no exact information as to the color of Tobique, and the many other clear rivers which abound in all the northern wilderness from Temiscouata and the St. John eastward. A Blue River empties into St. Francis, but I know not whether the name describes the water; and Blue Lakes are mentioned near the Cascapedia in the Geological Survey Reports (1881, D., p. 20), though the color is not in the water, but by reflection from the blue clay bottom. Blue water lakes occur, however, in Europe,* though green is much more common in clear lakes, both there and in this country.

The explanation of the difference between the green and brown colors is no doubt this: the physical composition of the purest river water is such that when white light enters and is reflected back through it, the green rays are absorbed least, and hence preponderate in the light which comes to the eye. The clear, brown rivers, on the other hand, though possessing green water as a basis, have added to it a brown liquid (not sedimentary) coloring matter, leached out from swampy places. What we know of the Restigouche and Metapedia is consistent with this, for the former has hardly any, if any, swampy area upon it, while the latter has at least some swamp around Metapedia Lake (Johnston, Notes on North America, I, 387). I have no such data for the two branches of Charlo River.

The subject has been carefully studied in Europe, and an important memoir on the subject has recently appeared.† It will aid to the solution of the problem if members of the Society will make exact observations upon the color of the water in our clear rivers, particularly giving attention to the character of the country through which they flow.

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*The deep blue color of the Lake of Geneva differs from that of the other Swiss lakes, which are all more or less of a greenish hue . . . the cause of the phenomenon has never been actually ascertained.—Baedeker's Switzerland, 15th Ed., p. 222.

†La Couleur des Eaux. Par Ad. Kemna. Bull. de la Soc. Belge de Geologie. X., 241.

5.—On the Heights of New Brunswick Hills.

Read April 6th, 1897; re-written April, 1898.

In the summer of 1896, I climbed two of the best-known and most accessible of the higher hills of the province—Squaw Cap in Restigouche, and Mount Pleasant in Charlotte. Later I sought information about their heights, but found, with surprise, that for neither was it accurately known; and later inquiry showed that this is true as to the heights of most New Brunswick hills. Indeed, nobody knows positively where the highest point in New Brunswick lies, much less how high it is.

It is generally stated that the highest point in the province is Big Bald Mountain, at the head of the Lower South Branch of Nepisiguit; but this, if not an error, is at least not proven. It rests solely on the authority of the Geological Survey map, which marks that mountain as 2,700 feet, the greatest height marked anywhere in the province. But this height appears to be a compiler's or copyist's mistake, for Dr. R. W. Ells, in his Geological Report (for 1881, D, 35) describing that region, estimates Bald Mountain at 2,500 feet—not 2,700—and he has recently had the kindness to write me that his estimate really was as given in his report, and that he does not know how the greater height came to be placed on the map. No other officer of the Geological Survey has been there, nor are measurements by anyone else known. He says, however, that he thinks Bald Mountain "the highest land in Northern New Brunswick—at least as far as I have travelled." The Geological map marks in that region "Peaks rising to 2,600 or 2,700 feet," which, of course, is so stated to include the height given to Bald Mountain. We must, therefore, consider that it is far from settled whether or not Bald Mountain is the highest in New Brunswick. If this measurement of 2,500 feet by Dr. Ells is correct, there is another higher peak in the province, namely, Bald Mountain, beside Nictor Lake, which is given on the Geological map as 2,537. This must therefore stand as, for the present, our greatest known height. It is not likely that any point in the province will reach 2,800 feet. Who will be the first to demonstrate the highest point in New Brunswick?

It will be of interest to note some heights elsewhere, for comparison. The highest in the world is Mount Everest, 29,000 feet; in Europe, Mount Blanc, 15,730 feet; in England, Scawfell, 3,208; in Wales, Wyddva, 3,571; in British America, St. Elias, 18,086; in the United States, Blanca Peak, 14,463; in New Hampshire, Washington, 6,290;

in Maine, Katahdin, 5,248; in Nova Scotia, the Cobequids, about 1,100. New Brunswick heights are therefore not great.

Our knowledge of New Brunswick heights above sea level is based upon the following data:

(1) Levels determined by canal, railroad, and waterworks surveys. These are many and valuable, but scattered, and not easily accessible, and he who would collect, and reduce them to a single datum, would do great service to our physiography.

(2) The line of levels run along the St. John from high tide at Chapel Bar, above Fredericton, to Grand Falls, by Robert Foulis, for the New Brunswick government, in 1826. They are recorded on a map in the Crown Land Office. It has been pointed out by Hind (Preliminary Report, 30) that Foulis' figures are too low, which Mr. Shewen tells me is confirmed by the railroad levels.

(3) Barometric and spirit-level observations made in connection with the Boundary disputes. One of these was a series across the province from Grand Falls to Bay Chaleur, made by the Boundary Commissioners in 1839. The full account of them is given in "Correspondence relating to the North American boundary," British Blue Book, 1840. A central station, whose height was determined from Foulis' levels, was established at Grand Falls, where the central observations for weather were made, and by mercurial barometers many heights along the Tobique, Nepisiguit, and Jacquet rivers were carefully determined. As Foulis' figures were used for the datum, all heights in this series are too low. These, with some others, are given in a list by Hind in his report on the geology of N. B., 1865, pp. 23-24, and many others from railway surveys and other sources are contained in the same work. Along the north line from the source of the St. Croix two lines have been run — one with barometer, by Bouchette, about 1817 (much too high), and another with spirit-level, by Graham, in 1840-41, published in a document of the 3rd Session, 27th Congress.

(4) The measurements by the Admiralty Survey of heights along the coasts, recorded on their charts. I do not know how they were made, nor their base level, but without doubt they were taken with care.

(5) The determinations with the aneroid barometer made by the officers of the Geological Survey of Canada, particularly by Robert Chalmers. These are all recorded on the official maps, and are frequently referred to in the various geological reports. They include lake surfaces, as well as hills. The controls for weather changes were obtained from the nearest meteorological stations in the province. Like all aneroid observations made by a single instrument in the field, the results can be regarded as only approximate. The base level is, on some maps, high tide; on others, mean tide.

(6) Aneroid and theodolite observations made by surveyors and others for their private satisfaction. William Murdoch, C.E., of St. John, has made more numerous measurements than any other that I know of, and he has kindly sent me a list of these. A few made by myself are recorded in a later note of this series (No. 13).

Most of our greater heights are of hills composed of very hard, intrusive rocks, the only kinds which have been able to withstand the long erosion which New Brunswick has suffered, and the awful battering which it received in the glacial period. They are either of granite, as in the higher Bald Mountain group, the Cow Mountains, Bald Mountain (Queens), Mount Pleasant, etc., or else of trap (Dolerite and Diorite), as in Squaw Cap,* the Blue Mountains, Moose Mountain, etc. The trap mountains are more abrupt and isolated than those of granite, both because they are intruded in smaller masses, and also, perhaps, because they are newer and less eroded, as well as harder. New Brunswick owes most of its bold and beautiful scenery to these intrusive rocks; and flat and tame indeed would much of its surface be were it not for them. Some heights occur in the hard pre-Cambrian rocks, as in Bald Mountain, and others near Nictor, and those along the Shepody Road in Kings and St. John. Some appear to be in much softer rocks, as Shepody Mountain, Green River Mountain, etc., though none of these are of great height. Possibly some of them are protected by local caps of trap, as in Chamcook.

The heights of New Brunswick will not be completely nor accurately known until a unified topographical survey of the entire province has been made; and this, because of its great expense, will be long in coming. In the meantime, there is here offered, to those of us who enjoy the pleasures of the chase, the opportunity to pursue, to our complete content, that most elusive and alluring of all great game, new, hard facts—in this case all the more charming since they must be sought through the hardships of the northern wilderness. The determination of our principal heights is a fine problem for young New Brunswickers.†

The heights recorded for the province have been taken above various datum lines. A single datum was wanting, but this has recently been established, by the calculation of mean tide level at St. John, by Mr. E. T. P. Shewen,‡ and no doubt future measurements will all be referred to it.

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* The Geological Survey map colors it as composed of Upper Silurian rocks, but I found it to be made of the same intrusive, igneous rocks as compose Sugar Loaf and the other heights in that vicinity, and the red color on the map should be extended southwest to include them. Probably the surveyors did not visit them, and were deceived by the name Slate and by local descriptions. The rock breaks up into flat, somewhat slaty, pieces.

† Two observers working from the railroad levels with good barometers, one remaining at base level to check the other, could do much in summer excursions. Or a long line of levels could be carried across country by two parties with good aneroids—or, better, mercurial barometers—one going ahead a few miles to a new station, while the other remained as a check for weather; the latter then coming up, while the former was fixed as a check. This would establish a line of stations in which, supposing the instruments to work together, the only source of error would be the difference in weather pressure between the two stations, which would be the less the nearer the stations were together.

‡ See this Bulletin, later page.

A List of the Heights above Sea Level of the Best-known Hills of New Brunswick, with Authorities.

[A., Admiralty Charts; B., Boundary Commissioners; M., William Murdoch; G., myself (see note 13 of this series); G. F., Geological Survey, Maps of Formations; G. S., Geological Survey, Maps of Surface Geology.]

Bald Mountain, Nictor—2,537 (G. F.)
Bald Mountain, South Branch Nepisiguit—2,500 (R. W. Ells).
Squaw Cap—2,000 (G. S.—probably on authority of Hind).
Bald Head, Victoria—1,866 (G. F.)
Blue Mountain, Victoria—1,724 (G. F.)
Mars Hill, Maine—1,688 (B. C. and G. F.)
Moose Mountain—1,030 (G. F.)
Nashwaak Mountain—855 (G. F.)
Bald Mountain, Queens—1,120 (G. S.), 1,390 (M.), 1,462 (G.)
Shepody Mountain—1,050 (A.)
Sugar Loaf, Restigouche—950 (A.)
Mount Pleasant—1,200 (G.)
Chamoook—637, 627 (A.)
Ben Lomond—850 (M.)

For fuller lists, see Hind (already referred to) and Bailey, Report, 1886, G. 6.

6.—Dalhousie and Saint Andrews.—A Coincidence.

Read June 1st, 1897.

There is a curious likeness between the most northerly and most southerly towns of New Brunswick—Dalhousie and Saint Andrews. They stand where tidal rivers empty into salt bays, and circling about them are superb hill and sea views, in which Dalhousie has the advantage as to hills, and Saint Andrews as to water. Prominent in their landscapes are the Lower Carboniferous sandstones, which bear rich farms and wear into soft, red cliffs, contrasting beautifully with the blue of the sea. Both places are summer resorts, with big hotels, and the colors and chatter of the summer visitor in the streets. All of this is due to similar physiographic environment. Both are extremely neat, with tasteful, old-fashioned residences and gardens, which shows something in common in their people, perhaps a large proportion of thrifty Scotch. Both are regularly laid out, on ample scale, for both were expected to be—and for a time were—the principal towns of their counties. But the grass grows and quiet reigns in their streets, though with them both there is that air of self-respecting submission to the fall from better days which so often makes both places and people charming. For both are being surpassed by neighbors far less

attractive, but more happily situated for business, which in both cases happen to be about sixteen miles away at the head of navigation. One may trace yet other resemblances, some natural, some accidental. All of these things—physiography, history, people, accident—combine to produce in the two places an atmosphere not only remarkably alike, but extremely agreeable; and we may speak affectionately of the one as the Saint Andrews of the north, or of the other as the Dalhousie of the south, according to our point of view.

7.—On Halophytic Colonies in the Interior of New Brunswick.

Read Nov. 2nd, 1897; re-written April, 1898.

In the geographical distribution of plants no phenomena are of greater interest than the occurrence of colonies isolated far from their congeners in the midst of a different flora. The best known case of this, and one which will occur to everyone in this connection, is the presence of Arctic plants on high mountains even near the equator, and in bogs and other cold places. We have Arctic plants in New Brunswick, as Dr. Matthew* and Professor Fowler† have shown; but we have also another kind of isolated colony, which has not yet been described by our botanists—a colony of sea-shore plants at the Salt Springs near Sussex.

These springs—three or four in number—occur three miles east of Sussex, beside the highway road to Moncton. The brine was formerly, but is not now, boiled down for salt. They break out in the open fields and flow down to a fresh-water brook near by. On the sandy shore around the springs and along their outlets grow plants which give the place the appearance of a bit of the sea-shore. Several years ago I noticed these plants, and last August I visited the place, and collected the species listed below. The Phanerogams were identified for me by Mr. Walter Deane and Dr. B. L. Robinson of Cambridge, and the Algæ by Mr. F. L. Collins of Malden, to all of whom, for their valued aid, I tender my sincere thanks. They are listed about in the order of their abundance, and the notes were made on the spot.

1. *Salicornia herbacea, L.* The most abundant and characteristic plant; very red and succulent.
2. *Spergularia (Buda) salina*, Presl. On the sandy banks; very abundant.
3. *Spergularia salina*, var. *minor*, Rob. (?)
4. *Spergularia borealis*, Rob.

*See Canadian Naturalist, 1869. †See Trans. Royal Soc. Canada, V.

5. *Ranunculus Cymbalaria*, Pursh. On edge of the streams from the springs.
6. *Atriplex patulum*, L., var. *hastatum*, Gray. In sandy places.
7. *Distichlis maritima*, Raf.
8. *Puccinellia maritima*, Parl., var. *minor*, Watson. In very salt places.
9. *Scirpus pungens*, Vahl.
10. *Juncus bufonius*, L.
11. *Ilea fulvescens* (Ag.) J. Ag.
12. *Rhizoclonium*, probably *Kochianum*.
13. *Rhizoclonium*, probably *riparium* var. *implexum*.

It will be noticed that all of the above species, except No. 10, are of marked halophytic habit, characteristic of salt marshes or sea-coasts. Probably a more skilful collector would find yet other species. One in the list, *Spergularia borealis*, is new to our flora.

It is easy to understand how these plants persist where they are, for the salt water of the springs is sufficiently like the salt water of the sea. But how did they come there? The nearest sea-coast is, in an air line, at least twenty-one miles away, with high hill-ranges between. For the occurrence of such a colony, one of three explanations is possible:—First, the plants may have been transported from the sea-coast by man; but the large number of the species, and especially the presence of the Algæ, is against such accidental introduction. Second, natural modes of dissemination may have carried them from the coast; but the most of them are so little specialized for such locomotion that this is very difficult to believe. Third, under different geographical conditions in the past they may have extended continuously from the sea to this place, but have since become extinct between. This is doubtless the correct explanation, and is homologous with that of the occurrence of isolated Arctic colonies. During the latest post-glacial subsidence this region dipped beneath the sea to an extent estimated by Dr. Matthew at 200 feet.* At that time the sea, bringing the coast plants with it, must have extended up the Kennebecasis, deeply burying these springs, which, as shown by the Intercolonial Railroad levels, are not over seventy feet above present high-tide mark at St. John. The subsequent elevation of the land, with the return of the fresh water, would of course exterminate the Halophytes everywhere except where they could find salt, which happened to be the case at these springs.

There are other salt springs in New Brunswick—in the parish of Upham, and at Bennett's Brook, near Petitcodiac; while others are said to occur on Coal Creek, Queens County. There is also a brook

* Bulletin of this Society, No. 2, page 4.

with slightly saline taste just above Plaster Rock, on the Tobique. Here is a most attractive problem for our local societies — to determine whether other colonies occur in these places.

Halophytic colonies occur about the salt springs near Syracuse, New York, and no doubt at other places in Eastern North America; but they appear not to have been studied from this point of view.

8. — Upon the Manner in which the Bay of Fundy Rivers of New Brunswick empty into the Sea

Read Dec. 7th, 1897; re-written April, 1898.

The remarkable difference between the way in which most of the rivers east of St. John and those west of it fall into the Bay of Fundy must be well known to members of this Society; but I have not seen in our physiographic literature any special reference to its causes. On the one hand, those of the western series — the St. Croix, the Digdeguash, the Magaguadavic, New River, the Lepreau — all have falls where they meet the salt water, and, at least at high tide, fall directly into it from considerable heights.* On the other hand, the eastern series (beginning really not at St. John, but beyond Mispec, which has a fall and belongs with the western series), including the two streams at Quaco, Big Salmon, Little Salmon, Quiddy, Goose, Point Wolfe, and Upper Salmon rivers, and the brooks amongst them, all run evenly into the sea without natural falls. At first the question as to the causes of this constant difference in the two series is puzzling, but really its solution is not difficult.

We notice, first of all, that this feature of their mouths is really characteristic of their entire courses. Thus those of the western series, running all in comparatively open country, consist largely of long deadwaters (in some cases forming large lakes), or stretches with little fall, and often without ledge-rock bottoms, separated by falls over rocky ledges; and it is up one of these deadwaters of the sunken valley to the next fall above that the tide in every case runs. But those of the eastern series, which all run in deep, V-shaped valleys, cut down 400 to 600 feet below the level of an elevated plateau, have bottoms of ledge rock, and run as torrents, but with no vertical falls of any account, and with deadwaters or lakes only on top of the plateau. The question, then, resolves itself into this — what has produced the falls and deadwaters in the one case and not in the other?

* This fact is noted by Mr. Chalmers in his Report on Surface Geology, 1890, N. 13.

Falls in glaciated regions are chiefly the result of the damming or filling of shallow valleys by glacial drift dropped across them at the close of the Glacial Period, by which the water was held back and made to seek an outlet over the lowest point of the rim of the valley, which usually is a rocky ledge. Such dams are easily to be seen at the falls on these western rivers. On the other hand, where long stretches of rapids or of even descents over ledge-rock occur, the river is probably in its pre-glacial channel; and pre-glacial channels usually have no falls, other than small ones due to unequal hardness or jointing of the rock, and hence to uneven erosion, because there was ample time in the pre-glacial ages for any which may have existed to have become eroded out, as all falls are tending to do. In general, then, we may conclude that where falls and deadwaters are, the pre-glacial valleys are more or less filled up, while long series of rapids over ledge-rock, as a rule, indicate a pre-glacial channel. Now, while the western series of our rivers have large portions of their valleys of the dammed-up sort, those of the eastern series show no glacial dams, and no glacial falls — at least in their lower courses; but the channel is always of bed rock, except where thinly covered by gravel and boulders, brought down by the stream itself. But why were these eastern valleys not also dammed by the glacial drift? Was the region not glaciated? Now there is abundant evidence that it was, though probably not so heavily as the less elevated western section. But while the quantity of drift dropped in Southern New Brunswick was sufficient to fill the comparatively shallow valleys of the western series, it could not fill to the tops these eastern valleys of 400 to 500 feet of depth, and, unless they were filled completely to the top, and a little more, the rivers would not be forced out of them, and hence would form neither new falls nor new valleys, but would simply cut out and wash away the glacial dam itself and resume their pre-glacial beds. The depth of these valleys, then, if this explanation be correct, has been their salvation, and the different depths of the valleys in the two series is the real reason for the presence of the falls at the mouth of the one series, and their absence from the other.*

* The same general explanation will no doubt also apply to some other deep valleys, such as that of the Restigouche, which has no falls, but everywhere a rocky channel.

Dr. G. F. Matthew, in remarks made after the reading of this paper, suggested, as subordinate influences at work to aid in producing the differences between the two series, the following: First, the high eastern plateau tended to turn aside the glacial currents into the St. John, and hence less drift was dropped into the eastern than into the western series, which have valleys directly along the line of the glacial flow. Second, the much greater slope of the eastern rivers must have given them greater power to wash out drift. Third, the formation through which the eastern series have cut their valleys is fairly uniform

9.—The Crayfish in New Brunswick.

Read March 1st, 1898.

In the sixth Bulletin of this Society there was published a short paper with the above title. In the *Educational Review* for November, 1889, appeared an article, with some additional information, unsigned, but known to be by the same author. In the proceedings of the United States National Museum, volume XIII., p. 612, in a work by Dr. Walter Faxon, the chief authority on this group, the New Brunswick localities of the two preceding papers are summarized, but no new ones added. Since then nothing further has appeared, nor does a paper by Dr. Faxon, on the Crayfishes, now in press, contain any new data for this region. The subject is of sufficient interest to warrant calling the attention of the Society once more to it.

Only a single species of Crayfish is known to occur in New Brunswick—*Cambarus (Astacus) Bartonii* (Fabr.) Gir. It has been found abundantly in the valley of the St. John (into which it has no doubt spread from Penobscot waters), in the Restigouche, Upsalquitch, and Miramichi; but it has not been reported from the Nepisiguit, St. Croix, Richibucto, Petitcodiac, nor from Nova Scotia nor Prince Edward Island. As it cannot live in salt water, it probably has not spread into either of the latter provinces, but it ought to occur in other New Brunswick rivers, especially those connected by low, swampy portages with the Penobscot or St. John. The distribution of single species in relation to the influences controlling it is always of much scientific interest, and members of this Society should be on the watch for additional data in this case.

The Crayfish cannot be mistaken for any other animal. It is like a miniature lobster, three to four inches long, of a dark, ashy-brown color. It lives only in fresh water, and forms burrows in alluvial lands.

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in texture, while the western valleys have cut across many bands of different composition and hardness, producing an alternation of deeply eroded, with less eroded, stretches. The filling of the former by drift would force the rivers to seek new outlets over the harder ridges Practically, however, the alternating bands are too broad to have had much effect of this kind, and an inspection of the geological map of Charlotte shows that there is no relation between positions of the falls and the transition between formations. Fourth, post-glacial changes of level, known to be going on, may have buried falls once existing at the mouths of the eastern series, as they have done in the case of the St. John, off Partridge Island. But against the former presence of such falls on the eastern series must speak the fact that there are at present none above the mouths, as on the western series.

10.—The Marine Invertebrates of the Western Part of Bay Chaleur.

Read March 1st, 1898.

There is no part of our marine invertebrate fauna so little known as that of the western part of Bay Chaleur. The subject has been studied for the Bay of Fundy by Stimpson, Verrill, and members of this Society, and for Northumberland Strait by Whiteaves, and the works of these investigators are well known: but for Bay Chaleur, except references by Whiteaves to dredgings at its mouth, and scanty notes by Bell (Canadian Naturalist, IV, 197) on Caraquette, with a single reference to Dalhousie, together with a reference by Morse to the occurrence of *Littorina litorea* at Bathurst in 1855 (Bulletin Essex Institute, XII, 176), there appears to be nothing in the literature of the subject. Yet the question as to what invertebrates occur in the western part of that bay is of considerable interest in connection with the distribution of the southern colony so remarkably developed along our North Shore from Caraquet to Bay Verte, the history of which may be found fully traced in the Transactions of the Royal Society of Canada, VIII, iv, 167–185, and by Upham in American Journal of Science, XLIII, 1892, p. 203. It was therefore natural that during a visit to Dalhousie and Campbellton in August, 1896, I should examine the shores with some eagerness. As it was time of neap tides, I could not see all of the littoral fauna, but to my surprise, what I did see showed no trace of the southern species which I had expected to find there. At Campbellton the Restigouche River makes the water brackish and the shores muddy, conditions which result always in a sparse fauna. At Dalhousie, however, the abundant species were *Mya arenaria*, *Macoma fusca*, *Mytilus edulis*, *Littorina palliata*, *Tectura testudinalis*, small crabs, a small starfish probably *Asterias littoralis*, and many Bryozoa, etc. *Littorina litorea* was, however, very rare, and I could not find a single specimen of *Purpura lapillus*. Stranded on the beaches in abundance was a large medusoid jelly-fish resembling *Cyanea arctica*, though often of a deep amethyst color. *Fucus vesiculosus* and *nodosus* were abundant, the former less so than the latter. In fact the general aspect of the shore forms, including the dead shells cast up on the beaches, was much more like Passamaquoddy Bay than like Shediac Harbor, which I visited last summer, and which has the southern colony. It must be noted, however, that Bell reports *Crepidula fornicata*, a decidedly southern form, from Dalhousie, but I saw no trace of it. In general, then, these notes,

scanty as they are, seem to show that the southern fauna is but slightly represented at the head of Bay Chaleur. Though the summer temperature of the water seems high, it is probably, owing to the proximity of deeper water and more considerable tides, lower than at Shediac, and a little below the surviving point for these southern forms; and perhaps also the more rocky character of the shores is unfavorable to sand-loving species such as most of the southern ones are. Dredging may yield some other forms, though the general character of the coast does not promise a rich fauna.

11.—A Natural History of New Brunswick projected in 1771.

Read March 1st, 1898.

From June, 1770, until June, 1771, Lieut. William Owen, R.N., lived at Campobello, and his journal, part of which has been printed by the Historical Society, contains in the yet unpublished parts some items of no little scientific interest. Thus, under date of October 1st, 1770, he says that, when near Indian Island, he "made here two hauls of the trawl, but took nothing material except a few curious shells, and other sub-marine productions." No doubt this is the earliest existent reference to dredging in New Brunswick waters. Three years earlier he speaks of dredging off the coast of Massachusetts and finding scallops, and "sea-eggs, starfish, coral, weeds and other curious sub-marine productions." During the entire year at Campobello he kept a very careful meteorological record of temperature, wind direction and force, and general weather, the whole given in full in his journal. This is no doubt the earliest record kept in New Brunswick, and is so full and carefully made that it must be of much more than antiquarian interest. But most important of all is the following passage:

"It was his [i. e., the author's] intention (and some time before he left the island he began) to make very particular observations on the quantity of rain and snow that fell; the greatest depth of the snow upon a plain; the depth the frost penetrated into the earth; the nature and quality of the soil, and the different strata under; some remarks in the three kingdoms — animal, vegetable, and mineral; the progress of vegetation; the migration of birds and fish; the seasons for the spermaceti whale, cod, haddock, and pollock fisheries, as well as the river fisheries of sturgeon, salmon, shad, bass, and alewives; the mode and time of killing seals; the Indian's seasons and manner of hunting for their furs and peltries; their fishing and fowling; the mode and best season for hunting the moose or orignal, the cariboo, the fallow deer, and every other miscellaneous matter or event that might occur. This work he left to be carried on by a sober and ingenious young man he left there, who was, unfortunately, lost in the "Owen" (with all her crew and passengers) on his return to England eighteen months after."

This comprehensive plan, even though not carried out, entitles Lieut. Owen to a place in the list of naturalists who have worked in New Brunswick, and his name would come next after that of Nicolas Denys, whose natural history of the Maritime Provinces, published at Paris in 1672, is the foundation work for our natural history.

12.—On the Physiography of the Basin of the Mahood (Lepreau) Lakes.

Read April 5th, 1898.

At the head of the Lepreau River lies a chain of small lakes known to a few fishermen but hitherto unvisited by any naturalist. No officer of the Geological Survey has been there, and, aside from a brief mention of them in one geological report, there does not seem to be a single reference to them in all scientific literature. The published maps show them inaccurately in details, and the manuscript plans in the Crown Land Office differ much from one another and from the actual geography. There is perhaps no part of the province so near to settlements which is so little known. Last summer, with three companions, I spent two weeks—July 10th–24th—on the lakes and river, and, although we found little of interest, it is, nevertheless, some satisfaction to know just what kind of a country it is from the scientific standpoint.

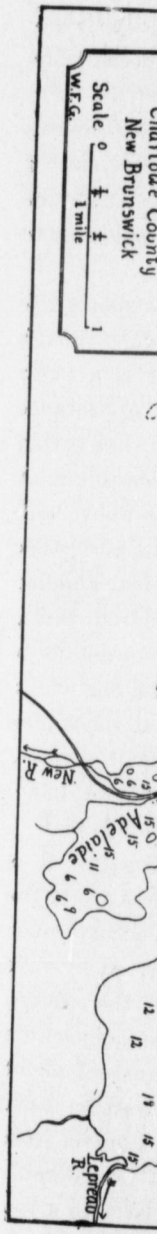
Most of the lakes in this chain were first surveyed and mapped in 1837 by William Mahood, Deputy-Surveyor for Charlotte County. As there is no name in use for them taken collectively, I have ventured to apply Mahood's name to them, to preserve the memory of a worthy man and skilful surveyor, who did more than any other to make known the geography of Charlotte County. His name is already applied on some maps to the lake commonly called Disappointment or Mistake Lake, which, though not shown on the accompanying map, may be considered as belonging to the same series. The names of these lakes were apparently all given by Mahood—Victoria in honor of the young Queen who in that year came to the throne, Adelaide for the Consort of the King who had just died, Ormond in honor of an Irish Earl from near whose seat Mahood had come; while Tomoowa, now obsolete, seems Indian, and is perhaps that of a guide. Long Lake is descriptive, but was not added until after the others, which is true also of Robinson's Pond. Six miles to the southeast, and emptying into the Lepreau, lie two other lakes, now commonly known as the Hurd Lakes, but on the maps called Coronary and Rooskey, and these names also, as the late Mr. Andrew Inches has told me, were given by Mahood in

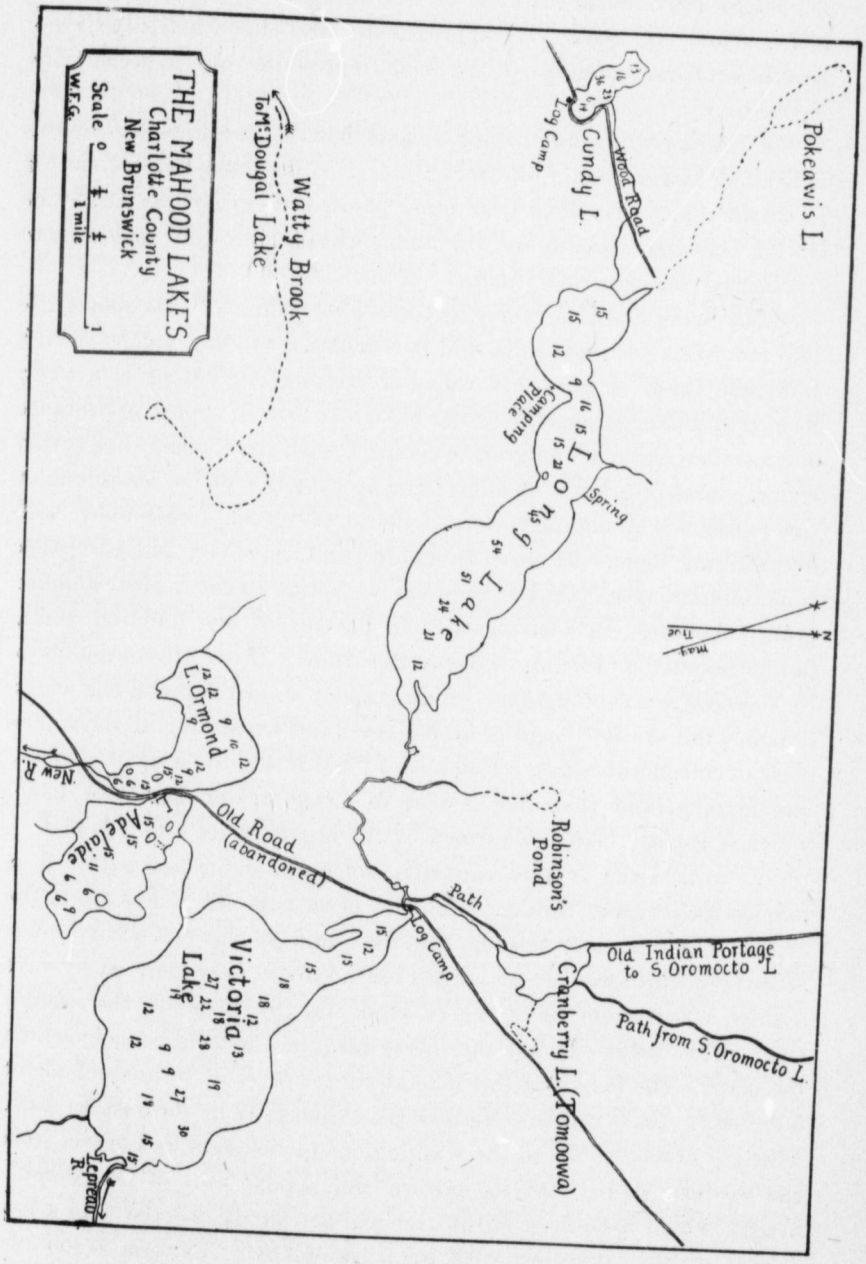
remembrance of those places in Ireland, near which his boyhood had been passed. The accompanying map is based partly on Mahood's original plan, partly upon others, with many corrections based on angles taken by compass by myself. Though still far from accurate, it is yet much nearer the truth than any other of that region known to me. The depths were measured by me.

The Mahood Lakes lie in an undulating country, near the summit of a minor watershed, from 550 to 600 feet above sea level. They drain eastward through the Lepreau, but interlocking with them are streams which flow north, west, and south. The country is built of granite, heavily glaciated, and across it run trains of immense, and often angular, boulders. It is to these trains of boulders that the lakes owe their very existence, for in all cases the outlet is over a dam of this kind, a dam so hard to erode and so impossible to remove that the waters have not been able to cut their way through it. The lakes are all shallow, even the deepest part of Long Lake not exceeding sixty feet. We have here all of the conditions and characteristics of a land of bad drainage. Mr. Chalmers, simply from an inspection of the maps, has described this region with perfect exactness, and I cannot do better than to quote his words, especially since they contain the only printed scientific reference to these lakes :

"The great number of small lakes which dot the surface of the region about the head-waters of the Musquash, Lepreau and New rivers is a somewhat remarkable feature. The region here would seem to be a comparatively undrained one. The small volume of the rivers, their consequent feeble erosive power, and the hardness of the rocks, are such that the rivers have been unable, since the glacial period, to cut channels sufficiently deep to drain off these lakes. These rivers and lakes are therefore in much the same condition as in their early post-glacial history, and will necessarily remain so for a long time owing to the slow wearing processes going on."—(Geological Survey Report, 1890, N, 15.)

The lakes may be reached by a foot-path from South Oromocto Lake, or by an extremely bad wood-road from MacDougal Lake ; and by the latter route we were portaged in with canoes and baggage. Formerly there was a winter road from Lepreau Village to Lake Victoria, but with the passing of lumbering this was abandoned. In 1839 a road, locally called the "Old Magaguadavic" or "Military Road," was surveyed from St. George Village to the Nerepis, and passed among these lakes by the route shown on the map. Its course is shown fully on Wilkinson's map. It was little more than a track through the woods, was soon abandoned, and now not a trace of it remains.




THE MAHOOD LAKES
Charlotte County
New Brunswick
Scale 0 1 mile
W.F.G.
Watty Brook
To Mt. Dougal Lake
Pokeawis L.
Cundy L.
Log Camp
Wood Road
Camping Place
Spring
Lodge
L. Ormond
New R.
Adelaide
Old Road (abandoned)
Path
Log Camp
Victoria Lake
Robinson's Pond
Old Indian Portage to S. Oromocto L.
Path from S. Oromocto L.
Cranberry L. (Tomoowa)
Mag. True
N

Cundy is a small lake amidst dense woods in an undulating country. Its height above mean sea level is, according to my aneroid measurement, about 600 feet. Its approximate size, shape and depths are, like those of the remainder of the chain, represented on the accompanying map.

Of Pokeawis, I know nothing, except that the stream which empties it is much larger than that from Cundy. Like other features dotted in on the map, it is added from other plans, principally one loaned me by Mr. George Barnhill of St. John, who knows this region more intimately than any other man.

Long Lake lies about forty feet lower than Cundy. Its shores rise into low rolling wooded hills, and it occupies a winding valley, though I do not think it is an old valley of erosion, but rather is a basin formed by a dam amongst irregular hills. It has the typical appearance of a northern lake of the granite country, with dark, somewhat turbid water, shores of granite boulders lined up by action of the ice to almost the regularity of masonry, with a dense evergreen forest above and overhanging them. It has one sandy point, however, and altogether is not unattractive. At its lower end it empties amongst great angular granite boulders by a straight, rapid passage of one hundred yards, falling about four feet into a deadwater below. From this outlet down to Victoria is a thoroughfare winding about amidst a heath bog which occupies the shallow basin of an old lake, and expanding at times into pools of considerable size. Robinson's Pond is said to be small, shallow, and marshy, and the same is true of Cranberry or Tomoowa Lake, which is rapidly being overgrown by the bog from its southern end.

Victoria Lake is well known to some St. John people, for it is famous for its trout fishing. For the most part its shores are of the typical boulder sort, but on the west and southwest occurs much attractive white sand beach, which has no doubt been derived by wave and ice action from the ridge of sand and gravel along the western side. This ridge extends out northward in the peninsula shown on the map. The height of this lake above sea level is, by aneroid, about 550 feet*. It is rather a shallow lake, especially in its western part, which is probably due to the washing out of the sand and gravel from the western shore. At its eastern end appear hills of considerable height, which have been burnt over and are partly covered with a low second growth bristling with great rampikes. Victoria is on the boundary between the great burnt country, of which I shall presently speak, and the unburnt country to the westward.

* See the next note of this series

Southwest of Victoria, some forty feet higher and emptying into it, lies Lake Adelaide, a shallow lake with wooded shores. The same description will apply to Ormond, and both are typical of badly-drained granite country. Between Adelaide and Ormond is nothing but a glacial dam of morainic materials only a few yards wide; indeed in places it is hardly wide enough for the road which was once intended to run over it. Yet Ormond stands about thirteen feet higher (thirteen feet ten inches according to Mahood's map) than Adelaide, and drains into New River. The dike between must be composed largely of clay in order to form so efficient a dam. This, however, may not be perfect, for it is said that at the western end of Adelaide, some eighty feet from shore, is a large "bubbling spring," and moreover, that attempts made in the days of lumbering to "flood" Ormond were always unsuccessful. These two facts may be connected, and mean that there is a high-water communication between the two lakes.

From this brief account it will appear that these lakes do not differ in any important character from innumerable others in the granite areas of the province, and they possess no special scientific attractions.

The Lepreau River flows from the eastern end of Lake Victoria, and runs to the eastward eight miles, where it is joined by the North Branch. The country slopes away rapidly in that direction, and is of the roughest granite character, so that the river, in addition to its considerable fall, is constantly obstructed by trains of boulders and ledges which it has been unable to erode away. While it has no marked falls in that interval and very few deadwaters (only two or three), it has innumerable rapids, particularly of the kind over and among boulders. Probably no stream in the province carrying an equal volume of water is so difficult for canoe navigation. It required of us, at a time when the water was fairly high, two long days of the severest labor, with twenty portages by actual count, all along the rough bed of the river, to cover this eight miles to the North Branch. The entire country has been burnt over, and so thoroughly that it can bear no second growth. The very soil has been burnt and washed away, and nothing shows but the bare granite boulders, with scanty moss and an occasional low bush, while the great rampikes show how noble a forest once clothed this land. The view from some of the low hills as one looks eastward is the most desolate it is possible to imagine; to me the Arizona deserts are less forbidding. It is said that this country was burnt shortly after the Saxby gale, which levelled immense quantities of timber, and this gave the fire tremendous power. It

started near Lepreau Village and swept northward and westward. Earlier than that date, a fire started near Musquash and burnt the country to the eastward.

At the North Branch the river turns to the southward and flows twenty miles to the salt water. The river continues to fall much, though with no large falls, until Eagle Mountain is reached. This mountain, which by direct aneroid measurement we made 520 feet above the river at the brook just above it, and about 850 feet above sea level, affords a splendid view in all directions, including especially the burnt country. Here, again, one has forced upon him a conception of the awful power of these great forest fires. The granite hills are not only stripped forever of their covering, but are scorched and bleached. Before one's eyes lies, white and grinning, the very naked skeleton of the land.

Below Eagle Mountain the navigation becomes easier. Just below Squaw Mountain the sharp boundary between burnt and unburnt country is passed, and one comes with joy into the grateful shade of the woods. Here, too, the granite country is left behind, and the character of the river changes. It now runs rapidly, but smoothly, over a gravel bottom, justifying its Indian name of *Wis-e-amk-ay-nis*, or *gravelly river*, and becomes a charming canoe-stream. Its water seems to become clearer the farther it is from the lakes, and it is richer in water-plants than any other stream I have noticed. Its course is broken by three great falls, and one or two minor ones; the former are known, respectively, as Ragged, Big and Little Falls. Ragged and Big Falls are each over eighty feet high, could very easily be dammed, and have immense basins above them in which great quantities of water could be stored. This fact, together with the ease with which water could be stored in abundance among the lakes at the head of the river, is likely to make the Lepreau a valuable river in the time to come when economical transmission of power and increasing cost of fuel will direct attention to natural sources of power. Finally, the river falls over a ledge into salt water at Lepreau Village.

13.—On New Heights in New Brunswick, determined with Aneroid in 1897.

Read April 5th, 1898.

During the summer of 1897 I made, with a good aneroid barometer, a number of measurements for heights above sea-level in New Brunswick. These have been corrected for weather changes by comparison with readings from the barometers of the meteorological stations at

Fredericton and St. John. I wish here to thank Dr. Harrison of the University, and Mr. Hutchinson of St. John for lists which they have supplied to me. Mr. Hutchinson also, on July 9th, determined the error of my aneroid, and this of course has been taken into account in calculating the results below. Many of my readings were taken at times so different from those of the two stations that I have rejected them, and I have kept only those of the five important points here mentioned. In none of the cases admitted did the time between my reading and those of one of the stations exceed twenty-four minutes, except in one of the Mount Pleasant observations, when it was sixty-six minutes, on a very clear day. It will be noticed that in all cases comparison with figures from the Fredericton Station gave results higher than those from the St. John Station. The list of readings from Mr. Hutchinson was reduced to mean sea-level, while those from Fredericton were for a height 164 feet above it; and the constancy of the discrepancy suggests that the height assigned to the Fredericton Station is too great. I do not give all of the figures in detail, since at the best, like most other measurements of this kind which have been made in New Brunswick, they can be but approximations, but I have calculated them carefully and repeatedly, and think there is no error in the figuring. The three places first mentioned have not been measured before:

Surface of Victoria Lake, Charlotte County.—Saturday and Sunday, July 17 and 18.—Two observations compared with Fredericton, 624 and 614 feet; two compared with St. John, 480 and 510 feet; mean of all, 557 feet. This agrees with another measurement made July 10th, which by direct, uncorrected reading made Cundy Lake about 500 feet above the railroad at Bonny River, and hence about 600 feet above mean tide. Cundy is about forty-five feet above Victoria, which thus would be 555 feet above the sea.

Eagle Mountain, Charlotte County (near boundary of Kings).—By direct measurement, July 20, this mountain was 520 feet above the mouth of Eagle Mountain Brook; latter, by comparison with Fredericton, is 334 feet above the sea; hence Eagle Mountain is 854 feet.

Mount Pleasant, Charlotte County.—Aug. 12 and 13.—By comparison with Fredericton, 1,224 feet; with St. John, 1,175; mean, 1,200. Gesner, in his first Geological Report, guessed its height to be 1,300 feet, and Mahood, upon one of his MS. plans in the Crown Land Office, guessed it at 3,000 feet.

Bald Mountain, on the Kings-Queens Boundary.—Aug. 14.—By comparison with Fredericton, 1,494 feet above mean sea-level; by comparison with St. John, 1,430 feet; mean of the two, 1,462 feet. Conditions were particularly favorable, and my observations covered the time of both stations. Gesner, in one of his reports, guessed its height to be 1,120 feet; the Surface Geology map, probably following Gesner, gives it as 1,120 feet; Mr. William Murdoch of St. John, by theodolite angle, has given it to me as 1,390 feet.

Cherry Hill, Harvey.—Sept. 3.—By direct measurement, above the track, 315 feet; by comparison with Fredericton, 884 feet above mean sea-level.

ARTICLE VI.

BATRACHIA OF NEW BRUNSWICK.

By Philip Cox, Ph.D.

Read April 5, 1898.

As the following list records only the writer's personal observations, it must be found to contain fewer species than have hitherto been assigned to the province. He does not believe it includes all our batrachian fauna, though he regardsthe occurrence here of some forms, included in early publications, as extremely doubtful. It is the result of many years' research in various parts of the province, made as reliable as possible, by means of the views and opinions of distinguished specialists, who were always consulted on doubtful matters.

Among the Urodela, *Desmognathus fuscus*, Rafinesque, and *A. opacum*, Gravenhorst, the latter closely related to *A. punctatum*, a common salamander, are both likely to be found. They have a place on old lists.

Of the Anoura, *Rana septentrionalis*, Baird, and *R. cantabrigensis*, Baird, may likely be found in the western part of the province, or in the lake region near the Bay of Fundy.

Amblystomidæ.

Amblystoma punctatum, L. Yellow-spotted Salamander.
Generally distributed, but not abundant.

A. jeffersonianum, Green. Granulated Salamander.
Common in river valleys of the southern parts of the province; rare in the northern.
Oromocto Island, Sunbury Co. Roy McLean Vanwart.

A. jeffersonianum, var. *laterale*, Hallowell.
Occurring with the last; but more abundant, and characteristic of our fauna.

Plethodontidæ.

Plethodon cinereus, Green. Red-backed Salamander.
Same range as *A. jeffersonianum*, but rather rare. Have not collected it on the North Shore.

P. cinereus, var. *erythronotus*, Green. Red-backed Salamander.
Specifically related to the last, but with dorsal stripe very red. Common, and characteristic of our region.

P. glutinosus *(Salamandra glutinosa)*. Green. Blue-spotted Salamander.
Very rare, and only in the southern parts of the province.

Spelerpes bilineatus *(Salamandra bilineata)*. Green.*
Small brook at Curry's Mountain, York Co. Roy McLean Vanwart.

S. bilineatus, var. *borealis*. Baird.
The typical form in New Brunswick.
Valley of the St. John.

DESMOGNATHIDÆ.

Desmognathus ochrophæa, Cope. Painted Salamander.
Oromocto Island, River St. John, *fide* Prof. E. D. Cope. Its first record.
In gratitude to this distinguished naturalist, whose kind heart and facile pen were ever at the service of the humblest plodder, I may be pardoned for quoting from a letter, among the last he ever wrote: "The specimen of *D. ochrophæa* represents a variety with a spotted belly, such as I never saw in the United States."

PLEURODELIDÆ.

Diemyctylus viridescens, Rafinesque. *(Salamandra millepunctata,* Storer*)*.
Spotted Newt.
The most aquatic of our Salamanders. In all suitable lakes and ponds.

D. viridescens, var. *miniatus*, Hallowell.
A smaller, red, finless, and less aquatic variety, always found with the former. Represents, probably, a mere seasonal phase.

BUFONIDÆ.

Bufo lentiginosus americanus, LeConte. Toad.
Very common and variable. A more extended and careful examination may show the occurrence here of at least two sub-species.

HYLIDÆ.

Hyla pickeringii, Storer. Tree-Frog.
Found everywhere.

H. versicolor, LeConte. Tree-Frog.
Seems to be rare. Have heard its note in several parts of the province, but seen only one specimen, collected in Gloucester County, and now in the museum of the Miramichi Nat. Science Association, Chatham, N.B.

RANIDÆ.

Rana virescens *(Rana halecina)*, Kalm. Green Frog.
Generally distributed over the province.

* Striped-back Salamander.

R. virescens brachycephala, Cope. Green Frog.
A short-headed and stouter form; the dominant type in New Brunswick.

R. palustris, LeConte. Marsh Frog.
In the southern part of the province; not common. Have not met with it in the four northern counties.

R. catesbiana, Shaw. Bull-Frog.
All over the province, but local. The most aquatic of our frogs.

R. fontinalis, LeConte. Spring-Frog.
Generally distributed; varies greatly. In *fontinalis* I recognize a stout, pustular form, the prevailing type in the northern counties.

R. fontinalis nigricans, Agassiz. Spring-Frog.
A small, black variety, or sub-species met with in rocky brooks. Noonan Brook, Sunbury Co.

R. fontinalis clamitans, Holbrook. Spring-Frog.
A long-legged, slender, less webbed and less aquatic variety, which I have collected only in the St. John valley. Mr. C. F. B. Rowe has taken specimens in the vicinity of St. John.

R. silvatica, LeConte. Wood-Frog.
Occurs generally, but not abundant. [Mr. C. F. B. Rowe has noted that this species spawns several weeks earlier than other frogs.—ED.]

APPENDIX.

REPORT ON THE SUMMER CAMP AT QUACO.

Held July 1-10, 1897.

In past years the Society has held Summer Camps at different points of scientific interest in the province, the object being twofold — (1) to enable members to acquire experience in field work, (2) to stimulate, in the localities visited, an interest in the study of nature.

In July last a camp was held at Quaco, this village having been selected as presenting a number of advantages for our purposes. About thirty persons attended, and in every way the camp was a success. The residents of Quaco attended the evening lectures, and a strong interest was aroused in our work. Lectures were given by President G. U. Hay, Dr. G. F. Matthew, Prof. L. W. Bailey, Prof. A. W. Duff, and Dr. W. F. Ganong. Field work was carried on daily under the different leaders, and many important observations were made on the geology, physiography, and botany of the surrounding region.

Professor Bailey and Dr. Matthew led the geological parties, President Hay and Dr. Ganong had charge of the botanists, and Professor Duff carried on tidal observations in the harbor. Messrs. Berton and Rowe made a collection of the small mammals, reptiles and batrachians. The camp was under the management of the Secretary of the Society, Percy G. Hall, and valuable local assistance was rendered by our resident members — Dr. Gilmour and Geo. J. Trueman.

Report on the Geological Data obtained at Quaco — Summer Camp of 1897.

By Dr. Geo. F. Matthew.

The fine exposures along the coast at Quaco in sea-cliffs of varying height, give excellent opportunities for studying the geology of that district. Here only, in all New Brunswick, is there a formation of the Mesozoic, or Reptilian Age, of sufficient extent and thickness to represent in any adequate degree the strata of vast extent in many regions of the earth, which tell the story of this important portion of the world's past history.

Heretofore there has been recognized at Quaco only two members of the Mesozoic system, viz., the bright red sandstones, so conspicuous on numerous cliffs along the coast, and the overlying pebble beds. A third member of this system, probably as important in volume and thickness as the two lower ones together, was recognized in our excursions along the eastern part of the shore. This member is so like the Lower Carboniferous rocks that it has heretofore been confounded with them. The proofs that it is Mesozoic are the following: 1. Its lowest bed are found to graduate by alternation of measures into the pebbly member of the heretofore recognized New Red Sandstone 2. Its conglomerates are full of rounded fragments of dark-red shale, which in this district can have no other source than the Lower Carboniferous rocks. 3. The plant remains found in its grey sandstone layers (though poorly preserved), by the flabellate leaves with stout petioles, and the leathery strap-shaped leaves that are found, as well as by the absence of Sigillaria, Lipidodendron, and Calamites, appear to be a Mesozoic assemblage, and certainly are not of the ordinary Carboniferous type.

This upper member of the Red Sandstone series holds the shore from Melvin's Beach to Fown's Beach; it also appears on the shore at Berry's Beach, beyond which in going westward it passes inland; and it has a considerable width behind Quaco Village.

Our party visited the intrusive trap and manganese deposits at Quaco Head. The trap has forced its way through the red sandstones, partially altering it and discharging the red color from the sandstone for some distance from the line of contact; the trap also becomes fine grained and loses its feldspar crystals near the contact with the sandstone.

The shores at Quaco and the surface deposits there abound with pebbles derived from the pre-Cambrian volcanic rocks of the hills inland. There is the greater profusion of these because the great pebble beds of the middle member of the Mesozoic or Red Sandstone system abound with fragments from this source. At Vaughan's Creek (McComber's Beach) the pebbles of the conglomerate are mostly of purple quartzite and felsite, sometimes without any admixture of sand, so that when the calcareous cement which holds them in place weathers away, they fall to the beach in great numbers, and repeat in modern times their accumulation as beach-shingle in the Mesozoic Age.

Tidal Phenomena at Quaco.

By Prof. A. Wilmer Duff.

The point that the writer was chiefly interested in was the occurrence of those somewhat puzzling phenomena called "secondary undulations." Anyone who examines the record of the Kelvin Tidal Gauge at St. John will find that it gives a wave-shaped curve, the heights of which correspond with the time of high water and the hollows with the time of low water; but, in addition, he will discover that on this main curve there are smaller indentations, indicating minor risings and fallings of water level, the whole time from greatest of these minor undulations to the next greatest rise being, on an average, about forty minutes. These small and comparatively rapid oscillations of level are the so-called "secondary undulations," and the time of forty minutes required for them to complete their cycle of changes of level is called their period.

The author had already shown* that these secondary undulations could be explained as due to a long, slow oscillation of the whole body of water between the New Brunswick and the Nova Scotia coast, the vibrations being similar to these that are set up in a wash-basin full of water when it is disturbed. It became, then, an interesting point to determine whether the rest of the body of water in the bay partook of this same general motion, and whether the period was the same as at St. John. The author fully expected that it would be.

With this in view, the tide gauge described in a former communication† to the Society was used at Quaco. On three different days the gauge gave clear records of "secondary undulations;" but, contrary to his expectations, the period in all cases was $12\frac{1}{2}$ minutes. This was a somewhat puzzling result, until it occurred to the writer to examine the chart of the bay off the New Brunswick coast in the neighborhood of Quaco, when he found that the presence of a reef called the Quaco Ledges, and the two headlands that project into the bay above and below Quaco, respectively, marked out a smaller bay (open, it is true, to the east), in which the water would naturally oscillate in a period of its own, determined by its own dimensions. From the smallness of its dimensions these oscillations might be expected to be much quicker than those across the bay at St. John, although the irregularity in shape of this small bay precludes any attempt to calculate mathematically what the period of the oscillations of the water in it would be.

*See American Journal of Science, Vol. III, No. 17, 1897.

†See Bulletin XV of the Natural History Society of N. B., 1897.

The author has thus been led to the view that a large body of water such as the Bay of Fundy is broken up into smaller areas of oscillations, each having its own characteristic period as determined by its dimensions. In a part of the bay where there is a comparatively free, unobstructed sweep from side to side, as between the general contour of the New Brunswick coast at St. John and that of the opposite Nova Scotia coast, the period of oscillation would be that of the whole bay, or perhaps half that dimension, since such a large body of water might have itself a tendency to divide up into two halves, each oscillating in half the period that the whole would take if set into free swingings to and fro.

The author hopes on future occasions to explore other parts of the bay in the same way, with a view to confirming or refuting this hypothesis.

It should be noted that the point here considered is merely the cause of the periods characteristic of these motions. How the motions themselves originate, what causes the initial disturbance, is a different question. The difference is similar to the difference between the enquiry, What disturbs a wash-bowl, and, the other enquiry, what determines the rate at which the water "wish-washes" when disturbed? It can, however, hardly be doubted, I think, that the first disturbance in the bay comes from the action of wind in a storm, since an examination of many cases of "secondary undulation" at St. John and at Quaco seems to show that they are only prominent when the sea has been disturbed by a gale. Thus there need be none of the mystery as to the origin of "secondary undulations" which some writers delight in attributing to them.

Report on the Botany of the Summer Camp.

By G. U. Hay.

During the ten days that the Society was at work at Quaco and vicinity, several botanical excursions were made about the village, and one to Salmon River. There was much interest manifested in these excursions and in the lectures given in the evenings, one by Dr. W. F. Ganong, and the other by Mr. G. U. Hay. Many smaller gatherings were also held for the study and analysis of plants, in which many of the young people of Quaco took part. The examination of the beach in front of the village revealed an absence of plant and animal forms that might be expected to occur here. The two common forms of

Fuci—F. Vesiculosus and *F. Nodosus*— were common. *Corallina officinalis* was quite abundant in pools, with several species of *Ulva*. On the adjacent cliffs of West Quaco, clumps of the brilliant *Sedum Rhodiola*, with patches of *Ligusticum Scoticum*, form a pleasing contrast to the dark back-ground of trap rock. In the salt marshes above the limit of the tide the vegetation was more varied and abundant. *Atriplex hastata*, *Salsola kali*, *Statice limonium*, *Carex paniculata*, *Carex norvdegica*, *Carex maritima*, *Comandra livida*, *Glaux maritima*, and other forms common to such a habitat, were observed. Further up from the shore were *Kalmia glauca* in great abuundance, *Cypripedium acaule*, *Andromedra polyfolia*, etc., and the honeysuckle, *Lonicera involucrata*, its first recorded appearance in the southern part of the province.

The visit to Salmon River did not result in the discovery of any rare species of plants. This river, with its narrow gorge and lofty hills on each side, reminds one strongly of the Restigouche.

At Greer Settlement, five miles from Quaco, the beautiful *Cypripedium spectabile* was found in great abundance, and on the roadside near by a few groups of *Scrophularia nodosa*, its first recorded appearance in this province. This plant belongs to Southern New England and the Middle States. It was thriving well here, but whence or how it came no one in the vicinity could tell. The abundance of the showy blossoms of the *Cypripedium* made our lecture hall during the remainder of our stay a place of beauty, from the presence of this orchid of tropical-like richness of color.

A visit to the ravine near Rourke's River, during the half-day previous to our departure, was one of the most pleasant outings that the botanists enjoyed. Amid the sandstones and calcareous slates, there was growing, in the greatest profusion, *Cystopteris bulbifera*, *Cystopteris fragilis*, and other ferns ; *Geranium Robertianum* in great luxuriance, *Habenaria rotundifolia*, *Equisetum scirpoides*, etc.; and on a hill near by one specimen of *Echium vulgare*.

Zoology.

The beaches at Quaco show little animal life, and that only of the very commonest forms. There are few tide-pools, and these are rather barren.

Several hauls of the dredge were made in Quaco Bay, but with disappointing results. A few dead shells and two or three living forms

of the commonest species were brought up from muddy bottoms. The conditions off Quaco are not at all favorable to an abundance of animal life, which clusters rather about sheltered passages where gentle tidal currents sweep constantly through.—[W. F. G.]

Origin of the Name Quaco.

By Dr. W. F. Ganong.

There is no real doubt as to the origin of this word. By the Micmacs it was, and is, called *Gool-wah-gah-kek* (the first *g* very obscure and easily missed), from *Goolwaakw*, the hooded seal, with the locative, *ek*. Hence the word means, "Place of the hooded seal." It first occurs on the Franquelin-DeMeulles map of 1686 in the form *Ariquaki*, which, allowing for the French sounds, for the omission of the obscure preliminary *g*, for the replacement of the *l* by *r*, as was invariable with the French, and for the omission, common on French maps, of the final *k*, is plainly from the Indian word. It next appears on Blackmore's map of 1712 as *Roquaque*, of which the relation to the French form is plain, and later plans have *Oreequaco*. Finally, on a plan of 1762, it first occurs in its present form. Several other explanations of the word have been given, but in no case has any evidence been adduced in their support. The history of the word is traced with greater fulness in the Transactions of the Royal Society of Canada (new series), Vol. II, section ii, page 264, and in a letter in the St. John Daily Telegraph, Nov. 16, 1896.

Another word, in the same vicinity, of great interest is *Point St. Tooley*, applied locally, though on no chart, to the eastern headland of Quaco Bay. This is probably a survival, and English corruption, of Point St. Louis, given by Champlain in 1604. Champlain named a river at Quaco (probably Vaughan's Creek), *Riviere de St. Louis*, and it seems probable, though there is no proof of it, that this name became extended to the cape, and was passed along by the French and New England pilots down to the present.

REPORT ON ZOOLOGY.

The Committee beg to submit the following notes. Dr. Cox has prepared a list of the Batrachians of the province, which will be found in another part of this bulletin. Several inquiries have been made for a list of our insects, and the Committee hope to have a list of our Butterflies and Hawk Moths prepared in time for publication in the next bulletin. Dr. Cox has kindly furnished the notes on fishes for this report.

Additions to the List of New Brunswick Fishes.

(For Catalogue, see Bulletin XIII, 1896.)

Siphostoma fuscum (Storer). Jordan and Gilbert. Common Pipe-fish.
A single specimen taken in a smelt bag-net in Miramichi Bay, February, 1898, and donated to the museum of the Mir. Nat. Hist. Association.

Atherina notata, Mitchell. Silverside.
Abundant around the shores and islands of Mir. Bay in mid-summer.

Aspidophoroides monopterygius (Bloch). Storer. Alligator-fish.
One found among smelts in a net in Mir. Bay, Feb., 1898, and donated to museum of Mir. Nat. Hist. Association.

Phycis tenuis, Mitchell. White Hake.
Not uncommon in Mir. Bay in early part of winter.

Pleuronectes glaber, Storer. Smooth Flounder.
Miramichi Bay and Bay des Chaleurs, but not abundant.

Birds.

The numbers refer to the list of birds printed in Bulletin 1, 1883.

Section A.

(Species which occur in St. John and Kings Counties.)

6. Bluebird (Sialia Sialis). Only three authentic instances of occurrence in the province said to be known.

Note.—A female collected by M. G. B. Henderson on October 20th, 1897, on Loch Lomond road, about four miles from this city. Several seen.

76. Rusty Blackbird (Scoleophagus Carolinus). A male collected on April 2nd, 1898, by A. Gordon Leavitt.

101. Red-headed Woodpecker (Melanerpes Erythrocephalus). Only reported from "Garnett's."

Note.—A male collected at Little Lepreau on June 5th, 1897, by G. L. Hanson.

114.—American Hawk-owl (Surnia Ulula Caparoch). Given as rare, and none reported for this immediate vicinity.

NOTE.—A female collected by Byron Lingley at Lily Lake on November 24th, 1894. Also a female collected at Little Lepreau by G. L. Hanson on January 29th, 1896.

136. Black-crowned Night Heron (Nycticorax nycticorax Naevius). Only a few observed near St. John.

NOTE.—Male collected at Little River, October 24th, 1895: two males on September 5th, 1896, by M. G. B. Henderson; and a female, at same place, on September 7th, 1896, by Wm. Hare.

197. Ruddy Duck (Erismatura rubida). Only two instances of its occurrence known.

NOTE.—A. Gordon Leavitt has a pair, male and female, in the same plumage (brown and grey), which were brought to him by a farmer living near Quaco. They were shot on October 23rd, 1893.

SECTION B.

(Species which have not been observed in St. John or King Counties, but which occur in other parts of the Province.)

227. American Titlark (Anthus Pensilvanicus). On Red Head marsh, on October 9th, 1897, A. Gordon Leavitt collected a female, and on the same day, at the same place, Walter Harrison collected two females.

Lincoln's Sparrow *(Melospiza Lincolni)*. A specimen taken in June, 1897, at Scotch Lake, York County, by W. H. Moore. Mr. Moore also observed two Shore Larks at Macnaquack, February 26th, 1898, and at Scotch Lake, on March 5th, 1898, the White-winged Crossbill.

MAMMALS.

Mr. Geo. W. Bailey reports a specimen of the Grey Squirrel *(Sciurus carolinensis)*, taken in York County. Not before observed, except in Charlotte and Carleton Counties.

A. GORDON LEAVITT.
WILLIAM McINTOSH.
CHAS. F. B. ROWE.
Zoological Committee.

Report of the Botanical Committee.

The following are the names (printed in full-faced type) of new plants added to our provincial flora during the past year, and new localities for some rare plants :

89. **Stellaria borealis,** Bigel. Salt Springs, near Sussex. Dr. W. F. Ganong.
91. Arenaria peploides, L. Portage Island, Miramichi. Dr. Cox.
273. Lonicera involucrata, Banks. Quaco. Hay.
366. *a* **Hieraceum pilosella,** L. Charlo, and Eel River, Restigouche. Dr. Cox.
436. *a* **Sabbatia chloroides,** Pursh. St. John. Miss A. R. Warner.
457. *a* **Schrophularia nodosa,** L. Greer Settlement, near Quaco. Hay.
513. *a* **Chenopodium Bonus-Henricus,** L. Chatham. Dr. Cox.
901. Pellæa gracilis, Hook. Loch Lomond, St. John Co. R. B. Gilmour.
902. *a* **Asplenium trichomanes,** L. Loch Lomond, St. John Co. R. B. Gilmour.

G. U. HAY,
Chairman Botanical Committee.

Bibliography of Scientific Publications Relating to the Province of New Brunswick, other than those contained in the Bulletin of the Society, 1898.

By Samuel W. Kain.

Lists similar to the one here given will be found in Bulletins XIII–XV. They contain titles from 1890 to June, 1897. The present list contains titles from July, 1897, to June 1898, with a few omitted from previous lists.

Geology.

Bailey, Prof. L. W.—The Bay of Fundy Trough in American Geological History.
Trans. Royal Soc. Canada, 2nd series, Vol. III, Sec. IV, pp. 107–116, 1897.

Belding, A. M.—Bog Manganese in Albert County.
St. John *Daily Sun*, December 25th, 1897.
(Pub. Anon.)

Dawson, Sir J. W.—On the Genus Lepidophloios.
Trans. Royal Soc. Canada, 2nd series, Vol. III, Sec. IV, pp. 57–78, 14 pl., 1897.

Matthew, George F.—The Rockwood Bog. (Abstract.)
St. John *Daily Sun*, November 4, 1897.

Studies in Cambrian Faunas:

Part I. On a new sub-fauna of the Paradoxides Beds of the St. John Group.

Part II. Billing's Primordial Fossils of Vermont and Labrador.
Trans. Roy. Soc. Can., 2nd series, Vol. III, Sec. IV, p. 175, 4 pl., 1897.

Mickwitz, August.—Uber Die Brachiopodengattung Obolus. *Eichwald.*
Memoirs Imp. Acad. Sciences, St. Petersburg, 8th series, No. 2, pp. 21-22, 1896.
(Describes fossil shells from Caton's Island, and reviews Dr. G. F. Matthew's studies on the genus Botsfordia.)

Trueman, Howard—Reclaiming the Misseguash Marsh.
St. John *Daily Sun*, December 29, 1897.
(Pub. Anon.)

Whittle, Charles Livy—The Beach Phenomena at Quaco, New Brunswick.
Am. Geologist, Vol. VII, pp. 183-187, 1891.
(Omitted from list in Bulletin XIII)

Genesis of the Manganese Deposits at Quaco, New Brunswick.
Boston Soc. Nat. Hist.. Proc., Vol. XXV, pp. 253-258, 1891.
(Omitted from list in Bulletin XIII.)

Meteorology.

Kain, Samuel W.—Thunderstorms in New Brunswick, 1897.
U. S. Weather Review, Vol. XXVI, pp. 105-106, March, 1898.

McLaughlin, W. B.—Remarkable Sounds heard along our Southern Coast.
St. Croix Courier, March 31st, 1898.
Also *U. S. Weather Review*, Vol. XXVI, April, 1898.

Botany.

Ganong, W. F.—On Raised Peat Bogs in the Province of New Brunswick.
Trans. Royal Soc. Canada, 2nd series, Vol. III, Sec. IV, pp. 131-163, 1897.

Vroom, James—Trees and Forests.
St. John *Daily Sun*, August 2, 1897.

Zoology.

Hall, Ansley—The Herring Industry of the Passamaquoddy Region, Maine.
U. S. Fish Com. Report, 1896. pp. 443-447, map, 1898.

Moore, H. F.—Observations on the Herring and Herring Fisheries of the Northeast Coast, with special reference to the vicinity of Passamaquoddy Bay.
Ibid., pp. 387-442, pl. 1, map, 1898.

Perkins, Henry F.—Notes on the Turtles of New Brunswick.
St. John *Daily Sun*, February 5th, 1898.

METEOROLOGICAL ABSTRACT FOR 1897.

Observations recorded at St. John Observatory. Latitude, 45° 17'; Longitude, 66° 4'.
D. L. Hutchinson, Director.

Barometer.	Temperature.	Wind Direction and Ve

METEOROLOGICAL ABSTRACT FOR 1897.

OBSERVATIONS RECORDED AT ST. JOHN OBSERVATORY. LATITUDE, 45° 17′; LONGITUDE, 66° 4′.

D. L. HUTCHINSON, Director.

	BAROMETER.			TEMPERATURE.			Cloudiness: 0 = Clear. 10 = wholly clouded.	Precipitation Rain and Melted Snow.	WIND DIRECTION AND VELOCITY.																				Thunder Storms.
	Mean.	Highest.	Lowest.	Mean.	Maximum.	Minimum.			N.		N. E.		E.		S. E.		S.		S. W.		W.		N. W.		Calms	TOTAL MILES.	
									Hours.	Miles.	Hours.	Miles.	Hours.	Miles.	Hours.	Miles.	Hours.	Miles.	Hours.	Miles	Hours.	Miles.	Hours.	Miles.			
January	30.00	30.86	29.11	19.7	32.5	—13.5	5	3.94	65	645	109	1087	12	204	61	1470	25	347	95	1115	154	2026	190	2789	33	9,683	0
February	30.03	80.55	29.60	21.6	41.5	— 1.5	5	1.08	64	546	62	745	50	503	28	398	16	196	38	395	62	597	320	4073	32	7,383	0
March	30.00	30.92	29 10	29.1	46 5	— 8.5	6	5.99	50	338	74	646	59	343	73	902	77	713	62	812	49	510	270	42.6	30	8,480	0
April	30.04	30.65	29.48	38.4	62	15.5	7	3.82	50	506	107	1152	50	310	56	404	126	1118	95	1362	102	1326	77	1099	57	7,277	0
May	29 98	30.37	29.69	49.4	64.7	28.5	7	9.95	65	502	140	1432	36	193	78	443	197	1495	64	869	8	45	54	643	10 2	5,622	1
June	29 91	30.38	29.47	55.6	73 5	42	6	3.76	41	181	100	819	46	269	73	616	146	885	70	1018	28	117	133	1210	83	5,115	4
July	30.05	30.41	29 68	60.6	78.8	47.3	7	2.73	42	264	62	541	41	253	93	575	310	1823	70	841	1	6	25	237	100	4.540	2
August	29 96	30.13	29.63	61.7	76.5	48	5	3 88	61	357	30	201	45	480	69	533	183	1177	128	1395	56	564	67	616	105	5,123	6
September	30 01	30 39	29 61	55 1	84 2	26.7	5	1.39	58	323	31	147	47	226	23	90	83	443	116	1221	30	137	241	3586	91	6 173	0
October	30.13	30 65	29 42	46.8	68.8	26	4	3,50	69	468	38	281	16	49	32	356	94	817	176	1720	33	236	210	3396	76	7,323	0
November	29.99	30.70	29.87	35.2	54.5	7.5	7	6 87	30	208	105	803	14	147	58	1091	23	383	111	3.86	26	228	319	5136	34	10,282	0
December	30.01	30.66	29.20	26.7	53.5	2.5	6	3 56	78	527	27	281	11	57	49	I002	32	542	96	1316	68	544	298	4400	75	8,669	0

Barometer readings are reduced to sea level and 32° Fahr. The – sign indicates temperature below zero. The maximum temperature, 84.2, was registered on the 6th of September; the minimum temperature, —13.5, on the 19th of January.

MEAN SEA LEVEL AT ST. JOHN.

(Abstract of paper by E. T. P. Shewen, C.E.; read March 1st, 1898.)

The determination of mean sea level at St. John furnishes a fixed datum from which to calculate tidal fluctuations, besides elevations for geological, geodetic, and physiographic studies.

Last year this determination was made from an analysis of two years of tidal observations, recorded by the Thomson gauge at Reed's Point, covering the period between April 1894, and May 1896. The gauge is in charge of Mr. D. L. Hutchinson of the St. John Observatory; and the records obtained have been carefully reduced to datum by Mr. W. Bell Dawson, Engineer in charge of the Tidal Survey. The resulting values of mean sea level, and of high and low water, ordinary spring tides, have been referred to a bench mark cut for the purpose on the southeast corner of the Custom House. (See Bull. N. H. S. of N. B., No. XIII, p. 109.)

Mean sea level is 41.65 feet below the bench mark, or 12.67 feet below high water ordinary spring tides, the range being 25.33 feet.

City Levels.—City levels are taken from forty feet below assumed (extreme) high water. The elevation of any point above mean sea level is the reduced level, according to city datum, minus 25.49 feet.

Intercolonial Railway Levels (St. John to Shediac).—The elevation of any point above mean sea level is the reduced level, according to I. C. R. datum, minus 86.95 feet.

EUROPEAN AND NORTH AMERICAN RAILWAY DATUM (NOW I. C. R.)

	Feet.
High water spring tides, St. John (Bay of Fundy)	100.00
Mill street	104.95
The Marsh	102
Lawlor's Lake	162
Rothesay (9 miles from St. John)	107
Hampton (22 " " "	117
Sussex (44 " " "	155.53
Penobsquis (51 " " "	154
Moncton Station (89 " " "	136.74
Sackville (128 " " "	116.25
Shediac Wharf, rail level (Northumberland Strait)	93.30
High water, Shediac (108 miles from St. John)	89.30

A detailed statement of levels from St. John to Shediac is given in Report of the Railway Commissioners of New Brunswick, 1859, pp. 84–88.

Mr. A. L. Light, Chief Engineer of the European & North American Railway, reported, on the 2nd Feb., 1859: "It will be observed that the level of the rails on Shediac wharf is 6.70 below high water at St. John, and the level of high tide at the latter place is 10.70 feet above that at Shediac Harbour."

On the close of the exploratory survey for the Intercolonial Railway, made in 1864, Sandford Fleming reports that the various levels were found to be relatively as follows:

First Datum.

Restigouche to Green River; then to Toledi and Rimouski waters; thence to River Trois Pistoles; also from the Restigouche to the Tobique; thence to Nashwaak and to Keswick Summit — said to be high water on the Miramichi..... 84.81

Second Datum.

From a point five miles up Keswick valley to Keswick Summit; also from the same point past Fredericton to Little River..... 101.81

Third Datum.

On this datum levels were carried from Little River to Coal Creek..... 58.08

EUROPEAN AND NORTH AMERICAN (NOW I. C. R.) RAILWAY DATUM.

Fourth Datum.

Said to be 100 feet under high water on Bay of Fundy, at St. John City, 0.00

The datum for Nova Scotia is low water at Parrsboro, on the Basin of Minas.

The datum for the Matapedia survey is high water above Campbellton on Bay Chaleur, and on the River St. Lawrence at St. Flavie.

High water, River St. Lawrence, at Trois Pistoles..... 70.00

THIRTY-SIXTH ANNUAL REPORT OF THE COUNCIL

OF THE

NATURAL HISTORY SOCIETY

OF

NEW BRUNSWICK.

The Council of the Natural History Society beg leave to submit the following report for the year now ending:

Membership.

A very satisfactory increase has taken place in the membership, to which we note the following additions:

Ordinary	12
Associate	24
Corresponding	1
	37

Finance.

The Treasurer makes the following statement:

Receipts.

Balance from 1897	$ 6 44
Membership fees	140 07
Investment, interest on	144 00
Proceeds of lecture by Prof. Bailey	14 50
Bulletins sold	19 90
Dividend from Botsford estate	10 00
Donations	11 00
Government grant	125 00
	$470 91

Expenditures.

Balance on Bulletin XIV	$ 88 75
Printing and distributing Bulletin XV	183 37
Maintenance of Museum	88 60
Expense Camp for field work at Quaco	27 99
Miscellaneous (expressage, labor, postage, etc	50 64
Balance on hand	31 56
	$470 91

Library.

The rapid expansion of the library has necessitated some changes in arranging for space to accommodate the books we now have, and at the same time allow for future additions.

Among important accessions we notice Geological Reports on New Brunswick (complete set), written by Dr. A. Gesner, presented by Henry F. Perley, and the Journal of the Royal Geographical Society, which we obtain in exchange for our bulletin.

Publications.

Bulletin XV was issued in June last. It contains valuable articles by Dr. Geo. F. Matthew, Professor A. Wilmer Duff, and Dr. W. D. Matthew. As this number concludes Volume III, it is furnished with an index.

Bulletin III (1884) has long been out of print, and the Society has been unable to supply copies to numerous applicants. We are glad to be able to announce that, by the enterprise of one of our members, this number has been reprinted without any expens to the Society.

A number of the shorter papers read before the Society have been published in the daily papers.

Lectures and Essays.

Nine regular meetings were held, at which papers were read as follows:

Feb'y 2. Tidal Phenomena of the St. John River at Low Summer Level, by Prof. A. Wilmer Duff. (Pub. in Bulletin XV.)

March 2. Address on Peat-Bogs, by Dr. Geo. F. Matthew.
Note "Upon the Colour of the Waters in New Brunswick Rivers," by Prof. W. F. Ganong.

April 6. Note "Upon the Heights of New Brunswick," by Prof. W. F. Ganong.
Address on the Geological Features of Quaco, by Dr. Geo. F. Matthew.
The Relations of France to Newfoundland, by H. Geo. Addy, M.D.

May 4. Address on "A New Palæozoic Insect, with Notes on the Fauna in which it Occurs," by Dr. Geo. F. Matthew. (Pub. in Bulletin XV.)
"Some Probable Jesuit Influences Upon our North-Eastern Flora," by Prof. M. L. Fernald.

June 1. "The Indian Potato; What was It?" by Rev. W. O. Raymond.
"Trees and Forests," by James Vroom.

Oct. 4. Reports on the work of the Quaco Camp, by President Hay, Dr. Matthew, and Percy G. Hall.

Nov. 2. Address on the History of Rockwood Bog, by Dr. Geo. F. Matthew.

Dec. 7. "Notes on a Wild Garden," by Geo. U. Hay.
Note "Upon the Manner in which the Bay of Fundy Rivers of New Brunswick empty into the Sea," by Prof. W. F. Ganong.

Jan'y 4. "Niagara," by Prof. L. W. Bailey.
Canadian Earthquakes in 1897, by Samuel W. Kain.

In addition to the above, an elementary series of lectures was delivered, viz.:

London Museums; Geology from a Railway Train; Peat-Bogs — three lectures by Dr. Geo. F. Matthew.

*Philosophy of Art — Dr. D. R. Moore.

Upon Trinidad and the Customs of Its People — J. V. Ellis, Jr.

Pre-Historic American Pottery — S. W. Kain.

Anatomical Features of Birds; Plumage of Birds; Observation, Collecting, and Mounting — three lectures by A. Gordon Leavitt.

Invertebrates.

The Chairman of this Committee reports that the entire collection of insects has been re-mounted and re-arranged by Mr. Wm. McIntosh. He has also added some 500 specimens, which, with about 200 specimens presented by Mr. Philip McIntosh and Mrs. S. B. McPherson, constitute the most important accession of the year.

Archæology.

But little work has been done in this department. A circular has been received from Prof. Penhallow asking the co-operation of the Society in a scheme having for its object the collection of information relative to the ethnography of Canada. The Committee hope to aid in this work when definite plans have been arranged by the promoters.

Museum.

The museum has been open to the public, as usual, on Tuesday evenings and Saturday afternoons, and, as the register shows, has attracted many visitors. The rooms underwent a thorough cleaning in October, but constant attention is required to keep them in good condition.

Botany.

The Committee on Botany record a few plants found new to the province. A list of these will be found on page 75.

Geology.

The report of the Chairman of the Geological Committee deals at some length with the work at Quaco (in connection with the Summer Camp), where a third member of the Mesozoic system, the presence of which has not been before noticed, was recognized by Dr. Matthew.

*Published in pamphlet of 23 pp., 1897; reviewed in Pop. Sci. Monthly, Oct., 1897.

General.

A movement, originating, we need scarcely say, in the minds of the Associate Members, is now on foot to open the rooms to the public three afternoons in the week. They propose to employ a lady librarian and curator, who will place and keep the museum in good order, and catalogue and re-arrange the library, under the direction of the regular officers of those departments. The necessary funds will be obtained by enlarging the membership and by special donations.

A programme of the winter's work has been distributed, and exhibits a new departure—that of laboratory work—which we think will prove both interesting and profitable.

We desire to remind you that a building fund has been established by one of our members; and we trust that further donations will soon be forthcoming; for we must remain alive to the fact that the space at our disposal is quite inadequate to our purpose, and that our collections, being unsafely housed, must, in case of fire, be entirely destroyed. Let us hope that our new building is not so very far in the future.

The Summer Camp of July last was, perhaps, the most enjoyable in the history of the Society. The trustees of the St. Martins Seminary very courteously placed their large building at our disposal, and we found ourselves in comfortable quarters, provided with excellent facilities for class-work and lectures, and centrally and pleasantly situated. Amongst those who attended we may mention Prof. L. W. Bailey, Dr. Geo. F. Matthew, President G. U. Hay, Prof. W. F. Ganong, and Prof. A. Wilmer Duff.

To the press of St. John we owe our best thanks for the free publication of notices and reports of meetings, and of articles of much greater length; and also to the gentlemen who contributed to the lectures and essay series during the year.

While on reviewing the past year we do not find so many remarkable features as in its predecessor, yet we feel quite justified in considering it one of more than average excellence. It witnessed a large addition to the membership, a most successful Summer Camp, considerable accession to the museum and library, the issue of a large bulletin, and, finally, the appointment of a permanent assistant librarian and curator. We feel confident that the ensuing year will be equally active and equally prosperous.

Respectfully submitted.

PERCY G. HALL,
Secretary.

REPORT OF THE FREDERICTON NATURAL HISTORY SOCIETY.

(Instituted February 2nd, 1895.)

The Fredericton Natural History Society, of which L. W. Bailey, Ph.D., LL.D., is President, held nine regular meetings during the year ending 20th February, 1898, at which the following papers were read :

1897.

Mar. 15. "The Geology of England from a Railway Train," by Dr. G. F. Matthew.

April 19. "The Body-Covering of Animals," by Dr. L. W. Bailey.

May 17. "The Bony Framework of the Human Body," by H. H. Hagerman, B.A.

May 27. "The Forms, Sizes, and other Characteristics of Flowers," by Prof. W. F. Ganong.

Oct. 18. "Niagara," by Dr. Bailey.

Nov. 22. "The Face of the Earth," by Dr. Bailey.

Dec. 13. "The Botany of the Restigouche," by G. U. Hay, M.A.

1898.

Jan'y 17. "Rocks, and What They Tell Us," by Dr. Bailey.

Feb'y 21. "Rock Ruins," by Dr. Bailey.

Through the efforts of members of the Society, the common schools of the city of Fredericton have been supplied with sets of common minerals for class use, and the High School is being supplied with a collection of the minerals of New Brunswick. Some field work has been done by the members of the Society, but not as much as might be desired. Mr. W. H. Moore, however, one of our ornithologists, has been able to add two birds to the list of summer residents of New Brunswick — the Marsh Wren *(Cistothorus palustris)* and Lincoln's Song Sparrow *(Melospiza lincolni)*.

JOHN BRITTAIN,
Secretary.

REPORT OF THE KINGS COUNTY NATURAL HISTORY SOCIETY.

Organized October 2nd, 1897, at Sussex, Kings Co., N. B.

OFFICERS.

President—Robert King, A.B., Sussex.
Vice-President—Miss Louise Wetmore, Sussex.
Secretary-Treasurer—Mr. W. N. Biggar, Sussex.
Chairman of Executive Com.—Mr. Wm. Goold, Sussex.

OBJECTS OF THE SOCIETY.

The objects of the Society, as set forth in its Constitution, are as follows:

The study of the natural history of the Province of New Brunswick in general, and especially of Kings County;

The collection and preservation of specimens;

The foundation of a library of scientific books;

The meeting of members at regular periods for mutual instruction in natural science.

MEETINGS, MEMBERSHIP, ETC.

Regular meetings are held at 9.30 a. m. on the first Saturday in each month. The Society, which started with twenty-four charter members, has now fifty-two names on its roll. The increase in membership and interest has been steady, and the results obtained by united endeavor, so far, satisfactory. For convenience in working, the members are divided, according to their own preference, into five sections, as follows: Geology and mineralogy, botany, zoology, ornithology, and entomology. Each of these sections is in charge of a committee of three. The annual membership fee is twenty-five cents, and visitors, invited by members, are welcomed. The election of officers takes place on the Saturday before Labor Day in each year. The thanks of the Society are due the Natural History Society of New Brunswick, and especially to President G. U. Hay for help in organizing, copies of bulletins, and many other favors.

W. N. BIGGAR,
Secretary.

DONATIONS TO THE LIBRARY, 1897.

Donor's Name.	Residence.	Work.
Royal Geographical Society	London	Journal.
Hugh Robert Mill	do	1 Vol., 4 Pamphlets.
Trustees British Museum	do	Guides.
Royal Society	do	Proceedings.
Royal Colonial Institute	do	Journal.
Geological Society	do	Abs of Proceedings.
Director Royal Gardens	Kew	Bulletins.
Manchester Geological Society	Manchester	Proceed. and Trans.
Biological Society	Liverpool	do
Liverpool Geological Society	do	do
Marine Biological Association	Plymouth	Journal.
Natural History Society	Glasgow	Proceedings.
Mason College	Birmingham	Calendar.
Royal Society of Canada	Ottawa	Proceed. and Trans.
Ottawa Field Naturalists' Club	do	Ottawa Naturalist.
Department Inland Revenue	do	Bulletins.
Department of Agriculture	do	Census Reports.
Experimental Farms	do	Bulletins.
Hon. Geo. E. Foster	do	4 Volumes.
Henry F. Perley	do	Gesner's Reports.
Entomological Society of Ontario	London, Ont.	Can. Entomologist.
Hamilton Association	Hamilton	Journal
Natural History Society	Montreal	Can. Record of Scien.
Historical and Scientific Society of Manitoba	Winnipeg	Report.
Nova Scotia Institute of Natural Sciences	Halifax	Proceedings.
Canadian Institute.	Toronto	Transactions.
Toronto Public Library	do	Report.
Astronomical and Physical Society	do	Transactions.
R. F Stupart	do	Weather Review.
Government of British Columbia	Victoria	Mining Record.
Natural History Society of British Columbia	do	Bulletin 2.
Dr. Geo. F. Matthew	St. John, N. B.	Pamphlets.
Dr. W. D Matthew	do	do
Thomas Cunard	do	3 Volumes.
D. Russell Jack	do	30 do
Mrs. Gilbert Murdock	do	Water Rep , 1854-94.
Samuel W Kain	do	Gray's Botany.
New Brunswick Historical Society	do	Collections.
Scientific Association of Trinidad	Port of Spain	Proceedings.
Australian Museum	Sydney, N.S.W.	Report.
Australian Association for Advancement of Science	do	Report, Vol. VI.
Linnæan Society of N. S. W.	Elizabeth Bay.	Proceedings.
New Zealand Institute	Wellington, N.Z	Proceed. and Trans.
U. S. Bureau of Ethnology	Washington	Reports.
U. S. Geological Survey	do	Reports and Bulletins
U. S. Fish Commission.	do	do
U S. National Museum	do	Reports and Proc.
U. S. Department of Agriculture (Botanical Division)	do	Bulletins.
U. S. Coast and Geodetic Survey.	do	Report.
U. S. Weather Bureau.	do	Weather Review.
Smithsonian Institution	do	Report.
University of California	Berkeley, Cal.	Bulletins.
University of Michigan	Ann Arbor,	Report.
Cornell University	Ithaca, N. Y.	Bulletins.
Tufts' College	Tufts'Col. Mass	Studies.
John Hopkins University	Baltimore .	Circulars.
Amherst College	Massachusetts	Calendar.
Leland Stanford, Jr., University	Palo Alto, Cal .	Proceedings.
Boston Society of Natural History	Boston	Proceedings.
Boston Public Library	do	Report.
Essex Institute	Salem	Transactions.
New York Academy of Sciences	New York	Journal.
New York Microscopical Society	do	Abstract of Proc.
Linnæn Society of New York	do	Report.
American Museum of Natural History.	do	Bulletin.

DONATIONS TO THE LIBRARY — *(Continued)*.

DONOR'S NAME.	RESIDENCE.	WORK.
New York Public Library	New York	Bulletins.
University of New York	Albany	Museum Report.
Colgate University	Hamilton	Circulars.
Natural Science Association of Staten Island	New Brighton	Proceedings.
Rochester Academy of Natural Sciences	Rochester, N.Y	do
Iowa Academy of Sciences	DesMoines	do
Academy of Natural Science	Philadelphia	do
Minnesota Academy of Natural Sciences	Minneapolis	Bulletins.
Texas Academy of Science	Austin	Transactions.
Indiana Academy of Natural Sciences	Indianapolis	Proceedings.
California Academy of Sciences	San Francisco	do
Colorado Scientific Society	Denver	Transactions.
C. G. Lloyd	Cincinnati	Plates.
Missouri Botanical Gardens	St. Louis	Report.
Field Columbian Museum	Chicago	Publications.
Societe Scientifique du Chili	Santiago	Actes.
National Museum	Montevideo	Annales.
Royal Academy of Science	Stockholm	Proceedings.
Comite Geologique du Russie	St. Petersburg	Memoirs.
Imperial Academy of Sciences	do	Bulletins.

DONATIONS TO THE MUSEUM.

DATE.	DONOR'S NAME AND DESCRIPTION OF ARTICLE.
1897.	
Feb.	MR. E. J. ARMSTRONG. Specimen of Asbestos.
	MR. L. L. CASSIDY. Specimens of Gold, Silver, and Copper Ores.
Mar.	MR. G. S. FISHER. Specimens of Wood gnawed by Beavers, from Rockwood Bog.
	MR. W. A. JACK. Tadpoles and small Fishes.
Apr.	MRS. GILBERT MURDOCK. Cup and Saucer, manufactured in 15th century. Fire Bucket, Two Vases, One Dollar Bill and one Quarter Dollar, which went through St. John fire of June 20, 1877.
	MR. A. GORDON LEAVITT. Harlequin Duck (mounted).
May.	GEN. D. B. WARNER. Honeycomb in spruce tree, on stand.
	MR. W. F. BEST. Star-fishes and Sea-urchins from Partridge Island.

DONATIONS TO THE MUSEUM — *(Continued)*.

DATE.	DONOR'S NAME AND DESCRIPTION OF ARTICLE.
1897.	
May	MR. JOS. ALLISON. Curious section of Wood.
	MR. NORMAN ROBERTSON. Mineral specimens from Kootenay, B. C.
Oct.	MR. W. A. BUTLER. Calamites approximates.
	MR. ROBERT THOMSON. Ammonite imbedded in flint pebble ; also minerals from Giant's Causeway, Ireland.
	MR. F. J. MCNAUGHTON, Fossil Footprints of reptile from Joggins, N. S.
Nov	DR. GEO. F. MATTHEW. Section of Rockwood Bog, and section of large cedar tree.
Dec.	MR. WM. MCINTOSH, PHILIP MCINTOSH, and MRS. S. B. MCPHERSON. Collection of Native Insects, 534 specimens.
	MR. JOSHUA P. CLAYTON. Pair of child's clogs from Bury, Lancashire, G. B. Chart of St. John Harbor, dated September, 1761.

DONATIONS TO THE FUNDS, 1897.

A. Gordon Leavitt, Esq. (to Building Fund).....	$10.00
Anonymous.....	1.00
	$11.00

Officers and Committees of the Natural History Society for 1898.

Patron—His Honor the Lieutenant Governor, Honorable A. R. McClelan.

Council for 1898.

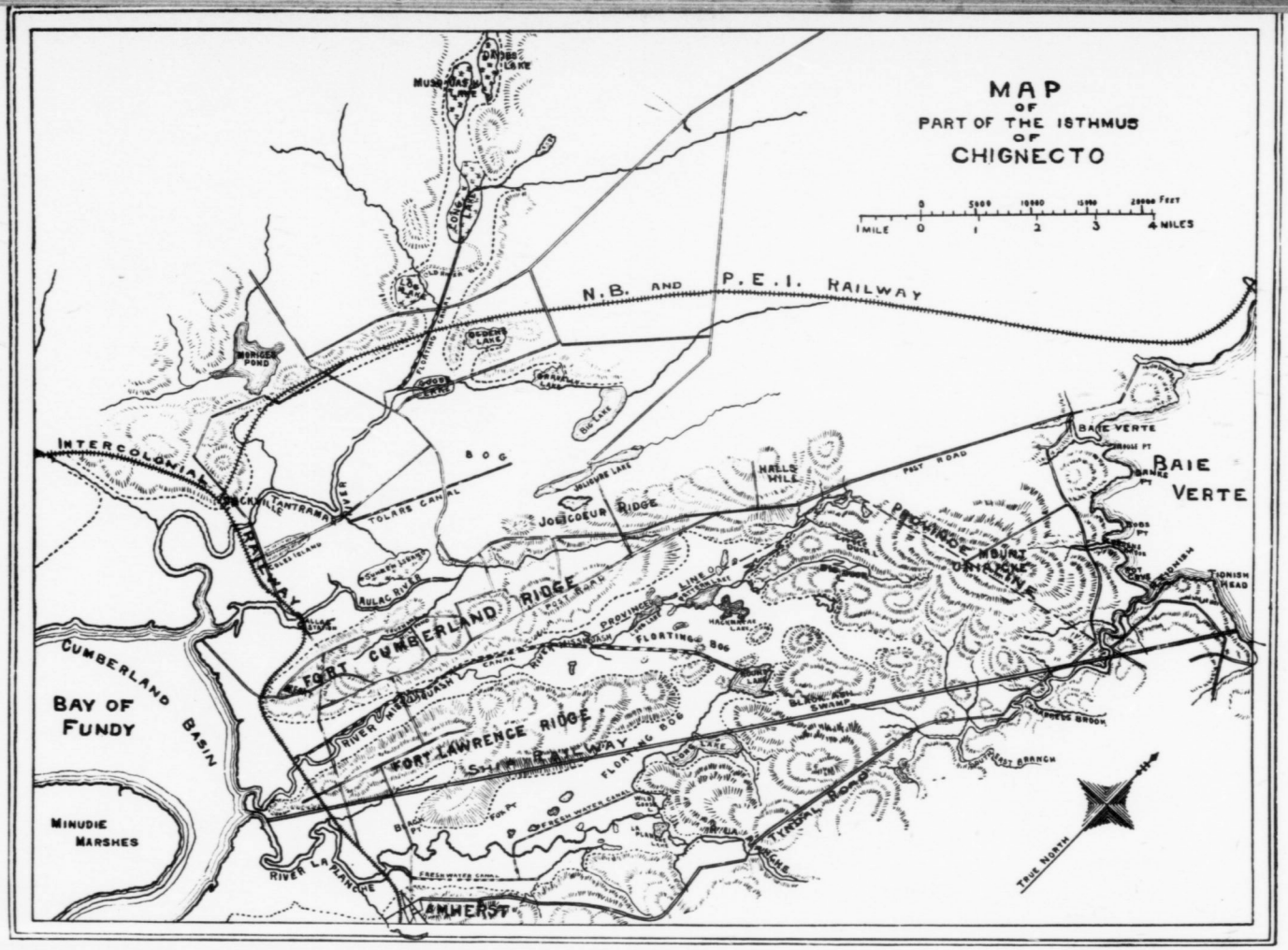
President—Geo. U. Hay, M.A., F.R.S.C.
Vice-Presidents—H. George Addy, M.D.; William Murdoch, C.E.
Treasurer—Robert Matthew, Esq.
Secretary—Percy G. Hall, Esq.
Librarian—Samuel W. Kain, Esq.
Curators—Dr. Geo. F. Matthew, A. Gordon Leavitt, and William McIntosh.
Additional Members—J. Roy Campbell, W. Frank Hatheway, Frank E. Holman.
Delegate to the Royal Society—William J. Wilson.
Assistant Librarian and Curator—Miss Edith McBeath.

Associate Members' Branch.

President—Mrs. Geo. F. Matthew.
Secretary-Treasurer—Mrs. Frank E. Holman.

Standing Committees for 1898.

Physics—Wm. Murdoch, Prof. A. Wilmer Duff, E. T. P. Shewen, C.E.
Geology—Dr. G. F. Matthew, Prof. L. W. Bailey, Geo. J. Trueman.
Ornithology—A. Gordon Leavitt, A. Morrisey.
Botany—Geo. U. Hay, Mrs. Wm. Bowden, Jas. Vroom, Mrs. H. Geo. Addy, Wm. McIntosh.
Archæology—S. W. Kain, F. E. Holman, R. Matthew.
Library—S. W. Kain, Mrs. Geo. U. Hay, R. Matthew, Mrs. W. F. Hatheway.
Rooms—Dr. H. Geo. Addy, Miss K. A. M. Cotter, Mrs. Geo. U. Hay, J. E. Wilson, Wm. McIntosh, Mrs. F. E. Holman.
Finance—R. Matthew, J. Roy Campbell, W. F. Hatheway.
Press—S. W. Kain, A. Gordon Leavitt, P. G. Hall, Miss Dorothea Matthew, Miss Edith McBeath.
Lectures—Geo. U. Hay, Miss A. Jack, Dr. H. Geo. Addy, S. W. Kain, P. G. Hall.
Publications—Dr. G. F. Matthew, S. W. Kain, Geo. U. Hay, P. G. Hall, A. Gordon Leavitt.
Microscopes—Dr. W. W. White, Wm. McIntosh, Chas. F. B. Rowe.


MAP
OF
PART OF THE ISTHMUS
OF
CHIGNECTO
1 MILE 0 5000 10000 15000 20000 FEET
0 1 2 3 4 MILES
N.B. AND P.E.I. RAILWAY
INTERCOLONIAL RAILWAY
TOLARS CANAL
BOG
JOGGOEUR RIDGE
HALLS HILL
POST ROAD
BAIE VERTE
BAIE VERTE
PROVINCE MOUNT DIAMOND LINE
FORT CUMBERLAND RIDGE
PROVINCE LINE
FLOATING BOG
CUMBERLAND BASIN
BAY OF FUNDY
FORT LAWRENCE RIDGE
FLOATING BOG
MINUDIE MARSHES
RIVER LA PLANCHE
AMHERST
TRUE NORTH