Stockholm Congress of 1897 the true international work was begun, and the problems there proposed are now the subjects of careful study in all parts of the earth. Let us hope that the reports to be presented at the future Congresses will be such as to add to the present stock of knowledge, prove advantageous to both producers and consumers, and assist all engineers in economically using the materials and forces of nature for the benefit of man.

Mansfield Merriman.
Lehigh University.

*THE DEVONIAN SYSTEM IN CANADA.**

I.

To the student of the early literature of the Paleozoic rocks, and especially to the paleontologist, the name of William Lonsdale will always be associated with the Devonian System.

Although the term Devonian was first definitely proposed by Sedgwick and Murchison in a paper read April, 1839, and published in the fifth volume of the second series of Transactions of the Geological Society of London, the authors of this paper are careful to state (1) that "Mr. Lonsdale, after an extensive examination of the fossils of South Devon, had pronounced them, more than a year ago, to form a group intermediate between the Carboniferous and Silurian systems," and (2) that "the previous conclusions of Mr. Lonsdale * * * led the way to their proposed classification of the Cornish and Devonian formations."

Lonsdale, himself, in another paper printed in the same volume, distinctly claims that his suggestion, on the evidence of their fossils, that the South Devon limestones are "of an intermediate age between the Carboniferous and Silurian systems, and consequently of the age of the old red sandstone," was first made in December, 1837. S. P. Woodward, in the preface to the first part of his 'Manual of the Mollusca,' dated March, 1856, speaks of Lonsdale as his "friend and master, *the founder of the Devonian system in geology.*"

Yet so lately as in August, 1897, Mr. Marr is stated to have said* that "the Devonian system had been founded on stratigraphical grounds by Murchison and Sedgwick, and on paleontological grounds by Lonsdale and Etheridge." Surely it would have been more correct to have said that the existence of the Devonian as a distinct geological system was first indicated by Lonsdale in 1837 on purely paleontological evidence, and subsequently confirmed by Sedgwick and Murchison in 1839 on stratigraphical considerations.

However this may be, rocks of Devonian age have been discovered at various times in almost every province and district of the Dominion, and it is thought that a brief summary of the history of these discoveries and of the present state of our knowledge of the Devonian rocks of Canada, from a paleontologist's point of view, may be of interest on this occasion. In accordance with long usage in Canada, the line of demarcation between the Silurian and Devonian systems in this address will be drawn at the base of the Oriskany sandstone. It will also be convenient to consider the information that has so far been gained about the Devonian rocks of Canada in geographical order, from east to west, under the three following heads, viz.: (1) The Maritime Provinces and Quebec; (2) Ontario and Keewatin, and (3) Manitoba and the Northwest Territories.

I. THE MARITIME PROVINCES AND QUEBEC.

Nova Scotia.—In a memoir accompanying a geological map of Nova Scotia, by Dr.

* Address of the Vice-President and Chairman of Section E—Geology and Geography—of the American Association for the Advancement of Science, Columbus Meeting, August, 1899.

* *Quarterly Journal of the Geological Society of London*, Vol. LIII., page 460.

Abraham Gesner, published in the Proceedings of the Geological Society of London for May 10, 1843,* the following paragraph occurs:

"*Old Red Sandstone or Devonian group.*—Above the Silurian beds there occurs in several parts of the province, a bright red micaceous sandstone or conglomerate, accompanied by thin beds of red shale and marly clay, and in some places containing seams of fibrous gypsum. Hitherto no organic remains have been found in it. At Advocate Harbor and on the Moose River this sandstone is seen lying uncomformably beneath the coal measures. At the latter locality the sandstone dips W. 21° and the coal measures dip N. N. E. 60°. It is from a joint consideration of the mineral characters of this formation, and its relative position as compared with the coal measures, that the author has regarded it as the equivalent to the old red sandstone."

This would seem to be the earliest statement in regard to the occurrence of rocks of Devonian age in British North America, but Gesner then included in his old red sandstone group certain outliers of Carboniferous limestone and possibly Trias, that are now known to be associated with rocks still held to be Devonian.

Not quite two years later than this, in a paper read before the Geological Society of London on January 22, 1845, Sir William Dawson says that beyond Cape John the newer coal formation "seems to overlie, unconformably, a series of hard grits, slates and limestones, with scales of *Holoptychius*, Encrinites and fragments of bivalve shells, and which are probably of newer Silurian or Devonian age. The last-mentioned rocks, with various kinds of trap, form an elevated ridge belonging to the Cobequid chain of hills."†

Influenced, as he elsewhere tells us, by information supplied by Sir Charles Lyell, Gesner's earlier statements as to the Devonian rocks of Nova Scotia were modified in his 'Industrial Resources of Nova Scotia,' published at Halifax in 1849. In this volume the paragraph about the Devonian rocks is as follows:

"*Old Red Sandstone or Devonian Group.*—Above the Silurian strata there occur thick beds of conglomerate, bright red and micaceous sandstones, red shale and marly clay. At Advocate Harbor, Parrsboro,' Moose River, Horton, Shubenacadie and other places these rocks are seen dipping beneath the coal measures and gypsiferous red sandstones. The scales of fishes and other organic remains found in these deposits are too scanty and imperfect to afford conclusive evidence of their relative age; but from a joint consideration of them, the mineral character of the formation and its position, it may be classed as the equivalent of the old red sandstone of Europe or a part of the great carboniferous series. The strata contains but few minerals of importance."

The first edition of the 'Acadian Geology,' by Sir William Dawson, published in 1855, contains a 'Tabular View of Rock Formations in Nova Scotia,' in which the Devonian is defined as including the "fossiliferous slates of Bear River, Nictaux, New Canaan, Pictou, Arisaig, etc., and perhaps also parts of the metamorphic rocks of the Cobequid and Pictou, hills." In the fourteenth chapter of this volume the fossiliferous slates at Arisaig and the East River of Pictou are regarded as of Devonian age, on the authority of James Hall, but in a supplementary chapter, dated August, 1860, they are referred to the Silurian. Nine 'fossils from the Devonian and upper Silurian (?) rocks of Nova Scotia' are figured in this volume, but none of these are specifically determined and only three are Devonian. But, in the supplementary chapter, four of the fossils of the Nictaux and one of the Bear River series are determined specifically. Of the former it is stated that Hall "compares them with the fauna of the Oriskany sandstone, and they seem to give indubitable testimony that the Nictaux iron ore is of Lower Devonian age." A fuller list of fossils from Bear River and Nictaux, in which sixteen species

* Vol. IV., Part I., p. 187.

† *Quarterly Journal of the Geological Society of London*, Vol I., p. 235.

are described generically and nine specifically, was published in 1891.*

In the second and much enlarged edition of the 'Acadian Geology,' published in 1868, Sir William Dawson confirms and elaborates most of the statements about the Devonian of Nova Scotia in the first edition and 'Supplementary Chapter,' and figures a new Devonian Spirifer (*S.Nictavensis*) from Nictaux.† He notes the occurrence of 'obscure remains, evidently of land plants,' in more or less altered rocks on the flanks of the Cobequids, etc., and more particularly the discovery, in 1866, of "stipes of ferns, apparently of two species, a *Pinnularia*, and branching stems much resembling those of *Psilophyton*, a characteristic Devonian genus," in a gray altered sandstone or quartzite underlying unconformably a Carboniferous conglomerate at Bear Brook (now known as McCulloch Brook), near the Middle River of Pictou.

Doctor Honeyman, in a paper read before the Nova Scotia Institute of Natural Science in November, 1870, and since published in its Transactions, describes as of Devonian age a red band of argillites on McAra's and McAdams' Brooks, near Arisaig, which he calls the 'McAra's Brook Strata,' but in which he did not succeed in finding any fossils. Later collectors, however, have been more successful, and in 1885, Mr. T. C. Weston, of the Canadian Geological Survey, obtained from these argillites "fragments of plants and fish teeth not certainly determinable, together with certain interesting" imprints "like those of *Protichnites carbonarius*."‡ From the same rocks, in 1897, Dr. Ami and Mr. Hugh Fletcher, of the same survey, collected fragments of *Pterygotus* and of Pteraspidian and other fishes. The fish remains obtained in these rocks in 1897 have been examined by Mr. A. Smith Woodward, of the British Museum, who thinks that they are either uppermost Silurian or lowermost Devonian.

From 1872 to the present time Mr. Fletcher has been engaged in a minutely detailed examination of the geological structure of northern and eastern Nova Scotia, for the Geological Survey of Canada, which has published geological maps of a greater portion of this area on a scale of one mile to the inch. In 1887 he referred to the Devonian system the rocks below the Carboniferous conglomerate at Loch Lomond, Richmond County, Cape Breton.* From that point he has since traced rocks that he has described as Devonian, on stratigraphical and lithological grounds, westward through the peninsula of Nova Scotia as far as the head of Cobequid Bay and along both sides of Minas Basin, where he has estimated that they attain a thickness of from 10,000 to 15,000 feet.† With some Silurian and the associated igneous rocks, he believes them to form the mass of the Cobequids.

Most of these rocks that Mr. Fletcher refers to the Devonian had, however, previously been referred to other geological horizons. Among the more notable of these are the Horton series in Kings County, and the Riversdale series and Harrington River rocks in Colchester County. On purely paleontological evidence the Horton series had been referred to the Lower Carboniferous, and the Riversdale series to the Millstone Grit, by Sir William Dawson, though it is now pretty generally conceded that both are unconformably overlaid by a marine Carboniferous limestone.

* Acadian Geology, Supplementary Note to the Fourth Edition, pp. 20 and 21.

† Page 499, Figs. 176, *a*, *b*.

‡ Geological and Natural History Survey of Canada, Annual Report, New Series, Vol. II., p. 68 P.

* Geological Survey of Canada, Report of Progress for 1877–78.

† See the Annual Reports of the same Survey for 1877–78, 1879–80–81, 1886, and 1890–91.

Owing to circumstances it has unfortunately happened that very little paleontological work has been done in Nova Scotia or on Nova Scotian material since 1873. With the view of stimulating the prosecution of researches in this direction, collections of fossils have been made, during the past four years, and chiefly by Dr. Ami, of the Geological Survey of Canada, from many localities in the province, and some selected sets of these fossils have been forwarded to specialists.

In the Christmas and New Year's week of 1897 and 1898 Mr. David White, of the United States Geological Survey, examined the fossil plants from Nova Scotia and New Brunswick in the Peter Redpath Museum at Montreal and in the Museum of the Geological Survey at Ottawa. On the evidence of these plant remains Mr. White came to the following conclusions, which are summarized, by permission, from an unpublished report, in the form of a letter addressed to Dr. H. M. Ami, and dated January 12, 1898: (1) That the plant-bearing portion of the Horton series of Nova Scotia, as shown by Sir William Dawson in 1873, is nearly contemporaneous with the Pocono formation of the eastern United States, which has long been assigned to a basal position in the Carboniferous system. (2) That the Riversdale series of Nova Scotia (which Sir William Dawson referred to the Millstone Grit) is of Carboniferous age and assuredly newer than the Horton series. (3) That the plant-bearing beds near St. John, New Brunswick, are not Middle Devonian, as had previously been supposed, but Carboniferous, and that they are the exact equivalents of the Riversdale series of Nova Scotia.

Early in January last, collections of fossil plants from the Horton and Riversdale series and Harrington River rocks, at several localities in Nova Scotia, were sent to Mr. R. Kidston, of Stirling, Scotland, an experienced paleo-botanist, for examination and study. In a manuscript report upon these collections, addressed to the Director of the Canadian Survey, and received May 8, 1899, Mr. Kidston comes to almost exactly the same conclusions as those previously arrived at by Mr. White, and on perfectly independent grounds. In this report Mr. Kidston expresses the following opinions: (1) Of the Horton series he says: "These rocks appear to be undoubtedly Lower Carboniferous." "There is no evidence at all to support the opinion that they are of Devonian age." "All the evidence derived from a study of their fossils points very strongly against this view." (2) Of the Riversdale series he says: "The two divisions of this series, the Riversdale Station and Harrington River rocks, may be treated together, as they contain the same fossils and are evidently of the same age." The whole of the fossil plants from the Riversdale series have a most pronounced Upper Carboniferous facies and markedly possess the characteristics of a Coal Measure Flora. "Judged from a European comparison, no other conclusion can be arrived at." (3) Lastly, he says that "the question of the age of the Riversdale series is inseparably connected with the question of the age of the plant beds of St. John, New Brunswick." "The species contained in the Riversdale series are also met with in the St. John plant beds, where, however, a greater number of species has been discovered." "I do not," he adds, "wish to express my views as to the age of the St. John plant beds too strongly, but, from what I have been able to learn from a study of the literature of the subject and an examination of specimens from these beds, it appears to me that they possess a flora of a much higher horizon than that assigned to them, and that in reality they are most probably Upper Carboniferous." "It must, however, be remembered that since Sir William Dawson

wrote his work on the Pre-Carboniferous Flora very much has been done in Europe to work out the zones of the Coal Measure Flora, and careful and accurate figures have been published which did not exist at the time he was carrying out his investigations." "A thorough revision of the work, especially in the light of subsequent collections and possible discovery of more perfectly preserved specimens, seems most desirable, and also that a better series of figures be published."

As complete a collection as possible of the fish remains of the Horton and Riversdale series of Nova Scotia was sent to Mr. A. Smith Woodward, in January, 1899, for examination and study, but no report upon these specimens has yet been received.

The Devono-Carboniferous problem in Nova Scotia and New Brunswick is far too complicated a question to be discussed at any length in an address of this kind. At present, however, it is obvious that there is some discrepancy between the views of the two geologists on the Canadian Survey staff, who have studied the question from a stratigraphical and lithological point of view, and those of the paleontologists whose names have been cited in this connection, as to the age of the Horton and Riversdale series of Nova Scotia, and of the plant-bearing beds near St. John, New Brunswick.

New Brunswick.—It would appear that Devonian rocks, or at any rate rocks that have for many years been regarded as of Devonian age, were not recognized in New Brunswick until 1861. For, although Dr. Gesner made extensive geological explorations in the province last named, from 1838 to 1843, the strata that he refers to the old red sandstone, in his first report on a geological survey thereof, published in 1839, and in a short paragraph in chapter eleven of his volume on New Brunswick, published in 1847, are now regarded as of Carboniferous age.

The occurrence of fossil plants in rocks near St. John was noticed by Dr. Gesner as early as in his second report on the Geology of New Brunswick, published in 1840, and Sir William Dawson states that a well-characterized specimen from these rocks, which he subsequently identified with the *Calamites transitionis* of Goeppert, was shown to him by the late Professor Robb in 1857.*

In 1860 a small collection of fossil plants from the shales at the foot of the city of St. John, near the barracks, recently made by Dr. G. F. Matthew, was submitted to Sir William Dawson for examination. On the evidence of their fossil plants these rocks at St. John were referred to the Devonian system by Sir William, in a paper 'On the Pre-Carboniferous Flora of New Brunswick, Maine and Eastern Canada,' published in the *Canadian Naturalist and Geologist* for June, 1861. Seven species are recognized in this collection, six of which are described as new. Professor L. W. Bailey, in his Report on the Geology of Southern New Brunswick, says that "the same author in June, 1861, after an examination of certain fossils in eastern Maine, asserted the Devonian age of the rocks containing them, and also of the sandstones constituting the peninsula of St. Andrews, which they closely resemble."

Immediately after this, rocks containing similar fossils, and presumably, therefore, of Devonian age, were recognized at other localities in the neighborhood of St. John, or in St. John county, as at the Little and Mispec rivers, and more particularly at the Fern Ledges, in Lancaster parish. From the latter locality extensive collections of fossils were made by Dr. Matthew, Professor Hartt and other local collectors in 1861, 1862 and 1863, and more recently by Mr. W. J. Wilson and Dr. Matthew. The luxuriant and singularly varied fossil flora of the Fern Ledges has been described by

* Acadian Geology, Second Edition, p. 502.

Sir William Dawson in 1862,* by Professor Hartt in 1865,† by Sir William Dawson and Professor Hartt in 1868,‡ and by Sir William Dawson in 1871§ and 1882.|| The 'revised list of the Pre-Carboniferous plants of N. E. America' in the first part of Sir William's memoir on 'the fossil plants of the Devonian and Upper Silurian formations of Canada,' published by the Dominion Survey in 1871, contains the names of seventy species of fossil plants from the Devonian of New Brunswick, nearly all of which are from the Fern Ledges. In the second part of the same memoir, published in 1882, two additional species were described.

The remarkable assemblage of air-breathing articulata and mollusca associated with these plant remains has been described by Salter in 1863,¶ by Scudder in 1868,** by Sir William Dawson in 1880,†† and by Dr. Matthew in 1888‡‡ and 1894.§§. In the latter of these two papers Dr. Matthew states that the "air-breathing articulates of the plant-bearing bed of St. John so far recognized consist of:

Insects, nine species of eight genera	9
Myriapods, six species of several genera	6
Arachnid similar to Anthracomartus	1
Probable pedipalp. (*Eurypterella*)	1
Probably Arachnid or Isopod (*Amphipeltis*)	1
Scorpion (*Palæophonus arctus*)	1

"Two species of land snails have also been found, raising the number of air-breathing animals found in the plant-beds of St. John to twenty-one kinds."

Elsewhere in this paper Dr. Matthew says that "later discoveries lead the author to think that *Eurypterus pulicaris*, Salter, should be referred to the myriapods or to the insects," and in the foregoing list it is evidently included with the insects. To this list, also, should be added a trilobite and an annelid (*Spirorbis Erianus*, Dawson), which indicate marine or at least brackish water conditions, while from the description and figures it is difficult to see in what respects the very imperfect specimen described as a land shell under the name *Strophites* (since changed to *Strophella*) *grandæva* differs from the presumably marine genus *Macrocheilus*.

Detailed description of the stratigraphical relations of the presumed Devonian rocks near St. John, by Dr. Matthew, were published in 1863* and 1865,† and many additional facts in relation thereto are contained in Professor Bailey's Report on the Geology of Southern New Brunswick, published in 1865. In 1863 Dr. Matthew gave the local and provisional names of the Mispec, Little River and Bloomsbury groups to the subdivisions of the supposed Devonian system in St. John county, the Little River group, including both the Cordaites shales of the Fern Ledges, with their numerous fossil plants, insects, etc., and the Dadoxylon sandstone. The Little River group was at first supposed to be of Upper Devonian age; but, in consequence of the investigations of Professor Bailey and Dr. Matthew in 1870, Sir William Dawson, in 1871, expressed the opinion that the Mispec group represents the Upper Devonian, the Little River group the Middle Devonian, and the Lower Conglomerates (presumably the

* *Quarterly Journal of the Geological Society of London*, Vol. XVIII., pp. 296–330.

† In an Appendix to Professor Bailey's Report on the Geology of Southern New Brunswick.

‡ Acadian Geology, Second Edition, pp. 534–556.

§ Geological Survey of Canada. Fossil Plants of the Devonian and Upper Silurian Formations of Canada.

|| *Ibid.*, Part 2.

¶ *Quarterly Journal of the Geological Society of London*, Vol. XIX., pp. 75–80.

** Acadian Geology, Second Edition, pp. 523–526.

†† *American Journal of Science*, Vol. XX., p. 413.

‡‡ Transactions of the Royal Society of Canada, Vol. VI., Sec. 4, pp. 57–62.

§§ *Ibid.*, Vol. XII., Sec. 4, pp. 95–100.

* *Canadian Naturalist and Geologist*, Vol. VIII., pp. 241–259.

† *Quarterly Journal of the Geological Society of London*, Vol. XXI., pp. 429–30.

Bloomsbury group) the Lower Devonian. Matthew, in 1888, after stating that there is one unconformity between the Perry sandstone and the Mispec beds and another between the Mispec beds and the Cordaite shales, thus redivides the Devonian rocks of St. John county, the unconformities being marked by a dividing line.

"Perry Sandstones with Upper Devonian flora, according to Sir J. W. Dawson, but lithologically representing the Lower Carboniferous sandstone.

"Mispec Conglomerate and slate.

"Cordaite shales and flags, Middle Devonian flora. *Insect remains* (in oldest beds of the Cordaite shales).

"Dadoxylon sandstone (with an older Devonian flora, G. F. M.).

"Bloomsbury Conglomerate, etc."*

On behalf of the Canadian Survey, in 1870, Professor Bailey and Dr. Matthew traced beds corresponding to the plant-bearing beds near St. John as far to the westward as Lepreau Harbor, in Charlotte county, where many fossil plants like those at the Fern Ledges were collected. Ten years later the distribution of the Devonian rocks in the southern part of the province, as far as then known, was thus summarized by Messrs. Bailey, Matthew and Ells:

"The areas of Devonian occurring in southern New Brunswick may be stated as follows:

"1. A large basin, or double synclinal, east of St. John Harbor, occupying the valley of the Mispec, with a southern area extending northeasterly across the Black River, near the forks of the East Branch.

"2. Isolated outcrops on Coal Creek and on Canaan River and North Fork, presumably of this age, but lacking evidence of fossils.

"3. Small areas about St. John and Carlton, with possibly Partridge Island.

"4. A small area about the eastern extremity of Spruce Lake, on the St. Andrews Railroad.

"5. A belt stretching west from Musquash Harbor to Lepreau Harbor, in which is contained the so-called anthracite mine of Belas Basin, with a smaller detached area along the shore from By Chance Harbor to Dipper Harbor.

"6. A large area in the northern part of Charlotte county, embracing the former pale argillite series and extending into Queen's county."*

* Transactions of the Royal Society of Canada, Vol. VI., Sec. 4, p. 61.

Prior to 1894 the Devonian age of these rocks had never been called in question. But, in a footnote to page 79 of Sir William Dawson's 'Synopsis of the Air-Breathing Animals of the Palæozoic Period in Canada up to 1894,' published in the Transactions of the Royal Society of Canada for that year, Dr. Matthew says of the Little River group (which includes the plant-bearing beds near St. John) that he has "recently found some reason to suspect that these beds are as old as Silurian." And, as already stated in connection with this phase of the Devono-Carboniferous problem in Nova Scotia, both Mr. White and Mr. Kidston, on the evidence of their plant remains, have independently and quite recently expressed the opinion that the plant-bearing beds near St. John are the exact equivalents of the Riversdale series of the Nova Scotia Carboniferous.

In northern New Brunswick an area of gray shale (with *Psilophyton*) and conglomerates, which are regarded as of Devonian age, on the east side of the St. John River, near the mouth of the Beccaguimic, is indicated in a map accompanying Dr. Ells' 'Report on the Iron-ore Deposits of Carleton County,' in the 'Report of Progress of the Geological Survey of Canada for 1874–75.' Dr. Ells, also, in the 'Report of Progress' of the same Survey for 1879–80, says that areas of Devonian rocks are "seen at intervals along the lower Restigouche River," and that they "form a synclinal basin extending from near the town of Dalhousie westward to a point about two miles above Campbellton and terminating on the south side of the river at Old Mission Point." This report is descriptive of explorations made in 1879, and in it the Devonian age of

* Geological Survey of Canada, Report of Progress for 1878–79, p. 11 D.

the rocks at Campbellton is assumed exclusively on the evidence of a few fossil plants (*i. e.*, two species of *Psilophyton*, one of *Lycopodites* and one of *Cordaites*) that had been identified and described by Sir William Dawson. The remarkable fish-fauna at Campbellton was not discovered until June 27, 1881, but it will be more convenient to consider it later on, in connection with the equally notable fish-fauna discovered in 1879, on the opposite side of the lower Restigouche River at Scaumenac Bay, in the Province of Quebec, as the two localities are only about sixteen miles apart. Another area of Devonian rocks in the northern part of the province is that on the Upsalquitch River, discovered by Dr. Ells in 1879 and described also in the 1879–80 report.

Quebec.—The Geological Survey of Canada was instituted in August, 1842, but prior to the confederation of the provinces in 1867 the scope of its operations extended only over Upper and Lower Canada, now known as the Provinces of Ontario and Quebec.

With the view of ascertaining whether the coal measures of New Brunswick did or did not extend into Canada, its first Director, Sir W. E. Logan, devoted the summer seasons of 1843 and 1844 to a geological examination of the Gaspé peninsula and of the country between it and the Baie des Chaleurs. In 1843 he surveyed the coast from Cap Rosier to Paspebiac, and in 1844 the exposures between Cap Rosier and Cape Chatte, thence following the Chatte River to the Cascapedia and crossing to the Baie des Chaleurs. During these two years the main geological features of the part of the province examined were, for the first time, definitely ascertained, and the absence of any productive coal measures north of the Baie des Chaleurs demonstrated. In 1843 the sandstones and limestones of Gaspé Bay, since known as the Gaspé sandstones and limestones, were carefully studied and their fossils collected. In 1844 the Gaspé sandstones were traced for a considerable distance up the St. Lawrence, and in the 'Report of Progress' of the Survey for 1847–48 they are said to extend from the very extremity of the Gaspé district to Matapedia Lake, a distance of 150 miles, and their thickness is estimated at 7,000 feet.

As early as 1845, if not in 1844, the Devonian age of the Gaspé sandstones was recognized by Logan. In the Annual Report of the Survey, under his direction for 1844 (which, though written in 1845, was not published until 1846), these sandstones are said to "resemble the Chemung and Portage groups of the State of New York, with perhaps the addition of what the geologists of that State term their old red sandstone" (*i. e.*, the Catskill group), and to be overlaid by the Carboniferous series. At that time the Gaspé sandstones were regarded as of Upper Devonian age, but the numerous fossils that Logan had collected from them had not then been critically studied by any competent paleontologist. In an entry in his notebook for August 20, 1843, published in the 'Life of Logan' by Dr. Harrington, it is distinctly stated that the plants of these sandstones are 'not Carboniferous.' A few years later, in a communication to the meeting of the 'British Association for the Advancement of Science' at Ipswich, in 1851, Logan thus expresses himself: "None of the productive part of the New Brunswick coal measures reaches Canada, but there comes out from beneath it, on the Canadian side of the Bay Chaleurs, 3,000 feet of Carboniferous red sandstones and conglomerates. These are succeeded by 7,000 feet of Devonian sandstones, which rest upon 2,000 feet of Silurian rocks consisting of limestones and slates."*

Six of the species of fossil plants collected from the Gaspé sandstones by Logan in

* Report of the Twenty-first Meeting, page 61.

1843 were described by Sir William Dawson: four (*Psilophyton princeps*, *P. robustius*, *Lepidodendron Gaspianum* and *Prototaxites Logani*) in the *Quarterly Journal of the Geological Society of London* for January, 1859;* and two (*Cordaites angustifolia* and *Selaginites formosus*) in the *Canadian Naturalist and Geologist* for June, 1861. In the former of these papers the two remarkable genera *Psilophyton* and *Prototaxites* were first proposed and defined. Subsequently, however, in 1888, Sir William somewhat modified his earlier descriptions of *Prototaxites* and changed its generic name to *Nematophyton*.† *Selaginites formosus* was abandoned 'as a vegetable species' by its author in 1871, because additional material showed that the specimens upon which it was based are 'probably fragments of some Eurypteroid crustacean,'‡ as suggested by Mr. Salter.

The supposed worm-tracks from the Gaspé sandstone between Tar Point and Douglastown, discovered by Logan in 1843, were described and refigured by the writer, under the name of *Gyrichnites Gaspensis*, in the Transactions of the Royal Society of Canada for 1882.

Logan's examinations of the Gaspé series of sandstones and limestones were supplemented by those of Murray on the Douglastown and St. John rivers in 1845; of Richardson on the Magdalen River and upper part of the Dartmouth in 1857, and of Bell of the Dartmouth, York and Malbaie rivers in 1862. Sir William Dawson also made extensive collections of fossils around the shores of Gaspé Bay in 1858 and 1869, and Dr. Ells a general geological survey of the Gaspé peninsula, from Gaspé Basin to the Matapedia River and from the St. Lawrence River to the Baie des Chaleurs in 1880–83, and a similar survey of the Devonian basin of the Causupscal River in 1884.

The collections made by Sir William Dawson in 1869 added thirteen additional species of fossil plants to the flora of the Gaspé sandstones, and these species were described and illustrated in the first part of his memoir on the 'Fossil Plants of the Devonian and Silurian Formations of Canada,' published by the Canadian Survey in 1871. The 'Geology of Canada,' published in 1863, contains lists of some of the marine invertebrate fossils of the Gaspé limestones and sandstones, collected by Logan, Dawson and Bell, and these fossils were more fully determined or described by E. Billings in the first part of the second volume of Paleozoic Fossils, published by the Canadian Survey in 1874. A small species of *Cephalaspis*, also, collected by Professor G. T. Kennedy, then one of Sir William Dawson's assistants, from the Gaspé sandstones on the north side of Gaspé Bay in 1869, was described and printed by Professor Ray Lankester, in the *Geological Magazine* for September, 1870,* under the name of *C. Dawsoni*.

In the 'Geology of Canada' it is stated that the "limestones of Cape Gaspé appear for the most part to belong to the Lower Helderberg group." * * * "The fossils at the summit, however, bear a striking resemblance to those of the Oriskany formation, with which several of them are identical. It appears probable, therefore, that we have a passage from the Lower Helderberg to here the Oriskany, and the latter formation may be more especially represented by the lower part of the Gaspé sandstones." Eleven years later, in 1874,† E. Billings expressed the opinion that the lower 330 feet of the Gaspé

* Vol. XV., p. 477.

†The Geological History of Plants, page 21; and Transactions of the Royal Society of Canada for 1888, Sec. 4, pp. 27–47.

‡ Geological Survey of Canada. The Fossil Plants of the Devonian and Upper Silurian formations of Canada, Part 1, p. 65.

*Volume VII., p. 397.

† Geological Survey of Canada. Paleozoic Fossils, Vol. II., Pt. 1, p. 1.

limestones are Upper Silurian (Lower Helderberg), the middle 880 feet passage beds, and the upper 800 feet Devonian.

At the other end of the province a small area of rocks on the Famine River, in Beauce county, and another on the west side of Lake Memphremagog, in the county of Brome, were recognized as Devonian by Logan in 1863.*

Quite recently, too, a re-examination, by Mr. Schuchert, of some of the brachiopoda from the small masses of limestone on St. Helen's Island, opposite Montreal, has shown that these limestones are probably the equivalents of part of the Hamilton formation of Ontario and New York, and not of the Lower Helderberg.

Although the Devonian system is pre-eminently the Age of Fishes, yet for many years scarcely any remains of fossil fishes had been found in the Devonian rocks of Canada that are at all closely comparable with those of the old red sandstone of Scotland and Russia. As early as 1842, however, the rocks on both sides of the lower Restigouche River were examined by Dr. Gesner, who says that he found the "remains of fish and a small species of tortoise, with fossil foot-marks,"† in the shales and sandstones at Escuminac (now called Scaumenac) Bay, which he supposed were of Carboniferous age. The statement in regard to the fossils at this locality attracted no particular attention at the time, but in September, 1879, Dr. Ells found a natural mould of the exterior of the ventral surface and of one of the lateral appendages of a Pterichthys-like fish in a concretionary nodule at Scaumenac Bay, and in June, 1881, remains of a species of *Cephalaspis* in the brecciated limestones near Campbellton. The first of these discoveries led to further investigations by officers of the Canadian Survey in 1880, 1881 and 1882, which revealed the existence of a remarkable assemblage of fossil fishes and land plants of Upper Devonian age at Scaumenac Bay, and of an entirely different series of fishes and plants of Lower Devonian age on the opposite, or New Brunswick side of the river, near Campbellton. Large collections were made at each of these localities, especially of the fossil fishes, which were described by the writer in 1880,* 1881† and 1883,‡ and described and illustrated in 1887§ and 1889.‖ Many of these specimens were exhibited at the meeting of this Association at Montreal in 1882.

In the collections from Scaumenac Bay made up to 1882 and described by the writer the Elasmobranchii are represented by two species of *Acanthodes* (*A. concinnus* and *A. affinis*); the Ostracodermi by numerous, remarkably well-preserved and nearly perfect specimens of a *Bothriolepis* (*B. Canadensis*) which Gesner seems to have thought was a small tortoise; the Dipnoi by a supposed *Phaneropleuron* (*P. curtum*), the type of Traquair's subsequently described genus *Scaumenacia*,¶ and the Teleostomi by a *Glyptolepis* (*G. Quebecensis*), a *Cheirolepis* and a new genus (*Eusthenopteron*) closely allied to *Tristichopterus*. A few of the superficial and presumably sensory grooves on the cranial shield of the Canadian *Bothriolepis* were mistaken for sutures, as the similar ones of the European species had been by Lahusen, but

* Geology of Canada, pp. 428–436.

† Report on the Geological Survey of the Province of New Brunswick, etc., St. John, 1843, p. 64.

* *American Journal of Science*, Vol. XX., p. 132; and reprinted in the *Canadian Naturalist and Geologist*, Vol. X., p. 23.

† *American Journal of Science*, Vol. XXI., p. 94; and reprinted in the *Annals and Magazine of Natural History*, Fifth Series, Vol. VIII., p. 159; and *Canadian Naturalist and Geologist*, Vol. X., New Series, p. 27 and p. 93.

‡ *American Naturalist*, Vol. XVII., p. 158.

§ Transactions of the Royal Society of Canada, Vol. IV., Sec. 4, p. 101.

‖ *Ibid.*, Vol. VI., Sec. 4, p. 77.

¶ *Geological Magazine*, June, 1893, Decade 3, Vol. X., p. 262.

some of the specimens of that genus from Scaumenac Bay threw quite a new light on the structure of its mouth organs and of the so-called 'lid' with its pineal element. And, similarly, a portion of one side of the head of a specimen of *Eusthenopteron* from the same locality, which by an oversight was referred to *Phaneropleuron*, has almost all the sclerotic plates of the eye preserved.

From the collections made near Campbellton in 1881 and 1882 four species of fossil fishes were described, viz.: *Cephalaspis Campbelltonensis;* a supposed *Coccosteus* (*C. Acadicus*), the type of Traquair's subsequently characterized genus *Phlyctœnaspis*,* and two kinds of fin spines.

Numerous fossil fishes from both of these localities have since been collected by Mr. Jex for Mr. R. F. Damon, of Weymouth, England, and these have been acquired by the Edinburgh and British Museums. These later collections have yielded some additional species, one from Scaumenac Bay, which was described by Dr. Traquair in 1890, and six from Campbellton, three of which were described by Dr. Traquair, one in 1890 and two in 1893, and three by Mr. A. Smith Woodward in 1892. The latest novelty from Scaumenac Bay is a new *Cephalaspis* (*C. laticeps*, Traquair), of which it is said that "this is the first occurrence of a cephalaspid in rocks of later age than the Lower Devonian."† The three additional species from Campbellton that Dr. Traquair has described are two ichthyodorulites (*Gyracanthus incurvus*‡ and *Cheiracanthus costellatus*)§ and another *Cephalaspis* (*C. Jexi*).|| The three from the same locality described by Mr. A. Smith Woodward, in the eighth volume of the Third Decade of the *Geological Magazine*, are all elasmobranchs, viz., *Acanthodes semistriatus*, *Protodus Jexi* and *Diplodus problematicus*, the latter being the type of Traquair's genus *Doliodus*,* published in 1893.

In 1882 Sir William Dawson determined or described the fossil plants from Scaumenac Bay, four specifically and four only generically, and identified six species of fossil plants from near Campbellton with the *Psilophyton princeps*, *P. robustius*, *Arthrostigma gracile*, *Leptophlœum rhombicum*, *Cordaites angustifolia* and *Prototaxites Logani* of the Gaspé sandstones. He asserts that the plant and fish-bearing beds at Scaumenac Bay are "no doubt the equivalents and continuation of the upper part of the Gaspé sandstones," and that the fossil plants from near Campbelltown are "perfectly identical with the lower part," of these sandstones.†

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(*To be concluded.*)

* *Geological Magazine*, Decade 3, Vol. VII., p. 144.
† *Ibid.*, Decade 3, Vol. VII., p. 16.
‡ *Ibid.*, p. 21.
§ *Ibid.*, Decade 3, Vol. X., p. 146.
|| *Ibid.*, p. 147.

* *Ibid.*, p. 145.
† Geological Survey of Canada. The Fossil Plants of the Erian (Devonian) and Upper Silurian Formations of Canada. Part 2.

THE FAMILY NAME OF THE DORMICE.

In a paper 'On the Genera of Rodents,' published in 1896,‡ Mr. Oldfield Thomas very properly rejected the family name Myoxidæ commonly applied to the Old World dormice, for the reason that *Myoxus*, on which it was based, is a synonym of the earlier generic name *Glis*. In adopting the name Gliridæ he divided the family into two subfamilies, Glirinæ and Platacanthomyinæ; the former including four genera: *Glis* Brisson, 1762; *Muscardinus* Kaup, 1829; *Eliomys* Wagner, 1843, and *Graphiurus* Cuvier, 1838; the latter *Platacanthomys* Blyth, 1859, and *Typhlomys* Milne-Edwards, 1877. It now appears that Gliridæ is untenable for this family because of previous application to other groups; in

‡ Proc. Zool. Soc. London, 1896, p. 1016.