

IV.—NOTES ON THE GEOLOGY OF NEWFOUNDLAND.—BY T. C. WESTON, F. G. S. A., LATE OF THE GEOLOGICAL SURVEY OF CANADA.

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The following notes have been written partly to record a few palæontological facts not mentioned elsewhere and partly to give a brief outline of the various geological formations and show the similiarity in the fossil faunas of Newfoundland to the members of the upper and lower silurian of Canada. Should the reader wish for a more detailed account of the geology, he will find it in the admirable reports of the late director of the Geological Survey of Newfoundland, Alex. Murray, also in those of his assistant, Jas. P. Howley, and of the late Sir W. E. Logan, Geological Survey of Canada, 1863.

The Laurentian.—In considering the more interesting geological features of the island, we shall commence with the base of the great geological column, which in Canada has an estimated thickness of 32,750 feet.

The Laurentian rocks of Newfoundland are similar to those of Canada, consisting of gneiss, granite, syenite, limestone, quartzite, mica schist, etc., all of which are frequently cut by granite and other dykes. They form a large portion of the island which, as Mr. Murray remarks, "has materially contributed to produce the remarkable geological and topographical features which it presents." Probably it was the chopped up appearance of the Laurentian and Huronian formations which caused him to remark that "Newfoundland was formed of the chippings of the world." The Laurentian of Newfoundland, so far as we know, is totally destitute of the remains of either vegetable or animal structure, and therefore must still be considered azoic, although this term has been abandoned by some geologists in the nomenclature of Canadian rocks owing to the discovery in the Upper

Laurentian of certain forms which resemble *Stromatocerium rugosum*, one of the Protozoa of the Silurian. This peculiar mineral aggregate (?), received from Sir W. E. Logan and J. W. Dawson the name *Eozoon Canadense*. Literature enough to fill a cart has been published for and against this supposed organism, among which Dawson's Dawn of Life is the most interesting. With the exception of Sir J. W. Dawson, probably no one has done more work at this supposed fossil than the writer, who has prepared hundreds of microscopic sections, micro-photographs, micro-drawings, illustrative collections for the Paris, London, Philadelphia and late Chicago Expositions, and for other public and private collections; still he could never make up his mind that *Eozoon Canadense* is of organic origin. Mr. Billings, late palæontologist to the Geological Survey of Canada, pronounced strongly against the organic character of *Eozoon*. I have frequently conversed with Dr. Selwyn, Mr. Whiteaves, Dr. Ami, Dr. Ells, the late Mr. Vennor (who obtained the Tudor specimens), and other members of the Canadian Survey, but none of these gentlemen ever admitted that *Eozoon* is a fossil. However *Eozoon* will always remain an interesting subject for students in palæontology and mineralogy.

The Huronian.—In Canada the Huronian system represents a thickness of about 20,000 feet of strata consisting of quartzites, slates, limestones, sandstones, chert, jasper, conglomerates and other rocks in which no fossils have been found. While important measures represented in Canada are missing in Newfoundland, there is a great similiarity between the Huronian of the two countries. Its exact thickness in Newfoundland does not appear to be known. Murray gives a section of 11,370 feet of strata consisting of diorites, quartzites, jaspers, slates, conglomerates, sandstones, etc. Like our Canadian Huronian, these rocks in Newfoundland have yielded no fossils unless we consider Billings' *Aspidella terranovica*, and two other obscure forms mentioned by the same writer as organic.

In his report for 1868 Mr. Murray speaks of these forms described by Billings—Palæozoic Fossils, Vol. II, Part I., and also

refers to other forms found in Huronian argillite by the Rev. Mr. Harvey. At the time of the discovery of these fossil-like markings they were considered to be most important, and were supposed to belong to the genus *Oldhamia*, and specimens were sent to Sir W. E. Logan. Billings would not decide one way or the other as to their organic affinity, and they were handed to me. I said at once they were concretionary, and, what had not been observed by others, that these markings lay transverse to the bedding of the slate in which they were.*

Billings describes his *Aspidella terranovica* thus: "Small ovate fossils five or six lines in length, and about one-fourth less in width. They have a narrow ring-like border within which there is a concave space all round. In the middle there is a longitudinal roof-like ridge, from which radiates a number of grooves to the border. The general aspect is that of a small *Chiton* or *Patella*, flattened by pressure. It is not probable, however, they are allied to either of these genera."

While in the City of St. Johns in 1874, I made a diligent search for these forms and collected several of the so-called *Aspidella*. These, together with all other specimens now in the Dominion Geological museum, vary so much in form and appearance that I am afraid they also will ultimately be classed with the concretionary forms already spoken of, collected by the Rev. Mr. Harvey. Thus it will be seen that we have no definite organic remains either in the Laurentian or Huronian rocks of Canada or Newfoundland.

The Primordial Silurian of Newfoundland and Canada.
—In spite of the oft-repeated assertion of Professor Jukes and the late director of the Geological Survey of Canada,—“If the fossils don't agree with the stratigraphy, so much the worse for the fossils,” my long experience as a collector of fossils and close observer of the various geologic horizons leads me to think that if the stratigraphy does not agree with the fossils so much the worse for the stratigraphy. To illustrate the faith the late

*Notes by the writer, and a reproduction from a nature print in Trans. Nova Scotian Inst. of Science, Second Series, Vol. I, Part 2, page 139.

director of the Newfoundland Survey had in palæontological evidence, I will relate one incident out of many similar ones known to the writer:—In the summer of 1874 Murray wrote to Sir W. E. Logan, then director of the Canadian Survey, saying: “I have made my Manuel’s River rocks Primordial; I am doubtful, however, whether my stratigraphy is correct; neither Howley nor I have been able to find the ghost of a fossil; could you arrange in any way to send Weston down for a few weeks.” The result was that I left by the next steamer which called at Newfoundland, and a few days after my arrival at St. John’s was sent by Murray to Manuel’s River where he got lodgings for myself and indian guide. The following day I commenced my search for fossils, and in a short time was rewarded by finding, in the gray argillites, the well-known crustacean *Microdiscus Dawsoni*, Hartt, which occurs in abundance in the primordial slates of St. John, at Ratcliffe’s Mill Stream, and other localities in New Brunswick. This crustacean, *Microdiscus*, is a puny thing, not larger than the half of a small pea, but it told me a big tale about the geological horizon—told me that Murray’s stratigraphy was correct, and that I stood on primordial strata similar to those of St. John, New Brunswick.

I may mention here that the term primordial, used by Barande and the late palæontologist of the Canadian Survey, Mr. E. Billings, is seldom used now—St. John Group being thought a better name for that extensive group of rocks. This Cambrian division of the lower silurian of Newfoundland according to Murray would, if found consecutive at any one locality, represent a thickness of 6,000 feet of black, gray and other coloured argillites, micaceous calcareous slates and limestones, sandstones, conglomerates and other rocks, some of which are prolific in fossils, especially the iron-stained argillites of Manuel’s River and other localities in Conception Bay. The fauna is similar to that of the primordial of St. John, Ratcliffe’s Mill Stream, and other localities in New Brunswick.

Among the forty or more genera and species of this group in Newfoundland Billings describes about sixteen species, some of

which are now placed in the next zone—Middle Cambrian. I mention here only a few of the most typical forms:

Eophyton linnaeanum, Torrell.

Cruziana similis, Billings.

Lingula Murrayi, Bill.

Hyalithes excellens, Bill.

Senella reticulata, Bill.

Stenothecca pauper, Bill.

Microdiscus Dawsoni, Hartt.

Paradoxides tenellus, Bill.

The Upper Potsdam as represented in Canada and parts of the United States does not appear in Newfoundland.

Calciferosus.—The calciferous group which in Canada forms a prominent feature, having a thickness of 300 feet and a large fossil fauna, does not appear to be defined in Newfoundland, although it is said to be represented there by a thickness of 1,000 feet, and another set of strata over 200 feet thick which may belong to the upper calciferous zone.

This great thickness of rock does not appear to have yielded any typical calciferous fossils. From my personal observations I am inclined to think that a great portion of it belongs to the series known as "The Quebec Group," of which I shall now say a few words:

The Quebec Group.—This great metalliferous group which forms an important feature in our Canadian geology is largely developed in Newfoundland and is characterized by the same varieties of rock, among which are various coloured limestones, black, gray, green, red, and other shales and slates, conglomerates, serpentines, etc., forming a thickness of over 5,000 feet. It is in Newfoundland, as in Canada, the great mineral-bearing belt of rocks, in which silver, copper, lead, iron, manganese, plumbago, gypsum, marble, petroleum, etc., have been found.

It was recognized by the finding of typical Levis fossils—Graptolites—which are peculiar to this zone of the Quebec group of Canada.

It is probable, however, that a portion of the rocks now classed as Quebec group in Newfoundland belong to a higher zone. A glance at some of the fossils from these limestones (which may be seen in the museum of the Geological Survey of Canada) especially silicified forms which have been exposed by dissolving the matrix with acids, will show the resemblance between them and our Canadian Black River and Trenton forms which is remarkable.

The following are a few of the more interesting fossils collected in various localities in Newfoundland, by Murray, Richardson, and Weston :

PROTOZA,—

- Trachyum rugosum*, Bill.
- “ *cyathiforme*, Bill.
- Stromatocerium rugosum*, Hall.
- Calothium affine*, Bill.
- “ *filloni*, Bill.

HYDROZOA,—

- Callograptus elegans*, Hall.
- Tetragraptus* (*Graptolithus*) *fruticosus*, Hall.
- “ *bryonoides*, Hall.

BRACHIOPODA,—

- Lingula irrene*, Billings.
- “ *Murrayi*, Billings.

GASTEROPODA,—

- Pleurotomaria numera*, Billings.
- Murchisonia simulatrix*, Billings.
- Maclurea crenulata*, Billings.
- “ *emmonsi*, Billings.

CEPHALOPODA,—

- Orthoceras piscator*, Billings.
- “ *servile*, Billings.
- Nautilus calciferus*, Billings.

CRUSTACEA,—

Bathyurus timon, Billings.*Asaphus morosi*, Billings.*Illænus arcuatus*, Billings.*Agnostus fabius*, Billings.

For other fossils of the Quebec group from Newfoundland, see Billings' Palæozoic fossils.

In this short description it would take too much space to record information obtained of other members of the upper and lower silurian. Some of these are not represented as in Canada, while others probably never will be well defined owing to the absence of, or a poor state of preservation of the fossils, which consist chiefly of corals, stems of encrinites, and other forms which are not typical of any formation between the Trenton and Devonian. I shall therefore conclude with a few remarks on the Devonian, Carboniferous and Superficial formations.

The Devonian.—This formation in Newfoundland is supposed to be equivalent to a portion of the Gaspé sandstones of Canada, which at Gaspé, according to one of Logan's sections, has a thickness of 7,036 feet, consisting of sandstones, shales, limestones, conglomerates, etc. It is not well defined but some of the fossils which characterize the Gaspé sandstones at Gaspé have been found also in Newfoundland, among which are *Psilophyton*, *Lepidodendron*, *Sigillaria*, *Sphenopteris*. The Gaspé series contains a large fossil fauna and is important owing to its petroleum springs and other minerals.

Carboniferous formation.—Murray states that the carboniferous of Newfoundland is clearly an extension of the rocks which constitute the coal-fields of Cape Breton and Nova Scotia. The formation consists of conglomerates, shales, limestones, sandstones and interbedded coal seams. Jukes, in his geology of Newfoundland, speaks of a seam of coal 6 inches thick on the Coal Brook. Other thicker workable seams have of late years been reported. A description of the coal mining district by Dr. Gilpin is to be found in the transactions of this Society (Trans. N. S. Inst. of Sc., Vol. III, page 357.)

The limestones of this formation are often prolific in fossil shells; one of these bands is 26 feet thick, and is composed chiefly of a species of *Terebratula*; others hold *Stigmaria* root-lets, *Sigillaria* and beautifully preserved ferns. The carboniferous rocks of Nova Scotia are more than 14,570 feet in thickness. One of the bands of conglomerate is 1,400 feet thick. The carboniferous formation is probably the most important group of rocks in the 28 miles of strata which once formed, what we only have a portion of now, the crust of the earth.

Superficial Deposits.—The superficial deposits of Newfoundland are represented by stratified clays containing modern shells. Some of these clays are from 50 to 60 feet thick. Erratic boulders fill many of the valleys and cover large portions of the island.

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