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I.—GEOLOGICAL NOMENCLATURE IN NOVA SCOTIA.—BY HUGH FLETCHER, B. A., *of the Geological Survey of Canada.*

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NEW GLASGOW CONGLOMERATE.

Another of the debatable questions in Nova Scotian geological classification is that of the age of the New Glasgow Conglomerate.

This formation is thus described by Sir William Logan:

“ At the bridge of New Glasgow is exposed a series of conglomerates, which, in general colour, are between a brick-red and chocolate or Indian-red, and whose inclosed masses, varying from the smallest pebbles to boulders of two feet in diameter, are, for the most part, unmistakably derived from the red and greenish-gray sandstones, red shales and impure nodular limestones of the Millstone Grit, some of them containing the same vegetable organic remains. With these pebbles and boulders are associated a few from the rocks still lower down. The whole are inclosed in a matrix of the same mineral character, constituting an argillo-arenaceous cement, which is also calcareous, and in the interstices of the boulders and pebbles is often observed a network of white calcespar aiding to keep them together. There are interstratified in the rock, bands, from a few inches to several feet in thickness, of fine red sandstone and red shale, which serve to give assurance of the dip, and these occur at such distances apart as to render the conglomerate beds thick and

massive, their transverse measure varying from ten to sometimes nearly 100 feet.

“ From a point a short distance above the bridge, to one much farther below, these conglomerates have a breadth of very nearly a mile, giving a total thickness of about 1,600 feet. This great mass of conglomerate composes Fraser’s Mountain, towards the south flank of which, pre-enting the outcrop escarpment of the inferior part, the red and gray strata of the Millstone Grit dip in such a way as, without other evidence, to induce the supposition that the one series overlies the other conformably. But on the west side of the East River Mr. Hartley has evidence to show that there is a want of conformity, at least in some places.

“ Three miles eastward of New Glasgow these conglomerates have a breadth of about fifty-four chains, and they are here immediately and conformably overlaid by the following ascending section :

	ft.	in.
Gray limestone which has been quarried for burning	20	0
Measures concealed	10	0
Bluish-gray slightly calcareous sandstone		5
Bluish-brown concretionary limestone, the surface of which presents concentric botryoidal thinly laminated concretions, with grayish and red clay in the interstices and inequalities		10
Gray and red clay		8
Reddish concretionary limestone, with concentric botryoidal laminae as before	1	0
Whitish-gray limestone	1	0
Gray and red mottled clay, resembling fireclay	1	4
Gray flaggy sandstone	1	8
Gray clay		6
Whitish arenaceous limestone, holding abundance of <i>Spirorbis arietina</i>	2	2
Grayish-blue, spotted, slightly argillaceous sandstone	1	0
Measures concealed, including several feet of underclay . .	24	0
Coal and black carbonaceous shale, including about eighteen inches of good coal at the bottom, which used to be mined by Mr. W. Fraser, for the purpose of burning the limestone in the lower part of the section	4	5
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	69	0

“Very nearly on the strike they are again met with on a brook on the property of Mr. James Small, on the road to Little Harbour, Merigomish. The one locality is as much as three miles from the other; but the botryoidal concretionary limestone layers in both are so peculiar and so strikingly like in appearance, and in their relation to any overlying seam of coal, that no doubt can be entertained of their equivalence; and I have no evidence yet to shew that the mass is here of less volume than farther to the west.”

Another exposure of these rocks, 1,372 feet in thickness, occurs at Alma mills bridge on the Middle River, beyond which they reappear in Rogers Hill and Mount Dalhousie at the eastern end of the Cobequid range, also at the head of River John, and in considerable thickness on Waugh River. To the eastward, they have been followed through Quarry and Olding Islands to the Big Island of Merigomish.

In tracing them west from New Glasgow to the Middle River, they appear along the northern flank of Waters Hill to directly overlie the altered Devonian rocks of that locality. Exposures would seem to give direct proof of the unconformity of the conglomerate with the rocks of the Millstone Grit, which unconformity we should naturally have expected from the presence of pebbles derived from rocks of the latter division in the former.¹

Of these rocks Gesner wrote thus in 1836:² “The red sandstone * * * covering the great coal basin of Pictou * * * is often associated with beds of conglomerate * * * these towards the surface seem to pass insensibly into a red soft sandstone, which from its ready disintegration yields a rich and fertile soil.” At the same time, however, he correlates the Mountain Limestone with the Permian of Caribou Harbour and Pictou Island; while certain fossils of that limestone at Economy and Merigomish he calls *Belemnites* and *Ammonites*.

¹ Logan and Hartley—Geol. Survey Report 1866-69, pages 13 to 15 and 64 to 66.

² Geology and Mineralogy of Nova Scotia, pages 141, 134, 126 and 29.

In 1845, Sir J. W. Dawson described these rocks as follows : "The coal measures of the Albion Mines, on the banks of the East River of Pictou * * * are succeeded, in ascending order, by a great bed of coarse conglomerate, which, as it marks a violent interruption of the processes which had accumulated the great beds of coal, shale and ironstone beneath, and as it is succeeded by rocks of a character very different from that of these older coal measures, forms a well-marked boundary, which we may consider as the commencement of the Newer Coal Formation.¹"

The fossils of this latter, he adds, show the continuance of the coal flora with terrestrial vertebrate animals through a thickness of 5,000 feet or more.

This description indicates what seems to be the true structure ; yet in 1853² he prefers to regard the conglomerate as a gravel beach contemporaneous with the Albion coal measures, which it "guarded against the disturbing causes which in other localities prevented the continuous accumulation of coal."

In 1868³ he argues in favor of the theory that "the New Glasgow conglomerate is to be regarded as an anomalous and peculiar modification of the Millstone Grit, succeeded in ascending order on the south side by the great coal measures of the Albion Mines, and on the north by a depauperated representative of these beds, graduating upward into the Upper or Newer Coal measures ;" and in 1878⁴ again assigns it to "the upper part of the Millstone Grit or lower part of the Middle Coal formation," the depauperated Albion mines measures being the 660 feet next overlying, succeeded conformably by the "Upper Coal formation."

The physical conditions under which a beach of shingle could accumulate 1,600 feet of coarse conglomerate contemporary and in juxtaposition with 5,567 feet of beds of entirely different character, including more than 2,000 feet of black bituminous

¹ Quarterly Journal of the Geological Society of London, Vol. I., p. 322. Cf. also Trans. N. S. Inst. Nat. Sc., Vol. II., p. 95, Vol. II, Part 3, page 155.

² Geol. Jour. X, pp. 42-47 ; Acadian Geology, First Edition, 1855, p. 249.

³ Acadian Geology, Second Edition, pp. 322-326.

⁴ Suppl. Acad. Geol., pp. 34 and 49.

shales and many large seams of coal, seemed so anomalous, that Sir William Logan naturally set aside as untenable the supposition of contemporaneity with the Albion coal measures, tacitly classified the conglomerate beneath the latter, but coloured it on his map of the Pictou coal field as distinct from both the Coal Measures and the Millstone Grit. "No rocks," he says,¹ "having the typical character of this conglomerate appear to have been brought to the surface by either the south or the east fault, or by Mr. Hartley's west fault. This does not, however, disprove their possible presence beneath the whole of the productive area abutting against these faults and constituting the base of Dr. Dawson's Middle Coal formation, as inferred by Mr. Hartley."

"This inference seems to be supported by the presence, immediately on the summit of the conglomerate, of the coal seam worked by Mr. William Fraser (Moose) for the burning of his limestone, and another said to overlie it; and although the occurrence of these is not strengthened by the known existence of any of the larger workable coal seams in the Pictou synclinal, the deposits of which have yet to be examined by the officers of the Survey, it would not be surprising to find, in a country apparently so broken by great dislocations, that the absence of the larger seams may be due to a structure resulting from some of these faults, of as important a character as those affecting the productive part of the field above New Glasgow."

Since 1869, however, the district referred to has been closely examined by the Geological Survey, shown to be broken by no great dislocations, but on the contrary to be occupied by undisturbed strata which conformably overlie the conglomerate and are equivalent to those above the productive coal measures of the Joggins section. A glance at the geological map of this district will suffice to show that the conglomerate is the natural base of the Upper Carboniferous or Permian rocks of Merigomish, Pictou, River John and Waugh River.

In support of Sir J. W. Dawson's later views it has been stated that the fossils of the strata immediately overlying the

¹ Geol. Surv. Rep. for 1866-69, page 52.

conglomerate at the East River more nearly resemble those of the coal measures of McLellan Brook than those from Permian rocks.¹ But when we remember the vagaries of this method of classification with regard to fossils from the Millstone Grit in Cape Breton² and in New Brunswick,³ and the striking similarity of fossils from these formations both in Europe and America,⁴ too much importance need not be attached to such a statement.

Mr. R. G. Haliburton in 1867⁵ inferred, on evidence obtained from explorations undertaken for the practical purpose of discovering and developing coal mines, that discoveries similar to those already made must soon be made in other directions. He described the Pictou coal basin as constituting two distinct basins, the one lying to the southward and the other to the northward of the conglomerate, which, according to him, underlies the productive measures. But he could find no equivalents of the southern coal measures in the northern basin and assumes that they were always distinct basins, and now differ from their measures having been formed under different circumstances.

On the assumption that the conglomerate was the base of a coal formation, the productive portion of which was concealed by unconformity and might be reached, a borehole was in 1876 put down 734 feet, under the direction of Sir Win. Dawson, at Sutherland Point on the East River below New Glasgow. No such coal measures were, however, found to intervene.

In 1893, Mr. H. S. Poole, whose intimate knowledge of the field is the result of many years of close observation and study,⁶ discussed the geological position of the New Glasgow Conglomerate in a paper on the Pictou coal field, classifying it as the base of his Permian series while pointing out that it has an interest of a practical character in connection with the

¹ Trans. N. S. Inst. Sc. Vol. X, Session 1899-1900, p. 178; Sum. Rep. Geol. Surv. 1897, p. 134.

² Geol. Survey Report for 1874-75, page 192.

³ Geol. Sur. Can. Report for 1872-73, page 222 and subsequent reports and maps.

⁴ Geol. Mag., London, May 9, 1900; Acadian Geology, p. 283; Trans. N. S. Inst. Sc. Vol. X, p. 235.

⁵ Trans. N. S. Inst. Sc., Vol. II, Part 1, p. 93 and Vol. II, Part 3, p. 155.

⁶ Trans. N. S. Inst. Sc., Ser. 2, Vol. I, Part 3, p. 240.

possible extension of the coal seams beneath it. He showed clearly that there is no recognized unconformity between the Millstone Grit and Coal Measures in Nova Scotia, that no beds equivalent to the conglomerate are known in the southwest part of the Pictou field, where the Millstone Grit is best exposed in regular sequence under the coal measures, and that the supposition that "the underlying strata of the Richardson seam rested upon the conglomerate dipping to the southward,"¹ which largely led Dawson to put the New Glasgow Conglomerate at the base of the coal measures, arose from an entire misconception of the relation of this seam, (which lies high up in the coal measures, 1129 feet above the main seam), to the north fault.

Mr. Poole showed further that although the conglomerate apparently coincides in dip with the strata underlying it in the district of Pine Tree, its unconformity near the East River west of New Glasgow is indisputable. In the country about Greenhill, the Middle River and Plainfield, it rests only on metamorphic and Lower Carboniferous rocks. The Devonian rocks of Waters Hill "are certainly not overlaid by deposits of an age intermediate between Lower Carboniferous and the conglomerate," while the latter contains pebbles of strata evidently newer than the Lower Carboniferous, regarded by Logan as Millstone Grit, by Poole, as possibly upper coal measures.

The coal measures are nowhere known to rest on the conglomerate and "the strata overlying it are, with the exception of the till, the highest in the field," comparatively little disturbed, everywhere conformable to it and in some parts of their course holding fossils supposed to be characteristic of the upper Carboniferous or Permian and Triassic. On the other hand, the unconformity found below it is characteristic of the contact of the base of these so-called Permo-Carboniferous rocks, as shown on Dr. Ells' geological map of Cumberland County.²

¹ Trans. N. S. Inst. Sc., Vol. II, Part 1, p. 96 and Vol. II, Part 2, p. 156.

² G. S. C. Report for 1885, Part E.

NOTE.—Reference to the map accompanying Mr. Poole's paper on the Pictou Coal Field, Trans. N. S. Inst. Sc., vol. viii. (2d ser., vol. i), p. 223, will facilitate the understanding of these notes on the New Glasgow Conglomerate. On Mr. Poole's map the limits of that Conglomerate and of the other rock-formations of the coal-field are well defined.