POSTSCRIPT

BY

SIR W. E. LOGAN, F.R.S.,

ADDRESSED TO

ALFRED R. C. SELWYN, Esq.

DIRECTOR OF THE GEOLOGICAL SURVEY OF CANADA.

MONTREAL, 1*st July*, 1870.

SIR,—Having been absent from Canada between the end of March and the latter part of June, I had not, until lately, an opportunity of perusing Mr. Robert Bell's Report on the Nipigon country. His explorations there were entered on by my instructions, and prosecuted while I was still director of the Geological Survey, and as I thus feel myself responsible for his work, I am desirous of making a few remarks regarding it. R. Bell's report.

Mr. Bell's Report was printed, and Mr. Bell had started on his present season's investigations, before my return to Canada, and my remarks must therefore appear as a postscript to the General Report you are about to transmit in a printed form to the Government.

The explorations of Mr. Bell and his party have greatly extended our knowledge of the country to the north of Lake Superior, both in a topographical and a geological point of view, and important results are likely to follow. These gentlemen have displayed much perseverance in going over a large extent of ground, and determining its main features, the principal one of which, geographically, is the large lake which empties into Nipigon Bay. On being mapped to scale, however, the area of this lake does not appear to be by any means so great as was at first anticipated, nor does its magnitude seem to have been understated by previous explorers.

On a plan of the north shore of Lake Superior, resulting from Mr. T. W. Herrick's explorations, and published in the Report of the Crown Land Commissioner in 1863, the estimated dimensions of the lake are said to be between 100 and 200 miles in length, by about sixty miles in breadth. With the aid of this plan, but limiting the dimensions of the lake by geo- T. W. Herrick's plan.

Map compiled by R. Barlow.

graphical features represented on a map of Lake Superior published in 1832 by the Society for the Diffusion of Useful Knowledge, Mr. R. Barlow, topographical draughtsman to the Geological Survey, several years ago came very near the truth both as to the size and position of the lake, in delineating it on the map compiled by him and published in 1866, on the scale of twenty-five miles to the inch, for the geological purposes of the Survey. As represented by Mr. Barlow, Lake Nipigon is very little different in size from that which the protraction of Mr. Bell's measurements makes it now.

Bell's map a sketch.

Considering the great extent of the shore-line of Lake Nipigon and the comparatively short time employed in surveying it, there must unavoidably be a great number of parts which have been only approximatively determined; the map must therefore for the present be considered no more than a sketch, of which the details may be improved hereafter as occasion may serve.

Height of Lake Nipigon over Lake Superior.

At the time of my departure in March the height of Lake Nipigon above Lake Superior was estimated by Mr. Bell at about 150 feet, and it was so represented by him in various lectures and in conversations with members of parliament and others; but I now find it stated in the Report to be 313 feet. In the absence of Mr. Bell it is difficult for me to imagine the reason of this difference. Two aneroid barometers were supplied him for the purpose of determining heights, and the greater height is that resulting from the readings of the instruments for the three principal ascents, amounting to 263½ feet, with an estimated height of 49½ feet for the remainder, consisting of thirteen separate slopes. The height as now given much more nearly approaches that published by Mr. S. J. Dawson, founded on the observations of Mr. Armstrong, and an apology is due to all those who may have been misled by Mr. Bell's mistake.

Unconformable trap.

In the geological branch of his investigations, Mr. Bell has carried the Upper Copper-bearing rocks of Lake Superior much farther north than they were previously determined. He appears to have ascertained that the great trappean overflows between Pigeon River and the Battle group of islands, rest unconformably upon the outcrop of the slates and the succeeding variegated sandstones, conglomerates and marls through which they have been poured, and occupy a gap or depression in the range of the Laurentian and Huronian rocks.

Question of Triassic age.

On lithological grounds alone Mr. Bell expresses the opinion that these volcanic products are of Triassic age. This opinion was long ago insisted on by Mr. Marcou, and no doubt lithological character is entitled to weight, when structural evidence cannot be brought to bear; but I am desirous of guarding you against the supposition that there is no such evidence in the present case, tending to carry the age of these rocks in a

contrary direction. An allusion has already been made to this evidence in the *Geology of Canada*, p. 85.

Evidence of Lower Silurian age.

From the western extremity of Lake Superior the trappean strata appear to strike eastward with considerable regularity for 300 miles, until they pass Michipicoten Island and reach the eastern coast. Here the strike suddenly changes to a bearing at right angles to its previous course, with an upward slope to the eastward sufficiently rapid to bring an estimated thickness of at least 10,000 feet to the surface at Mamainse, in no very great distance across the measures. This sudden change of strike, and its accompanying phenomena have much the aspect of a great dislocation, or it may be a great undulation. Its effects are apparent for nearly a hundred miles along the east coast of the lake, and at the extremity of Gros Cap, are visible to within a few miles of the base of a series of Lower Silurian fossiliferous limestones and shales. These Lower Silurian rocks, in a comparatively undisturbed condition, strike across the bearing of this great disturbance, and are followed by a series of palæozoic strata, including Middle and Upper Silurian, Devonian and Carboniferous, belonging to the Michigan trough, all in a like condition, and apparently free from trappean intrusions.

Sudden change of strike E. side of L. Superior.

If the trappean rocks of Lake Superior were post-Carboniferous, it would be a startling fact that a series of rocks older than the traps should cross the line of such a great disturbance in these, and approach so near, without the smallest effect being produced upon the inferior strata; and this alone would challenge a very rigid examination before allowing the traps to be of Triassic age.

Sault Ste. Marie sandstones.

According to the late Dr. Houghton, in his Report of 1840, as State Geologist of Michigan, sandstones are seen to rise at a low angle from beneath limestones near Nebish rapids. These limestones are fossiliferous, and are part of the Lower Silurian series to which allusion has just been made. They here lie in the strike of similar limestones, observed by Mr. Murray in 1860, on St. Joseph Island, where, as well as in an outlying patch on Campement d'Ours, dipping at the same low angle as before, they contain an abundance of well marked Birdseye and Black River fossils, and where they rest upon eighty feet of similar sandstones, which are supported by Huronian strata. There does not appear to be any reasonable doubt that these nearly horizontal sandstones belong to the same series as those at Sault Ste. Marie rapids, and that they extend to the foot of Gros Cap Mountain; passing thence to Point Iroquois, White-fish point and Isle du Parisien. To the eastward of this island Mr. Murray represents them in a narrow strip, leaning against the Laurentian gneiss at a moderate angle, and stretching seven miles along the south side of Goulais Bay; also as forming the township of Kars and the chief part of the

Birdseye and Black River formation.

Murray's distribution of sandstones.

promontory between Goulais and Bachehwahnung Bays. He represents the large island in the latter bay, and the coast to the north of it as composed of them, with a conformable conglomerate beneath, while on the mainland amygdaloidal trap rocks appear beyond them in several places, resting on Laurentian gneiss and dipping westward at considerable angles. But in the neighbourhood of Ance aux Crêpes, on the south side of Mamainse promontory, older sandstones, in a disturbed condition, appear to be confusedly mixed up with the trap.

Macfarlane's section of Mamainse.

Mr. Macfarlane carefully examined the rocks of Mamainse promontory for the Survey, in 1866, and in his Report to me, at pp. 132-137, will be found what he has said of them. He roughly measured by pacing the beautiful section, which I had previously estimated as at least 10,000 feet thick, and separating it into forty-nine described masses, he raises the whole volume to 16,208 feet, of which 2137 feet are conglomerates, the rest being various kinds of igneous rocks. After various descriptive details, regarding lithological peculiarities and the conflict of sedimentary and eruptive masses, Mr. Macfarlane says:—

"From what has been stated above it would appear that there is, at several points, evidence of the existence of a sandstone of greater age than the bedded traps and conglomerates, and it would appear not unreasonable to suppose that it belongs to the lower group of the Upper Copper-bearing series. You have however pointed out (Geology of Canada, p. 85) that there are extensive areas of almost horizontal sandstones on the east shore, whose indicated dip, and freedom from intersecting trap dykes "seem to support the suspicion that they overlie unconformably those rocks which, associated with trap, constitute the Upper Copper-bearing series." In confirmation of the opinion you have expressed, I have to report that at a point to the south of Pointe aux Mines, where the Mamainse series adjoins the Laurentian rocks, the lowest member of the former is unconformably overlaid by thin bedded bluish and yellowish-grey sandstones striking N. 50° E. and dipping 18° north-westward. The lowest layer is a conglomerate with granitic and trappean boulders, and a bluish fine grained and shaly matrix. It is about six feet thick, and is followed by thirty feet of thin bedded sandstones, some parts of which might yield good flagstones. Some of the surfaces of these are very distinctly ripple-marked. Above these come thin, shaly, rapidly disintegrating layers, in which are spheroidal concretions from five to ten inches in diameter. It is not possible to ascertain the total thickness of these sandstones, since they descend beneath the level of the lake. They are similar in lithological character to the sandstones which occur on the north side of Pointe aux Mines."*

Unconformable upper sandstones.

These upper unconformable sandstones, there appears to me no reasonable doubt, are Mr. Murray's upper rocks from Mamainse to Gros Cap, and from Gros Cap to Nebish and Campment d'Ours; and it will thus readily be inferred from what has been said, that the reason why the tilted rocks of the Mamainse section, with a vertical thickness of over three miles, so suddenly disappear in their progress towards the Lower Silurian rocks to the south, is that they run under these unconformably.

* For the relation of the Pointe aux Mines sandstones to 3,000 feet of trappean rocks there, see Geology of Canada p. 82.

In the northern peninsula of Michigan the Sault Ste. Marie sandstones appear to run along the south shore of Lake Superior, parallel with the fossiliferous limestones, for 150 miles, and gradually to turn to the south-westward from the neighbourhood of Marquette, as if following the rim of the Michigan trough to which they probably belong. Farther to the west, the rocks of Keewenaw promontory are represented as constituting an anticlinal form, having sandstones on each side, with traps and conglomerates between. As will be seen from the following remarks by Professor Hall, a fossiliferous limestone equivalent to that of Campment d'Ours rests on the sandstone on the south side of the anticlinal.

Birdseye and Black River limestones on S. side of Keewenaw Point.

"In 1846, Mr. C. C. Douglas discovered a fossiliferous magnesian limestone, resting upon sandstone, on the south side of Keewenaw Point in a line between the head of the bay and the mouth of Misery River. In 1848 or 1849 Messrs. J. W. Foster and J. D. Whitney brought from this locality several species of fossils, which were submitted to the examination of the writer. The geologists of Michigan represent that the same sandstone at Grand Island is succeeded by a fossiliferous limestone, which is doubtless that of the Keewenaw Point. The character of the fossils from the locality on Keewenaw Point is such as to leave no doubt that the limestone is equivalent to the Buff limestone of Wisconsin, holding the identical fossils, and representing the Birdseye and Black River limestones.*"

Fossils in the sandstone.

From the sandstone itself on the south shore of Lake Superior the only fossils obtained are a *Lingula*,† collected by Mr. Forest Shepherd in Tequamenen Bay, which Hall compares with a Calciferous species, and a *Pleurotomaria* § obtained by Mr. Murray near Marquette, which Mr. Billings compares with *P. Laurentina* of the Calciferous, but states to resemble also *P. aperta* of the Birdseye and Black River formation.

This concurrent testimony from different observers of the south shore of Lake Superior, you will perceive all points one way, and apparently shews a wide extent of the sequence indicated near the exit of the lake. What the structural evidence north of the lake may be, remains to be ascertained. Should the unconformable overlying trap support the supposed Upper Silurian rocks of the northern country, the north and south evidence would agree. Should the trap rest on the Upper Silurian rocks, the inference would be, unless the evidence on the south can be explained away, that there are two trappean periods, one Lower Silurian or pre-Silurian, and the other post-Silurian. But it is not the duty of the Geological Survey to predict what the age of the northern trappean rocks may be, but to investigate the evidence carefully and state it impartially.

I have the honor to be, Sir,

Your most obedient servant,

W. E. LOGAN.

* Hall, Supplementary Notes on the Potsdam sandstone; XVIth Report of the Regents of the University of the State of New York, p. 215.

† Hall, same report, note p. 214. § Geo. Can. p. 86.