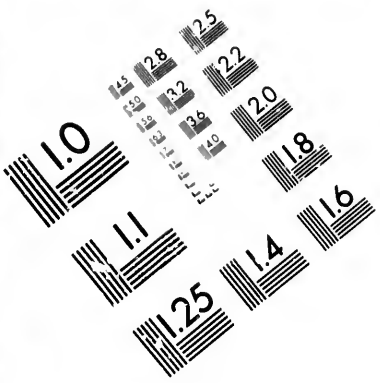

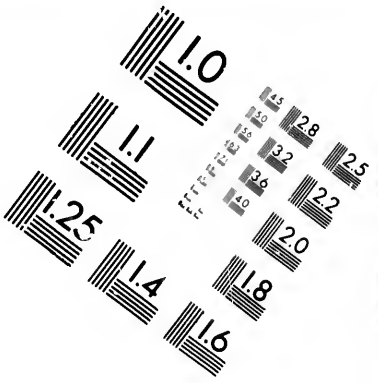

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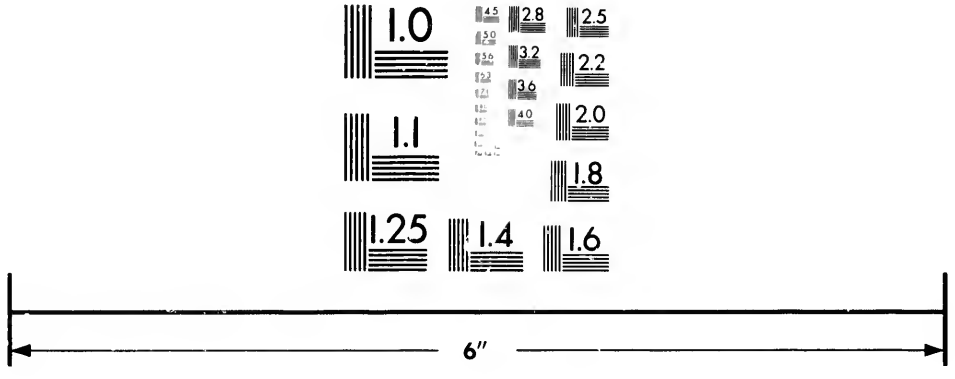

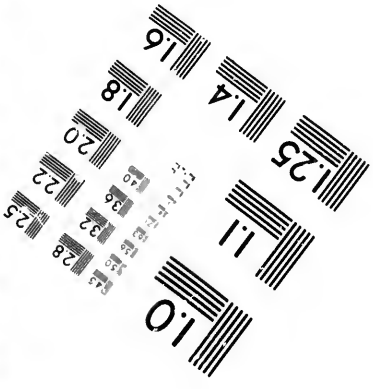

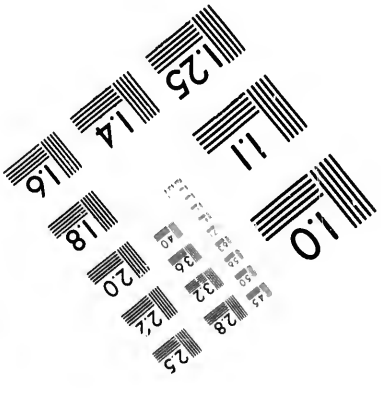

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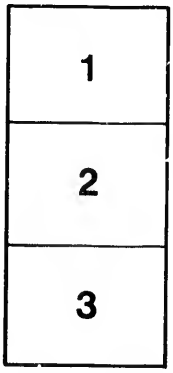

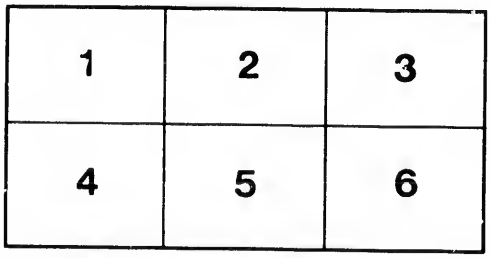

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Ottawa

GEOLOGICAL SURVEY

OF

Newfoundland.

REPORT FOR 1891 AND 1892,

ON THE

HUMBER VALLEY

AND

CENTRAL CARBONIFEROUS AREA OF THE ISLAND.

BY

JAMES P. HOWLEY, F.G.S.

St. John's, Newfoundland:
"EVENING TELEGRAM" JOB-PRINT,
1893.

ERRATA.

Page	
12,	11th line from bottom, for N. 25° E., read N. 25° E., S. 25° W.
21,	10th line from top, omit No. 9 in margin.
21,	12th line from top, add No. 9 in margin.
21,	9th line from bottom, for clay, read coal.
22,	4th line from bottom, for blush, read bluish.
23,	23rd line from bottom, omit No. 2 from margin.
23,	22nd line from bottom, add No. 2 in margin.
28,	12th line from top, for eleven, read sixteen.
28,	16th line from top, for seven, read twelve.
35,	4th line from top, for 1892, read 1893.
42,	5th line from top, for coaly with lay layers, read coal with clay layers.

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GEOLOGICAL SURVEY OF NEWFOUNDLAND,
MARCH 31ST, 1892.

HONOURABLE SURVEYOR GENERAL,

SIR,—I have the honor to submit the following report of the operations of the Geological Survey during the season of 1891.

Acting upon a suggestion contained in the report for the preceding year, with reference to the possible existence of valuable coal deposits in the central Carboniferous area of the island, the Government were pleased to direct that a more minute investigation of this region be undertaken. Accordingly, as soon as the necessary preparations for the season's work could be completed, our party started for the Bay of Islands, embarked at Humber Arm, and proceeded up the Humber River in a boat and canoes; our objective point being the Grand Lake valley, or eastern branch of the Humber River. As a considerable delay had necessarily to be incurred in getting all the season's provisions, boats, camp gear, &c., over the Grand Lake portage to the latter lake —a distance of about eight miles—I availed of this delay to make a flying journey up the main Humber towards White Bay, in order to investigate a rumour relative to the existence of coal in that direction. In the meantime, Mr. Bayly had instructions to proceed to the Grand Lake, and when everything was safely portaged, to store our provisions in huts—one at the outlet of the Junction River, and one at the mouth of the inflowing Sandy Lake River—so as to have them convenient for use while working around the shores of the lake. This being accomplished, he was further instructed to sink a series of pits along the north shore of the lake, at points indicated, where it was hoped the underlying bed rock might be reached, and a clue to the structure thereby obtained; with what result will appear later. Taking along with me two Indians and a single canoe, I continued up the Main River, investigating the structure as I went, whenever an opportunity presented itself. Having reached the great bend, where the river forks and forms two considerable streams, the one known as Birchy Pond Brook, leading up north-easterly, in the direction of our route was then followed. Birchy Pond is a shallow, sandy lake, surrounded by low land. A beautiful steady, winding about through a fine tract of flat intervale,

extends beyond the lake two or three miles; then the river approaches the surrounding hill ranges, where it is split up into several smaller streams, which are of too rocky and turbulent a nature to admit of further progress by canoe. Selecting one of these, which led upwards in a general course about east-north-east, and being provided with several days' provisions, &c., we proceeded on foot, following the course of the stream, until it became so exceedingly rugged and walled in by cliffs of greyish gneiss, as to compel us to abandon the brook and take to the forest. Our progress was necessarily slow, and it took three days to reach the point aimed at. This was a suite of long, narrow lakes situated in a deep gorge, hemmed in by lofty hills—which upon the north side of the upper lakes rise directly from the water's edge. On the last lake of the suite, a gigantic cliff of light-coloured rock formed a perpendicular wall of great height all along the north side. This proved to be composed almost entirely of white, or light-coloured marbles, similar to those at the mouth of the Humber River. All the surroundings, together with the situation of the lakes, and the remarkably conspicious feature presented by the marble cliffs, left no doubt as to the identity of the place described to me. Similar marbles had been previously recognized in journeying up the brook, though not in so great a volume. The existence of these deposits had been hitherto unknown, and probably might have remained so for many years to come, but for the accidental circumstances which led us to explore this particular locality the present season. On ascending the high land to the northward of the lakes, in order the better to define our position, we found that but a comparatively short distance separated us from the waters of White Bay. Several large bergs of last season's ice-floe still floated about on the bosom of the placid waters. Partridge Point, forming the entrance to the Bay was clearly visible away to the eastward, while the deep, sombre valley intersecting the hill range, apparently almost alongside, indicated the position of Sopp's Arm on the north side of the bay. As, however, our time was limited, and we had no particular object in visiting the shores of White Bay, we began to retrace our steps, closely scrutinizing our surroundings as we journeyed along. It soon became quite evident that, while the information furnished relative to the physical features of this part of the country was exceedingly correct and reliable, yet, in the more important point: that of the existence of a coal deposit hereabouts, the imagination of the informant had been drawn upon too extensively. Not only was there no probability of coal occurring in the neighborhood, but the entire absence, even of a single member of the Carboniferous

series, was most apparent. In fact, the surrounding country was constituted of rocks clearly belonging to the great Laurentian and Lower Silurian epochs. We had left the basic conglomerate of the Carboniferous basin, of the Humber Valley, far down the river on our first day's journey.

Being quite satisfied of the inaccuracy of the information furnished me with regard to the existence of a coal deposit here, no time was lost, therefore, in useless search. An immediate retreat was commenced down the Humber to Junction Brook, whence we portaged across to the Grand Lake, where we rejoined Mr. Bayly and party. They had been so far unsuccessful in their operations at the head of the lake, being everywhere met by such an immense superficial deposit of sand, gravel and boulders, as to utterly preclude the possibility of reaching the bed rock, by means of surface cuttings. Nevertheless, they came across numerous loose pieces of coal scattered through the gravel, and also some fragments of rock containing fossil plants, of a character which indicated pretty clearly that true coal measures lay beneath. Having spent a few more days in a further attempt to reach the latter, we then moved camp across the lake to the mouth of Coal Brook. Here a regular system of costeaning was carried out along both sides of the brook, as far as the measures were accessible. Later on, we again moved camp two miles westward, to a small brook called Aldery Brook, where good sections were exposed in like manner. Some considerable work was also accomplished on two other small brooks flowing into the lake on the south side—one about midway between Coal and Aldery Brooks, and the other about a mile still further west. The sections exposed on these latter, were not, however, nearly so extensive or easily reached as on the former brooks, owing to the great depth of the surface accumulations. Details of the sections uncovered on Coal and Aldery Brooks, will be found further on, under the head of Geological Structure.

While these costeaning operations were in progress near the head of the lake, Messrs. Bayly and Thorburn, with an Indian, ascended Sandy Lake stream, and made a survey of the Goose Pond tributary, where it was hoped some rock exposures, affording a clue to the structure in that direction, might exhibit themselves. In this, again, we were disappointed; no such exposure of the bed rock occurring so far as the survey extended. Later on, an expedition was undertaken to the extreme western end of the Great Lake, partly to investigate another rumor referring to a coal seam having been seen in that direction, but

chiefly to make a re-survey of the lake itself; more especially the southern reach inside Sir John Hawley Glover's Island, a portion not hitherto finished. It was now well up in October, and the weather, which all throughout the summer had been of an exceptionally favorable character began at last to break up. The prospect of accomplishing any more work here for this season, with pick and shovel, was at an end. We accordingly packed up and got across the lake again, being delayed several days, owing to the stormy character of the weather. Before leaving the portage we experienced some slight snow showers, and for days the distant Bonne Bay hills to the north wore quite a winterish aspect.

On arriving at the marble cliffs near the mouth of the Humber River, it was the intention to spend several days there, endeavoring to procure some good specimens of the rock; but almost immediately I received your telegram, requesting me to visit and inspect the asbestos deposits near St. George's Lake. The time intervening till the arrival and departure of the mail boat, left me but three or four days at the outside to accomplish the journey in, consequently I had not a moment to spare. Leaving Mr. Bayly to procure the marble specimens, I started on foot with two Indians, from the Humber Sound, and after a day and a half of exceedingly hard travel arrived at the place. Capt. Prideaux, in charge of the works at the time of my visit, kindly housed me while there, and showed me the various openings and outcrops in the vicinity of the mine. In the meantime the weather had set in wretchedly cold, wet and stormy. Seeing that I now ran a great risk of missing the steamer were I to return to Bay of Islands, I concluded instead to continue on to Bay St. George, which course would give me at least an extra day. Another object was held in view by the adoption of this route, viz.: to acquire a more accurate knowledge of the country hence, such as would enable me to lay down, with tolerable certainty, the route of that portion of the western extension of the Railway, which circumstances prevented our completing last season. Two days' journey took us out to Sandy Point, where we found that the steamer had not yet arrived coming west, having been greatly delayed on her passage up by the extremely boisterous character of the weather of late.

THE HUMBER VALLEY.

It may seem needless on my part to enter into a lengthened description of the topographical and physical features of the lovely Humber Valley in the present instance. The subject has been so frequently treated of before in previous reports, letters, papers, etc., that there would appear to be nothing further to add on this head. As, however, each season's exploration tends to extend our knowledge of the country generally, and as there still lingers in the minds of many persons a considerable amount of scepticism as regards the truth of these reports, especially in reference to the existence of good agricultural lands, extensive timber forests, and valuable mineral deposits, etc., a certain amount of repetition is clearly unavoidable.

The introduction of the camera into our survey outfit during the past two years, has done much to dispel these doubts; but, in order to render this means of appeal to common sense and reason more effective, I have prepared a series of views illustrative of the scenic beauty of the splendid valley to accompany the present report. They will convey a far better idea of what this section of country is really like, than anything I could write on the subject.

For the first two miles of its course the Humber River runs in a deep, narrow, crooked gorge, or cañon, where during the lapse of ages it has cut a passage for itself through the lofty coast range into the Humber Sound. Beyond this, the river expands into a wide stream with smooth flowing current which is unbroken by rapids or rough water for nearly eight miles. This is called the Lower Steady of the Humber. The valley continues narrow, but gradually increases in width, and the marginal fringe of low land on either side becomes more level, and covered with very superior soil as Deer Lake is approached. Though still densely timbered along these lower reaches by spruce, fir, yellow and white birch, etc., yet all the available pine which once grew here in great luxuriance, and of excellent quality, has long been culled out. Nothing but the stumps are now left to testify to the size and character of this particular timber. The beautiful Deer Lake, sixteen miles long, is separated from the steady by about one mile of running water, terminating with a short, strong rapid, known as Fisher's Rapid. On either side the lake, the hills recede further and further back, till on

approaching the head, a very wide area of low wooded country extends away from its shores, and stretches far to the eastward up the Main River Valley. Several beautiful patches of good intervale land occur wherever any tributary brook flows into the lake. Those on the valley of South Brook, near the south-west corner, and North Brook, near the head of the lake, are c considerable extent. A small section near the mouth of the former has been partially cleared, and has yielded excellent and abundant hay crops for many years past. Nichols' farm, about a mile above the lake, on the main river, has been frequently adverted to, especially in last year's report. I doubt if the soil here could be surpassed by anything in the Lower Provinces of Canada, certainly not, so far as I have had an opportunity of comparing them. The dense forest surrounding Deer Lake has also long since been culled of its pine, but there is much valuable spruce and fir, especially the latter, still intact, while white and yellow birch are very abundant and of fine size. Here also grows, more profusely than I have seen it elsewhere, the black ash *(Fraxinus Sambucifolia)*.

From the head of Deer Lake, the Valley of the Humber extends for miles to the north, east and south, bounded only in the far distance by the hill ranges, which constitute its marginal outline. The extent of this part of the valley is not less than (20) twenty miles wide by about (25) twenty-five long, including an area of 500 square miles. The narrow valleys of the Lower Humber and Grand Lake, and also that above Sandy Lake on the eastern branch added to the above give a total of about 800 square miles as comprising the area of the Humber Valley proper. Two parallel water systems constitute the main drainage of the region. They might almost be considered distinct, were it not that they are connected by Junction Brook, running almost at right angles to either, through which the Grand Lake discharges its waters into the main Humber. It would appear as though, at no very remote date, the Grand Lake waters really had their outlet at the western end of the lake, and discharged into St. George's Bay, nor would it be a very difficult feat of engineering skill to cause the waters again to resume their old-time channel.

The ascent of the main branch above Deer Lake for some five miles, to where it is joined on the south side by Junction Brook, is quite easy—the river being wide and smooth, with a deep, gently-flowing current. The country on either side is very flat and densely timbered, the land being all of superior quality. At the mouths of some of the smaller tributaries there are extensive tracts of magnificent intervale.

A mile above Junction Brook the first bad rapid occurs upon the river, and from thence to Willow Steady, some two miles further, a succession of low, rocky ledges strike across, causing shallow bars and broken water; many portions also being encumbered with boulders. Willow Steady is a beautiful spot. The broad expanse of smooth water is studded with well-wooded islands, the timber being chiefly birch and poplar, while the land on either side of the Steady is level, densely wooded, and the soil exceptionally good. A long interval of some twelve miles of more or less broken water and occasional strong rapids, but with frequent shoal, sandy bars and smooth current, intervenes, between Willow and the Upper Steady of the Humber. Low ledges of sandstone, shales, marls, etc., crop out along this section, and at two points produce falls, one of which (the Big Fall) has a jump of ten or twelve feet over a ledge of coarse conglomerate which strikes directly across the river. The entire country along this section is again well wooded, though some of the coarser sandstones coming to the surface produce at times patches of more or less barren land, covered only with a thin soil. In the vicinity of the Big Fall fire has laid bare a very extensive tract of country on either side of the river; but there is a vigorous growth of young timber, chiefly birch, rapidly taking the place of the denuded forest. Four miles above the Big Fall commences the beautiful Upper Steady of the Humber, extending, with little interruption, to the great bend and fork of the river nine miles above. This section of the valley is very low and flat, and chiefly composed of aldery intervale sand. The river is here split up into several channels intersecting the low ground, and cutting it up into numerous flat islands or intervales, elevated only a few feet above the ordinary summer level of the water. The soil of which this intervale is composed is exceedingly rich, deep, and free from stones, and undoubtedly ranks amongst the very best in the island. It is usually a dark, rich-brown loam, containing much vegetable matter, together with other elements eminently calculated to produce fertility. Owing to its slight elevation above the river, it is periodically covered by the overflow during the spring freshets. This only tends to further enrich and add to its productiveness by depositing from the surcharged waters a thin stratum of silt each time. Whenever these lands are brought under proper cultivation, I have no hesitation in pronouncing the opinion that they will produce the finest hay or cereal crops with the minimum of labour or use of artificial fertilizers. From the forks the intervale land was found to extend up the Birchy Pond Branch some four miles further, being especially of excel-

lent character around Birchy Pond. On the other branch, which runs directly west from the fork, and at ten miles above expands into Adie's Pond, there is also a good deal of fine intervale land and much heavily-timbered country. Along these upper reaches of the river the timber is still almost untouched. Only now are the proprietors of the Humber saw-mill beginning to push forward in this direction, and as there is a very considerable quantity of pine (besides the spruce, fir, and birch) covering a large area on this branch of river, there seems every prospect of the mill-owners finding ample material to prosecute their lumbering industry here for many years to come.

Turning now to the southern branch or Grand Lake valley of the Humber, we find an immense plateau laying between the two waters covering an area of over one hundred square miles, which is more or less densely timbered, but interspersed throughout with marshes and ponds. Much of the surface soil covering this large tract of country appears to be rather sandy; but there are also extensive patches of good land and marshy intervale, especially along the numerous small tributary brooks. Exactly similar lands in New Brunswick, when properly cleared and cultivated, make good farms and bear excellent crops of hay and cereals. The southern or Grand Lake basin includes the whole of the long, narrow valley which encloses the Grand Lake and the country extending eastward up the Sandy Lake river to Sandy Lake, and the valley above the latter to the Upper Birchy Pond, which forms the headwaters of this branch of the Humber. The area of this latter valley is about 150 square miles. With the exception of a narrow fringe along the shores of the Grand Lake, which in most cases might be availed of for cultivation, most of the surrounding country is very high and mountainous, especially on the upper and western half of the lake. Very much of the low country north and east of the Grand Lake, and between it and Sandy Lake, is marshy or otherwise composed of low, barren, sandy ridges, and it was proven by the boring in 1879, and by our subsequent excavations, that this character of superficial deposit attains a great depth all over the region. It cannot be called a good soil by any means, though capable of much improvement by cultivation and blending of its various qualities. Those portions more densely timbered, as along the shores of Grand Lake and on the Goose Brook Valley, show a better quality of soil; and there are many tracts of intervale on the Main Brook and tributary streams. The densely-timbered slopes along the margin of Grand Lake exhibit all the usual variety of forest-growth, common to this island, in great profusion.

White pine is particularly abundant in some places, and is pretty fairly distributed throughout as far as the eastern half of Sir John H. Glover's Island. Eastward from the head of the lake most of the timbered parts of the country lying between Grand and Sandy Lakes display a fair proportion of pine. On the Goose Brook tributary, near Sandy Lake, some good specimens of the red pine *(pinus resinosa)* were observed last year. Up to the present this section of the Humber Valley has scarcely been encroached upon by the lumber men, who found the difficulty and danger of running logs down Junction Brook too much to cope with. Here, too, so far, the forest has escaped destruction from fires, though much damage was done thereby near Sandy Lake and above some years ago. The wealth of the timber resources still available on the magnificent Humber Valley, together with the superior quality of soil covering so large an area and capable of being cultivated to advantage, far exceeds anything on the eastern side of the island. It may safely be estimated that at least four hundred out of the eight hundred square miles which comprise the entire valley are of this favourable character, while I have little hesitation in saying that half the remainder would compare favorably with most of the land cleared and cultivated on the eastern seaboard. Its capabilities have been fairly tested at one or two points, notably Nichols' farm, Deer Lake, so frequently alluded to. Nichols is quite confident of his being able to raise wheat crops every year without difficulty, and, in proof thereof, furnished me with an excellent sample of grain grown on his farm last season.* The picture of Nichols' clearing will afford a good idea of the country there about, while those of Willow and Upper Steady will convey a much better conception of the flat, timbered country and extent of intervale land, than any written description. In point of scenic beauty, however, the views on the Lower Humber and along the Grand Lake are much to be preferred, especially those charming cascades of which there are probably a hundred or more around the shores of the Grand Lake and on the Great Island. The beauty and variety of the scenery alone is likely to attract many tourists to this region in the near future, so soon as better facilities for reaching it than those at present existing are afforded. In this connection I would strongly urge that, in the meantime, the Grand Lake portage be improved and rendered somewhat more passable than

*Since the above was written, Nichols was presented with a small sample of the Ladoga Russian wheat, introduced here by His Excellency Sir Terence O'Brien, K.C.M.G. It grew most luxuriantly last season, 1892, and the grain raised from this sample (some of which is now in the museum) has been pronounced, by those competent to judge, of a very superior quality.

it is. The expenditure of a couple of hundred dollars in clearing, stumping, and draining the track would prove a great benefit to wayfarers crossing this part of the island, especially to the telegraph people at Sandy Lake station.

GEOLOGICAL STRUCTURE.

The hill ranges which form the marginal outline of the Humber Valley are, as might be expected, composed of various geological formations, or portions thereof, but as these have been frequently treated of in former reports, it is not my intention at present to enter into details of their structure. A general outline of their distribution and chief characteristics, as observed at various points, will sufficiently indicate their prevailing geological features. The gorge of the Lower Humber is walled in by immense cliffs of bluish gray mica slate, interstratified with grey quartzites and immense beds of limestone. All these rocks are greatly crumpled and folded into huge, billowy undulations. They have apparently undergone much metamorphism, and the limestones in particular have nearly all lost their original character. They now constitute a variety of beautiful marbles, ranging from pure, white statuary, through various shades of yellow, red, drab, grey, etc., to black. This is the well-known Humber marble deposit, a good idea of which may be gathered from the views of Marble Head, and the marble cliff, nearly opposite; while the bird's-eye view down the gorge fairly illustrates this interesting portion of the river.

These valuable marbles have never as yet been properly tested, nor has their distribution been followed out beyond a very limited extent. Their strike, which is nearly at right angles to the course of the river, or N. 25° E., magnetic, would carry them in the one direction, towards the head of Adie's Pond, where they pass beneath the overlying Carboniferous series, which latter rest for a long distance directly upon the Laurentian gneiss of the Long Range Mountains. The slates with their accompanying marbles reappear, as already shown, towards the shores of White Bay, on a small tributary of the Humber, and in the same general line of strike. In all probability their equivalents will be found on the sea shore of Little Coney Arm, White Bay, amongst the rocks described by Mr. Murray, in his Section (page 16) Report for 1864, and again in the marble deposits of Canada Bay. In their western extension, all we know as yet is the occurrence of altered limestones on

the headwaters of Harry's Brook, and also the brook flowing into the extreme western end of the Grand Lake, which, from certain resemblances, and their position in relation to the mica slates and general strike of the beds, would seem to indicate that they are the same. Some thin, impure beds of dirty white and flesh-colored, coarsely crystalline marbles, with thin strings of mica running through them, arranged in parallel layers, were met with near the extreme western end of the Grand Lake this season, dipping toward the S. Eastward. This rock exactly answers the description of a limestone or marble identified by Mr. Murray at Hauling Point, White Bay, in 1864, which he believed then to be the equivalent of those at Coney Arm, on the north side of the bay. No doubt, should these immense marble deposits ever become utilized for building or ornamental purposes, and prove of sufficient economic importance, the work of tracing out their distribution more thoroughly will soon follow. In all probability it will be found almost continuous between the two extreme points at which they have been recognized—a distance of over one hundred miles.

Slates, quartzites, &c., similar to those described above, form all the hill ranges along the Lower Humber, and the shores of Deer Lake for some three miles, or up to the point opposite Burnt Island. They are much folded and contorted, and have evidently undergone considerable metamorphism. The same strata, very much broken and faulted, are repeated over and over again. Numerous quartz veins intersect these slates throughout, and at Burnt Island, on Deer Lake, some of these have been found to contain small quantities of molybdenite in specks or thin plates. An attempt at mining this ore, under the impression that it was galena, was made here some years since, but soon abandoned on finding it so sparsely disseminated through the quartz. In a cove just beyond Burnt Island, the slates and quartzites strike inland, and are succeeded at a short interval by the basic members of the Carboniferous series. In their southerly extension, the same rocks continue to form the marginal fringe or lip of the valley, sweeping around the eastern foot-hills of the Laurentian Ridge, which occupies the tongue of land between the two great lakes—Deer Lake and Grand Lake—they strike all along the north side of the latter a short distance back, and run out to the shore near the eastern end of Sir John Hawley Glover's Island. From thence to the extreme western end of the lake they occupy both shores, and the greater part of the island also. In this direction they appear to have been subjected to even a still greater degree of disturbance than elsewhere. Hugh masses, chiefly of dark gray and

greenish trap, disrupt the strata in all directions. One of these forms an immense headland on the southern reach, inside the great island, which, towering above the surrounding country, becomes a most conspicuous object, distinctly visible, even from the extreme head of the lake. A reddish syenite, chiefly composed of feldspar, occupies much of the central portion of the big island, and is seen to strike into the mainland of the southern reach. Towards the western end of the lake the slates in many instances are unmistakable mica schists, frequently characterized by numerous embedded coarse garnets, while many of the more compact beds are not to be distinguished from ordinary gray gneiss. On the south side of the Great Lake, proceeding eastwardly or towards the head, the Carboniferous series occupy most of the shore line from the eastern end of the island; but at one or two points, as in the vicinity of Old Harry Mountain, and again, about a mile west of Hind's Brook, bands of red and green jaspery slate, intersected by trap dykes, crop out on the shore for short intervals. They were met with again on Aldery Brook and Coal Brook about a mile from the shore, greatly disturbed and altered, and resting upon a long ridge of Trapean Hills, which form the rearground or southern rim of the valley, and run up and down the country nearly parallel with the shore of Grand Lake, striking away to the eastward in the direction of the falls on Kitty's Brook. Thus we have the outline of the Humber Valley pretty well defined on three sides, north, west and south; but so far the eastern margin has not been closely examined, nor is it certain what are the chief characteristics of the prevailing rocks in that direction. The relative position of all these sedimentary strata places them between the recognized Laurentian and Carboniferous series, in all cases where the contact with either has been observed. They are probably all referable to the lower portion of the great Silurian and Cambro-Silurian formations, but their highly altered condition, and the absence of organic remains, renders it difficult to assign to each set of strata their exact geological position. The presence of the trilobite *Olenellus Vermontanus*, and a *Lingula* allied to *Lingula Prima*, observed by Mr. Murray at Canada Bay, in 1864, in close proximity to, if not actually amongst, the marble beds there, and also the finding of some fossils on the head of Harry's Brook, all of recognized Potsdam types, leaves little doubt that much of the strata in various parts of the distribution are referable to that and associated divisions of the Lower Silurian formation. Towards the westward similar rocks occupy much of the peninsula between the Humber Sound and the north side of Bay St. George.

They are succeeded toward the shores of Port-au-Port Bay by higher members of the same great series, including all the members of Sir Wm. Logan's Quebec group, largely displayed and clearly defined by their profusion of well-preserved, organic remains. Such, then, are the principal series of rocks which compose the rim or margin surrounding the great plateau of the Humber Valley, and, no doubt, also forming the floor upon which the Central Carboniferous basin of the island rests.

CARBONIFEROUS SERIES.

As indicated at the commencement of this report, the immediate object of last season's investigation was to examine more particularly into the structure and distribution of the Carboniferous series of formations, already known to occupy a large area of the Humber Valley. The possible occurrence of some more promising coal deposits than those hitherto revealed by the boring operations of 1879-80, having impressed itself forcibly upon me during the preceding season's survey. It was strongly urged that a more close and extensive exploration of the region should be entered upon. The Government were pleased to approve of the suggestion, and the result of the work has been already laid before them in a short preliminary report, furnished immediately after our return home last autumn. It is now pretty clearly established that the entire plateau, comprised within the valley of the Humber proper, is occupied almost exclusively by the Carboniferous series of rocks. They are spread out in nearly horizontal strata, or in low, wave-like undulations, stretching across the valley from north to south, while in their longitudinal extent they are bent so as to conform generally with the contour of the country; but, on the whole, they may be said to lie very flat, and, as a consequence, the lower members hold the surface over considerable distances. In this manner the whole of the main river valley is now known to be entirely occupied by the unproductive lower series, the highest strata observed on this part of the valley being clearly of the millstone grit formation, many hundred feet below, even the commencement of the true coal measures. It is then toward the south, in the direction of the general incline of the strata, we have to look for higher accumulations, and where the prospects of any portion of the true coal measures occurring might be reasonably expected; but before proceeding to de-

tail the result of the work in that direction, a short outline of the general distribution on the main river valley will be necessary. On the shore of Deer Lake, about three miles from the outflow, the first outcrop of the Carboniferous series is met with. It is an exceedingly coarse conglomerate, similar in most respects to the basic conglomerate in St. George's Bay. Here as there, it forms the lowest known strata of the Carboniferous series. It rests upon the mica slates, described above, on the north shore of the lake, but a similar conglomerate on the south side, near the head of the lake, rests upon gneiss. This basic conglomerate has been traced pretty continuously throughout the greater part of its extension. It was found on the one hand to strike inland from the north shore of Deer Lake, in the direction of Adie's Pond, and it was met with in considerable volume the past season on a tributary of the Humber, above Birchy Pond, and on the same strike. Here the conglomerate rests upon gray hornblendic gneiss. Sweeping around easterly and southerly, it turns into the country towards the head of White Bay, or between it and Sandy Lake, in which ditection it has not as yet been followed out. Succeeding it, all along the main branch of the Humber, and in their regular order of superpostion, are the sandstones, shales, marls, &c., of the next division—the Carboniferous limestone. This latter presents some peculiarities here, not met with elsewhere in the Carboniferous series of Newfoundland. Though called the Carboniferous limestone formation, yet in this section the limestone proper constitutes but a very small percentage of its bulk. The entire absence of gypsum, which forms such a distinctive feature of this division in the St George's Bay trough, is rather remarkable, not one particle of that mineral substance was observed anywhere throughout this central region. What would appear to be the position of the gypsiferous strata here, is occupied by a considerable mass of dark, grey shale, with thin irregular calcareous layers near the base. Some portions of these shales are highly bituminous, and on exposure to a sufficient heat ignite and burn with a clear flame, giving off the odor of naphtha. They are largely displayed on the main river, between the two falls, where they form a low, nearly flat, anticlinal fold, passing beneath heavy beds of coarse, red sandstone and conglomerate at either side. It is this overlying sandstone, &c., which, striking across the river in flat ledges, gives rise to the falls in question. The relative position of these shales in the series, together with their bituminous character, seems to corelate them with the pyrochists of the New Brunswick Carboniferous basin, in which the remarkable mineral substance

albertite was found. These shales are not actually met with again on this side of the trough, but they are known to occur in considerable volume on some of the smaller tributaries flowing into the Humber on the north side, above Deer Lake. This enables me to follow out their distribution and lay them down on the map with little difficulty. Resting upon these pyrochists, as already stated, on either side of the anticlinal fold, a great mass of heavy-bedded sandstones and rather coarse conglomerates, all more or less red in color, form the cliffs and ledges along the river above and below the falls. In the former direction, they are met with up to the beginning of the Upper Steady, where they disappear beneath the surface, and for a long distance no rock is exposed. This is where the flat intervale land occurs. Toward Adie's Pond on the main river, a few low, flat outcrops of red sandstone and conglomerate occur, and on the south side of that lake some thin beds of reddish limestone were seen, interstratified with the sandstones, &c., in 1879. On the south side of the anticlinal, a similar set of sandstones, marls, &c., occupy the bed of the river, forming numerous flat ledges, stretching across its course, down to within a mile of Junction Brook, where they again disappear. Some coarse-grained, grayish sandstones on this section of the river are probably referable to the succeeding millstone-grit formation; but there is little doubt that the bulk of the strata exposed on the main branch of the Humber is included in the Lower Carboniferous limestone and conglomerate divisions. Following the structure southward in the direction of the Grand Lake Basin, or southern branch of the Humber, the basic conglomerate first seen on the south side of Deer Lake, sweeps around the eastern base of the dividing ridge, towards the former lake, and thence follows its northern shore westward to the eastern end of the great island. The conglomerates and sandstones outcrop in considerable volume near Whetstone Point, about seven miles up the lake, and again opposite the island, where bare cliffs, including much of the brilliant, red, marly strata are exposed. A considerable portion of the eastern end of Sir John H. Glover's Island is also composed of these lower strata, and they again crop out on the south side of Grand Lake in great force, a little to the eastward of the Island, where beds of red and drab-colored limestone are of more frequent occurrence than at other points of their distribution. Nowhere on the shores of Grand Lake were the calcareo-bituminous shales met with in place; they were, however, seen on the Junction River, at a rapid called Kill-Devil, about two miles and a half from the outlet. Last year some shales, bearing a

strong resemblance to them, were also observed on Glide Brook, near the crossing of the telegraph line, two and a half miles from the head of Deer Lake. At Kill-Devil they are, as usual, overlaid by coarse, red sandstones, conglomerates, and marls, answering in every respect to those seen on the main river. From the last-mentioned outcrops on Junction Brook no rocks are exposed in place, in a southerly or easterly direction, for a long distance. In the latter direction a great flat plane stretches away for fifteen or twenty miles up the valley of Sandy Lake river, and some distance beyond Sandy Lake, covered with deep deposits of clay, sand, and gravel, which effectually conceal the strata beneath. Again in the former direction, that in which the accumulation of higher measures might naturally be looked for, nearly eight miles intervene, including the breadth of Grand Lake at its widest part, between the last-mentioned outcrop and the next succeeding it to the southward. We are thus to a great extent left entirely to conjecture what may be the subjacent structure of this great superficial mantle extending over so large an area of country. It is true the boring operations undertaken here in 1879-80, along the side of the Sandy Lake river, clearly revealed the existence there of at least a portion of the upper or true coal-bearing measures, with a few small included coal-seams. Whether these measures continue to increase towards the south and bring in any appreciable thickness of this valuable member of the Carboniferous series, or whether the lower unproductive divisions come again to the surface, between this and the south side of Grand Lake, are questions which at present cannot be answered with any degree of certainty, nor will it ever be possible to do so without resorting to the further and more extensive use of the boring rod. All the evidence which can now be brought to bear seems to point to the strong probability of higher measures existing near the centre of the upper end of Grand Lake. Much will depend upon the angle of inclination at which such beds incline to the horizon, as to whether any considerable thickness ensues or otherwise. Should the boring operations be resumed, and the result prove the existence of higher coal measures containing valuable coal seams, then their extent in an east and west direction, along the line of strike, would be a matter of the utmost importance to determine. Turning now to the southern side of the Grand Lake, we find several small patches of Lower Carboniferous strata, resting against the metamorphic and trappean hill range bounding the valley on this side. Beginning with the limestones and marls opposite the eastern end of the great island, and following the south shore eastward, towards the head

of the lake, higher and higher strata are brought in at each succeeding outcrop, until undoubted millstone grit, gray sandstones and fine gray conglomerates prevail. Near Hind's Brook these measures are well seen, and what appears to be the uppermost strata of the formation, coarse, thick-bedded, friable, gray sandstones and fine conglomerates characterized by numerous small, white quartz pebbles, are seen at the mouth of a small brook, two miles east of Hind's Brook, dipping S. 10° E., at a high angle of inclination. The next exposure of the rocks in place on the lake shore, takes place some two miles still further eastward. Here fine-grained, finely-micaceous, greenish-gray sandstones and loose, shaley layers just protrude above the surface, striking up and down the shore in an extremely straight line, bearing N. 60° E., S. 60° W. magnetic. These latter clearly represent a portion of the true coal measures. They dip at an angle of between 60° and 70° southward, and their strike eastward would carry them into the flat country at the head of the lake. No rock is exposed beyond this anywhere around the head of the lake, but on ascending any of the small brooks flowing into the lake on this side, exposures of the coal measures were invariably met with in greater or less volume, and at various distances from the shore. In each case they were found to dip south, or S. by E. invariably at a high angle and always ending abruptly against the trap and metamorphosed slates of the older formation, at an average distance of about one mile back from the Lake Shore. It was afterwards clearly ascertained, that the coal measures here, formed a deep narrow trough, with strata repeated on the southern side by a slightly overturned dip, so as to give the appearance of a continuous southerly inclination. The best and most extensive exposures of the coal measures were found to occur upon two pretty stout brooks, viz., Aldery Brook, two miles and a quarter from the head of the Lake, and Coal Brook, near its S. E. corner. On the former, the first exposures occur just twenty chains in a direct line from the shore of the Lake, or by the course of the stream about thirty-five chains. The following section is then brought in to the south or up the stream:—

Section of Coal Measures on Aldery Brook.

	Strata. Ft.	In.	*Coal.* Ft.	In.
Chiefly red and brown shales mottled with green occasional bands of coarse grey sandstone.....	272	0		
Greenish grey, coarse and fine grained sandstones with red and greenish arenaceous shales.....	112	0		
Thick and thin, coarse and fine grained greyish sandstones and loose arenaceous shaley beds a good deal concealed, some heavy beds of coarse whitish grit towards the top	230	0		

	Clay bed with thin dirt streak			1	0	
	Thick and thin sandstones, shales and clay alternating, some reddish and brownish strata a good deal concealed			163	0	
		Ft.	In.			
No. 1.	Tough underclay	4	8			
	Impure slatey coal	0	4			
				4	8	0 4
	Chiefly loose, rotten, shaley rock, with occasional beds of coarse grey sandstone and clayey layers a good deal concealed			140	0	
	Red and brown arenaceous shales and sandstones with occasional claybeds			70	0	
	Greenish grey, loose shaley rock with about 30 feet of massive whitish sandstone or fine grit towards the top			70	0	
	Fire clay with dirt streak			2	0	
	Greenish grey sandstones and shale alternating			73	0	
		Ft.	In.			
No. 2.	Shaley underclay	4	0			
	Coal	0	2			
	Tough clay with coal streaks	0	7			
	Coal	0	2			
	Carbonaceous shale and clay	0	4			
				4	9	0 6
	Loose shaley rock with clay layers and occasional thin bands of sandstone			42	0	
		Ft.	In.			
No. 3.	Underclay	2	0			
	Coal	0	2			
	Impure coaly clay	0	4			
	Coal	0	3			
	Clay with coal streaks	0	3			
	Carbonaceous shale	0	6			
				2	11	0 7
	Loose, shaley rock, thin sandstone bands and clay layers alternating			158	0	
		Ft.	In.			
No. 4.	Underclay	1	0			
	Soft shaley coal	0	7			
				1	0	0 7
	Loose, shaley rock with thin sandstone layers, several bands ironstone in irregular nodular layers, and some continuous beds of two and three feet thick			124	0	
		Ft.	In.			
No. 5.	Dirty band with shaly coal	1	2			
				1	0	0 2
	Loose shaley rock with ironstone bands			20	0	
		Ft.	In.			
No. 6.	Tough underclay	2	0			
	Coal	1	2			
	Shale and clay	1	0			
	Coal	0	4			
	Clay and shale	1	2			
	Coal and clay mixed	0	6			
	Shale	2	6			
	Coal	0	2			
				6	10	2 0
	Coarse and fine grained gray and whitish sandstone or fine grit with shaley partings, more shale towards top, several clay bands and dirt streaks			103	0	
	Thick band chocolate colored, arenaceous shale			17	0	
	Loose shaley bands with thin sandstones and clay partings three dirt streaks			49	0	
		Ft.	In.			
No. 7.	Underclay	0	3			
	Coal, bright and hard	0	9			

	Carbonaceous shale, with thin streaks and layers of coal	2	8				
	Coal, bright, hard and black	0	8				
				2	10	1	6
	Heavy bedded grey sandstones or grit			5	0		
	Carbonaceous shale and coal, much confused apparently a slip in strata here with a repetition of No. 7			2	00	1	0
	Loose shaley sandstone, with thin layers of clay			30	0		
		Ft.	In.				
No. 8.	Coal	1	2				
	Loose shale	0	10				
	Coal	0	6				
					10	1	8
No. 9.	Shale and clay			2	0		
	Thin bed of sandstone and shaley rock, with clay intercalations			19	0		
	Bed of dirty fire clay, containing six inches good coal				9	0	6
	Thin layers sandstone and shale			5	6		
No. 10.	Fire clay, containing six inches of coal			1	0		6
	Loose shaley sandstones, with shaley and clay partings, two dirt streaks in middle, with just a sign of coal in each			21	0		
No. 11.	Dirty clay band, with three in. hard coal				7		3
	Sandstones and shales, with one dirty clay band, containing streaks of impure coal			10	0		
		Ft.	In.				
No. 12.	Fire clay	0	2				
	Coal	0	3				
	Clay	0	1				
	Coal	0	4				
	Clay	0	1				
	Coal	0	6				
	Clay	0	3				
	Coal and clay mixed	0	4				
	Clay	0	2				
				0	11	1	3
	Sandstones and shales in thin layers, one thin coal streak in middle			8	3		
		Ft.	In.				
No. 13.	Coal and carbonaceous shale mixed, 6 in. good coal at bottom	1	9				
				1	3	0	6
	Sandstone and shale alternating, bed of fire clay mixed with coal			3	6		
		Ft.	In.				
No. 14.	6 in. good clay	1	2				
					8		6
	Alternations of shale and sandstone			27	0		
		Ft.	In.				
No. 15.	Carbonaceous shale, with thin layers of coal	2	0				
	Loose shaley rock	0	10				
	Carbonaceous shale, with thin layers of coal	1	4				
	Loose shaley rock	0	10				
	Soft coal and shale mixed	0	6				
	Loose shale and clay	1	2				
	Coal	1	0				
	Drab fire clay	2	6				
	Coal	1	2				
				8	4	3	0
	Heavy bedded, coarse grey sandstones, becoming thinner towards top, with shaley and clayey partings			46	0		
		Ft.	In.				
No. 16.	Dirty shale and clay	2	8				
	Coal	0	6				
	Wedge of shaley rock	1	6				
	Good, bright coal	1	3				
	Shale	0	3				
	Good coal	0	8				
				4	5	2	5

		Ft.	In.				
	Tough, shaley rock, with arenaceous layers			8	6		
No. 17.	Coal, hard and bright	0	10				
	Shale and clay	0	5				
					5	0	10
	Thin sandstones and shales			7	3		
No. 18.	Shales and clay, mixed with 3 layers of coal, 2 in., 4 in. and 1 in.			2	0	0	7
	Sandstones and shales			3	3		
No. 19.	Coal, hard and good	0	2				
						0	2
	Shaley sandstones and clay layers			4	0		
No. 20.	Carbonaceous shale and clay, with 8 in. good coal at bottom	1	2				
				0	6	0	3
	Sandstones, shale and clay parting			8	6		
No. 21.	Carbonaceous shale and coal mixed	1	0				
				0	9	0	3
	Sandstones and shales, one thin dirt layer near top			3	0		
No. 22.	Coal and clay mixed (2 in. coal)	1	2				
				1	0	0	2
	Shale and clay alternating			5	0		
No. 23.	Loose shaley rock and clay	1	0				
	Carbonaceous shale	0	2				
	Coal	0	6				
				1	2	0	6
	Shales and sandstones in thin layers			4	8		
No. 24.	Loose shale and clay, 3 in. coal at top, 1 in. in the middle	1	0				
				0	8	0	4
	Sandstones and shales, with clay layers alternating			19	0		
No. 25.	Thick bed of fire clay, with 3 thin coal layers, 2 in., 6 in., and 6 in. coal and carb. shale	7	0				
				6	2	0	10
	Loose shaley rock, with thin sandstone layers			4	6		
No. 26.	About 5 ft. fire clay, with 10 in. dirty clay and coal	5	0				
				4	7	0	5
	Soft sandstone, shale and clay partings			10	0		
No. 27.	Three feet of fire clay, with 3 thin dirty layers, about 1 ft. apart, averaging about 2 in. of coal	3	0				
				2	6	0	6
	Sandstones, shales and clay to end of section			5	0		
				1970	05	22	06

Between this and the Junction with the trap rock measures 450 feet horizontal distance where the strata was but little seen. It is probably all a repetition of the measures already given, and judging from the angle of inclination, would bring in about 400 feet extra. Close to the Junction, in a small exposure of the rock, is another seam, No. 28, which is a bed of blush fireclay 1 ft. 10 in. thick, with ten inches carbonaceous shale at bottom, containing two thin coal streaks about 1 and 2 inches respectively. One other thin dirt streak occurs between this and the Junction

Coal Brook, two miles further East, exhibits the next most important section of these same measures, yet exposed. A few low outcrops were uncovered on a small brook about half-way between these two, where some thin coal seams and underclays, showing coaly detritus were come across, apparently representing some portion of the Aldery Brook section, but they could not be sufficiently seen to enable me to identify them exactly. Their presence, however, indicates the continuity of the measures, which upon Coal Brook, gave the following section.

Section of Coal Measures on Coal Brook.

AVERAGE ANGLE OF INCLINATION IS ABOUT 50° DIP SOUTH MAGNETIC.

		Strata.		*Coal.*	
		Ft.	In.	Ft.	In.
	Coarse grey grit and fine conglomerate	20	0		
	Strata concealed	200	0		
	Fine grained, finely micaceous, greenish grey sandstones, not well seen	50	0		
	More or less concealed, partly exposed in costeaning, consists apparently of grey, fine grained sandstones, grey and red arenaceous shales, and fire clay, with dirt streaks, showing signs of coal	190	0		
	Ft. In.				
No. 1.	Tough, shaley, underclay 2 0				
	Coal, pretty solid, partly shaley 1 1				
	Clay, with coal streaks 0 3				
	Rotten shale and clay 1 2				
	Clay with coal streaks 0 4				
	Clay and shale 0 4				
No. 2.	Rotten shale and clay	3	10	1	4
	Thick bed fire clay, containing a little coal	22	0		
	Loose, rotten, shaley rock with several clay beds, and dirt streaks, a good deal concealed	3	0	0	2
No. 3.	Thin, impure shaley coal and clay	92	0		
	Hard, thick bedded, grey sandstones	1	0	6	
		8	0		
	Ft. In.				
No. 4.	Tough, shaley underclay 4 0				
	Coal, somewhat shaley but tolerably good quality 1 8				
	Drab clay with coal streaks 0 10				
	Coal compact and good 1 4				
	Clay 0 8				
	Impure coaly clay 0 3				
	Drab clay and shale 0 3				
	Alternations of thick bedded, coarse grained, grey sandstones, greenish grey, fine grained micaceous sandstones and shales, more or less concealed	5	7	3	5
		73	0		
	Ft. In.				
No. 5.	Loose shaley underclay 1 0				
	Coal, impure shaley 0 6				
	Drab clay or shale 0 2				
	Alternations of thick and thin greenish grey, fine grained sandstones, and arenaceous shales	1	2	0	6
		15	0		
	DIP HERE S. 18° E. ∠ 40°				
	Greenish and greyish sandstones and shales partly concealed	36	0		

	Much concealed, a few outcrops of greyish and greeenish sandstones and arenaceous shales			141	0	
	More or less concealed			53	0	
		Ft.	In.			
No. 6.	Tough shaley underclay	3	0			
	Shaley impure coal	0	2			
	Coal, fairly good	0	10			
	Tough shale and clay with coaly streaks	0	9			
				3	9	1 0
	Loose, shaley rock and clay			9	0	
		Ft.	In.			
No. 7.	Underclay	0	4			
	Shaley coal	0	6			
	Clay	0	2			
				0	6	0 6
	Thin sandstones and loose shaley rock			11	0	
	Fire clay with thin dirt streak			2	0	
	Loose shale and clay			7	0	
		Ft.	In.			
No. 8.	Coal and clay mixed	1	0			
				0	6	0 6
No. 9.	Grey sandstone beds			2	0	
	Wide band of shale and clay, with three thin coaly layers, the lowest being six inches			6	6	0 6
	Loose, rotten shaley rock and thin sandstones			13	0	
		Ft.	In.			
No. 10.	Thin coaly layer	0	4			
	Shale and clay	1	0			
				1	0	0 4
	Loose, shaley rock, succeeded by heavy beds of grey coarse grained sandstones			23	0	
	Thick bed of coarse grey sandstone			4	0	
No. 11.	Alternations of thin bedded sandstones, arenaceous shales, and underclays, with five dirty coaly streaks, showing signs of coal, not well seen. This occurs in centre of a sharp synclinal			25	0	1 6
	Grey sandstones again (repetition), underlaid by thin sandstones and shales			21	0	
	Tough, blue clay			2	0	
	More or less concealed, heavy beds grey sandstone on top			50	6	
	Coarse grained grey sandstone			9	4	
	Greenish grey, thin bedded sandstone			11	2	
	Greenish and reddish, shaley and slaty bands alternating			56	4	
	Bands of loose, reddish arenaceous shaley rock			16	0	
	Finely micaceous, fine grained greenish grey sandstone			14	2	
	Alternations of coarse grey sandstone, greenish and reddish rotten shaley rock			52	0	
	Alterations of greenish and grayish, and yellowish sandstones, thick and thin bedded, coarse and fine grained			47	6	
	More or less concealed; some layers coarse sandstone at base			28	0	
	Thick bed of coarse grained yellow weathering sandstone			8	0	
	Thick and thin beds of grey sandstone			10	0	
		Ft.	In.			
No. 12.	Clay with coaly streaks	0	3			
	Solid good coal	0	10			
	Drab clay and wedge of rock, thin coal streaks	1	9			
	Coal, somewhat slatey, but good	1	3			
	Coal, shale and clay mixed	0	2			
	Underclay and shale	2	0			
				3	11	2 4
	Rotten shaley rock and sandstone beds			6	10	
	Carbonaceous shale and clay band			2	7	
	Rotten shaley rock, with clay bands and thin layers sandstone			28	0	
		Ft.	In.			
No. 13.	Clay	0	1			

	Coal	0	1				
	Carbonaceous shale	0	9				
	Coal, somewhat shaley	0	6				
	Carbonaceous shale	0	6				
	Underclay shaley	5	0				
				6	4	0	7
	Grey sandstones			12	0		
	Loose shaley rock			3	6		
	Bed coarse sandstone			1	9		
	Thin sandstones and loose shaley bands			9	4		
	Thick and thin bands grey sandstone			6	10		
		Ft.	In.				
No. 14.	Loose rock, clay and coaly streaks	1	2				
	Fire clay, with thin streaks of coal and black carbonaceous shale	1	6				
				2	2	0	6
	Loose shaley rock, with sandstone layers			12	2		
	Bed of hard grey sandstone			1	6		
	Loose shaley and clayey beds			12	0		
		Ft.	In.				
No. 15.	Bright shaley coal and clay mixed	2	0				
				1	0	1	0
	Loose rotten shaley rock			1	9		
	Hard fine-grained sandstone bed			0	10		
	Broken loose shaley rock, alternating with greenish grey sandstones in thin layers			10	0		
	Fire clay, with coaly streaks			3	6		
	Loose shaley rock			3	6		
	Fine-grained grey sandstones			5	2		
	Loose shale and clay			3	6		
	Fire clay, with coaly matter			1	3		
	Shale and clay and thin sandstones			6	6		
	Grey sandstones			3	6		
	Loose shaley rock			1	10		
		Ft.	In.				
No. 16.	Dark fire clay, with coaly matter	2	0				
	Bright shaley coal	0	6				
	Carbonaceous shale	1	0				
				3	0	0	6
	Rotten rock and clay			3	6		
	Shaley sandstones, &c.			6	10		
	Greenish grey sandstones			1	0		
	Loose shaley rock			3	6		
	Alternations of loose sandstones, shales and clays, thick and thin bedded, greenish micaceous, and coarse grey and whitish sandstones, with fine conglomerate beds predominating towards base, a good deal concealed, down to junction			390	0		
	Total			1907	11	15	2

Of course, owing to the doubling up of the strata in both the above sections, which in reality represent a long, narrow, sharp, synclinal trough, there is, a considerable amount of repetition. The actual vertical thickness of the coal measures exposed is little more than half the above total, reckoned from the centre of the trough each way, the section on Aldery Brook includes all that of Coal Brook, and probably some both superior and inferior strata not seen on the latter. We may, therefore, take it to represent the greatest development of coal measures actually exposed in this region. From the centre of the trough to the

lowest outcrop on Aldery Brook we have then a continuous section, in regular succession, of coal measure strata amounting to about 1740 feet. It is almost certain that the low ground between the shore of the lake and the first rock exposure on Aldery and Coal Brooks is also underlaid in part, if not wholly, by strata belonging to the same measures. Their attitude, of course, cannot be determined, but, presuming they continue to dip southward at about the same average inclination, there should be at least 800 feet extra, making a total thickness of 2,500 feet. Whether that represents the entire development of the coal measures in the Central Carboniferous basin or not, can never be determined by mere surface exploration. Eastward from Coal Brook no exposures of the Carboniferous series were met with anywhere, notwithstanding a most diligent search along all the small streams, and on the shores of the numerous ponds distributed over this great plain. Neither was the survey of the Goose Pond tributary, so far as it was prosecuted, successful in finding a single outcrop of the rocks in place. The flat character of the surface would in itself seem to indicate that, in all probability, some portion at least was underlaid by the soft, easily disintegrated shales and clays of the coal measures proper. This fact, together with the actual presence of numerous small fragments of coal washed up on the shores of Grand Lake, especially on the N.E. side, near the mouth of the inflowing river, lead to the conclusion that seams of coal must underlie this part of the country. It was with a view to ascertain whether such were the case, and what might be their value, that the boring operations of 1879 and '80 were entered upon. Four bore holes were put down altogether, along the Sandy River Valley, at sufficiently distant intervals to afford a fair idea of the structure. In only one of these, viz.: bore A, near the mouth of the river, were any actual coal seams struck. The section bored through, for 250 feet in depth, is given in detail in Mr. Murray's report for 1879. After passing through 50 feet of sand, gravel and clay, the first rock, a white sandstone, was struck, and at a depth of 129 feet from the surface, a seam of coal, 1 ft. 4 in., and, again, at 134 feet, another small seam, of only 5 inches, were met with. Still lower down at depths of 170 and at 222 feet from the surface, beds of Carbonaceous shale and fire clays, with thin coal streaks, were bored through. At bore B the rock formation was only pierced for 75 ft., and here again fire clay, containing thin coal streaks, was found. Bore C, which, in point of position, lay a mile further to the north, was sunk 113 feet, 94 feet through rock, but no coal showed itself, and only a few dark shaley bands or dirt beds were

come across; while at D, the furthest up the valley, but 24 feet of rock was pierced, showing no signs of coal either. Thus the result of this boring experiment may be said to have failed in its main object, that of revealing the presence of workable coal seams. Yet it was not without its value, and has afforded a clue, which, together with what has been ascertained by the present season's operations on the south side of the Carboniferous basin, enables me to form a pretty clear conception of the whole structure. The strata passed through by the boring rod can scarcely be referred to any other than the true coal measures, and this is confirmed by the character of the loose debris in the vicinity, which often contained fragments of fossil plants, such as *Lepidodendron*, *Calamites* and *Neuropteris*, &c., characteristic of that series. The conclusions come to, then, from a study of all the facts gathered, are as follows:—The boring rod struck only the extreme northern edge of a low, flat trough, having an inclination southward at an angle of not more than four or five degrees. Possibly this angle may increase, causing greater depression towards the south, and this seems borne out by the comparatively high dip of the strata met with on Coal Brook and Aldery Brook, but I am at present inclined to the belief that between these points there is an anticlinal fold bringing some of the lower measures again near the surface, and that the Coal Brook section is but a repetition of that underlying the head of the lake. At all events, between the most southerly bore hole A and the first rock outcrop on Coal Brook, a horizontal distance of two miles and forty chains intervenes, across the head of the lake, where no positive knowledge of the underlying strata is yet within our reach. Should the low angle of inclination, indicated at the bore holes, prevail, and no anticlinal fold occur to the southward, there would still be a thickness of superior strata of some 1133 feet. If such be the case, there is a strong presumption that one or more coal seams, other than those found at A, occur within that thickness. Of course, much of the above is merely conjectural, but it is founded upon pretty strong circumstantial evidence —evidence which, it appears to me, amply warrants the further application of the boring rod to this important and interesting coal field. There is no other means of so inexpensive a character by which a definite conclusion on this head can be arrived at. Should the Government deem it a matter of sufficient importance to carry out this suggestion, I would strongly recommend that a small hand-diamond boring drill be used, capable of taking up a core, and thus afford a complete section of the strata pierced through. It would also have the advantage of portability,

a matter of weighty consideration in a country where the difficulty of transporting heavy material is so great. I do not think the cost of such an apparatus should deter us from employing its use, for were it the means of revealing but one workable coal seam, not known before, that, in itself, would amply repay the outlay. Then, again, it may be remembered that the coal area of St. George's Bay, as shown in my report for 1889, calls particularly for the use of such an apparatus. Nor are these the only localities in the island where the boring rod might be applied with advantage.

Materials of Economic Value.

Little more can be said of the coal deposits here, 'till a much more minute examination takes place. Altogether eleven actual outcrops were seen on Coal Brook. Indications of at least six on a small brook west of it, and twenty-eight on Aldery Brook. Of course most of these represented but thin unworkable seams of coal, often of an inferior character. Nos. 4 and 7 of Coal Brook section; 6, 7, 15 and 16 of Aldery Brook, are about the largest and best seams. Of these four average over three feet of coal each, while the fifth and sixth contain about two feet each of a very superior quality. But though most of the seams are of smaller dimensions, yet I take it that their peculiar position and attitude in the sections, greatly enhances their value as a whole. For instance, in the section on Aldery Brook, in a horizontal distance of only 335 feet across the centre of the trough, which in reality represents only 167.7 feet vertical thickness, nine distinct coal seams are recognized on one side, only two of which have as yet been clearly seen and measured on the other side. The remaining seven are also there beyond question, though not uncovered, yet sufficient coal detritus was met with in costeaning to indicate their presence. Hence we have at least eighteen layers of coal succeeding each other, in a nearly vertical attitude within a total horizontal distance of 335 feet leaving an average of less than nineteen feet of strata between each layer. Such being the case, it appears to me, all these seams could be worked from one opening, especially as they approach each other nearer and nearer as they descend. Beyond the ordinary test of burning in an open grate, the quality of none of this coal has as yet been proven, but specimens are now in the hands of Analysts, whose report may at any time be looked for.

The loose fragments of coal picked up on the north shore of the lake

indicate a good average quality of bituminous coal, whatever may be the value of the deposit from which it is derived.

Bituminous Shale.

The calcareo-bituminous shales or pyrochists described as occupying a position near the base of the Carboniferous Limestone series may yet prove of economic importance should they be shown to contain any appreciable percentage of bituminous matter. It is such shales which furnish the Rock Oil of commerce, and have been largely used for that purpose in Scotland, &c. The remarkable mineral Albertite, so valuable as a gas producing substance, and which sold at from $15 to $20 per ton in New Brunswick a few years since, appears to have been derived from just similar shales, and in about the same horizon.

Clay Iron-stone.

The clay iron-stone bands interstratified with the coal measures on Aldery and Coal Brooks are to all appearances similar to those found in most other coal fields. In England, this ore has been the principal source of the iron of commerce for which that country has been so far famed. It has been said that "England's greatness was chiefly due to her coal and iron." Judging from external appearances, the ore here is of a fairly good quality, and there can be no question that the deposits are very extensive. It occurs as usual in the form of irregular nodules, nodular bands and compact solid bands, intimately associated with the principal coal seams. Its prospective value on that account to the future development of large industries in this section of the island can hardly be realized now.

Molybdenite.

The occurrence of this mineral in small quantity on Burnt Island, Deer Lake, has been already mentioned, but it is of little importance

Asbestos or Chrysotile.

This peculiar and important mineral substance, which has only recently begun to attract attention in this country, has been known to exist amongst the magnesian group of rocks for a long time. It is, however, only within a year or so that the attention of capitalists from outside has been directed to Newfoundland, as likely to become a source of future supply. The Province of Quebec, in the Dominion of Canada, is at present the chief centre from whence American manufacturers of asbestos goods derive their raw material. But the comparative scarcity of the mineral, together with the increasing demand, seems to point to

a possible failure of this source in the near future. It was known through the operations of the Geological Survey, that extensive areas in this Island were occupied by the magnesian group of rocks, similar in all respects to those of Canada, from whence the asbestos was obtained. This led to prospecting for the mineral with the result. that specimens showing an excellent quality of fibre, were found at several points amongst the serpentines on the West Coast, chiefly in the vicinity of Port-au-Port Bay. The first attempts at actual mining, however, were only made during the past summer. A company of American capitalists having leased a mining property in the vicinity of St. George's Lake, situated between St. George's Bay and Bay of Islands, were the first to commence active operations, and it was this property which was visited during the latter part of last season. It is situated so far from the sea-board, and the difficulty and delay in getting materials wherewith to begin work on the spot caused so much delay at the outset, that little more could be accomplished last season, than a mere surface exploration over a limited area. At the time of my visit in October, all that had been accomplished consisted in an open cut of some fifty or sixty yards into the side of a low bare ridge of serpentine, and a few surface openings here and there to ascertain the strike of the serpentine belt. The open cut, however, afforded the only satisfactory exhibition of the rock and contained mineral. It consisted, at the base, of a thick mass of very loose, shaly, dark green serpentine with scaly layers and strings of very pure, amber-yellow and oil green steatite. Caught up in this shaly mass, and apparently surrounded by it; a great horse or boss of hard, dark, bottle-green serpentine, presenting highly polished and fluted surfaces is seen; and the whole is capped by large disconnected blocks of hard, dark-gray diorite. The mineral appeared to follow closely the outline of the harder serpentine, frequently penetrating it, but almost invariably splitting up into innumerable ribbon-like strings, which finally become mere threads. The best fibre and most persistent veins followed the outline of the harder serpentine or occupied the position between it and the overlying diorite. Where the two approached each other nearest so as to squeeze up the intervening rock, appeared to be the point exhibiting the greatest amount of asbestos. One vein at such a point measured nine inches wide, consisting of several rudely parallel layers of fibre divided by thin layers of serpentine. The fibre varied in length from one half to two inches and was of fairly good quality Specimens of beautiful fibre of about an inch long, and still others of from 2 to 3½ inches were shown me as having come from a

lower part of the cut, at a place not then visible, being covered with the debris from the mine, &c. The character of the deposit, judging from what little could be seen was, as is usually the case, exceedingly irregular and confusedly jumbled up. According to the experience in Canada, where asbestos mines have now been in active operation for ten or twelve years, there is apparently nothing to act as a guide in determining the value of a deposit except actual mining. No two properties present exactly the same features, and what may be found to hold good in one locality, proved entirely at fault in others, hence the difficulty in arriving at any conclusion as regards an undeveloped property, such as that described above. The indications are certainly good, the quality of the fibre excellent, and should the serpentine deposit in which the mineral occurs be found to occupy any considerable area, there is a reasonable prospect that asbestos will accompany it. At present the situation of the mine and character of the surface deposits, renders prospecting a tedious and expensive operation. The absence of some more feasible means of getting material on the spot, was sorely felt by those in charge last year, every pound of food consumed and every item of mining tools, &c., had to be carried on mens backs from the seashore through the woods, a two days desperate drag. Few men could be had to perform such labor, and these only at a high rate of wages. In order to facilitate the development of this and neighbouring properties, I would suggest the advisability of speedily opening up communication with the sea-shore by roads or other means. The Hon. P. Cleary had men at work all the summer prospecting a property of his near Bluff Head, Port-au-Port Bay, the result of which I am informed is of a very favourable character. The serpentine here is apparently more massive and forms extensive cliffs, exhibiting several small rudely parallel veins of asbestos. The fibre ranges from one quarter to about one and a half inches in length, and some of the specimens shown me from the locality were of excellent quality. Further up the coast at Lewis Brook and about two miles inland Mr. Hayes of Bay St. George holds a claim, from which a very fine sample of silky fibre about two inches long has been exhibited, but no prospecting of any consequence has taken place here as yet.

In view of the foregoing facts and the knowledge that the mineral is chiefly derived from the magnesian group of rocks, so familiarly known in Canada as Sir Wm. Logan's Quebec Group, which have been shown to occupy extensive areas in this island, both along the coast and in the interior, it is not unlikely that the next few years will witness a

great amount of activity in prospecting for this substance. Newfoundland is already regarded in Canada as likely to prove "Quebec's greatest rival 'ere long." Should this valuable material be found in available quantity in this country, as there is every reason to expect, its development is likely to prove one of our most important and remunerative mining industries in the near future.

Building and Other Useful Materials.

Amongst the Carboniferous series, particularly the lower divisions, good sandstones, suitable for building purposes, abound. Grindstones, whetstones, flagstones, limestones, &c., occur in many parts of their distribution, and fire clays are found in beds of varying thickness, from one to six feet, amongst the coal measures, chiefly underlying the coal seams. Of course the value of this latter clay depends greatly upon its adaptability to the manufacture of refractory bricks for furnace lining, coke ovens, &c., where it has to withstand a great degree of heat. While judging from external appearances, this clay seems to be exactly similar to those used for that purpose elsewhere, yet it must always be understood that nothing but an actual practical test can satisfactorily prove its capabilities. Fine sand, of a character admirably adapted for mortar for bricklaying, &c., forms an immense deposit around the head of Grand Lake. In some places banks of fifty or sixty feet in height are exposed on the lake shores. Some of this sand, it appeared to me, might be found applicable for moulding purposes, which would greatly enhance its economic value. Here, again, nothing but a practical test will suffice to prove its utility.

Marbles.

The Humber River marble deposits have been especially referred to in former reports, particularly so in Mr. Murray's report for 1866. Nothing has been done since that date to prove the quality of the rock, beyond the dressing and polishing of a few surface specimens. It was the intention last season to endeavour to procure some better specimens than those hitherto obtained, if possible, by clearing away the debris and blasting into the solid rock below, but, upon reaching the locality, it was found so encumbered with debris, fallen from the cliffs above, that it would take weeks of great labor to remove it. We had to content ourselves, therefore, with selecting specimens from the loose blocks only, which are, as might be expected, much weather-worn and stained. Some small pieces of the white marble are certainly of a very fine grain,

and appear well adapted for statuary purposes, should the same rock be found in sufficiently massive beds, and free from cracks. The variety of colours displayed in other specimens is very considerable, and often very beautiful. It has been now shown that the extent of this deposit is enormous, and it would indeed be very remarkable if somewhere throughout their range it was not found that they were more compact and less affected by atmospheric action.

The Museum.

There has been no falling off in the number of visitors who continue to be attracted by the collection in our museum. Many additional specimens have been acquired during the past year from various sources. I am greatly indebted to Sir Wm. Dawson, K.C.M.G., &c., Principal of McGill University, Montreal, for his uniform kindness in furnishing me with any information asked for, but more especially in his undertaking to examine and name all the fossils collected from our Carboniferous series from time to time. He has, during the past summer, returned to the museum the collections submitted to him from the St. George's Bay trough, all named and labelled, and has kindly offered to do the same with those collected last season at Grand Lake, as soon as I can send them on to him in the spring. The whole, when properly classified and arranged, will form a valuable and interesting collection of the Newfoundland Carboniferous fossil, fauna and floral. Amongst the other additions to the museum the past year may be enumerated an embryo white whale and dolphin, a couple of soles, a nice collection of West Indian shells from Lady Blake, a beautiful specimen of the Roseate Flamingo, presented by Captain Collins, and a peacock by Donald Morison, M.H.A. Amongst the mineral specimens, coal, clay-ironstone, fireclay, gypsum, asbestos, actinolite, tremolite, serpentine and marble have been added by the survey; while a sample of crude petroleum from Parson's Pond, West Coast, was presented by Mr. Muir. Mr. White, manager of the Newfoundland Consolidated Copper Mining Company's Works at Little Bay, has kindly, in compliance with a request from me, furnished the museum with a complete suite of specimens illustrative of the smelting industry—from the crude ore through its various processes of manufacture up to the final result, pure metal, or ingot copper. This is a very valuable and interesting collection, and conveys in itself, a concise history of the copper mining industry of the island. The collection is now assuming such proportions, and is so much appreciated by the public, that it be-

comes quite evident, should it go on increasing at the same rate, and it be desirable to maintain it efficiently, a larger apartment will soon have to be provided in a more central part of the city.

I have the honor to be Sir,

Your obedient servant,

JAMES P. HOWLEY.

me rate, and it
will soon have

HOWLEY.

REPORT FOR THE YEAR 1892.

GEOLOGICAL SURVEY OFFICE.
St. John's, Newfoundland,
January, 1892.

THE HONOURABLE SURVEYOR GENERAL,—

Sir,—The delay in the publication or the Report of the Geological Survey operations for 1891, caused by the great conflagration of July last, in which the manuscript copy of that report, then in the printer's hands was destroyed, having necessitated the re-writing of it, it was deemed advisable to incorporate that of the past season with it also. This course is all the more desirable, since the work performed last season was a continuation of the exploration of the Central Carboniferous basin of the Humber Valley.

The importance of the previous season's work, especially as regards the discovery of so promising a coal field near the head of the Grand Lake, amply warranted the further prosecution of the investigation during the season just past. As stated, however, in the preceeding year's report, it was doubtful whether much more could be accomplished by mere surface exploration, and the desirability of testing the ground more thoroughly, by means of a diamond boring machine, was then strongly urged. In the absence of such a machine, the only available course to pursue was that already adopted of costeaning the surface with pick and shovel. While the prospects of other valuable finds resulting therefrom appeared small, at all events, the coal seams already seen could be more thoroughly uncovered and their character and probable value more definitely determined. With this object in view, our party started for the Humber about the usual date in June last. A family bereavement prevented my accompanying them at the time, Mr. Bayly was, therefore, entrusted with the charge of the party until I could join them later on. He was instructed to proceed direct to the Grand Lake, and there to commence work on the section of the coal measures occurring on Aldery Brook. The entire face of the steep bank along the west side of the brook, having first been cleared of the timber, was to be stripped from top to bottom. All the clay, gravel, loose rock,

&c., encumbering the surface was to be removed, so as to lay bare the whole face of the cliff beneath, and thus afford a continuous section of the measures where the coal outcrops exhibit themselves. By the time this was accomplished I expected to be with the party and direct the subsequent operations.

The great conflagration of July 8th, already alluded to, in which, amongst so many others, my own residence was destroyed, materially interfered with all our arrangements for the time being, and delayed my departure till the middle of August. Further instructions were, however, sent to my assistant for his guidance in the meantime.

On my arrival at Bay of Islands, on the 20th of August, I at once proceeded up the Humber, and having reached the portage at Junction River, commenced a survey of this important stream. It had never previously been measured, owing to its exceedingly rugged character, and the difficulty of following its course on foot. The excessively dry season now being experienced, having caused its waters to shrink to an abnormally low level, presented a most favorable opportunity for carrying out this survey. It might be many years before another such should present itself.

This river forms the important connecting link between the main and the eastern, or the Grand Lake branch of the Humber. Its measurement would be the means of completing the connection of the two great water systems, and be also an important addition to the topography of the region. Another object held in view, was to ascertain the true position, together with the dip and strike, of certain rock outcrops known to occur along its course. These being the nearest exposures of the Carboniferous series to the sections of the coal measures on Coal and Aldery Brooks, though distant therefrom in a direct line eight miles, it was hoped they might afford some clue to the structure underlying the great flat intervening area. The rocks proved to be all low down in the series, apparently belonging to the Carboniferous limestone, or base of the Millstone Grit formation. They consisted chiefly of heavy bedded red sandstones, grits and fine conglomerates, with occasional bands of light-red marl. At one point near the Kill Devil Rapid, a set of drab shales with thin calcareous layers outcrop in the bed of the river, and form low cliffs along the east side for some distance. The latter point could not be reached owing to the impossibility of getting across. I have little hesitation, however, in referring these latter to the Calcareo-bituminous shales or pyrochists, and they are most probably the equivalents of the Horton series of Acadian Geology.

It was the first of September when I joined the party at Aldery Brook. My instructions had been faithfully carried out, and an immense amount of work had been performed in the interim. The quantity of debris covering the surface of the rocks greatly exceeded what we were led to expect, especially towards the base of the slope, and the dense compact nature of much of it, rendered its removal a most laborious undertaking. Thousands of tons of earth, gravel and rock, had been thrown down from the steep bank and shovelled into the brook, and the cliff laid bare for a distance of several hundred yards. All the coal seams seen last year were now thoroughly exposed to view, and were found to maintain pretty much the same character throughout. Some few exceptions, however, occurred. While Nos. 6, 8, 15 and 16 seams showed little variation from what has already been described in the previous report, some of the smaller seams rapidly decreased in size and, in some instances, thinned out. No. 7 seam was cut off by a slip of the strata, which caused much confusion just at this point. No. 16 is decidedly the best in the section. It was uncovered for over sixty feet up and down the bank; its attitude being nearly vertical, with a bend over towards the top. It averages two feet of good, solid coal throughout; but, owing to occasional intercalations of shaley or clayey wedges, frequently widens out to double that thickness.

Four other small seams, not clearly seen last year, were uncovered between Nos. 6 and 7. Towards the southern end of the cutting the surface accumulation was so deep and tough, that it was found useless to attempt penetrating it.

In order to verify the strike and continuity of the coal seams, and still further prove their character, we next commenced costeaning along the opposite or eastern side of the brook. Here, again, all the same seams were met with in their regular positions, but they were found to vary considerably. In almost every instance they had improved much in quality, and assumed larger dimensions. Nos. 1, 2, 3, 4 and 5 seams were pretty much as already described. No. 6 had widened out to eight feet, with about two feet of coal of good quality. Nos. 7, 8 and 9 were not quite so large as before, but Nos. 10, 11 and 12 had run together, forming one wide seam with alternations of coal and clay measuring twenty-two feet across. Only two feet of coarse sandstone separated this from another seam of five feet, supposed to represent No. 13. All these might be here considered one seam having a total breadth of twenty-seven feet, and containing altogether fourteen feet of coal.

The following are the details of the section of this seam exposed to view:—

	Ft.	In.
Underclay	2	0
Soft, impure coal, with clay streaks	0	10
Clay shale and thin coal streaks	3	0
Impure coal and shale mixed	0	7
Clay and carbonaceous shale	2	10
Soft coal	0	4
Coal with clay streaks	2	0
Shaley clay	0	8
Coal, soft and shaley at the top, more compact towards bottom	4	6
Carbonaceous shale	0	3
Coal and clay mixed	0	6
Shaley clay	0	4
Impure coal	0	6
Clay and shale	0	3
Soft, shaley coal	1	2
Clay, shale and thin coal streaks	1	0
Band of coarse, grey sandstone	2	0
Clay	0	2
Coal, hard at botfom	1	2
Clay	0	2
Coal, soft and shaley	0	10
Clay	0	2
Soft coal	0	10
Clay	0	10
Total	26	11
Coal	14	0

As may be judged from the above section, most of the coal contained in this large seam was soft and impure, being much mixed with dirty fireclay and rotten shale. The seam was also found to contract in width towards the bottom of the slope. The quality of the coal, however, improved much in character, and became more compact, on drifting in a few yards upon the strike of the seam. This would clearly indicate that upon getting away from the surface drainage, when it comes to be further developed, a really good seam of coal may be expected. Its outcrop is situated in a depression containing much moisture, and, in consequence, the exposed edge of the seam is greatly water-soaked. This absorption of water along the weathered edges of the seams has, in nearly every instance, greatly changed the character of the contained coal, so that its true quality cannot be properly determined from the specimens obtained so near the surface of the ground. Some of the coal from this large seam was intensely black, and appeared to be highly bituminous. Fine specimens were taken out from the bottom of the cuttings, but on exposure to the sun, they nearly all crumbled into small fragments. Ten feet beyond this, another seam, supposed to represent No. 14 of opposite side, gave the following section:—

	Ft.	In.
Loose, shaley underclay	1	0
Thin coal streak	0	1
Clay	0	10
Impure coal and carbonaceous shale	1	6
Drab clay and shale	1	0
Impure coal and shale	0	8
Clay and shale	0	8
Shaley coal, some good at bottom	0	9
Clay and shale	0	8
Fairly good coal	0	6
Shale on top	2	0
Total	9	8
Coal	2	10

No. 15 seam consists of two layers of soft coal, divided by about two feet of sandstone. The top layer is one foot six inches thick, and bottom layer eight inches; altogether two feet two inches of coal. No. 16 maintains p etty much the same character as on the west side of the brook, but contains thin, lenticular wedges of clay-ironstone. It here measures three feet seven inches, having two feet nine inches of excellent hard, bright, black coal, divided by five inches of tough, shaley clay, thus:—

	Ft.	In.
Tough underlay	0	3?
Hard, black, bright coal	1	4
Tough, shaley clay	0	5
Hard, bright, solid coal	1	5
Shale on top	0	2
Total	3	7
Coal	2	6

No. 17, 18, 19, 20, 21, 22, 23 and 24 are all small, several of them being mere dirt streaks with but little coal in them. No 25 had greatly improved, and on this side of the brook has widened out to six feet six inches, containing about one foot seven inches of exceedingly tough, solid, bright coal. It gave the following section:—

	Ft.	In.
Tough, carbonaceous shale	0	3
Coal, very hard and bright	0	6
Tough, carbonaceous shale	0	4
Hard, bright, good coal	0	8
Tough, carbonaceous shale	0	6
Coal and shale mixed	0	3
Shaley rock and ironstone	3	8
Carbonaceous shale and coal	0	4
Total	6	6
Coal	1	7

Three small seams, containing a little coal each, and one band of fireclay, with four inches of coal, were uncovered between Nos. 20 and 28

of last year, making a total of thirty separate outcrops of coal in the entire section. Little room for doubt now remains of the doubling up of the strata in the form of a sharp, synclinal trough, as set forth in last year's report. It follows, then, that the actual number of separate and distinct coal seams is in reality fifteen, all of which are repeated by being again brought to the surface. What the actual depth of this trough may be, can only be judged approximately from the angle of inclination on either side. The lowest seam probably reaches 500 feet below the surface, at a point where the strata begins to turn upwards. Of course, as we approach the centre of the trough, the depth of each individual seam becomes less and less.

One point of much importance in connection with the actual working of these coal seams, is the facility of reaching the mineral contained therein. While much of the coal is above the surface of the river's level, the comparatively little depth of the remainder renders every ton worth extracting, easily accessible.

While the conteaning operations on Aldery Brook, were being carried out, Mr. Bayly was despatched to survey and explore another small stream near the head of the lake, known as Kelvin Brook. The work had been partly accomplished last season, but so far as explored no rock outcrops had been met with. The brook was very small, and so overgrown with dense alder beds, as to completely choke up its channel, rendering the further following out its course a matter of extreme difficulty. As, however, there still appeared a prospect of finding some outcrops further up the stream, towards the base of the mountains on the south side of the valley, it was determined to make another effort to complete the measurement. The alder beds had to be cut through with axes for some considerable distance, when the brook was found to widen out somewhat, and become more accessible. It was then followed up to the point where it debouched from the Laurention range, a distance of two miles and a half to the Eastward of Coal Brook. Here, close up under the hills a few small outcrops of the coal measures, containing indications of the presence of one or more coal seams were come across. Upon receipt of this information, we moved camp to the locality, having first cut a portage road about two miles in from the head of the Lake. Three weeks were spent in costeaning and exploring along this brook, which resulted in uncovering some half dozen coal seams. The rock exposures were of a very limited extent, the banks on either side being almost entirely composed of deep deposits of sand, gravel and boulders. Altogether eleven different outcrops, showing

coal were uncovered along the eastern side of the brook, all close together. They were situated so near the waterside, and at so low a level, that in almost every instance the water came in and flooded the openings, before we could obtain perfectly satisfactory measurements, &c. As well as could be determined, we have here again a sharp narrow synclinal trough, clearly a continuation of that previously observed on Coal and Aldery Brooks. Immediately beneath the coal measures here, and resting directly upon the Laurentian gneiss, a set of coarse and fine reddish conglomerates and grits are seen, which strongly resemble the basic conglomerates of the series. Their relation to the over-lying coal measures would indicate that some great want of conformity, such as a tremendous upthrow fault, had brought them into this anomalous position. As no such disturbance of the strata was at all visible, and there appeared to be a perfect and regular succession from the lowest beds upwards I cannot but conclude (putting lithological resemblances aside), but, that these conglomerates and grits are in reality the summit of the Millstone grit formation.

The following is the section of the rocks here displayed beginning at the Junction with the Laurentian up stream:—

		Ft.	In.	Strata. Ft.	Strata. In.	Coal. Ft.	Coal. In.
Coarse, reddish conglomerate, grits and sandstones, with some thin, bluish arenaceous bands, a good deal concealed				594	0		
Coarse and fine, greyish sandstones, shales and some clayey bands, showing a little coaly matter. Rotten shale and clay towards top				260	0		
No. 1.	Underclay	1	0				
	Soft, earthy, impure coal	1	2				
	Drab fire clay	1	6				
	Soft, earthy, impure coal	1	2				
	Clay, with coal streaks	1	0				
	Coal and clay mixed	1	1				
	Carbonaceous shale and ironstone	0	4				
	Soft coal	0	4				
	Clay	0	5				
	Coal and clay mixed	0	10				
				5	2	3	8
	Thick and thin sandstones, with shaley layers			17	0		
No. 2.	Bluish fireclay, with coal streaks			1	0	0	3
	Sandstones and shales			8	0		
No. 3.	Fireclay, with a little coal			1	4	0	2
	Sandstones, shales and clay layers			36	0		
	Dirt Streak			1	0		
	Rotten, shaley rock and clay, with a few thin layers of sandstones			5	0		
No. 4.	Thin coal streak in fireclay			1	0	0	3
	Coarse sandstone and shaley rock			5	0		
	Clay	1	0				
	Shaley coal	1	2				
No. 5.	Fireclay	1	6	3	6	2	6
	Layer coarse sandstone	1	0				
	Impure, coaly layer	1	4				
	Coarse, gritty sandstone			2	0		

			Ft. Strata.		In. Coal.	
	Tough, shaley clay	2 0				
	Good, solid coal	3 6				
No. 6.	Carbonaceous shale	1 0				
	Good coal	2 8	6	2	7	0
	Carbonaceous shale and coaly, with lay layers	4 0				
			946	2	13	10

The uppermost seam in the above section has the appearance of being doubled over upon itself, thus causing the coal to assume twice its actual thickness, which would be about three feet six inches. This is not by any means certain, as the situation of the seam is at such a low level, and the influx of water was so great, as to prevent our studying it out thoroughly.

The quality of the coal in this latter seam was excellent, being bright black, clear, and very free from impurities.

Several attempts were made to reach the bed rock at points on the brook both above and below this outcrop, wherever the banks of gravel and clay seemed to offer some prospect of doing so. In no case were we successful, such was the depth and toughness of the superficial deposits. Numerous loose fragments of coal were met with in all these cuttings; and at one or two points, a very tough clay, which formed the base of the bank, contained many angular fragments, apparently not far removed from their parent bed. All these could scarcely have been derived from the few outcrops seen, furthermore, as some fragments were picked up in the bed of the brook further up stream, it is but fair to assume that other coal seams than those already discovered exist here.

In my last years report it was intimated that eastward from Coal Brook, very little prospect of any portion of the Coal measures outcropping on the surface appeared at all probable, and that consequently we were left to conjecture only what might be the structure in that direction. This latter discovery on Kelvin Brook, confirms the supposition then set forth, that the coal measures did underlie. at least some portion of the flat country to the eastward. It is now pretty clearly established, that the long narrow trough containing the coal seams, extends longitudinally from Aldery Brook to Kelvin Brook, a distance of over four miles on the line of strike. How much further eastward it may yet extend will necessitate the use of the boring rod to determine, as I do not think there can be any other outcrop of the measures in that direction. A close investigation of the Goose Pond and Kitty's Brooks

this season, revealed one small exposure on each, of a coarse reddish conglomerate and grit rock, of carboniferous age; identical with that described at the base of the section on Kelvin Brook. Both these occur far up the streams at the foot of the hill range, and rest in each case upon Laurentian gneiss. Whether as already hinted, these latter rocks are of millstone grit age, or brought into their present position by an upheaval, there is still ample room between them and the Sandy Lake waters, to bring in some portion of the coal measures proper.

Turning again to the western end of the trough on the south side of the Grand Lake, a few small outcrops of a coarse whitish grit and fine conglomerate, were observed at the mouth of a small brook, one mile west of Aldery Brook; and a similar rock occurs upon another small Brook, still a mile further west. On the former of these some costeaning, immediately above the rock exposures, uncovered a few bands of loose shale and clay, one of which showed some four inches of coaly matter with some thin strings of real coal. Nodules of ironstone were also met with in the shale. No costeaning was performed on the further brook, but a few loose fragments of coal were picked up along its course. There can be little doubt that these latter rocks are referable to the true coal measures, and that they probably extend to Hinds Brook, another mile west, where they most likely run out to a point. At all events, between the two extreme east and west points where coal has been actually seen, and where there is no doubt of the trough being continuous, a distance of six and a half miles intervenes. As nothing further could be accomplished with pick and shovel on Kelvin Brook, we moved back to Coal Brook, and spent the short remainder of the season in more thoroughly uncovering the section exposed here last year. Three new coal outcrops, not then seen, were come across; but they were all of small dimensions; one showing about one foot of impure coal, the second ten inches, and third about six inches.

While encamped here, Mr. Bayly and I, with one of our Indians, paid a flying visit to Hind's Pond, situated away up in the mountain range to the southward, and nearly midway between the Grand Lake and Red Indian Lake, on the Exploits. Rumours of coal having been picked up here, in which, however, very little reliance was placed, lead us to make the journey. Like all other rumours of the kind, I have so far investigated, this, again, proved to be without the slightest foundation. The country, so far as could be judged from the few rock exposures on the shores of Hind's Pond, and the vast amount of boulders

strewn over the barrens, is occupied exclusively by the Laurentian system.

The season for satisfactorily prosecuting geological research being now at an end, we began to make a move homeward, having first carefully packed all our specimens and transported them across the Great Lake. The heavy undertaking of portaging across to the Main Humber was effected in a few days. Meanwhile, Mr. Bayly, with part of the crew, began to run a new line, backwards from the Humber side, to ascertain whether a shorter and better route for a portage might not exist, with a view to its eventually becoming a roadway connecting the two waters. In this he was quite successful, so far as he went, in finding a tolerably level line almost out to the great marsh, by which the distance was greatly reduced. As the traffic across here is every year increasing, I would again strongly urge the appropriation of a small sum of money annually, to opening up and keeping in repair this very necessary highway. I believe, were a good wagon road once constructed over this section, the Grand Lake would soon become a place of considerable resort for tourists and others. The extra expense involved in getting anything over the portage in its present condition, would go a long way towards making it passable for wheeled vehicles. It is the only available means of reaching the Grand Lake from the Humber side, and sooner or later, the opening up for settlement of this magnificent valley, will render the construction of such a highway a matter of absolute necessity.

I have the honor to be, Sir,

Your obedient servant,

JAMES P. HOWLEY.