

GEOLOGICAL AND NATURAL HISTORY SURVEY OF CANADA.  
ALFRED R. C. SELWYN, C.M.G., LL.D., F.R.S., DIRECTOR.

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## REPORT

ON

## EXPLORATIONS

IN PORTIONS OF THE COUNTIES OF

VICTORIA, NORTHUMBERLAND AND RESTIGOUCHE,

## NEW BRUNSWICK.

TO ACCOMPANY QUARTER SHEET MAP 2. N.W.

BY

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PUBLISHED BY AUTHORITY OF PARLIAMENT.

MONTREAL:  
DAWSON BROTHERS.

1887.

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ALFRED R. C. SELWYN, C.M.G., LL.D., F.R.S.

*Director of the Geological and Natural History Survey of Canada.*

SIR,—The following report, which we have the honour to submit, embraces the results of observations and explorations made by us, with the assistance of Mr. J. H. Bailey, during the summers of 1885 and 1886, in northern New Brunswick.

The object of these explorations was twofold, viz, first, to obtain the necessary data for the completion of the quarter-sheet map of the series of New Brunswick maps, No. 2. N.W., which accompanies this report, and, secondly, the determination of the succession of the Silurian strata in the northern portion of the province, and their relations to other systems. As the investigations in the latter direction embrace areas beyond the limits of the map, and are not yet completed, the present report will be confined to the region which is now delineated, embracing portions of Victoria, Madawaska, Northumberland and Restigouche counties.

The courses and dips, both in the report and on the map, are given with reference to the true meridian, the variation being about  $20^{\circ}$ - $21^{\circ}$  west.

Our thanks are again due to the Manager of the New Brunswick Railway for free passes, and other facilities, on the several lines under his direction.

We have the honour to be,

Sir,

Your obedient servants,

L. W. BAILEY.

WM. McILANES.

October, 1887.



REPORT  
ON  
EXPLORATIONS  
IN  
PORTIONS OF THE COUNTIES OF  
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The area to which this report and the accompanying map refer, <sup>Region described.</sup> lies immediately north of that mapped and reported on in 1885; while upon the eastern and western sides it is bounded by the areas previously surveyed and mapped by Mr. R. W. Ells in the counties of Northumberland, Gloucester and Restigouche. On the west it is in part bordered by the state of Maine, and in part by that portion of New Brunswick which, above the Grand Falls of the St. John River, extends westerly between the last named state and the province of Quebec. It may be added that this latter tract, together with a small triangular area lying between the headwaters of the Green and Quatawamkedgewick rivers, in the county of Restigouche, embraces the only portions of New Brunswick which remain to be surveyed.

The formations represented within the area to be considered are, in <sup>Formations.</sup> descending order, as follows :—

- G. 1. Lower Carboniferous.
- F. Devonian.
- E. Silurian.
- D. Cambro-Silurian.
- A. B. Pre-Cambrian.
- Gr. Granite and related rocks.

G. 1. LOWER CARBONIFEROUS.

Within the district examined, the Lower Carboniferous rocks are confined to the valley of the Tobique. They are the northern half of the outlier described in part G. of the Annual Report for 1885, and as they have been already pretty well considered in previous years, little need be said of them here.

**Extent of area.** The greatest breadth of the outlier is about twelve miles, and it extends northerly on the Tobique to a point a little beyond Blue Mountain bend. The strata are lying everywhere nearly horizontally, with broad, low undulations shewing that they have been subjected to but little disturbance since their original deposition. Their succession on the Tobique, in descending order, seems to be :—

**Succession of beds.**

Coarse, red conglomerate.  
 Gypsum.  
 Soft, red, shaly sandstone, with thin bands of limestone.  
 Limestone.  
 Highly calcareous white and red sandstone.  
 Red and grey grits and conglomerates.  
 Soft red shales.  
 Red sandstones and conglomerates.

**Volcanic rocks.** At the edge of the basin on Otelloch stream, and at the Blue Mountains, small masses of volcanic origin occur. These consist of ash-like felsitic beds, volcanic agglomerates, traps and claystone porphyries, and are probably contemporaneous with the upper beds of the Lower Carboniferous.

**Trap.**

Just above the Blue Mountains, these beds are represented by a massive ledge of green, chloritic, highly calcareous, amygdaloidal trap, which is exposed on the left bank of the stream; in general aspect, this trap closely resembles those of Lower Carboniferous age in the southern part of the province. A flesh pink mineral, resembling natrolite, occurs in this ledge, but the vesicles are mostly filled with calcite.

**Blue Mountains.**

The principle exposure of the volcanic material, however, is that making up the mass of the Blue Mountains and rising in low cliffs from the water's edge at the bend of the river. These are red crystalline felsites, hardly distinguishable from those of Pre-Cambrian age, and dull reddish-purple, banded, felsitic beds of ash-like aspect, associated with volcanic breccia or agglomerate, with light-green, hard, serpentinous matrix. Where exposed on the steep sides of the upper peak, they show an almost horizontal, gently undulating stratification. None of these beds are seen in actual contact with the Lower Carboniferous, so that stratigraphical evidence of their relative age is wanting.

Their close similarity to the volcanic masses so common in other parts of the province at the base of the Millstone Grit, warrants the conjecture that these are also overflows which have occurred about that time. Limestones of Lower Carboniferous age, occurring about half a mile below these beds on the river, are quite hard and crystalline, but show no disturbance. Red and greenish-grey in colour, often

**Limestones.**

prettily marbled, and hard enough to take a good polish, these limestones would probably afford handsome marbles for ornamental purposes.

On the Otelloch, claystone porphyry is associated with the Lower Carboniferous sandstones, and soft, green and purple slates, of supposed Silurian age, are cut and overlaid by a trap similar to that first above described. The purple colour of these slates is often superficial, and is probably only a local discolouration, caused by the red sandstones which have overlaid them.

At the confluence of the Wapskehegan with the Tobique, on the <sup>Gypsum.</sup> left bank of the latter stream, twenty-three miles by road from the St. John River, and again two miles further up, high cliffs of gypsum are seen. These beds form the sides of a very slight undulation, dipping easterly at a low angle, the top of which, where it approaches the river, has been denuded, leaving only the underlying shales and limestones exposed. At the upper of these two exposures, locally known as Plaster Rock, the cliff rises vertically from the water's edge to a height of 150 feet; it is made up of beds of impure gypsum of different colours, varying from dull purplish-red to greenish-white, with thin layers, which are pure white and fibrous; it is underlaid by soft, red shales, with thin bands of limestone, and by massive beds of siliceous limestone. Ascending Salt Creek (so called from its slightly saline taste), which empties into the Tobique just above the cliff, the gypsum is seen at intervals, cropping out from the sides of the ravine worn by the brook, for a distance of a mile back from the river. East of this, no exposures are seen, the surface being hidden by a thick covering of drift, until the elevation known as Plaster Rock ridge is reached. This ridge, lying two miles back from the river, is four hundred feet above it, and forms a high, level, table land, clothed with a large growth of hardwood, and with a soil apparently well adapted for cultivation. Outcrops of coarse, red conglomerate, in heavy beds, lying almost horizontal, shew near the top of the slope. They would thus overlie the gypsum and form the summit of the Lower Carboniferous, on the Tobique. The gradually rising ground, lying between the Tobique River and the foot of the ridge, is pitted with a number of the large funnel-shaped pot-holes so common in districts underlaid by gypsum. Some of these holes are upwards of fifty feet in depth, with steeply sloping sides, and with a width at the top of about sixty feet.

Without attempting to calculate the amount of gypsum contained in these beds, it will be readily inferred, from the above considerations, that the quantity is very large—certainly many million tons.

Tufaceous  
limestone.

A rather remarkable outcrop of tufaceous limestone in thick beds, which seem to be a continuation of those underlying the gypsum, occurs in the bank just above the plaster cliff. This has been described by Mr. Hind in his "Preliminary Report on the Geology of New Brunswick," page 64.

Character of  
soil.

This Lower Carboniferous tract, as well as the Silurian area succeeding it on the river, is generally characterized by highly productive soils, well adapted for cultivation. Extensive intervalles and large flat islands occur in many places along the river as far as the main forks. Part of this low land is covered with groves of large elm and balsam-poplar; most of the lots adjacent to the river, however, are taken up, and settlement has already extended to within half a mile of the forks, or for fifty-four miles back from the St. John River. A projected railroad, connecting with the New Brunswick railway system at the mouth of the Tobique, and extending up the river as far as Plaster Rock, will, when built, add materially to the value of this section.

#### F. DEVONIAN.

Devonian on  
Campbell  
River.

A small area of soft, dark blue, calcareous slates and soft, dark-grey, rusty-buff weathering sandstones referable to this age occurs on Campbell River, extending for a mile or more above the mouth of the Don, and for about three miles below this point. The dip, as seen at a small island a mile and a half below the mouth of the Don, is S. 45° E. < 75°, and two miles below S. 80° W. < 70°.

The exposures are too few, and the strata too much crumpled, to allow of their structure being definitely ascertained, but they probably form an irregular synclinal lying in a trough in the older rocks, which has been protected by them from denudation. The few exposures seen are abundantly fossiliferous, although, owing to the cleavage which cuts the bedding obliquely, the forms obtained were generally imperfect and distorted. Those collected, however, which have been determined by Mr. Ami, justify the beds being placed in the Oriskany group, at the base of the Devonian. From a small collection made at the locality, Mr. Ami has furnished the following list:—

Devonian  
fossils.

1. The carbonized stem of some plant too imperfect for identification.
2. *Polypora*. Sp. indt. (Generic reference doubtful)
3. *Strophomena* (*Strophodonta*) *magnifica*, Hall. Several casts of the interior of this shell present the muscular impressions very perfect.
4. *Strophomena* (*Strophodonta*) *varistriata*? Conrad. A form which is most probably referable to the above species occurs in the collection.
5. *Strophomena rhomboidalis*, Wilckens. There are numerous examples of this species occurring at this locality, and they appear to be that



form or variety described and figured by Prof. Hall as the *S. rugosa* (Palæontology of New York, Vol. III.)

6. *Orthis hipparionyx*, Vannxm. Amongst the species collected are two or three casts of the ventral or flat valve of the above *Orthis*, showing the imprints of the muscular adductors and their bilobate character very well.

7. *Orthis*. Sp. indt. (Of the type of *O. oblata*. H.)

8. *Leptocælia flabellites*, Conrad. Small examples of a species of *Leptocælia*, which cannot be differentiated from the above, occur in the collection. They resemble those from Gaspé in a very marked degree.

9. *Eatonia*? (Portion of the cast of the ventral valve of a species of *Eatonia*, too imperfect, however, for specific identification.)

10. *Spirifera arrecta*, Hall. Numerous internal casts of this well-known and easily recognized species occur at this locality, and present all the characters and variations described by Prof. Hall in Pal. N. Y., Vol. III., p. 422.

11. *Spirifera*. Sp. indt. Besides the casts of *S. arrecta*, H., above referred to, there occur internal casts of another species of *Spirifera*, much longer, proportionally, and with elevated umbonal region. They present many points in common with *S. submucronata*, H., and with *S. cycloptera*, H., also.

12. *Pterinea textilis*, H. (or a very closely allied species).

13. *Pterinea*, or *Megambonia*. (Probably a species of the latter, and as yet undescribed.)

14. Pygidium of a trilobite resembling *Calymene*.

Of the above species, Nos. 1, 3, 5, 6, 8, 9, 10 and 12 are known from the Oriskany. For those who consider the Oriskany as forming part of the Silurian the above would then be referable to that system.

## E. SILURIAN.

The rocks of this system, within the district described, cover a very large area, embracing fully one half of the quarter sheet map, or all that portion of the latter which lies north-west of a nearly uniform but slightly crescentic line, extending from the head of the Three Brooks, on the Tobique River, to the valley of the Upsalquitch. To the north and west, the formation passes beyond the limits of the map.

The surface features of this Silurian tract have been pretty fully described in previous reports, and especially in those of Mr. Robert Chalmers, on the Superficial Geology of New Brunswick.\* A few additional facts may, however, be stated here. Over almost the entire district, the country is hilly and the scenery picturesque, but few of the hills reach an altitude of one thousand feet, while their slopes, though occasionally abrupt, are in general sufficiently moderate to ad-

\* Report of Progress, 1882-3-4, and Annual Report, 1885, Part G G.

mit of successful agricultural operations. Most of the eminences have the form of long, narrow ridges, or that of inverted canoes, with a regular and continuous crest line, but at times, this is replaced by a more or less serrated outline, or, more rarely, where igneous rocks occur, by conical or pyramidal forms.

Watershed.

The district is everywhere well watered, including upon the southern side, in addition to a small part of the St. John, a considerable portion of the Tobique River and some of its most important affluents, upon the west, the Salmon River, Little River and Grand River, tributary to the St. John, and upon the north, the more southerly branches of the Restigouche and Upsalquitch. The position and relations of these streams would seem to indicate the existence of a definite watershed extending north-easterly from the St. John River near the Grand Falls to and beyond the headwaters of the Upsalquitch, and parallel, or nearly so, to the course of the southern margin of the Silurian tract. By its tributary, the Wagan, the Restigouche approaches quite nearly to the head of Grand River, connected with the St. John, and the short portage between the two has long been used as an easy means of passage from one set of waters to the other. The Tobique again is readily navigable by canoes, through the Little Tobique, to its source in Nictor Lake, and this is separated by another short portage from the head of the Nepisiquit. Owing to the facilities of communication thus offered, the fine scenery which their streams afford, and the fact that, as a rule, they abound with fish, they furnish many attractions to tourists and sportsmen, while through the sale of the fishing privileges, they are becoming an increasing source of provincial revenue. They are also the seat of extensive lumbering operations.

"Fertile belt."

The general fertility of the Silurian district has been a frequent subject of comment, and certain portions of it, more particularly in Carleton county and in Aroostook county, Maine, are quite famed, both for the vigor of their forest growth and for their agricultural capabilities. Prof. G. L. Goodale, in the seventh report on the agriculture of Maine, commenting on this feature, and after alluding to the species of plants by which the county of Aroostook is characterized, divides it into two portions, both adjoining New Brunswick, but of which one, bordering the Aroostook River and lying to the south of Grand Falls, is much more fertile than the other, and embraces many species which are usually to be met with only in a more southern latitude. He finds this difference also to be coincident approximately with the character of the rocks in the tracts, that of the more southerly or "fertile belt" being especially marked by the presence of calcareous strata. If this be the true cause of the difference it may be expected that similar results would be observed where these several

groups of rocks, in their eastward extension, enter the limits of the province. And this would to some extent appear to be the case. Here, also, a "fertile belt," continuous with that of Aroostook, is well marked, and is rapidly becoming the seat of thriving settlements, but owing to a change in the course of the strata in passing from Maine to New Brunswick, the width of the belt in the latter is considerably increased, extending probably at least as far north as Edmunston, and eastward to the valley of the Restigouche. Even above Edmunston, much good land is to be found, but the more hilly character of the country in this direction, combined with the shortness of the season and the occurrence of early frosts, give here a less promising aspect to the work of the agriculturist.

The geological features of the district under review present but little diversity, being very similar to those of the Silurian tracts described in previous reports. The prevailing rocks are slates, mostly of dark grey colours, weathering to bluish-grey and often conspicuously banded, but in places they are greenish or reddish. They are very generally calcareous and at times markedly so, but bands of true limestone are infrequent. The slates not uncommonly alternate with sandstones, which are also calcareous, but beds of coarser character are rarely met with. Intrusive rocks are also not common, though covering some considerable areas. Geological features.

The attitude of the beds over the Silurian tract is usually one indicative of great disturbance, and over large areas, great masses of strata have been affected by extensive and complicated folds. But over other considerable areas, it would seem that the pressure to which the beds have been subjected has resulted only in local crumplings, the beds as a whole still occupying positions which are not far from horizontal. It is in this way that they are made to spread so widely and to acquire the appearance of having a much greater thickness than they actually possess. In connection with these movements, slaty cleavage has been very strongly developed, and in many instances makes the recognition of the true stratification a matter of some difficulty. Owing to the circumstances to which reference has been made, together with the paucity of fossils, any attempts to determine the relative position of the different groups of strata, their thickness or their correlation with those of other regions, are at once inconclusive and unsatisfactory. Indeed within the limits to which the present report relates, there are very few facts which help to throw much light upon questions of this character. So far as at present known, these relations seem most likely to be disclosed by the study of the regions to the north and west of that here described, more particularly those of the Aroostook region in the state of Maine and the Temiscouata re- Disturbance.  
Slaty cleavage.

gion in Quebec, but as these are still under examination, any further reference to the conclusions which they indicate would be premature. It will here be sufficient to say that of the fossils collected within the area under discussion, all are distinctly Silurian, indicating in most instances an horizon about that of the Lower Helderberg formation.

Fossils.

#### D. CAMBRO-SILURIAN.

The belt of rocks which has been classed in the accompanying map as Cambro-Silurian, is a continuation of the strata of that supposed age described in the report of last year as forming a rim protruding from underneath the eastern edge of the Silurian area in the district immediately to the south.

In the absence of any contained fossils, these sediments have been so placed on account of their stratigraphical position, under the Silurian, and on account of their close lithological resemblance to measures which have been referred to this age further to the south. As seen on Campbell and Galquac rivers, and at several intervening points, they consist of thick beds of felspathic sandstones and quartzites, with layers of hard, blue slate interstratified. They show evidence of having been crumpled everywhere into sharp folds, the tops of which have been denuded, and the strata now stand on end or are tilted at very high angles; they preserve a tolerably uniform strike, however, of about N. 40° E. A persistent band of hard conglomerate, holding pebbles of white quartz, quartzite, jasper and black slate, occurs near the edge of this belt all along; it is seen in both the Galquac and Wapskehegan rivers, and Mr. Hind has noted the occurrence of large blocks of a similar conglomerate on Campbell River, about two miles above its junction with the Serpentine.

Typical rocks.

Conglomerate.

Although resembling in many respects the conglomerates occurring in the Silurian, the absence of any of the beds which are everywhere associated with the Silurian conglomerate, and its stratigraphical position (dip N. 55° W. < 75° to 90'), render it probable that it is here a basal conglomerate of the Cambro-Silurian, holding pebbles which have been derived from some Cambrian or Pre-Cambrian rocks which have not yet been noted.

#### GENERAL REMARKS ON THE PRE-CAMBRIAN AREA.

The region within the limits of the present sheet, lying to the south-east of the great Silurian area, is everywhere of a very rugged and mountainous character. Its general height above the sea, as ascer-

General elevation.

tained by barometer levels, is over 1,200 feet, and throughout the whole district, in every direction, peaks rise above this general level to a height of 2,000 to 2,700 feet. Among the more prominent of these, of which the heights are known, are Bald Mountain, near the head waters of the south branch of Nipisiguit River, about 2,500 feet above the sea; Sagamook or Bald Mountain, rising abruptly from the southern shore of Nictor Lake, 2,537 feet; Bald Mountain, about three miles above Indian Falls, on the right bank of the Nepisiguit river, 1,922 feet; Bald Head, six miles back from the Tobique, at Riley Brook, a very symmetrical, conical peak, rising to a height of about 1,900 feet, and the Blue Mountains, upper and lower, coming close to the left bank of the Tobique, thirteen miles below the forks, about 1,724 feet.

From these central highlands flow off to the sea rivers, which empty into the Bay of Chaleur on the north-east, into the Straits of Northumberland on the east, and into the Bay of Fundy on the south. Owing to the great height of this central watershed, these streams are all very rapid and difficult of navigation, flowing through deep, narrow valleys, with often high, precipitous banks. As an example of their rapidity of descent, the right hand branch of the Tobique may be taken. From the lake at its source to the main forks, a distance of twenty-seven miles, it has a fall of about 780 feet, or an average descent of a little over twenty-five feet to the mile. Early in the season, before the water has fallen to its summer level, most of these streams may be traversed with light birch bark canoes, by making portages around falls and rapids, and shoeing the canoes with cedar splints in the rougher stretches. Brook trout abound in all the waters, and salmon ascend many of the streams. On the Tobique, the salmon now afford good fly-fishing, although up to quite recently, it was generally believed that they would not rise to a fly. White-fish, *Coregonus albus*, are also plentiful in the Tobique, and in the lakes at the head of the right hand branch Togue, *Salvelinus Namaycush*, are caught in large numbers through the ice in the winter. Eels are common in the lakes, and lampreys in the streams draining them, where they were observed about the end of June, making their spawning beds in rapid parts of the stream, by dragging away the stones and pebbles from one place and dropping them just below, forming a hollow about eighteen inches in depth, with corresponding mound of pebbles below.

Animals, useful for food or valuable on account of their skins, are fairly plentiful in parts of this region. Moose and cariboo are found in considerable numbers, and black bear, beaver, otter, lynx, marten and mink, are trapped quite extensively by the Indians and by white hunters; of these fur-bearing animals, the otter and beaver are fast

**Timber.** becoming rare and, at the present rate of destruction, will in a very few years be almost extinct in the district. Large areas are still covered with a thick growth of black spruce of fair size, and in this lumber the chief value of the tract lies; the pine has been exhausted for many years, only a few scattering specimens of white pine and sapling red pine are now to be seen. Cedar of good size is plentiful along most of the water courses, and hardwood trees, of different varieties, maple, birch, ash, &c., are almost everywhere intermixed with the spruce. The rocky character of the surface, covered over large areas with boulders of granite, gneiss and quartzite, derived for the most part from the underlying rocks, and its extreme roughness render it generally quite unsuited for cultivation and dependant for future value on its forest growth.

#### A.B. PRE-CAMBRIAN.

**Geological boundaries.**

A large part of the area under consideration is occupied by rocks supposed to be of this age. Their occurrence on the Nepisiguit River and on the streams flowing into the Miramichi has been already referred to by Dr. Ellis in the Report of Progress for 1879-80, pages 30 and 31 n, and the geological boundaries in this part of the region are laid down from his work. North of the Nepisiguit River, the western edge of these rocks is defined by the unconformable overlap of the Silurian slates, which here extend eastward to a point about midway between the head and foot of Nictor Lake; further south, a band of slates and hard sandstones, apparently more recent than the Pre-Cambrian, and overlying them, lies between them and the Silurian. These are thought to be of Cambro-Silurian age.

**Typical rocks.**

The typical rocks of this formation, as seen in its south-eastern extension, consist of very hard crystalline felsites, generally of a red colour, highly chloritic quartzites and felspathic and micaceous schists. The stratification of these beds is generally very obscure and difficult to ascertain with certainty; their general strike, as nearly as it could be obtained, is N. 70° E. Owing to the densely wooded nature of the country and the absence of rock exposures *in situ* over large areas, the structure can only with difficulty be worked out, and on the accompanying map, an attempt has only been made to fix, with an approach to accuracy, the boundaries of the formation. It is cut by large areas of intruded granite, which will be referred to later on under that head.

**Succession on Campbell River.**

Ascending the right hand branch of the Tobique, the first rocks supposed of this to be age are seen just below Sixteen-mile Brook, or about four miles above the mouth of the Serpentine; these are massive ledges of greenish-grey crystalline felsite mottled with red blotches,

without apparent dip. This exposure seems to mark the western edge of the Pre-Cambrian on the Tobique, as just above, where the stream bends to the west, are seen hard felspathic sandstones and blue slates, belonging apparently to the overlying Cambro-Silurian; these extend for about a mile beyond, or until they again are overlaid by the soft, calcareous beds of the Oriskany basin, elsewhere described. Above these last named beds, for some distance, no exposures are met with; the soil is, however, filled with angular blocks of a coarse amygdaloidal diorite, which occurs in place about two miles above the mouth of the Don. Hard, crystalline, red and greenish-grey felsites follow, and, with occasional ledges of fine-grained syenite with specks of clear quartz and red felspar—the grains of quartz sometimes circled with felspar—and of amygdaloidal diorite, continue to the foot of Tobique Lake. Although obscure, the strike, where recognized, seemed to be about east and west. Along Tobique Lake no exposures are seen, but the shores are plentifully strewn with blocks and boulders of fine red syenite and greenish-grey chloritic syenite. The immediate shores of the lake are low and densely wooded with black spruce to the water's edge, giving the lake a dark and gloomy appearance. A ledge of felspathic schist, with a strike N.E., is mentioned by Mr. Hind as occurring on the shore of Milpagus Lake, which lies about a mile to the south-east of the head of Tobique Lake. About two miles east of this lake is Long Lake, a fine sheet of water five miles and a half in length, with an average width of about half a mile; although showing no ledges *in situ*, the same boulders are common along its shores to a point about midway up the lake, beyond which granite only is seen. Ledges of coarse, green, chloritic diabase and hard, green chloritic quartzite, with veins of quartz and quite micaceous and schistose in certain layers, occur on the portage to Serpentine Lake, which lies four miles to the north-east, and form the hills separating Portage from Adder Lake. The immediate shores of Serpentine Lake are quite low and flat, and but one exposure was seen; this occurs on a tongue of land jutting out into the lake from its western side, and is a hard, felspathic schist, striking about N. 70° E., and dipping to the north at an angle of 65°. On Serpentine River, between the lake and the stillwater, boulders of pale reddish crystalline felsite and syenite are common, and the former is present in place at the head of the dead water. From this point down to the edge of the Cambro-Silurian belt, the rocks are hard, grey quartzites and schists, highly chloritic, and often with many thin veins of quartz running parallel with the planes of cleavage. About eight miles above the forks there is a ridge of coarse gneissic granite, which seems to cut these beds—possibly a spur from the main granitic mass to the

east; this will be further referred to. East of the main body of granite, the Pre-Cambrian rocks consist mainly of felspathic gneisses and schists; they are described by Mr. Ellis in the Report of Progress for 1879-80, page 32 D.

Blue  
Mountains.

In addition to the main area of these rocks above described, another smaller tract lying to the southeast of the Blue Mountains is occupied by strata, which are probably also of Pre-Cambrian age. Very hard white and red crystalline felsites, not distinguishable in macroscopical character from those so common in the main Pre-Cambrian area, form high cliffs on the Gulquac River, a few miles up from its mouth. Although not occurring in actual contact with the Lower Carboniferous strata, they are seen for a considerable distance along the stream, rising in high bluffs on the right bank, while on the left, the red sandstones and conglomerates of the Lower Carboniferous lie in their usual, almost horizontal, position, and show neither alteration nor disturbance, both of which might be looked for were these felsites intruded since the deposition of the sandstones.

#### GR. GRANITE.

Two areas.

Two areas of granite come within the district under consideration. The larger of these has an average width of about twelve miles, and extends from the head waters of the NW. Miramichi in a south-westerly direction to and beyond the lakes at the sources of the Gulquac and Little S.W. Miramichi rivers. The smaller is a long narrow tongue, about four miles in width, running up into the Pre-Cambrian from the main granitic mass to the south. It lies about five miles to the east of the first and nearly parallel to it.

Character of  
the granite.

The granite in both of these areas is of the same character and is quite similar to that described in previous reports as intrusive and probably of Devonian age; in texture, it varies from medium grain to coarse, with large crystals of orthoclase felspar. The mica is often a black variety of this mineral, and is not unfrequently replaced by hornblende; sometimes both mica and hornblende are present. In the absence of exposures of rock *in situ*, the south-westward edge of the larger granitic mass has been fixed at the western limit of the large granite blocks and boulders which are strewn along the shores and neighbouring hill-sides about the upper half of Long Lake. The difference in the character of the boulders along the upper and lower stretches of this lake is strongly marked; along the lower part of the lake, chloritic quartzites, gneisses and schists form the larger number of the boulders, and large blocks of granite are markedly absent, while towards its head, those of granite are the prevailing feature and the others are seldom seen.

Boulders.



In addition to the areas already referred to, a ridge of gneissic granite, about a quarter of a mile in width, trending W.N.W., crosses Serpentine River midway between the lake and its junction with Campbell River, forming a series of rapids and falls. The granite composing this ridge differs very materially in structure from that described above; it is of a coarse, grey variety, with black mica, and generally with a distinctly gneissic arrangement of its constituents and is in places traversed by ramifying veins of semi-vitreous, rusty-weathering quartz. Owing to the generally contorted and highly altered aspect of the Pre-Cambrian, evidence of the intrusion of the granite in the altering and crumpling of the beds\* is not readily recognized. Both of these results of intrusion, however, are here present, though to a limited degree; as the granite is approached on either side, the quartzites become hard, quartzose schists, cut in every direction by numerous veins of quartz, and noticeably more twisted and distorted. Although it cannot be stated with any certainty that these gneissic granites may not form a part of the system of rocks which encloses them, yet it would require a more detailed examination to settle the point, and they are provisionally classed on the accompanying map with the intruded granites. In last year's report, Part G., mention was made of a very similar mass of granite which forms the high hill at the forks of the South-West Miramichi River in Carleton county; this was also provisionally placed with the intruded granite.

What has been said of the shores about the head of Long Lake will apply equally to the whole region about the head waters of the Gulaquac, and to the watershed between these waters and the Little South-West Miramichi. Nowhere were any ledges seen, and everywhere the surface was strewn with large granite boulders. On the Little South-West Miramichi, however, ledges of grey granite occur and the eastern edge of the main granitic mass, as well as the limits of the smaller belt are here clearly seen. In both cases they are cutting Pre-Cambrian gneiss and schists.†

Character of  
the surface.

#### MATERIALS OF ECONOMIC IMPORTANCE.

Although the district under consideration, as far as it has been examined, has not proved very rich in economic minerals, yet it contains some which are worthy of mention. That valuable minerals, other than those enumerated, may exist in the district is, of course, possible and even probable. A thorough prospecting exploration of the whole

\* This cannot by itself be taken as evidence of intrusion—it can be readily otherwise explained—nor does it even always accompany intrusion.—A. R. C. S.

† Report of Progress, 1879-80, page 32, D.

region, with the time and means at our disposal, has been impossible; in the unsettled portions—and these embrace fully three-fourths of its entire extent—no examination, which can claim to have been at all an exhaustive one, has been made. The principal streams have been examined and to some extent the country bordering them, and a number of traverses made from point to point through the forest-covered areas. These have afforded the means of obtaining a good knowledge of the general geology of the region and have enabled us to lay down, we hope with a fair approach to accuracy, the boundaries of the different geological systems; they have not resulted, however, in the discovery of any minerals of economic importance, although the highly altered character of the strata over large areas and the numerous intrusions and contacts would seem favourable to the formation of mineral-bearing veins.

The following are the more important minerals known to occur in the district:—

*Gypsum*.—Large beds of this mineral occur on the left bank of the Tobique River just above the mouth of its affluent the Wapskehegan, or about thirty miles from the St. John. Their mode of occurrence and some idea of the probable extent of the deposits has been given in preceding pages. The occurrence of these beds and their value to the agriculturist was early pointed out, and the neighbouring farmers have used the gypsum as a fertilizer to a greater or less extent ever since the country has been settled.

In more recent years it has become, to a limited degree, an article of commerce, although distance from a market and the rude means of transport available have prevented its extended use. It has been shipped either by carrying it down the river during high water on rafts or by hauling on the ice in the winter time. Considerable quantities have each winter been hauled in this way by the farmers of Aroostock county, who esteem it highly as a fertilizer for their crops of potatoes, large quantities of which are grown in that region for the manufacture of starch. It is stated that upwards of a thousand tons have been taken away in this manner in a season.

There are now two mills on the Tobique, one at Three Brooks and the other at Quaker Brook, which are fitted with machinery for grinding the gypsum, but owing in a large measure to the poor facilities for shipment their operations are on a very limited scale. This drawback, the want of means of carriage, will, it is expected, soon be done away with, as a railway is projected, and surveys for it have been made, to run up the valley of the Tobique as far as the gypsum beds. Connecting at the mouth of the river with the New Brunswick railroad system, it will afford an outlet for the plaster as well as for the lumber and other products of the districts.

*Limestones.*—The only deposits of limestone known in this district, which give promise of burning to form good lime, are of Lower Carboniferous age and occur near the summit of that series on the Tobique. They occur in thick beds at several points along the river above the Wapskehegan; many of these beds are too silicious for calcination, but there are among them some of good quality which would probably yield good lime.

The slates of Silurian age throughout this tract are, over large areas, highly calcareous and are often banded with layers of fine pure limestone; none sufficiently pure for calcination have been noticed.

*Building Stones.*—Some of the sandstones and grits of the Lower Carboniferous formation on the Tobique seem to be well adapted for building stones. They vary in texture from fine-grained sandstones, approaching freestones, to coarse grits and conglomerates; and in colour, from white, through pink, to purplish-red. Their hardness is equally variable, and as they occur at different points in massive beds, it seems probable that they may furnish good building material.

*Roofing Slates.*—Mr. Hind mentions the occurrence of excellent roofing slates on the right hand branch of the Tobique River, below the forks of the Serpentine.

*Brick-clays.*—Clay which seems well adapted for the manufacture of bricks occurs in thick beds at several points along the St. John River. Owing mainly to the limited demand it has not yet been utilized to any extent.

*Marl.*—Considerable deposits of this material, which is valuable as a fertilizer, were noticed in the bed of a small lake, lying on Lower Carboniferous limestone, a short distance above Burnshaw Brook, on the right bank of the Tobique. Many others of the small lakes throughout the district, notably those lying on the highly calcareous strata of the Silurian, are likely to yield it.

*Gold.*—The discovery of gold has been from time to time reported from almost every part of this region. Up to the present, however, the only finds which can be regarded as authentic have been made by washing the drift, and these have nowhere been rich enough to indicate that extensive working would give remunerative results. Mr. Hind reports the occurrence of fine gold, in small quantities, in the drift in many places throughout the region—notably “in a valley on the north side of Blue Mountain.”\*

None of the numerous quartz veins throughout the district have yet been found to be auriferous; the only discoveries of this metal, which are considered to be well authenticated, are those from the drift.

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\* Preliminary Report on the Geology of New Brunswick, by Henry Youle Hind, M.A., F.G.S., Fredericton, 1865.

