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GEOLOGICAL SURVEY OF CANADA.

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

REPORT

ON THE GEOLOGY OF

NORTHERN NEW BRUNSWICK,

EMBRACING PORTIONS OF THE COUNTIES OF

Restigouche, Gloucester, and Northumberland,

1881.

BY

R. W. ELLS, M.A.

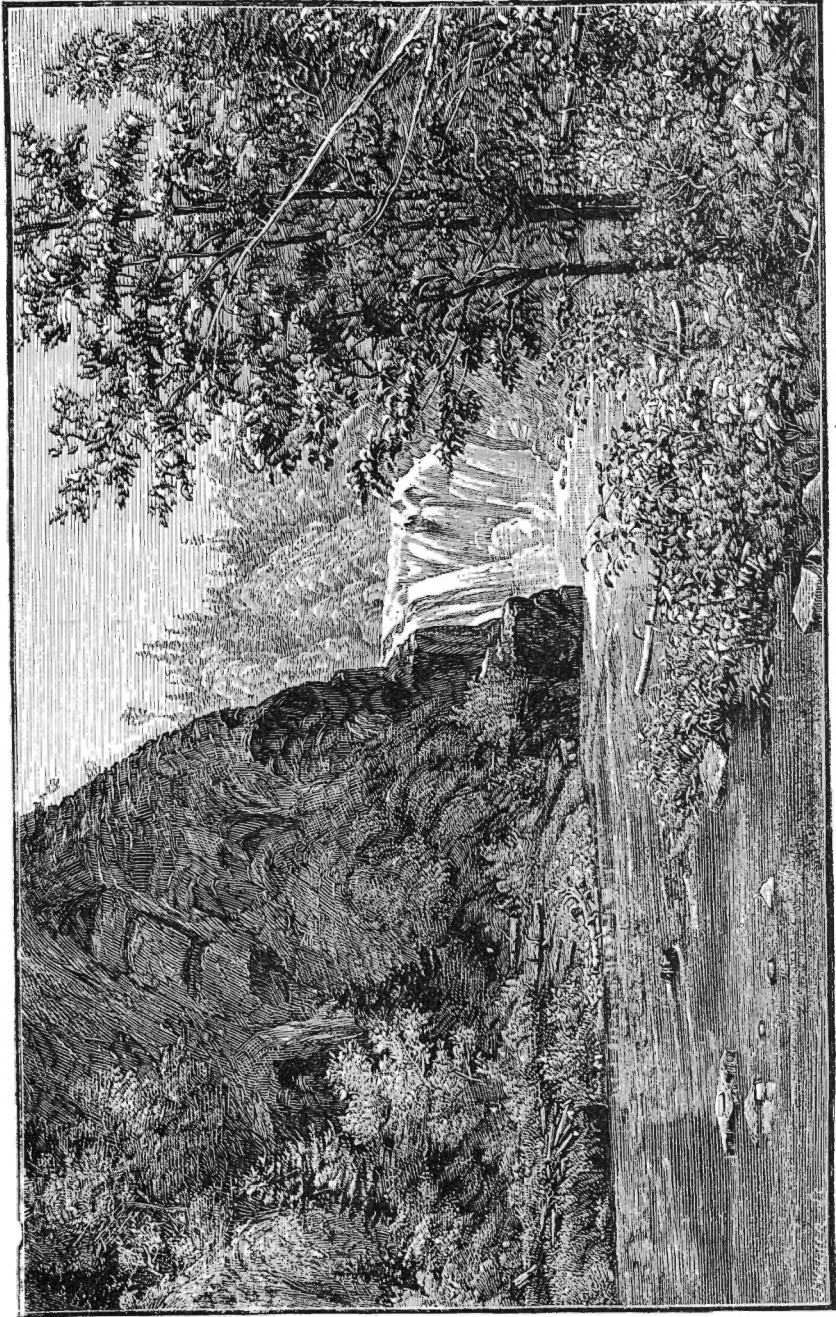


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1881



GEOLOGICAL SURVEY, 1880.

TÊTE À GAUCHE FALLS, N.B.

From Photo. by R. W. ELLS.

ALFRED R. C. SELWYN, ESQ., LL.D., F.R.S., &c.,

Director of the Geological Survey of Canada.

SIR,—The present Report, comprising the result of the explorations of the past two seasons in northern New Brunswick, is herewith submitted. The map to accompany it has been prepared on the scale of four miles to one inch, in conformity with those lately published of the southern part of the Province, but from the lack of some topographical details which will necessitate a few weeks' further survey to render complete, it has been deemed best to withhold its publication till next year.

During the season of 1879 I was assisted by Mr. Frank D. Adams, Assistants.
B. Ap. Sc., now permanently attached to the staff of the Survey, and by Mr. Thomas D. Peers, of Halifax, N.S., and in 1880 by the latter of these gentlemen. Our thanks are due especially to Messrs. W. J. Obligations.
O'Brien of the Customs Department and Savings Bank, Bathurst, for many kind attentions, to Messrs. Burns, Adams & Co., of the same place, who kindly furnished us with the means for towing our supplies up the Nipisiguit River, and also supplied us with provisions from their depots in the interior, and to Mr. Joseph Hickson, Fishery Inspector for the County of Gloucester. Also to Mr. Reid, of the Clifton Grindstone Quarries, and to the Crown Lands Department for copies of surveys of rivers and other information. The work of the Survey during the season of 1879 consisted principally of the exploration of the Rivers Nipisiguit, Upsalquitch, Restigouche, Tobique and its right hand branch, and the Tête à Gauche, embracing a canoe journey of some Area examined
650 miles; surveys of the coast from Bathurst north to Campbellton, and of the roads in the counties of Restigouche and northern Gloucester, as well as examinations of the Devonian rocks in the vicinity of Dalhousie before undetermined. In 1880 the work embraced the Jacquet River and the Quebec shore from the Metapedia to the mouth of the Nouvelle River opposite Dalhousie, the explorations of the North-west Miramichi and its branches, the Sevogle and Little South West to their sources, the main South-west Miramichi, the south branch of the Nipisiguit, and the wilderness country lying around the heads of these streams, and road surveys in southern and eastern Gloucester. In the greater part of the area embraced in these explorations, the work was necessarily performed by canoe; good chain surveys of the principal rivers being often obtained from the Crown Lands Department of the Province, by means of which our work was greatly facilitated. The

GEOLOGICAL SURVEY OF CANADA.

General character of country in the interior.

entirely unsettled state of the country inland, and its dense forest growth, often blown down and forming an impenetrable jungle, rendered the work very difficult, and the tracing of geological boundaries, with accuracy, in many places an utter impossibility. During the two seasons nearly 2000 miles of exploration in canoes and nearly 1000 miles of road and other surveys were accomplished; and, considering the unsatisfactory character of the country, it is believed that the relations and boundaries of the different geological formations have been determined with a fair approach to accuracy. A series of photographic views was also obtained, illustrating points of interest along the principal rivers and the general character of the country and its scenery.

I have the honor to be,

Sir,

Your most obedient servant,

R. W. ELLS.

Geological Survey Office, }
May, 1881. }

REPORT
ON THE GEOLOGY OF
NORTHERN NEW BRUNSWICK,

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RESTIGOUCHE, GLOUCESTER, AND NORTHUMBERLAND,

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Previous to the commencement of the work in this portion of the Province, in 1879, the determination of the various geological formations was of a very general character, and their boundaries somewhat loosely defined. Explorations had been made to a limited extent along the coast by Sir W. E. Logan, in 1843, in connection with the so-called Bonaventure formation; by Dr. Abraham Gesner about the same date, the result of whose observations appeared in his report to the New Brunswick Government; by Prof. H. Y. Hind, in 1864, who made a traverse of the Tobique and Nipisiguit Rivers, as also of the main south-west Miramichi, by whom the great bulk of the metamorphic rocks, as seen in these streams, was assigned to the Quebec Group, and whose report to the New Brunswick Government (1865) contains a large amount of very valuable information. Brief papers also appeared in the *Canadian Naturalist* by Prof. L. W. Bailey, of Fredericton, who made a canoe voyage from the St. John River to Bathurst, by way of the Tobique and Nipisiguit Rivers, and in the *Transactions of the Nova Scotia Institute of Natural History*, by the Rev. Dr. Honeyman, more particularly with reference to the country about the upper part of the Bay Chaleur, and in the vicinity of Dalhousie.

Work previously done in this area.

The working out of the stratigraphical relations of the different geological formations in the southern part of the Province has, however,

furnished us with a key by which we can more readily decipher the somewhat complex structure of the northern area, and in this respect the different divisions will be found to correspond with those given in the Geological Survey Report 1877-8, on southern New Brunswick.

Two large streams, the Nipisiguit and the Tobique, take their rise in close proximity to each other near the central point of the northern half of the Province. The former enters the Bay Chaleur at the town of Bathurst, the latter, the St. John, about twenty miles below the Grand Falls, or just above the town of Andover. Both are easily navigable for canoes, and thus form a favorite route for travellers and tourists, not only from the magnificent scenery along their course, but from the quantity and excellence of the fish, both salmon and trout, which are especially abundant in the Nipisiguit. On this river the salmon are at present able to ascend only to the Grand Falls, or twenty miles from its mouth, but if fishways were erected by which they might pass this barrier, the stream above is especially adapted for their introduction and increase. Above the Falls, however, trout of the finest quality, reaching as much as five pounds in weight, are found in the greatest abundance. About its head-waters, moose, cariboo and bears are numerous, whilst beavers are plentiful in most of the smaller tributaries. The surface of the country, especially along the upper part of the river, is exceedingly mountainous; ranges of hills from 1200 to 2000 feet in height, with scattered peaks of even greater elevation, affording a succession of magnificent views which can be surpassed in no other portion of the Province. The Nipisiguit receives a number of tributaries, but none of any considerable size with the exception of the Main South Branch which comes in at 60½ miles from its mouth. This stream rises about thirty miles to the south, and flows through an exceedingly rough and mountainous country. From the frequency of its falls and rapids its lower part, for about six miles, is difficult for canoes, but above this point no such obstacles exist.

From the head of Nipisiguit Lake a portage of about two and a-half miles extends to Nictor Lake or head of the Little Tobique or Nictor River. This lake is about four miles in extreme length, with an average width of about half a mile. A large mountain towers along its southern margin and thence stretches away to the south-west. From this lake the Little Tobique or Nictor flows for some thirty-five miles, mostly through a country very flat in the vicinity of the stream, the banks being from two to six feet above water and densely wooded with cedar, spruce, etc., till it meets the main branch or Campbell River and the Mamozekel. Thence the river becomes broad and flows through a magnificent farming country occupied by Silurian and Lower Carbon-

General description of the Nipisiguit river.

General description of the Tobique river.

iferous sediments, and now rapidly filling up with an industrious population. This stream contains abundance of salmon, which ascend the Right Hand Branch and the Serpentine, a branch of the last named stream. They do not, however, readily rise to the fly, but are taken in considerable quantities by spearing, despite the vigilance of the fish wardens. White fish (*Coregonus albus*) are also found in this river and can be taken by spearing.

Ascending the Nipisiguit, at sixty-two miles from its mouth, a small stream (Portage Brook) enters from the north, and affords a partial route to the Upsalquitch Lake, whence canoes can easily descend the Upsalquitch River to the Restigouche. The total length of the Portage between the Nipisiguit and the head of the lake is about seven miles, but in a good state of water this can be shortened by means of small brooks and beaver ponds to little more than one mile. On the Upsalquitch, after passing the lofty ranges of hills which characterise the country occupied by the felsitic and precambrian rocks hereafter described, the surface becomes less broken; the softer Silurian strata not affording such marked physical features. A second portage occurs on the river about eight miles below the lake, where a series of falls for a distance of over a mile render this portion of the river impracticable for canoes. The total descent on this stretch from the head of the portage to the mouth of Ramsay's Brook, two miles below, was found by aneroid to be about 130 feet. Below this the river is easily navigable for canoes, and much fine scenery is observed throughout its entire length.

The Great Falls about six miles from the mouth of the river afford no obstructions to canoeing. Much apparently good land occurs along the lower part of this river, but the portion above the Forks is too rough and broken from the presence of hard felspathic and trappean rocks, to afford much valuable land for agricultural purposes. Examinations were made along the Restigouche in 1837, by Mr. Richardson of this Survey, as far up as the mouth of the Patapedia River, which for some miles forms the boundary between the Provinces of Quebec and New Brunswick. In continuation of this work our explorations were carried on to the point where the portage extends across to the St. John River.

The country along the upper part of the Restigouche is much less broken than about its lower portion; and much fine farming land will doubtless be found over the area occupied by Silurian rocks which here cover a large extent of country. At present, however, this region is inaccessible to the settler, and is available only as a source from which large quantities of spruce timber are derived. The route from the Restigouche to the St. John is up the Waagansis for about seven miles to the north end of the portage to Grand River. This carry is

about three and a-half miles in length, whence by the Grand River the St. John is reached about fourteen miles above the Grand Falls.

The breadth of country in the Restigouche Valley occupied by rocks of Silurian age, from its southern margin on the Tobique to the Quebec boundary, across the strike of the beds, is about seventy miles. As much of the finest farming land of the Province is on rocks of this horizon, there will, doubtless, be found in this area, which comprises over 4000 square miles, a very large proportion of land suitable for settlement, which will be available as soon as means of access can be provided.

The country in the vicinity of the Nipisiguit and Miramichi Rivers is of a totally different character. It is for the most part very rocky, the harder metamorphic rocks forming much more striking features. The soil is generally thin and often entirely denuded; so that except for timber a very large portion of the area between the Main South-west Miramichi and the Nipisiguit and the Tobique Rivers is worthless. The frequent fires also which have ravaged the country of the Miramichi River have destroyed large quantities of valuable timber, and for many hundreds of square miles the surface, especially in the vicinity of the head-waters of the North-west Miramichi and its branches, is completely wasted, nothing being left but the bare rock.

In connection with the general progress of the work, explorations were made to some extent in the country to the south of the Tobique River, but as the time available for this area was limited, further examinations will be necessary before definite results can be obtained. During the entire exploration particular attention was paid to the discovery of minerals of economic value, and though traces of several were found, the quantities were so small and the conditions of their occurrence such, that in so far as yet seen but small inducement for the investment of capital in this direction is presented. Further reference will be made to this subject under the heading of Economic Minerals.

MIDDLE CARBONIFEROUS.

The portion of the Province covered by rocks of this age is very considerable, and includes not far from a third of its superficial area. In its general outline it is roughly triangular, the apex being placed in the south-western portion of the Province at the Kedron Lakes on the boundary of Charlotte county. The length of the northern side of the triangle, from the apex to the Island of Miscou, is about 210 miles, its southern side to Cape Tormentine about 160 miles, and a direct line between the two eastern ends about 140 miles. Allowing for sea area under the Gulf of St. Lawrence, the number of square miles belonging

Settlement
lands on the
Restigouche.

Character of
the country
on the Nipisi-
guit and
Miramichi
rivers.

Area of the
Carboniferous
system of
eastern New
Brunswick.

to this System will not fall far short of 10,000. It includes the greater part of the counties of Westmorland, Queens, Sunbury and Gloucester, a large portion of York and Northumberland, and the entire county of Kent in so far as known. Throughout the greater part of the country under discussion, the strata lie in a nearly horizontal attitude, rarely reaching an angle of 10° , but generally forming low undulations with angles of from 1° – 4° . The surface of this large area is generally low and level or broken by ridges of moderate elevation. There is, however, a slight dip of the beds towards the waters of the Gulf of St. Lawrence, and from the general outline and structure of the formation, it would appear to have, at one time, formed a long sheltered and shallow bay, a western prolongation of the great Carboniferous basin which extended as far eastward as the Island of Cape Breton, and stretched from Gaspé on the north to the ridge of the Cobequids, in Nova Scotia, on the south. In the counties of Sunbury and Queens, the thickness of this formation has been determined by boring, but no efforts in this direction have yet been attempted in its eastern portion, and it is quite probable that it will be found to increase in thickness as we approach nearer the productive measures of Nova Scotia. Some color is lent to this supposition also from the non-occurrence of those ridges of older rocks (Lower Carboniferous and Devonian), which are found in the western portion about the head of the Grand Lake and on the Canaan River. The rocks resemble those already described in the Report of 1872-3 in the Grand Lake coalfield. Grey sandstone, shales and conglomerates predominate, but in the vicinity of the Gulf purple beds are seen like those exposed about the shore of Grand Lake, in Queens county. The boundary of the formation has been traced on its northern side from the Main South-west Miramichi near Boiestown, to the shore of the Bay of Chaleur, below Bathurst. The entirely unsettled state of a great part of the country, with its generally low and often swampy character, renders detailed observations very difficult. The Intercolonial railroad, however, affords a very fair section from Bathurst to Moncton, but the ordinary carriage roads disclose very rarely any rock exposures.

On the Intercolonial going south from Bathurst, exposures, though not very plentiful, are yet quite sufficient to determine the character of the formations. Leaving the Nipisiguit River where the red beds of the upper part of the Lower Carboniferous are seen resting on the granite we find, at the crossing of the Red Pine Brook, layers of reddish-purple sandstone and shale which probably are transition beds between the Lower Carboniferous and the Millstone Grit. Purple beds thence extend at intervals for several miles southward till we pass Red Pine station. These are presumably basal beds of the Millstone Grit

Probable greater thickness of the formation near the Gulf shore.

Bathurst to Newcastle.

as they are often found in this attitude in other parts of the Province. About midway between Red Pine and Bartibogue stations, grey sandstones, coarse and of the usual type of the Millstone Grit, come in for the first time in this direction, lying in a nearly horizontal position or with a slight northerly dip at angles of 1° to 3° . From this to Newcastle the same character is observed in all the cuttings. The sandstones are generally thin-bedded and unfitted for quarrying. Extensive peat bogs occur about the head-waters of the Tabusintac, but the surface is for the greater part sandy and covered with a sparse growth of scrubby spruce and pine.

Shore east of
Bathurst.

Going eastward from Bathurst along the post road, which keeps near the shore the greater part of the distance, we find at Bass River, about four miles below the town, large blocks and probably ledges of grey grit of the usual coarse Millstone Grit type. These probably overlie directly the red beds which are exposed at the crossing of the Nipisiguit, and which constitute the upper portion of the Lower Carboniferous formation. As the country along the shore is generally low, exposures are limited, and, with one exception at Ellis' Brook, thirteen miles below Bathurst, where ledges of purple-red sandstone and shale are seen, the road shews no ledges in all the distance to Shippegan. The shore alongside, however, affords good sections for the greater part of the way from Salmon Beach eastward. The beds are all horizontal in attitude or in slight undulations as is the case over the central area. At Clifton, seventeen miles below Bathurst, there are large grindstone quarries extending for a stretch of two miles along the shore. The cliff here consists of grey sandstone and shale, and contains two seams of coal, the larger of which, according to Mr. Reid, the owner of the quarries, has a thickness of eighteen inches. This, however, includes much carbonaceous shale, the finer coal being only a few inches. The shales contain abundance of fine ferns of carboniferous type, and at several points portions of stems are seen standing upright in the face of the cliff. These exposures extend along the shore nearly to Blue Cove, about two miles below the point where the post road turns off to Caraquette, but disclose no beds of coal of any importance. At Caraquette, about half a mile below the church, a thin irregular seam is seen on the shore, of no value. Borings were made, some years ago, for the purpose of testing this place but without success. As we approach Shippegan the grey beds gradually sink and purple sandstones and shales come in. These in the Island of Shippegan are reported to contain a seam of coal several feet in thickness, but at the time of my visit, owing to wet weather and the unwillingness of the settlers to disclose its exact position, an examination of it could not be made. From Shippegan to Tracadie River the coast line is low, and consists of peat

Coal seam at
Clifton.

Coal at Cara-
quette.

Coal at Ship-
pegan Island.

bogs and sand bars; no exposures are seen, but the generally dark-reddish color of the soil would lead one to infer that the underlying rocks are purple sandstones and shales. The remainder of the coast from Tracadie to Bartibogue River has not yet been examined, but from the latter stream to Newcastle grey sandstones and grits form frequent exposures along the shore and continue westward up the Miramichi (N. W. branch) to the western limit of the carboniferous basin on the Little South-west Miramichi and Big Sevogle.

The shore on the south side of the Miramichi River and harbor to Point Escuminac is generally low, and consists in many places of sandy beaches and peat bogs. Low cliffs of grey and sometimes purple sandstone and shale occur at intervals, and ledges are seen on the shore below high water-mark, but the beds are so uniformly horizontal that surface examination alone affords but little information.

Over this country coal seams are reported at various points. Besides those already mentioned on the Bay Chaleur, thin seams are stated to occur on the Renous and Dungarvon, branches of the Main South-west Miramichi, and in the vicinity of the latter also at Doaktown. Coal is also said to occur on Barnaby River, about one and a-half miles from its mouth, and on the Napan, back of Chatham. Thin seams also are found on the shore at Black Brook, about six miles below Chatham. Many of these places have not yet been visited, but the reports all agree in saying that the outcrops are very thin and do not exceed a foot in thickness at any place. It would almost seem desirable that some effort to test the thickness of the formation in the vicinity of the Gulf should be made. Could workable beds be found at Shippegan their value would be very great; since from their nearness to the Montreal market a manifest advantage would be obtained over the mines of Pictou and Cape Breton.

LOWER CARBONIFEROUS—BONAVENTURE FORMATION.

The rocks constituting this formation extend in a continuous belt from the South-west Miramichi River above Boiestown, north-east to Bathurst, and appear at various points about the upper part of the Bay Chaleur. The limits of the formation are well defined on the North-west Miramichi, the Little South-west and Big Sevogle. About Bathurst it is seen well developed on the Nipisiguit River, whence it extends northward underlying the town and harbor and extending up and past the mouth of the Tête à gauche River, along the post road and to the mouth of Peters Tête à gauche. River, and occupying the coast to this point. Where ledges are absent the formation is readily recognized by its characteristic red soil. On the Nipisiguit itself it extends up about thirteen and a-half miles from the mouth, occupying, for the most part, the southern bank of the river

Shore east of Chatham.

Coal seams of the Miramichi.

Extent of the formation about Bathurst.

while the granite occupies the bed and the northern bank. The red beds, however, at times extend past the north bank, but in such cases, owing to the low and wooded character of the country, the exact boundaries can not be made out. The beds, like those of the overlying Millstone Grit, have a nearly horizontal attitude or lie in gentle undulations, the inclinations not being greater than from two to four degrees. At the Rough Waters, three miles above Bathurst bridge, they are seen lying unconformably upon the granites; a layer of decomposed granitic *debris* intervening and probably constituting the lowest member of the Lower Carboniferous. This is overlaid by a thin bed of fine reddish conglomerate a few inches thick and capped by bluffs of dark-reddish gritty sandstone and shale. These about one mile below the railroad bridge, dip N. 80° E. < 4°, but just above the road bridge four miles below, the dip is reversed to S.W. < 2°.

Copper mine at
Bathurst.

At this point a deposit of copper ore occurs, and has in former years been worked to a small extent. The ore, which is the green carbonate, resembles that noted as occurring in rocks of similar age near Dorchester, Westmoreland County. Similar deposits also occur on Mines Basin, N.S., all of which have been worked unsuccessfully. In all these cases these deposits are due to the action of organic matter upon solutions containing copper, by which the copper has been precipitated around the vegetable remains. Dr. Gesner in "Industrial Resources of Nova Scotia," (1849), mentions several localities in the counties of Cumberland, Colchester and Pictou where similar deposits occur. He alludes also to the locality at Bathurst, and states that the ore occupied the site of a fossil tree, which had been transmuted into grey copper ore, and the removal of which exhausted the mine. He states also that the ore is frequently compact, although it is often filtered into a coal or lignite in which the vegetable texture of the original wood remains distinct. It is quite evident from this statement, as well as from the lack of success attending the operations on these deposits, that their economic value is but slight.

Going north from Bathurst along the coast, after passing Peters River, we find but small traces of Lower Carboniferous rocks till we reach Big Belledune Point. A very limited area, sufficient, however, to mark the deposit, occurs just above the mouth of the Nigadoo on the beach, and a larger area is observable on the Mill-stream, about half a mile west of the crossing of the Intercolonial railway. In character the beds in these localities resemble those seen at various points about the Bay Chaleur. Passing Belledune Point, just in rear of the Roman Catholic Church, horizontal beds of red conglomerate rest unconformably upon Silurian sandstones which dip N.W. < 40°. Thence up to the mouth of the Belledune River the red beds occur at

Bathurst to
Little Belle-
dune.

intervals, in most cases the unconformable contact of the formations being plainly visible in the low cliff of this portion of the coast. The conglomerates which are associated with red marly shales, frequently contain pebbles of Silurian slates and limestone as well as bands of greyish calcareous nodules. Pebbles of the traps which are seen cutting the Silurian beds at many places also occur, and prove that the outpouring of these lavas was intermediate between the deposition of the Silurian and Lower Carboniferous formations.

Still going north and passing Little Belledune Point, which consists of sand and gravel, similar red beds to those just described extend up to the point above Jacquet River or nearly to Nash's Creek. Beautiful sections are observed in the cliffs about one mile south of Armstrong's Brook, where the Silurian beds of sandstone and calcareous slates are seen forming several sharp folds and cut by dykes of dolorite. These cliffs have a height of fifteen to twenty-five feet, capped by from ten to twenty feet of horizontal beds which lie equally over both the Silurian slates and the trap, the latter often taking the form of interstratified beds. From half a mile below Armstrong's Brook these red beds completely occupy the shore to above Jacquet River, extending back from half a mile to a mile from the coast and shewing in small cuttings along the line of railroad. North of the Creek above Jacquet River (Nash's Creek) the red beds do not shew again till we reach the point below River Charlo, the shore being occupied by conglomerates, slates, limestones and trap of pre-carboniferous age. Heron Island, however, which lies off the mouth of Benjamin River, about two miles, is composed of soft red sandstones and conglomerates of this age, horizontal in position. These rocks resemble more closely the soft red sandstones of Triassic age of the Bay of Fundy than Lower Carboniferous sediments, but their stratigraphical relation to the Millstone Grit determines their age. These sandstones are dotted with numerous grey spots resembling sections of stems, which may possibly be caused by the decomposition of the red coloring matter by organic substances. Several curious fossil plants having peculiar jointed stems, with their fruits, were found on this island, as well as the footprints of a batrachian having five toes, which closely resemble those of the carboniferous beds of Nova Scotia. These forms have not yet been determined.

From the mouth of the Charlo River, north, the red beds again occupy the shore as far as the bluffs which terminate the trappean ridges south of the town of Dalhousie. They are seen at low tide along the beaches about the mouth of Erl River and probably occupy the basin of this stream to the east of the railroad. Above Charlo they extend back from the shore only a short distance beyond the rail-

road, but stretch along the line of the Intercolonial from Charlo station to Dalhousie station, and spread out so as to form a considerable area at the latter point. They lap round the western spur of the hills about Dalhousie to the west of Pointe LaLime, and form the high ridges south of Dalhousie station which extend westward for more than a mile, or almost to Maple Green post office. They are exposed on the beach about one and a quarter miles west of the station at Dalhousie for a distance of 200 yards, and shew in a cutting at that point. On the shore they rest upon trappean rocks on the one hand and soft, Devonian shales on the other.

Coast opposite
Dalhousie.

On the Quebec side of the Restigouche, opposite Dalhousie, the red beds of the Lower Carboniferous (Bonaventure of Sir Wm. Logan) are largely developed, and rise into high hills which extend from the mouth of the Scaumenac eastward to the mouth of the Nouvelle River. Above High Cape, which forms the bold headland at the mouth of the Scaumenac, no trace of this formation has been discerned, the shore being occupied principally by Devonian sediments. Between High Cape and Point Muguacha the red beds extend in an almost unbroken range of hills, but between Fleurant and Yacta Points they do not reach the level of the beach, but are seen to rest unconformably upon grey sandstones, shales and conglomerates, which have been found to be of Devonian age, and will be hereafter described. These red beds, as on the New Brunswick side, generally have a nearly horizontal attitude, but shew, at one or two points, local twists, which do not, however, affect the regular stratification of the beds to any great extent. The prevailing dip is mostly eastward at a low angle.

Stratigraphical
position of the
Lower Carboni-
ferous Bona-
venture
formation.

In none of these localities do we find the same variety in lithological character as is seen in this formation in the southern part of the Province. As developed in this area the Lower Carboniferous seems to represent the upper member of the formation, and probably corresponds to the upper part of Division 5 of the Geological Survey Report 1876-7. Its position would, therefore, be between the gypsiferous series and the base of the Millstone Grit. The resemblance of these beds also to the upper part of the gypsiferous formation, of the same age, as developed on the Tobique River, tends to establish this conclusion, while their intimate association with the base of the Millstone Grit, and the apparent passage of the beds of the lower into the upper establishes very close relation between the two.

DEVONIAN.

The principal areas under examination which have been shown to belong to this system, are those seen at intervals on the Lower Restigouche River, and which form a synclinal basin extending from

near the town of Dalhousie westward to a point about two miles above Campbellton, and terminating on the south side of the river at old Mission Point and on the opposite side at Pointe à Bourdeau. This basin is bounded on both sides by the trap ridges which enclose the lower part of the Restigouche, and against which the Devonian beds are seen to rest; and it conforms to the general outline of the hills. On the south side of the river Devonian beds are first seen near Pointe la Peuplier in the form of red sandstone and grey shales which dip N. 15° E. < 35° or towards the river; whence, though interrupted at intervals by trappean masses, they extend up to a point about one mile west of Dalhousie station, the dips of the beds, while locally varying, are constant from the hills in the rear. At two points at least, Pointe Pin Sec and Pointe LaLime, beds of carbonaceous shale are seen, one of which has a thickness of ten inches, and has been for a long time regarded locally as a coal bed. Though containing sufficient carbonaceous matter to burn, it does not, however, fulfil the requirement of a true coal and has no economic value. An interesting feature at this point is the intrusion of a sheet of trap directly over the shale, to which it forms a roof. Associated with the sandstones and shales of this locality are several beds of trap conglomerate; the pebbles being of well-rounded trap cemented by a paste of trappean ash. Similar beds occur at various other points as at Pointe la Garde and on the Upsalquitch River. This kind of rock is quite common in connection with the Triassic traps of the Bay of Fundy. At several places the shales were observed to contain abundance of plant stems, psilophyton and others.

Extent of the Devonian basin of the Lower Restigouche.

Carbonaceous shale of Pointe LaLime.

From the exposure above Dalhousie Station to the bridge at Campbellton the shore is occupied for the most part with traps or dolomite of various characters; but at the bridge at Campbellton, large ledges of grey and purple slaty felspathic rock are seen dipping to the north-west or away from the ridge of the Sugar Loaf Mountain. These rocks are ashy in their composition and appear to be made up of the debris of the felspathic ash rock that form so large a portion of the trap region of this vicinity. They resemble, in many respects, the so-called claystones of Queens and Sunbury Counties, which have been regarded as basal beds of the Lower Carboniferous. They are frequently earthy and soft, and without any apparent stratification, especially towards the base of the series, and form a ridge lying to the back of the town of Campbellton and extending westward for some two miles. On the road north of Sugar Loaf Mountain they dip N. 60° W. < 35°, but a reverse dip is seen near the west end of the snow-shed above Campbellton to S. 70° E. < 20°. On the post road south of the shed these purple and grey, felspathic, ashy and slaty rocks dip S. 30° W. < 63°. This peculiar kind of slate occurs only in the vicinity of Campbellton; and it is

Basal beds of the Devonian at Campbellton

probable these rocks underlie the coarse Devonian sandstones and grits which are exposed on the shore close by. The town itself is built largely upon trappean rocks, some of which have the aspect of stratified beds. They are highly crystalline dolerites, and the bedded structure is seen at a number of points in the vicinity of the Restigouche. The river in front of the town, from the steamboat wharf westward, is lined with Devonian rocks, generally grey in color, both sandstones and conglomerates. In the rear of the Royal Hotel these beds dip N. 25° W. < 25°-30°, but at the wharf the dip decreases in angle to 5°-10°. They exactly resemble the beds which are exposed on the Quebec side of the river, and at this place form the southern margin of a synclinal basin, the northern side being seen at

Synclinal basin
at Campbellton

Pointe à Bourdeau, about two miles above Cross Point opposite Campbellton, where the beds dip S. 20° E. < 45°. The conglomerates contain pebbles of limestone, slate, felsite, trap and jasper, and are interstratified with grey sandstones, which have been quarried in the vicinity of Pointe à Bourdeau for the Intercolonial railroad. Plant stems of Devonian type are common in the sandy and finer portions. Above the station at Campbellton hard thick-bedded sandstone, intersected by thin dykes of trap, contains abundance of fossil plants; a collection of which was made by Mr. T. C. Weston and examined by Principal Dawson. The following forms have been determined :

Fossil plants at
Campbellton.

Psilophyton robustius.

“ *princeps*.

“ (fragments).

Lycopodites Campbelltonensis, n.s.

Cordaites angustifolia and stems (?) of same.

With a number of other specimens of *psilophyton* fragments. At a distance of 1800 paces west of the Royal Hotel ledges of hard grey limestone have been found by Mr. Weston to be largely made up of comminuted fossils.

On the north or Quebec side of the river, Devonian beds apparently occupy the whole extent of the flat country lying between the base of the trap hills and the shore. They are well exposed at Cross Point, opposite Campbellton, where they dip N. 10°-20° E. < 10°. These beds are probably near the centre of the synclinal. Below this, exposures of similar rocks occur at Pointe la Garde and along the shore to near Battery Point. They are similar to those described at Pointe à Bourdeau, and like those of Pointe LaLime contain interstratified beds of trap conglomerate. The sandy layers contain abundance of plant stems, and the whole series dips southerly from S. 20° W. in the western exposure to S. 50° E. at Pointe la Garde, the angle of dip ranging from

Cross Point to
Scaumenac
River.

5° to 75°. Thence they occupy the greater part of the shore down to the mouth of the Scaumenac River and lie in a nearly horizontal position or with a slight southerly dip, resting against the flanks of the trap-pean hills that stretch continuously along the north side of the river as far east as Nouvelle River. At High Cape the Devonian beds are concealed by the unconformably overlying red beds of the Lower Carboniferous (Bonaventure) formation which extend down along the shore to the western side of the cove above Fleurant Point, with outcrops of Devonian rocks at Pirate Head, and at Pirate Brook where reddish conglomerate with pebbles of grey limestone, associated with grey Devonian shale is seen on the beach, dip S. $< 50^\circ$, with accompanying sandstone. In the cove above Fleurant Point, however, the grey beds of the Devonian are again seen, both the conglomerate, similar to those of Pointe la Garde and sandy and shaly beds. These beds contain splendid specimens of Devonian fishes, some of which have already been described by Mr. Whiteaves in the *American Journal of Science*, August 1880. The beds are mostly flat or dip north-eastward at a low angle. At Fleurant Point the conglomerate also occurs, underlying the softer shaly and sandy beds, and dips N. E. $< 7^\circ-15^\circ$. Rounding the point and entering the cove, we meet with the usual grey shales and sandstones containing abundant remains of fishes and plants, which dip N. 25° E. $< 10^\circ$. From this eastward to Yacta Point, the shore is occupied with Devonian beds, principally grey in color but in places a brownish-red, especially near their contact with the overlying red beds, dipping shoreward at low angles and forming cliffs from thirty to fifty feet in height, capped at the upper part of the cliff by horizontal red beds which here rise into ridges of 300 feet or more in elevation. At Yacta Point there appears to be almost a transition between the Devonian and Lower Carboniferous beds, but the conformability is more apparent than real, as is readily seen by observation of the beds between this point and Muguacha Head. The bold bluffs of Yacta Point soon sink down again, going eastward, and the grey beds again occupy the shore in low bluffs for several hundred yards, the red beds capping them unconformably and extending thence around Muguacha Point to the mouth of the Nouvelle River. Eastward of this river the grey beds have not yet been traced, but as they are said to occur on the Grand Cascapedia it is probable that in the intervening distance they are concealed by the Bonaventure formation which stretches along the shore to that place.

Scaumenac Bay

Fossil fishes.

Second outcrop of Devonian between Yacta Point and Muguacha Head.

The grey beds between Yacta and Fleurant Points are very rich in fossil forms of fishes and plants. Very valuable collections have been made from this locality, principally by Messrs. Foord and Weston,

the determination of which has not yet been concluded, and the results will appear in an accompanying report by Mr. J. F. Whiteaves.

Devonian beds
of the Upsal-
quitch river.

The only other area in which Devonian rocks have been recognized is on the Upsalquitch River, about nine miles above the Forks. They consist of grey sandstones and conglomerates, the latter containing pebbles of white quartz, felspar, jasper, slates, etc., which resemble exactly the grey Devonian beds of the Restigouche already described, and lie unconformably upon the Silurian and trappean rocks of this area. They dip N. 50° W. < 5°-7°, and extend down to seven miles above the Forks, but their extension eastward has not yet been traced, owing to the wilderness character of the country and the entire absence of settlements.

SILURIAN.

Distribution of
the Silurian.

The rocks of this System occupy an extensive belt reaching across the entire breadth of the Province, from the State of Maine to the Bay Chaleur, and are at many points well marked by characteristic fossils. In the eastern area they rest upon rocks probably of Cambro-Silurian age, which in their upper portions contain fossils (graptolites) of presumed Hudson River type, as well as imperfectly preserved brachiopod shells, and they extend in a broad sheet over the entire northern part of the Province and across the boundary into Quebec, forming a wide geosynclinal basin about 100 miles in breadth, the northern margin of which rests upon the rocks of the Quebec group near the river St. Lawrence. Along the Upsalquitch and lower Restigouche Rivers they are broken up or cut through by dykes, often of large size, of trap (dolorite) and felsite which about the mouth of the Restigouche are quite extensively developed, and form very prominent features in the landscape. The southern margin of the belt has been traced as well as the sections afforded by the various rivers followed, from the St. John River eastward to the Bay Chaleur. On the St. John River the calcareous and sandy beds characteristic of the formation are well exposed about the mouth of the Tobique River, a branch of the St. John. At the former point as well as along the river northward the slates are nearly vertical and strike N. E. and S. W. At the Narrows, a deep rocky gorge about half a mile from the mouth, they are much broken and slightly faulted, and contain frequent bands of white calcite along the lines of stratification. The dip above this continues northwest for about six miles or to the mouth of the Little Pokiok, the angle varying from 40° to 70°, the slates becoming more marly with minute scales of mica. Occasional hard bands mark the stratification of the beds. Just above the mouth of this stream the dip is reversed to S. 40° E. < 35°. Thence up to a brook about two and a-half miles below Trout Brook

Superposition
on the Cambro-
Silurian.

Silurian beds
on the Tobique
river.

the beds are well exposed, the dip remaining the same. At this point ledges of reddish conglomerate with thin bands of reddish limestone, lying in horizontal beds, come in and cover the Silurian strata. Just at the sharp bend below Red Rapids, a large dyke of greenish moderately coarse dolerite occurs, having an exposed breadth of about 140 feet, passing which no ledges are seen, the country being flat till the foot of the Red Rapids is reached, when the red beds of the Lower Carboniferous (Bonaventure) formation again occur. Thence up stream the river and the surrounding country on both sides for some distance is occupied by Lower Carboniferous rocks till we reach Blue Mountain Brook. This area constitutes the Tobique Lower Carboniferous outlier, and has been described in former Reports by Mr. Charles Robb, Prof. Hind, and others. About two and a-half miles above Blue Mountain Brook, Silurian grey, sandy and calcareous slates come in on the northern side of the river, dip S. 20° E. $< 45^{\circ}$ - 50° , the south bank showing high bluffs of felspathic rock. At the mouth of Riley Brook the grey, sandy and micaceous slates of this age are seen on the south side of the river with a dip of S. 35° E. $< 75^{\circ}$. They extend back from the shore for only a short distance, the hard felspathic rocks noted as occurring below forming a marked elevation to the south. From this upward to the Forks of the Tobique the river flows over Silurian slates.

The Forks of the Tobique are formed by the junction of the Nictor or Left Hand Branch and the Campbell or Right Hand Branch. On the latter stream, which flows from the south, Silurian rocks are recognized for some distance. Ascending this branch calcareous slates dip N. 25° W. $< 20^{\circ}$ - 40° and extend for two and a-half or three miles to huge ledges of green chloritic slates and moderately coarse diorites, which have a surface breadth of nearly a mile, and are succeeded by bluish-grey slaty rocks dipping up stream S. 10° E. $< 10^{\circ}$. These at the Lower Falls abut against a ridge of grey and green pyritous felspathic rocks which probably bounds the Silurian in this direction, the rocks above this on the river belonging to the metamorphic pre-cambrian series.

The Nictor, or Left Hand Branch of the Tobique, is occupied entirely by Silurian rocks. These for several miles above the Forks are somewhat broken and thrown into sharp anticlinal folds, but the prevailing dip is north-westerly (N. 20° W.) At about five miles from the Forks the rock exposures cease; the banks become low and shew no ledges for about twenty miles, when dark grey micaceous and iron slates are seen, dip S. 50° E. $< 60^{\circ}$. Ranges of hills extend along both sides of the river at a distance of half a mile or more, but the banks are densely wooded, principally with cedar. From this to the outlet

Lower Carboniferous outlier of the Tobique.

Limit of the Silurian on the Right Hand Branch or Campbell river.

Silurian of the Nictor or Left Hand Branch of the Tobique.

of NiCTOR Lake at the head of the stream, the exposures are few, but the general dip is S. E. $< 50^\circ$. The lake marks the limit of the Silurian formation in this direction, the southern shore being occupied by green chloritic slates and slaty talco-felspathic schists which dip N. 85° W. $< 90^\circ$, while a large mountain of red crystalline and porphyritic felsite rises abruptly from the water to a height of over 2000 feet, and stretching away in a long ridge to the south-west probably defines the southern margin of the Silurian in that direction. The talco-schists flank the northern base of the mountain and dip away from it at a high angle. The difference between the Silurian rocks of the Tobique and the crystalline schists of the lake is well marked both by the mineral and metamorphic character of the latter.

Limit of the
Silurian on
NiCTOR lake.

Upper part of
the Upsal-
quitch river.

Gabbros.

Fossils.

From NiCTOR Lake to the Upsalquitch the Silurian formation has not been traced owing to the densely wooded character of the country, but on the latter stream good sections are afforded for about thirty-one miles directly across the strike. After leaving the lake at its head the river runs in a very crooked and narrow channel nearly to the falls, a distance in a straight line of about six miles. The banks are low and swampy, and no ledges appear till we approach the mouth of the Little South East Branch. Here grey-mottled felspathic rocks (Gabbros) are followed down the stream by purplish, grey, slaty and dioritic beds, veined with yellowish-green epidote. Thence to the upper end of the falls frequent ledges of hard dense grey slates or quartzites, weathering a rusty-brown and breaking into angular pieces, no dip discernible, occur. At the falls, a ragged gorge a mile or more in length, the rocks are hard green conglomerates with pebbles of reddish and grey slates and felsites and a few of grey limestone; the dip at the upper part is not clearly defined, but at the lower end, about three-fourths of a mile above Ramsay's Brook, it is N. 10° W. $< 75^\circ$. These rocks contain indistinct traces of fossils, crinoids, corals and minute brachiopods. The paste of the rock is dark green and ashy looking, thickly studded with minute pieces of comminuted slate. At the lower end of the falls the conglomerate is mainly composed of small pieces of grey and red slate. It dips down stream at a high angle and underlies the slaty and sandy beds, which are well developed in the vicinity of Ramsay's Brook. At the mouth of this brook they dip S. 20° E. $< 70^\circ$ - 90° .

Going down the river the slates maintain a southerly dip, the angle gradually decreasing to 50° at Big Brook. Below this for some distance the rocks are ochreous on weathered surfaces and are very calcareous, approaching a limestone. They contain imperfect remains of brachiopod shells and crinoid stems. Just above Meadow Brook the regular sandy greenish grey slates shew on the west bank, dipping S. 10° E. $< 70^\circ$, and are underlaid by light-green chloritic grits and fine

conglomerates, which in turn rest upon hard crystalline felsites of the same aspect as those seen on the upper part of the Nipisiguit. This structure would indicate the existence of a synclinal in the Silurian rocks at this point. After passing the felsite hard green epidotic rocks extend down for nearly a mile, and are overlaid by the grey grits and conglomerates of the Devonian already described. This is at Ten-mile Brook.

No Silurian rocks are then seen as we descend the stream till we reach six and three-quarter miles above the forks of the North-west Branch, the intervening space being occupied by Devonian rocks and amygdaloidal traps and dolerites. At six and three-quarter miles ledges of grey, flaggy sandstone, dip S. 40° E. $< 30^{\circ}$, appear again and are associated with soft, splintery and marly shales, same dip. At five and a-half miles a high hill of fine grey, with shades of ochreous-brown, thin-bedded shales occurs, underlaid at the water's edge by hard dark-green dioritic-looking rock, and containing near the contact a small seam half an inch in thickness, with fossil corals; and half a mile below grey marly shales, overlaid by hard rusty quartz or sandstone, are seen, containing abundance of corals and brachiopods, dip S. 25° E. $< 20^{\circ}$.

Just above the four-mile tree several dykes of red porphyritic felsite and others of porphyritic diorite, one of which has a breadth of twenty-five feet, are seen cutting the slates and disturbing their bedding. Near the three and a quarter mile bend or ox-bow, ledges of brick-red felspathic rock are seen, probably an extension from a high peak of felsite a short distance west of the river at this point. They extend down to two miles above the Forks, and contain at one point a bed of trap conglomerate similar to that seen on the Restigouche River. This shews also on the North-west Branch, about seven and a-half miles from the Forks. Below this to the junction with the North-west Branch, grey sandstones and slates of the usual Silurian type occur, dipping S. 20° E. $< 75^{\circ}$.

An ascent of the North-west Branch, for sixteen miles, disclosed nothing but Silurian sandstone and slates, with the exception of the ledge of porphyritic trap conglomerate noted above. The beds, dip S. 20° E. $< 45^{\circ}$ - 70° for the first eight miles, and then N. 15° - 20° W. $< 70^{\circ}$, which dip they pretty constantly maintain as far up as our explorations extended.

Between the Forks and the mouth of the Upsalquitch, the Silurian rocks are continuous and occur in a series of folds which are cut by frequent dykes, generally of flesh-red felsite, porphyritic with crystals of pale red felspar, but in places a cream-white in color. They range in thickness from a few inches to over a hundred feet. Limestone

bands occur at intervals, and a great part of the slates are more or less calcareous. The beds are often disturbed by the intrusion of the dykes, though disturbances often occur when no dykes are visible.

The description of the Restigouche from Metapedia to Patapedia has been already given by Mr. Richardson (Report of Progress, 1858, page 115). The rocks are all Silurian, sandstone, slate or limestone. Above this to the Waagun or crossing to the River St. John, the Restigouche flows apparently along the crest of an anticlinal, the rocks dipping S. 20° E. to N. 20° W. $< 30^{\circ}$ – 60° . Exposures are not numerous, but when seen are all calcareous slates, soft with harder bands. Above the Kedgewick, the country in the vicinity of the river is generally low and the banks often swampy and bushy. The land in this section of the country should be well adapted for agricultural purposes. Beautiful terraces are observed at several points. On the Upsalquitch, about three miles from its mouth, four very perfect ones were seen. At the Chain of Rocks Brook on the Restigouche three perfect and one irregular one were noted, and at the forks of the Kedgewick two perfect ones occur. The usual height of the terraces is about ten feet each.

At the crossing from the Restigouche to St. John by the Waagun and Grand Rivers, only one rock outcrop was seen. This was on the Grand River, about eight miles from its mouth, dip S. 10° E. $< 40^{\circ}$. The portage, which is about three miles in length from the head of the Waagun to the Grand River, is mostly low and shews no exposures.

Between the Upsalquitch and the head of the Tête à Gauche River the country is almost inaccessible, being an unbroken densely wooded wilderness. An examination was, however, made of the latter stream to a point about six miles west of the upper lake. Here a ridge of grey and bluish-grey felpathic slates, lithologically resembling the Silurian of the southern part of the province, was found, but no fossils were observed. They probably are the equivalents of the grey beds seen in the Nigadoo River, and form the basal beds of the series. They dip N. 20° W. $< 55^{\circ}$. Just below the outlet of the first Tête à Gauche Lake ledges of reddish conglomerate, filled with corals of Silurian aspect, rest unconformably upon the metamorphic schists of the Tête à Gauche River to the south. Their limits cannot be traced, and they may be simply an outlier of Silurian rocks.

Near the coast, slaty and sandy beds containing fossils are seen in the Nigadoo River, and on the roads in the back settlements in that vicinity. At the falls in this stream the rocks also contain fossils, but the forms cannot be determined. They probably represent the upper member of the Cambro Silurian, as just above the mouth of the river on the coast, the calcareous beds of the Silurian are seen overlying them.

Upper Restigouche River.

Terraces.

Restigouche to the St. John River.

Upper Tête à Gauche.

Fossils of Silurian outlier.

Southern limit of Silurian.

It may therefore be stated generally that the Nigadoo River forms the southern boundary of the Silurian rocks in this direction.

Along the shore north of the Nigadoo River the beds constituting the base of the Silurian occur just above the mouth of that river. Between this and the Elm Tree River they are well exposed, and consist of calcareous and sandy slates, with bands of brownish-rusty conglomerate and some limestone. They are a good deal broken up, the dips indicating frequent anticlinals. North of Elm Tree River the limestone is considerably developed and in places very rich in fossils, crinoids, corals and brachiopods. Among the corals *Halysites catenulatus* and *Zaphrentis*, are abundant, as also *Strophomena rhomboidalis* and many brachiopods. These beds extend up the coast for about one mile above the mouth of the Elm Tree River till they are met by huge dykes of green epidotic diorite. The conglomerates which occur at Church Point and below the mouth of Elm Tree probably constitute lower members of the system.

The railroad though it affords but few cuttings between the Nigadoo and Elm Tree Rivers, yet shews in the trenches alongside several outcrops of Silurian slates and limestone. About half a mile north of Petite Roche station, one of these outcrops seen in a pit shows the limestone altered to a crystalline marble, but still retaining traces of crinoid stems. Crystalline limestones are more plainly seen on a road running just a short distance below Elm Tree crossing. Here, about three-fourths of mile beyond the railroad, quite extensive beds of marble, whitish-grey in color, are found in immediate proximity to large masses of diorite, but in all cases so far as the surface quarries have exposed the rock it is extensively shattered, and does not give much promise of workable beds. The alteration is also quite local, and the crystalline portion changes abruptly into ordinary grey fossiliferous limestone. At the Elm Tree crossing the diorites are well exposed and occupy a large area extending almost continuously nearly to Belledune station, cuttings being frequent. Only one small exposure of red slate was observed on this portion of the railroad, but on the shore extensive ledges of brown, hard conglomerate occur, which appear to be hardened by the action of the intrusive rocks. Fossiliferous beds of Silurian slates also occur on the shore, but these exposures partake of the nature of lenticular basins. In the vicinity of Belledune post-office the calcareous beds are again well exposed, and contain abundance of fossils similar to those of Elm Tree.

North of Belledune Point the shore is for the most part occupied by Silurian limestones, slates and sandstones, though frequently capped by the newer red beds of the Lower Carboniferous already described,

and broken by occasional dykes of diorite and trap, to the vicinity of Black Point. At several places the calcareous portions contain abundance of fossils. Below Armstrong's Brook they form the lower portion of cliffs which are unconformably capped by horizontal sandstones and conglomerates. They are frequently faulted and cut through by dykes of trap and inclined often at high angles. Between Nash's Creek and Black Point the limestone is said to form excellent material for cement. Limekilns also exist at several points along the shore to the south. Black Point consists principally of trap, which forms a dyke of considerable thickness, between which and Beaver Point the fossiliferous Silurian beds again come in and form an anticlinal arch. Thence to the mouth of New Mills Brook, the shore and railroad show almost continuous exposures of trappean rocks, with interstratified beds of reddish-brown conglomerate, hard and evidently altered by the intrusive masses. From New Mills Brook to the mouth of Louison River the calcareous beds seem to be wanting, the rocks being mostly hard altered conglomerates which, on the small island opposite New Mills station, show an anticlinal structure. Trappean beds again come in and extend with only two small bands of Silurian along the railroad to within one and a quarter miles of the Charlo River, whence they probably continue northward, but are overlaid along the coast by the horizontal red beds of the Lower Carboniferous.

North of Charlo station the back roads show alternate ledges of Silurian slates and trappean rocks, the latter greatly predominating, but the surface is largely covered by drift till we meet the bold ridges lying to the south of the town of Dalhousie. Good sections are afforded across the trappean ridges and Silurian beds which lie in the intervening depressions both on the road leading south from Dalhousie and along the shore around Bon Ami Point. From the town to the Eel River flat no less than five distinct ridges of trap can be seen. They have a course nearly east and west, and the depressions are occupied by wedge-shaped areas of Silurian rocks which are highly fossiliferous. The contact of the Silurian with the trappean rocks is well seen in the fine section afforded by the shore, and the relative age of the two sets of rocks can be easily made out. The Silurian rocks, limestones and slates show a marked alteration near the contact with the dykes, and at one place the traps have enclosed a fossil from the Silurian calcareous beds. It would thus appear that although the traps have an apparent bedded structure with the fossiliferous strata, they have been thrust up along the lines of bedding subsequent to the deposit of the Silurian rocks. The dip of the Silurian beds at Bon Ami Point is N. 50° E. < 50°, but this changes towards the Eel River flat to N. 15° E. < 45°.

South of the trap ridges which run along the south side of the Resti-

Belledune to
Charlo River

Trap ridges at
Dalhousie.

Fossils in the
trap of Bon Ami
Point.

gouche river, between Dalhousie and Glenlivet settlement the country becomes less broken and is occupied by Silurian beds. These are exposed at intervals on the long straight road leading west from Eel River to Balmoral and Blair Athol settlements, as well as on the north branch of that river, about two and a-half miles west of Shannonvale post-office at the Eel River Forks. On the former road the dip, which is S. $< 45^\circ$ in its eastern part, becomes reversed further east to N. 15° W. $< 60^\circ$, indicating that this road follows for the most part the crest of an anticlinal. At the latter locality the dip of the calcareous, sandy, micaceous slates is N. 10° E. $< 60^\circ$, or nearly the same as on the coast south of Bon Ami Point. From the Balmoral road the Silurian beds strike across to the Upsalquitch River, which has already been described. Exposures, however, are not numerous in this part of the country owing to the enormous covering of drift clays and gravel which extend from the Restigouche River to Bathurst, and are exposed in many of the cuttings along the line of the Intercolonial railroad.

On the Restigouche, in its lower part, no exposures of Silurian rocks are met with till we reach Morrissey tunnel, about four miles below the mouth of the Metapedia River. The basal beds at this place rest upon the high spur of dark blackish-brown and grey amygdaloidal and brecciated trap, through which the tunnel is pierced, and consist of fossiliferous grey sandy beds with interstratified beds of limestone conglomerate, the pebbles mostly of grey limestone, lenticular or roughly rounded in shape, cemented with a brown calcareous paste. On the north side of the tunnel these beds dip N. W. $< 75^\circ$, but in the course of a few hundred yards the dip is reversed to S. E. $< 45^\circ$, forming a narrow synclinal basin. Above this another ridge of hard green diorite comes out to the post road, and continues for nearly half a mile whence Silurian rocks extend up to the Metapedia.

The Glenlivet settlement and the road thence through Dawsonvale to the mouth of the Upsalquitch are occupied by Silurian rocks. On this road, about midway, the dip is N. 40° E. $< 40^\circ$, while on the post road at the forks of the road to Glenlivet it is S. 70° W. $< 50^\circ$. As we approach the Restigouche bridge the dip again becomes reversed to N. 50° W. $< 60^\circ$ - 80° , bending round on the Quebec side more to the west or N. 60° - 70° W. $< 50^\circ$.

On the north side of the Restigouche, Silurian slates and limestones were observed from the mouth of the Metapedia to a point nearly opposite Morrissey's tunnel, or seven and three-quarter miles above Cross Point, opposite Campbellton. Here they are cut off by the traps of the north side of the river and do not occur again along the shore to the east. On the Scammanac River, however, about one mile above the bridge, Silurian rocks, limestones conglomerates and fossiliferous breccias, are seen forming a len-

Country south
of the Resti-
gouche.

Junction of
trappean rocks
and Silurian.

Glenlivet.

ticular area enclosed by high ridges. The description of these trappean ridges is given in the Report of Progress, 1843, by Sir W. E. Logan, and will be discussed further on. Similar conglomerates and limestones are reported on the Scaumenac and Nouvelle Rivers on the north side of the trappean ridges, but their examination in this area has not been completed.

CAMBRO-SILURIAN.

General distribution of the Cambro-Silurian.

The area which we propose to include in this system embraces, as in the southern part of the Province, a considerable variety of rocks, many of which are highly metamorphic and all more or less altered, but not apparently from local causes as is so plainly to be seen in the Silurian strata already described. Fossils, which however are very imperfect, are found at several points, but the determination of the age of this system has been based principally upon lithological and stratigraphical evidence. It may in general be stated to form a continuous belt of several miles in width, extending from the mouth of the Nigadoo River, on the Bay Chaleur, to the main South-west Miramichi, beyond which our explorations have not been extended in that direction, but it appears evident from the work of Mr. Charles Robb (see Report of Progress 1866-69) and that of Prof. Bailey and Mr. Broad in the county of York, not yet published, that similar rocks stretch across the entire breadth of the country to the Maine boundary, and that they are, in part at least, the equivalents of the so-called Cambro-Silurian of Charlotte county, as described in the Report of 1878-79. In the area bordering on the Bay Chaleur they have been well recognized on the Nigadoo, the Millstream, the Tête à Gauche and the Nipisiguit Rivers. They are well developed on the North-west Miramichi and its several branches, and on the Little South-west, while on the main South-west Miramichi they form a broad belt, broken up by several masses of granite, but containing imperfect fossils at one point at least near their southern margin. In all these places the general lithological characters of the group are maintained, and certain belts can be traced continuously. As a group they rest unconformably on a series of feldspathic gneisses and crystalline schists, many of which resemble the pre-Cambrian rocks of the southern portion of the province, described in the Report for 1878-79. Brief descriptions of some of these rocks as seen on the Nipisiguit and elsewhere are given in Professor H. Y. Hind's Report to the New Brunswick Government (1865), but no attempt was at that time made to separate the Palæozoic systems from those of pre-Cambrian or Archean age, all being included under the general term Quebec group, a similar classification being made in the southern part of the province. Subsequent investigations in that area, however, have

Former work in these systems.

shewn that the rocks there are divisible into two distinct and widely separated portions; the better settled character of the country affording fair facilities for their determination. The northern portion of the province, however, is for the greater part entirely unsettled and an almost unbroken wilderness, densely wooded and accessible only by canoes in summer or on snowshoes in winter, so that accurate delineation of boundary lines is almost an impossibility. The sections afforded by the various streams, however, have enabled us to pronounce with a fair degree of accuracy on the limits of the various systems.

The most northerly recognized exposures of Cambro-Silurian rocks is seen on the Nigadoo River. On this stream, at various points upward from its mouth, ledges of grey, sandy and fine-grained slates occur, with darker thin bands of fine slates and coarser sandy beds, cut by frequent veins of white quartz which contain traces of copper, iron pyrites and galena. These rocks are considerably altered and are lithologically different from the overlying Silurian beds, though in places they are apparently conformable in dip. At several points on this stream, as at the Falls and the crossing of the back settlement road, indistinct fossils are found, but their forms are not well enough preserved to determine their age with certainty. On the Millstream, the next river to the south, at the Intercolonial railroad bridge, ledges of greenish and purple brown slates are seen resembling those seen in the Tête à Gauche. Fossils could not be determined definitely in these rocks, but certain weathered depressions occur which may indicate their existence. These slates are somewhat ashy in their texture, and contain abundance of minute kaolin specks, and on the Tête à Gauche are associated with soft, black and graphitic slates which hold abundant impressions of graptolites. Half a mile above the railroad bridge on the Millstream, Lower Carboniferous red conglomerates occupy the stream for a short distance, resting upon greyish felspathic and slaty rocks, sometimes calcareous and with minute specks of pellucid quartz, the rock at times schistose and soft, purple in color and ochreous from the decomposition of iron pyrites. At the Lower Falls, near the road crossing, about one and a half miles from the railroad bridge, the rocks change to a felspathic conglomerate, the paste being coarse and gritty, and weathering a reddish grey. These, however, contain slaty bands, the dip of the whole being apparently south, the angle doubtful. Through the back settlements of Dumfries, St. Louise and Robertville, these rocks are associated with greenish dolerites, moderately coarse, and in the vicinity of Dumfries church they dip S. 10° W. <60°. On the straight road south from Dumfries ledges of hard greenish and greyish dolerites occur near the crossing of the road to Dunlop settlement, but on this cross road, about half way, at the bridge over Grant's Brook, large

Northern limit
of Cambro-
Silurian.

Graptolites of
Tête à Gauche.

ledges of grey micaceous and well banded slates dip N. 20° W. <70-90°, associated with very rusty black and pyritous beds. These extend down Grant's Brook, and are much broken and twisted, probably from the presence of dykes of dolerite. They are probably the equivalents of the black and red manganese bearing slate seen further south on the Tête à Gauche, and which can be traced across the country to the main South-West Miramichi.

Concretionary
doleritic rocks.

Between Grant's Brook and Peter's River along the railroad the several cuttings disclose principally doleritic rocks, often highly felspathic and in places concretionary, the concretions varying in size from six inches to several feet, and in broken surfaces disclosing a circle of small holes in dots around the outer margin.

Tête à Gauche
River.

These rocks form a low and irregular ridge, and at several points carry thin veins of red hematite, which, however, was not observed in quantity sufficient to be of value. Passing Peter's River, which flows for the most part over rocks of this character, we reach in a short distance the Tête à Gauche, which for its entire length affords good exposures from near its mouth to the lakes, a distance of about 30 miles, the greater part of which distance is over rocks of presumed Cambro-Silurian age. These rocks first make their appearance on the post-road, about one quarter of a mile north of Peter's River, dipping S. 5° W. < 55°, whence they extend westward. On the Tête à Gauche red Lower Carboniferous rocks occur in the bank below the railroad bridge and just above the crossing of the post-road, but at the railroad beds of grey and purple ashy slates, similar to these seen on the Mill-stream, are associated with the graphitic black slates containing graptolites already mentioned, and which, although their forms have not yet been definitely determined, owing to their poor state of preservation, closely resemble similar forms found in the Quebec group of the Gaspé Peninsula. These beds therefore probably mark the upper portion of the Cambro-Silurian system at this point. Similar ashy beds, associated with others, grey and sandy, extend up to near the falls, being well developed in the vicinity of the mill, but no other fossil remains could be discerned. At the falls, about eight miles from Bathurst, reddish and green slates which form a conspicuous and well-defined part of the formation are seen. The reddish beds contain considerable manganese in the form of small nodules, and the rock was at one time quite extensively but unprofitably worked for this mineral, as well as for copper. The manganese bearing character of this belt is an important element, and serves to define the formation throughout its extension to the south-west, being easily observable at a number of points. These are associated also with black, rusty and

Manganese
mine at Tête à
Gauche falls.

manganese stained slates, which are also easily recognized over a large area as an integral part of the formation. They are doubtless the same as those seen on Grant's Brook, previously noted. They are frequently minutely wrinkled or covered with fibrous markings on the surface, and often much crumpled and disturbed. These two sets of beds, the red and black slates, very strongly resemble in lithological character some of the slaty beds of the so-called Quebec group. Between the falls and the narrows, about six miles further up stream, the black and manganese-stained slate predominates with occasional red beds, as at the falls. At the narrows they are met by a heavy band of mottled green diorite, about seventy-five yards in width, cutting the slates which here have a strike of N. 60° E. Thence up to Armstrong Brook, about three-eighths of a mile, black slates cut by diorites occur. Above this brook, for nearly a mile, few exposures are seen, with the exception of another heavy ridge of green diorite about mid-way, but at this point ledges of grey and graphitic sub-crystalline limestone occur. They appear to form a portion of the black slate group, and are associated with greenish and blue calcareous slates, which dip N. 50° W. < 65-90°. These limestones occur at intervals for several miles, sometimes with hard green massive chloritic and epidotic diorites and at others with black manganese-stained slates. Their crystalline character may be due in places to local alteration from the presence of the diorites, as in the case of the Silurian marbles of Elm Tree River, already mentioned, and may be repetitions of the same bed brought to the surface by folds. Their extension along the strike could not be traced owing to the wooded character of the country, but they have apparently a strike of N.E. and dip at a high angle, 80°. Above this, or about one mile below the South Branch, the black slates cease, and the stream is occupied with soft greenish talcose schist, dip E. < 55°, and cut by frequent veins of white quartz. This probably marks the northern limit of the Cambro-Silurian in this direction, the two sets of beds being apparently unconformable, though actual contact could not be seen. Thence up to the upper falls, about one mile below the first lake, talcose and chloritic schists, often felspathic, extend till they are covered by the fossiliferous Silurian beds below the outlet of the lake.

Sub-crystalline
limestones of
the Tête à
Gauche.

Northern limit
of Cambro-
Silurian.

The road leading up the Tête à Gauche River, on the south side, shews, above the falls and in the Rose Hill settlement, the same series of black iron and manganese-stained slates, already described as occurring on the stream. At the eight mile post, near the falls, there are ledges of grey schist with quartz veins, dip S. < 50°, with a similar dip, also, grey quartzites and purple or reddish dark mottled

rock resembling a schistose conglomerate which are doubtless a part of the series.

Between the Tête à Gauche and the Nipisiguit the only other stream shewing exposures is the Middle River. After passing the granite, which extends up about five and three-quarter miles from Bathurst, ledges of purple grey and felspathic schist are seen on the road alongside the stream, with a local strike of N. 35° W. Ridges of grey quartzite and dense fine grained diorites also occur, but the exposed breadth is not more than a couple of miles, the dense covering of drift concealing from view the underlying rocks over the greater part of this area. Perhaps the best section of these rocks is that afforded by the Nipisiguit River. On this stream, after passing the granites, which extend up to a distance of eleven and three quarter miles from the bridge at its mouth, a pretty continuous series of rocks, presumably of this age, are seen for about thirty miles, in which, however, great diversity of character exists, and it is quite possible, as in the area in Charlotte county, that other and older beds may be represented. After passing the granite, which forms the bed of the stream for about nine miles, the first rocks met with are reddish-grey micaceous and schistose slates, frequently clouded with purple and containing red stains and small strings of probably the red oxide of copper. They are a good deal disturbed, but dip generally S. 40° E. < 55°. On the south side of the river, at the 13-mile tree, these rocks have been worked for copper, the locality being known as the "Baldwin Copper Mines." They here contain a small amount of copper pyrites in quartz veins, but the rock is much broken and shattered, so that the dip is not determinable. Fresh surfaces are frequently striped or banded with yellowish-grey colors. A quarter of a mile above are ledges of bluish-grey or dark-grey schistose slates, which gradually shade off into the black ferruginous slates similar in aspect to those described on the Tête à Gauche. Just above the head of Round Island these become more schistose, resembling those seen below at the mine, and dip S. 80° W. < 75°. Ascending the river to the Middle Landing Falls (14 m.) we pass over a succession of schistose and slaty rocks, sometimes black and irony, at others grey and quartzose. At the foot of these falls the slates and schists are highly disturbed, hard and cut by quartz veins. They also contain beds of highly crystalline felspathic schist, dipping S. 70° E. < 70°-90°. which here form a sharp anticlinal and are much twisted along the axis. The schists weather rusty from the abundance of iron pyrites, and are flanked on the north side by the ordinary irony black slates, dipping N. 70° W. < 75°, which extend up stream, forming low ledges along the shore to near the 16-mile tree. Above this to the Chain of Rocks, greenish-grey slates, often massive and quartzose, occur which

Nipisiguit
River.

Baldwin Copper
Mine.

at the Chain dip $W. < 45^\circ$. Hard green quartzites extend thence to near Gilmore's Brook, where they are succeeded by dark iron slates similar to those seen below. They also dip $W. < 45^\circ$, and continue up to the narrows below Grand Falls, becoming schistose and more altered, with irregular veins of quartz often rusty. The Narrows is a deep gorge through schistose and slaty rock, with bands of talcose and mica schist, and extending from the basin to the head of the fall, about three-quarters of a mile. Some of the beds contain abundance of iron pyrites, which give the rusty character to the rock, and the surface of the schists is sometimes dotted over with scattered specks of clear quartz. They are frequently crumpled and all highly altered.

From the head of the Grand Falls (20½ m.) the rocks are mostly felspathic and schistose, with a general westerly dip, and resemble in some respects the Pre-Cambrian rocks of the southern coast. This may, however, be due to the more highly altered condition of this portion, as they are intimately associated with the red and black manganese-stained slates, and appear to form part of the same series. The Upper Narrows is a rough gorge of nearly half a mile in length, through green chloritic and felspathic slates and schists, cut by veins of rusty quartz, dip generally $N. 35^\circ W. < 45$, but much distorted. Between the head of the Narrows and the Nine-mile Brook (31 m.) the rocks are silico-felspathic, slaty and schistose, and just below Nine-mile Brook dip $W. < 75^\circ$. They are directly succeeded at this point by the black and rusty Cambro-Silurian slates of the Tête à Gauche, which apparently conform in dip with the underlying silico-felspathic beds, but it seems probable that the rocks in the stretch between the Upper Narrows and the Nine-mile Brook may belong to the older or Pre-Cambrian system and form an extension of the felspathic gneisses seen in the S. W. Miramichi. On the Nine-mile Brook, about two miles from its junction with the Nipisiguit, red slates of the usual type with nodules of manganese occur, which are doubtless continuous with those at the Tête à Gauche falls. Above the Nine-mile Brook black thin bedded slates extend up to 36½ miles, when hard green schistose and slaty felspathic rocks again come in and occupy the stream to near the mouth of Forty-mile Brook associated, however, with black slates at several points. Above this the rocks are hard, green and more siliceous; which character they maintain to within a short distance of the Indian Falls, where they are terminated by grey schistose felspathic gneisses, weathering reddish and dipping $E. < 60^\circ$. These probably mark the western limit of the Cambro-Silurian rocks in this direction.

The frequent recurrence of the well-marked bands of red and black slates on this stream indicates a somewhat extensive series of anticlines,

Narrows of the
Grand Falls.

Upper Narrows

Probable pre-
Cambrian axis.

Western limit
of Cambro-
Silurian on the
Nipisiguit
River.

Anticlines and synclines.

the axes of which would be probably represented by the hard, green chloritic and siliceous bands, described as occurring in connection with this group of rocks, while the synclines would be indicated by the softer slaty portion. Throughout the whole extent, although diligent search was made, no trace of fossils could be found—but the group as a whole is manifestly distinct from the highly crystalline gneisses and other felspathic rocks which occupy the country between the Indian falls and the lakes at the head of the river. And we have little hesitation in pronouncing these rocks to be newer than, and to lie unconformably upon, the Pre-Cambrian series presently to be described.

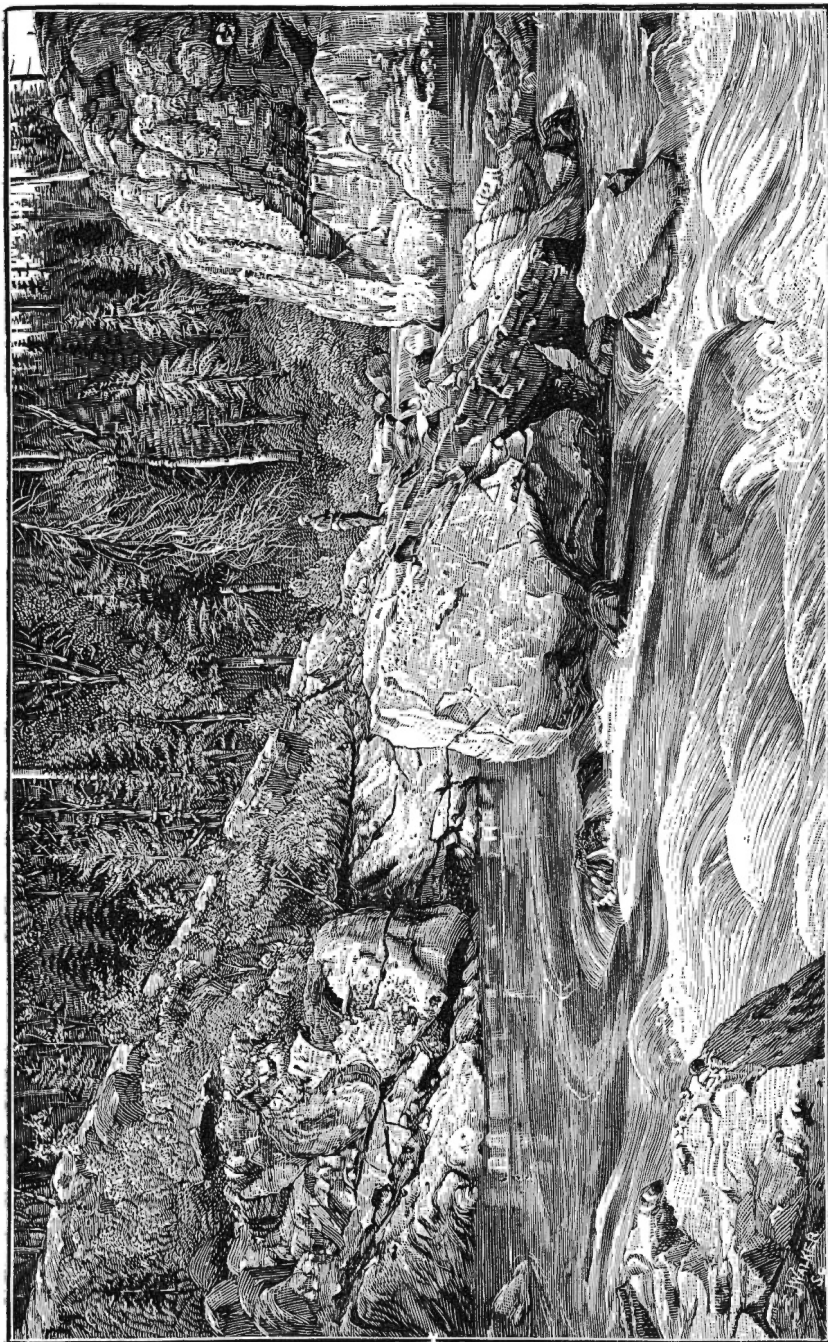
Persistent band in the Cambro-Silurian.

Between the Nipisiguit and the main South-West Miramichi River, the characteristic black and manganese-stained slates have been traced and are found to constitute a persistent band. Good sections across the beds are afforded by the North-West Miramichi and its branches, the Sevogle and Little South-west. The grey and green quartzites and schists seen at the Grand Falls of the Nipisiguit are also well marked in all these streams. In all cases they apparently, as a group, rest unconformably upon felspathic gneisses of a much older system. On the main South-West Miramichi, the green and red slates holding nodules of manganese like those of the Tête à Gauche falls are associated with beds of greyish slates, highly cleaved and containing fossils which, however from their distorted character cannot be determined, but appear to be more nearly allied to Cambro-Silurian than to Silurian forms. The rocks on this stream are much affected by granite masses, which in places have altered the strata in contact for several feet, and produced crystals of staurolite and mica in the surrounding beds. They do not, however, seem to belong to the oldest metamorphic belt, as they consist largely of quartzites and slates, till we approach the Forks, where at a distance of about four miles below we find genuine micaceous gneisses of Pre-Cambrian aspect.

North-West Miramichi River.

On the main North-West Miramichi, ashy, reddish and grey slates are first seen at the bridge at Chaplin's Island, about eight miles below the mouth of Portage River. These are similar in many respects to the ashy slates of the Tête à Gauche and the Nipisiguit. Their general dip is N. 50° W. < 40–60°. Above Portage River the series of black and irony slates already described, associated with grey and green sandy beds, are met which extend up to about one mile above Stony brook, a small stream from the south. Indistinct traces of fossils, of no use, however, for determination, were observed among the greyer beds. The black slates of this stream are cut by frequent irregular veins of quartz, often rusty and containing at one or two points traces of copper, but in quantity not sufficient to be of economic value. A short distance above Stony Brook the rocks change their character, becoming

Copper.



GEOLOGICAL SURVEY, 1880.

UPPER END OF NARROWS N. W. MIRAMICHI RIVER, N.B.

From Photo. by R. W. ELLIS

dense, hard silico-felspathic, often gneissoid and probably belonging to an older series, over these the river flows in a deep gorge, forming some of the grandest natural scenery in the province. They are often much disturbed, and dip at high angles. At the mouth of the Mountain Brook they resemble in character the gneissoid felsites of the upper part of the Nipisiguit, and these, with green chloritic and gneissoid schist, extend up for about twelve miles, above which point slaty beds, green and grey occur, which may be the extension of the Cambro-Silurian, as developed above Nine-mile Brook, on the Nipisiguit.

Rocks similar in character were observed also on the Big Sevogle and the Little South-west Miramichi. On the latter stream, after passing the Carboniferous beds which occupy the lower portions of the river for some twelve miles, green and grey beds of the usual type, with rusty and iron black slates and harder quartzite bands, extend up to within three miles of the mouth of the north fork, at which point gneissoid, reddish and grey felsites are met, which have an entirely different strike from the overlying series under discussion; and these continue up stream to the contact with the red granite belt of the northern portion of the province. As before remarked, in such an entirely unsettled country the impossibility of following the boundaries of the different formations continuously renders the fixing of their limits very difficult. Much of the surface is densely wooded, over great areas the woods have been blown down and ravaged by fire, and by far the greater portion is entirely inaccessible. Exposures also along the stream are not continuous, and it is possible that among the rocks included in the so-called Cambro-Silurian system, areas of other and older rocks may exist. The highly metamorphic character of the rocks also occasions great difficulty in assigning precisely each group to its proper horizon; but it is believed, both on general stratigraphical and lithological evidence, that the distribution as herein described is, approximately at least, correct. The apparent uncomformability of the two great systems is, however, quite evident at a number of points, though in such a large and generally disturbed area the most diverse dips are met with in close proximity to each other. And it is only by taking a broad and comprehensive view of the whole area under discussion that any satisfactory results can be arrived at.

Probable pre-Cambrian ridge

Contact of Cambro-Silurian and pre-Cambrian on the Little South-West.

Uncomformability of the two systems.

PRE-CAMBRIAN.

The area which we have included under this head is occupied largely by highly metamorphic rocks, many of which are very felspathic, and for the most part gneissic in structure. The well marked petrosiliceous

Distribution
of the
Pre-Cambrian.

beds and breccias and the crystalline limestones of the southern part of the province seem to be entirely wanting. With the exception of the sub-crystalline limestone of the Tête à Gauche of Cambro-Silurian age, and the locally altered marbles of the Silurian, no rocks of this kind have been met with in the vast stretch of country between the main South-West Miramichi and the Nipisiguit Rivers. The most northern prolongation of the rocks of presumed Pre-Cambrian age is seen in the upper part of the Tête à Gauche River, and consists of highly talcose and chloritic schists and slates; unconformable to the overlying Cambro-Silurian, and resembling in character many of the schists of the Pre-Cambrian of Albert and King's counties, described in the Report of Progress, 1878-9. On the Nipisiguit these rocks are much more extensively exposed, extending from below the Indian Falls, about forty-seven miles from the mouth of the river, some sixteen miles or so above the mouth of the Portage Brook, which takes its rise near the head waters of the Upsalquitch. They form lofty hills, reaching an elevation of not far from 2,000 feet above the sea, and present prominent features in the landscape which seem to indicate the extension of this formation.

Granite.

With the exception of the bright red granite in the vicinity of Bathurst, no rocks of this kind are seen along the river, but on the lower part of the main south branch which joins the Nipisiguit at $60\frac{1}{2}$ miles from its mouth, granites of red and grey color are seen, fine-grained and resembling in character many of the granites of the Laurentian areas of the province of Quebec.

Felsites.

Above Portage Brook, to the head of the river, the prevailing rock is a hard, dense, often porphyritic and generally reddish felsite, the peculiar color of which is well seen in the bald summits of many of the huge rounded hills that occupy both sides of the river for a long distance.

Characteristic
rock of the
Pre-Cambrian.

The typical rock of the Pre-Cambrian of this region is a greyish, felspathic gneiss, often with a reddish tinge on weathered surfaces, and frequently containing hornblende. These hornblende schists are common, and many of them are talcose. They are well displayed in the hills about Portage Brook and on the portage to Upsalquitch Lake. They are highly crystalline, the banding being well marked on weathered surfaces, and are much crumpled, generally at right angles to the planes of bedding. The general dip of the beds in this vicinity is N. 60° W. $< 45^{\circ}$. Great masses of this rock weather very rusty from the presence of iron pyrites, and are cut by quartz veins which, however, are often very irregular and reticulate, on weathered surfaces, in all directions. Similar rocks form high hills about the Upsalquitch Lake associated with hornblende schists, which dip N. W. $< 15-20^{\circ}$, and present the same minutely crumpled aspect. Below Portage Brook

exposures along the river are few, ledges of similar character appearing, however, at intervals. At Blue Ledge, two miles below the forks of the South Branch, greyish gneissoid rock composed principally of quartz and hornblende in layers appears to dip south-easterly at moderate angles. Two miles further down, at a sharp bend in the river, known as Devil's Elbow, ledges of similar rock extend along the north side of the river, and have a dip of S. 40° E. < 40°. This rock also occurs a short distance up the South Branch, associated with fine, dense, greyish granite containing black mica. They are all similar to the ledges occurring on the Upsalquitch portage, and are doubtless parts of the same series; and from this to the Indian Falls are seen in frequent ledges along the river and on the slopes of the mountain ridges on both sides. A short distance above the Indian Falls several prominent hills, known as the Bald Mountains, are seen to be composed of almost similar rocks; the dip, however, changes to S. 10-20° W. < 90.

The country to the south of the Nipisiguit, between Indian Falls and the Main South Branch, is very high and broken. Lofty mountains from 1,500 to 2,000 feet above the sea, in many places covered with impassable blow-downs, in others burnt completely bare, extend as far as the eye can see to the southward, and form the country about the head waters of the North-West Miramichi. Along the South Branch itself granite is the prevailing rock, sometimes grey and fine-grained, but more frequently red and coarse, and resembling that seen in Charlotte county, described in preceding reports. The character of the country, however, is such that it is impossible to tell with accuracy whether this coarse, red granite forms a broad, continuous belt or is divided into several ridges. The South Branch, after passing the forks, seven miles from its mouth, in ascending the stream shews no ledges, while the sides of the mountains alongside are generally an impenetrable jungle of green woods. Frequent pieces of gneiss and schist, however, in the bed of the stream seem to indicate that belts of these rocks are associated with the granites, and that the latter occurs in two or more ridges, separated by metamorphic areas. Below the forks of the South Branch, however, the granite is mostly fine-grained and differs entirely in character from the other and coarse red variety. The finer varieties may therefore be classed with the gneisses and felsite schists of the Pre-Cambrian, with which they are apparently intimately related. Large areas of these felsite schists and felspathic gneisses occur on the south side of the Nipisiguit River, below the South Branch, and are well disclosed in the elevations known as Little Bald Mountains, where they dip apparently N. 10° E. < 50°. An elevation one mile to the west having a reverse dip of S. 10° W. < 45°, shewing that these old rocks are thrown into anticlines. South of this, on the Little South West Miramichi, the

Upper part of
the Nipisiguit
River.

Broken country
to the south of
the Nipisiguit.

Two kinds of
granite.

Gneisses and
schists of
Little Bald
Mountains.

reddish-grey felspathic gneisses are also well developed and dip N. 50° E., generally at low angles of 5–20°. They here apparently rest upon, or dip away from, greenish-grey, fine-grained gneiss and hornblende schist, with crystals of clear quartz occasionally disseminated, dipping N. E. < 5–7°. Many of these schists are crumpled or twisted in small folds. Quartzose rocks and mica schists with chloritic and felspathic bands also occur. Above this to the contact with the granite about two and half miles below the middle North Branch, a succession of schists and felspathic gneisses with occasional dykes of reddish granitoid rock and felsites with micaceous diorite are seen, the dip becoming reversed as we ascend the stream, to S. 50° W. 45°. On the main South-west Miramichi, the rocks of this age seem to be confined principally to the gneisses of the upper part of the river or from a point about five miles below the forks. Other rocks along the river although schistose and gneissic seem to owe their metamorphism rather to local intrusions of red granite than to other causes, crystals of staurolite, etc., being developed in the beds along the line of contact with the granitic belt. The gneiss (pre-Cambrian) appears principally in low lying ledges in the bed of the river, and would be invisible unless in low stage of water. This area, however, owing to the difficulty of getting through the country was not fully examined, and further work in this section will be needed to fully establish the relations of the gneiss and mica schists to the granites and altered slates.

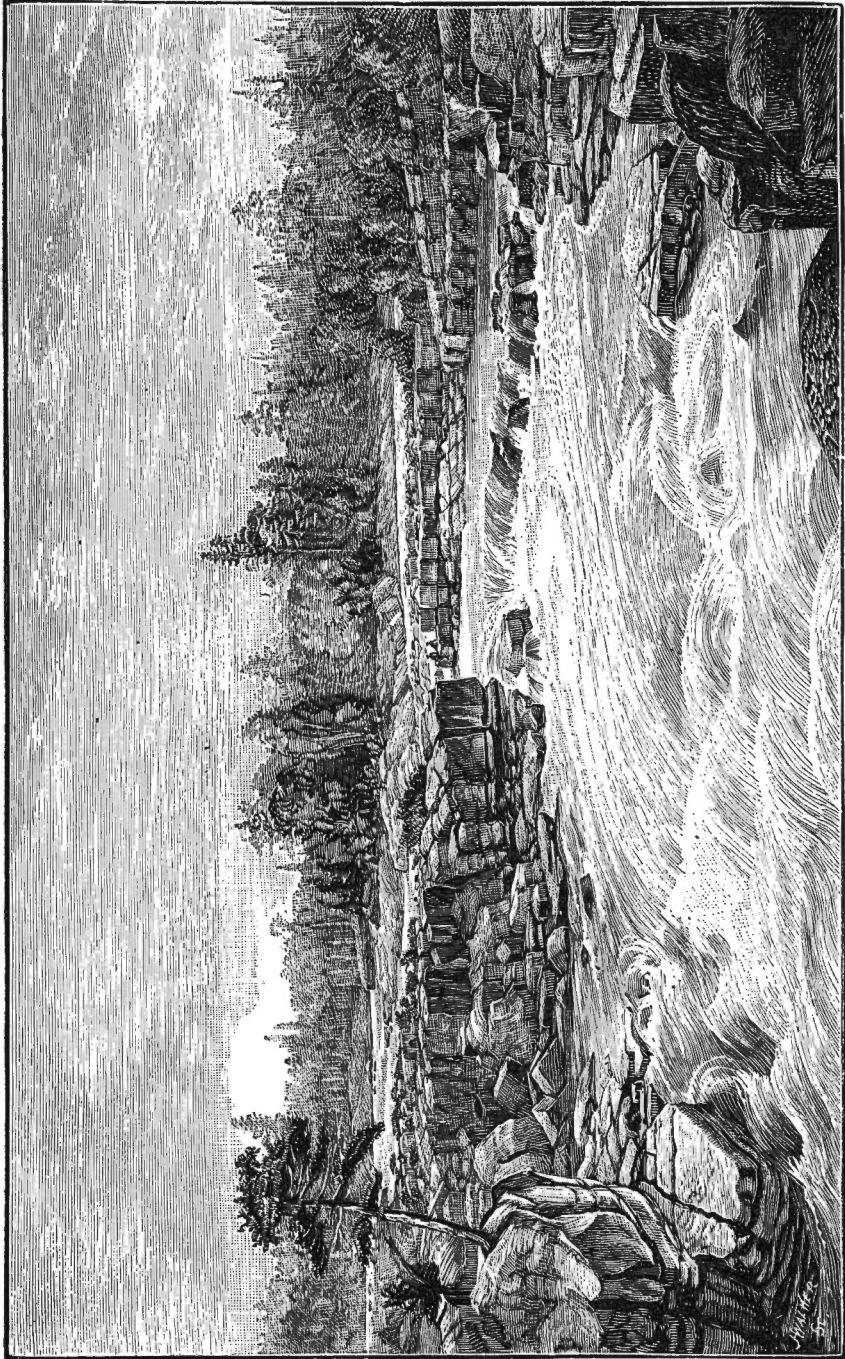
GRANITES, DIORITES, DOLERITES, FELSITES, &c.

Among the rocks generally regarded as of eruptive or irruptive origin, all of the above types are found. In the central area about the heads of the Nipisiguit and the North and South-west Miramichi, lofty peaks and continuous ranges of hills form the principal features of the landscape, and in these high lands the majority of the large streams flowing into the Bay Chaleur and the Miramichi take their rise. The general elevation of the lakes at the head of the Little South-west is, by aneroid, about 1200 feet above sea level. The granite here is exposed in low ledges along the stream, but further north about the head of the North-West Miramichi and south of the Nipisiguit branches, the country has a general elevation of about 1700 to 1800 feet. Isolated peaks like Big Bald Mountains rise above this to a further height of 630 feet, and long ridges of granite apparently extend south-westerly toward the main South-west Miramichi River. The typical granite of these mountains is the coarse red variety, similar to that of the southern part of the province in Charlotte county, having large crystals of red felspar, with quartz and mica, the mica being frequently

Little
South-west
Miramichi.

Main
South-west
Miramichi.

Character of
country in
interior.



GEOLOGICAL SURVEY, 1880.

PABINEAU FALLS, NIPISIGUIT RIVER N.B.

From Photo. by R. W. ELLS.

replaced by hornblende and these constitute the syenite of former reports, and occasionally both mica and hornblende are present.

In the vicinity of Bathurst, granites of this character are well exposed On the Nipisiguit they are first seen at the Rough Waters, three miles from Bathurst, where they form the bed of the river, overlaid by the soft red sandstones and fine conglomerates of the Lower Carboniferous. Thence they extend up stream for nearly nine miles, but do not shew on the south bank of the stream except at a very few points. They produce the rapids known as the Rough Waters, about three miles in length, and are well seen at the Pabineau Falls where the waters of the river have produced a rough and jagged chasm, forming a fall of great beauty.

Granite of the Nipisiguit.

The granites are cut by dykes, generally of small size, of almost pure felspar (orthoclase), though sometimes they have the composition of syenite the felspar greatly predominating. In the upper part above the Pabineau Falls they are well jointed, and almost resemble bedded rock. They also become much finer grained than the ordinary variety seen in the vicinity of the railroad bridge. These granites are also seen on the Little and Middle Rivers for a short distance above the railroad crossing, and the lower part of these streams is choked with huge blocks of this rock. Low ledges also appear on the line of the railway between Bathurst station and the Nipisiguit River, wherever the covering of drift has been removed.

On the main South Branch of the Nipisiguit the granites probably have their largest development in this portion of the province. This stream joins the Nipisiguit from the south at about sixty miles from Bathurst, and flows through a granitic country for the greater part of its length. Ascending, we first strike granitic and dioritic rocks at about half a mile from its mouth. This rock is mostly grey, composed of quartz, felspar (grey), and often black mica, though frequently the felspar is red and gives its color to large areas of the granite. It is, however, fine-grained, and entirely unlike the common red granite of Bathurst and the interior range of mountains at the head of this stream. This fine-grained variety extends up the South Branch about five miles, to within one and a half miles of the Fork, the red color predominating as we ascend the stream. In places it resembles very closely the fine red Laurentian granite in the vicinity of Kingston. No gneiss or mica schist is seen with this rock. It forms immense mountains, whose white weathering bald sides, often terminating in vertical bluffs of several hundreds of feet, flanked by huge heaps of debris, present prominent features in the landscape. The scenery is among the grandest in the province. Huge hills extend as far as the eye can reach, These are often burnt completely bare and

Character of the granite of the South Branch.

the mountain rock is entirely denuded of soil; at others small clumps of green woods break the sterile aspect of the country and indicate the course of some small stream. Thousands of acres of timber have been completely destroyed in this portion of the country, and the soil in many cases so completely burnt off that only a small growth of bushes can now find footing. These hills in the fall of the year are fairly blue with blueberries and abound with bears. The streams are for the most part, especially when a young growth has sprung up, well stocked with beaver, which, in spite of their wholesale destruction, are still plentiful in nearly all the streams of the interior.

Burned
country.

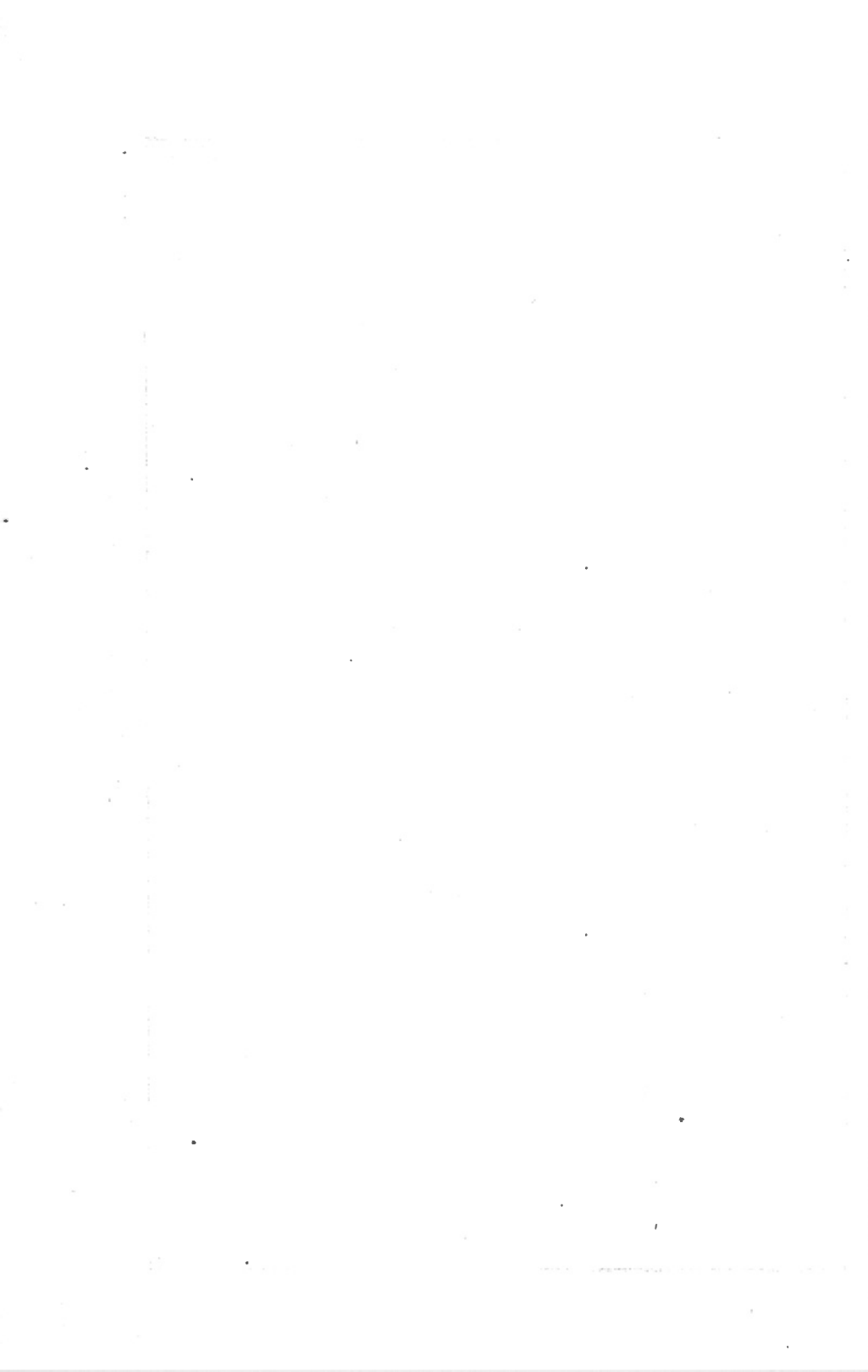
About one and a half miles below the fork of the South Branch, or six miles from its mouth, the fine-grained red granite suddenly changes to the ordinary coarse red variety. This is well exposed up to the Forks, above which the stream for some fourteen miles flows through a low and swampy hollow between high mountain ranges densely wooded and almost impassable. It is difficult, therefore, without further examination of some of the side branches to say definitely whether the granite forms a continuous belt from this point to the Big Bald Mountains near the head of the stream. It would, however, almost appear, from the quantity of schistose and gneissoid pieces brought down by some of the small branches from the east side, that the granite may occur in parallel ridges with areas of mica schists, gneisses, etc., intervening. This view is also supported by the strike of the gneissoid beds which flank the eastern extremity of the granite area.

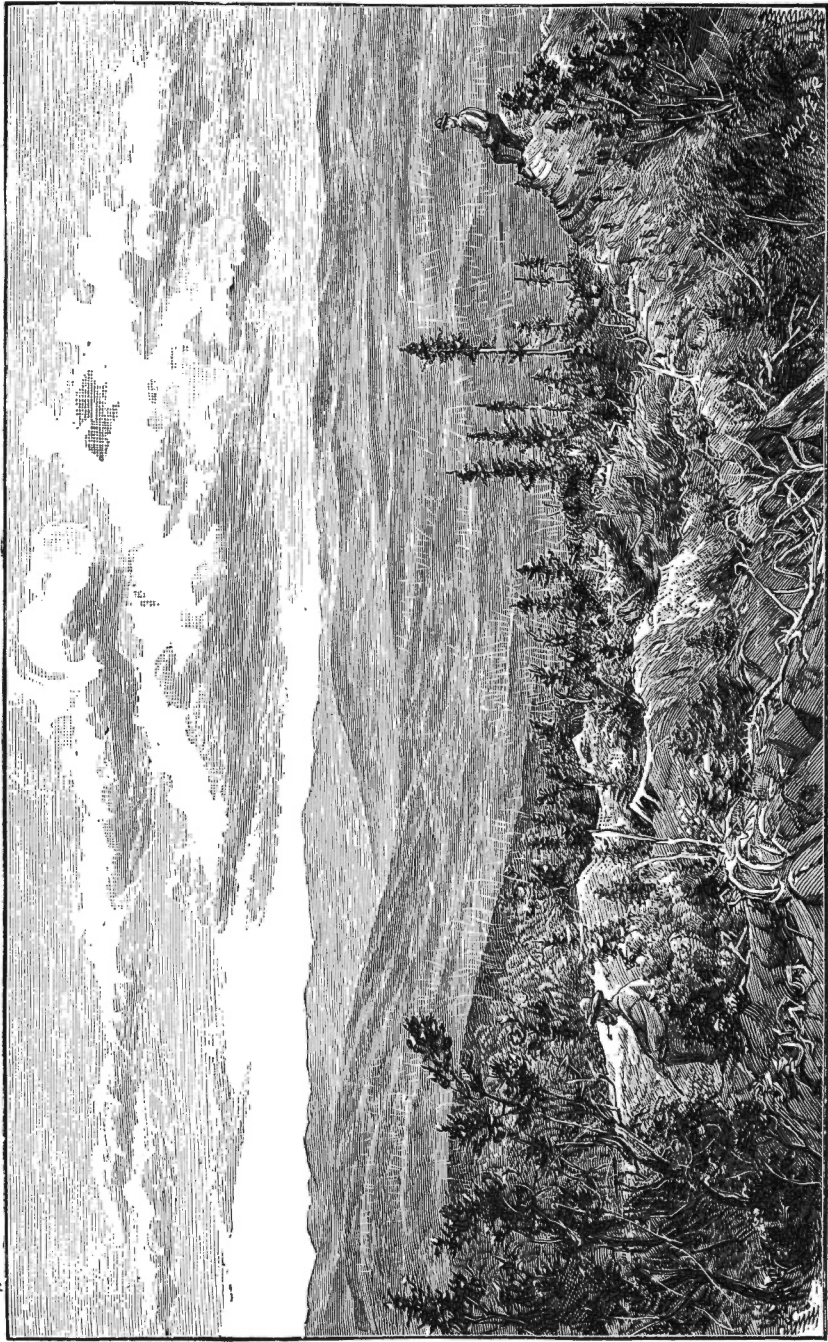
Probable distri-
bution of the
granite on the
South Branch.

From the observations we have been able to make in the country south of the Nipisiguit, or between that river and the main South-west Miramichi, it seems probable that there exist at least two and probably three main granitic axes, which extend North-eastwards from the Miramichi. The continuation of these granitic hills has been traced further west by Mr. Charles Robb, who has defined two of them east of the St. John River between Fredericton and Woodstock. On the main South-west Miramichi, however, other minor axes of granite are seen, in places separated by only a few yards of slaty or schistose rock. It is probable that several of these smaller bands merge into one, as they extend east or west from the river. Of these, the most southerly belt is that seen in the Little South-west Miramichi, where it first appears about two and a half to three miles below the Middle North Branch, extending north-east from the river about four miles, but terminating before it reaches the main North Branch. From its first contact with the Little South-west it extends up the river several miles, or to near the outlet of the Little South-west Lake, where ledges of mica schist and other rocks again come in. This belt is first seen on the main South-west, a short distance below Stony Brook, whence it ex-

Several granite
belts.

Little South-
west.





GEOLOGICAL SURVEY, 1880.

BALD MOUNTAIN, LOOKING UP NIPISIGUIT RIVER, N.B.

[From Photo. by R. W. ELLS.]

tends up stream for several miles, or to about one mile above Clear-water stream, having, however, in this distance a small band of hard grayish quartzose rock or slates which are probably of Cambro-Silurian age. The second main granite area on the main South-west begins just below McDonald's Brook and extends along the river to within about five miles of the Forks, with a direct breadth of a little more than six miles. Tracing this belt north-eastward it is found to constitute the high ridge between the waters of the Tobique and the Little South-west Miramichi, crossing the head-waters of the north branch of the latter stream, whence it continues north-eastward and crossing the head waters of the south branch of the Nipisiguit, rises into the bold elevations known as the Big Bald Mountains, with a height of about 2,500 feet, whence it stretches to the headwaters of the North-west Miramichi, where it terminates. The third and most northerly belt noticed by us is seen on the north-east of the main South-west Branch, above the Forks, where it appears as low lying ledges in the bed of the stream at intervals for some fifteen miles. The eastward extension of this belt has not yet been traced, but it probably is the same as is seen about the Tobique and Long Lakes, at the head of the Right-hand Branch of the Tobique River, and on the South Branch of the Nipisiguit in the vicinity of the Forks already described. None of these belts apparently cross the Nipisiguit, the area about Bathurst being the only one of the kind seen on that river or to the eastward of it.

The granites of the South-west Miramichi, though generally red in color, are occasionally grey, the mica is often black and the felspar is frequently in large crystals. The contact of the granites with the slates is well marked along this river. In places, crystals of staurolite are developed in the slate along the junction; at others the granite seems to lose its red color and becomes white, almost a pure felspar, the hard slates in contact are altered to a hard schist and crystals of mica are developed in cross veins in them near the junction. The purple slates and quartzites are also filled with crystals of iron-pyrites; and at other points the slates near the line of contact appear broken and confused for several yards from the granite, as though heavy disturbances of the strata in that vicinity had occurred. Further explorations, however, are desirable to establish the connection of the granite areas between the Tobique waters and the Nipisiguit as well as to more fully determine the relations of the granites to the mica schists in that area, but it is to be feared from the generally densely wooded character of the country that accurate tracing of boundaries will be an impossibility.

Felsites—These are largely developed along the upper portion of the Nipisiguit River, as well as around the southern side of the Nictor Lake,

or head of the Little Tobique River. On the south side of this lake a huge mountain rises to a height of about 2,500 feet, flanked on its north side along the shore of the lake, by green talcose and chloritic schists, of Pre-Cambrian aspect. This high mountain is composed of hard, dark red crystalline felsite, porphyritic, with crystals of red feldspar, and stretches off in a long ridge towards the south-west, or to the right-hand branch of the Tobique. It probably forms a continuous ridge to the Forks of that stream, as rocks somewhat similar in character appear at that point. The hills fall abruptly towards the east, or across the portage between the Tobique and Nipisiguit waters, but rise again to the eastward, and continue towards the south-east branch of the Upsalquitch River. This portage shews no ledges, but large blocks of the crystalline felsite lie scattered about, along with pieces of the schist. The Upper Lake or head of the Nipisiguit is enclosed by lofty hills, which are broken at the outlet. Descending the stream, ledges are not very numerous for several miles, but where seen consist of dark, red or purple tinted felsite often brecciated, and large angular blocks of the same are frequent. Just below the Little South Branch is a high mountain, composed apparently of dense banded, light red felsite, with abundance of iron pyrites along the joints. These are cut by dykes of fine, very hard, diorite, greyish in color, the felsites being porphyritic, like that of the Nictor Lake, and generally breaking into sharp, square blocks. Three miles below the Little South Branch, or at the 68-mile tree, ledges of the same banded rock occur, which seem from the banding to dip S. E. $< 20^\circ$. Two miles lower down a huge dome of felsite, with bald sides and top, forms a conspicuous object, its bright, red color being distinguishable for a long distance. Thence down, to within a short distance of the Portage Brook, where the portage to the Upsalquitch River strikes across, these rocks continue till they are met by the schistose or gneissic rocks already described under the heading Pre-Cambrian.

The scenery along this portion of the Nipisiguit is very fine. The felsite hills occur in a succession of peaks often rounded or dome-shaped, which stretch along both sides of the river, and the view from any of them shews the surface of the country to be a sea of mountains in all directions. In character, the rock resembles much of the old Pre-Cambrian felsites of the southern portion of King's and St. John counties both in the occurrence of breccias, petrosilex and its general porphyritic and highly crystalline nature. It would appear, from comparison with other rocks elsewhere, to be the equivalent of the felsite series of the southern portion of the province, and therefore to be a part of the mica schist and gneiss series, probably a lower portion of it.

Below the Portage Brook, on the Nipisiguit, but few pure felsites are

Felsites of
the Upper
Nipisiguit.

Character and
probable age.

seen; where they occur the exposures are limited, and of the nature of dykes; but on the Upsalquitch a large area of these rocks is again met with, which is probably the eastward extension of the main felsite belt from the upper part of the Nipisiguit. Just below the Upsalquitch Lake, however, several exposures of diorites, gabbros and mottled felspathic rocks occur, apparently intervening between the gneissoid rocks of this region and the Silurian, already described as occurring in this river. Just below Meadow Brook, a small branch of the Upsalquitch from the east, the typical hard, red crystalline felsites again appear, the extension as mentioned of the felsite rocks above described, and are associated with hard, green epidotic rocks. The felsite belt has been traced eastward almost to the shore of Bay Chaleur, and forms a ridge along the north side of the Jacquet River, rising into considerable elevations at several points, though in none possessing the marked prominence of the hills in the interior. They are flanked along the Jacquet River by Silurian beds, often fossiliferous, and the beds of brown, red conglomerates, mentioned in the vicinity of New Mills, as well as at other points along the coast in that vicinity, have probably been largely derived from the debris of these felsites, as the pebbles composing the conglomerates are nearly all of this character.

Gabbro.

Felsite belt of the Upsalquitch and Jacquet Rivers.

Descending the Upsalquitch, no other exposures of any size are met with. A high, red mountain of felsites occurs about three miles above the forks of this stream, and ledges of the same occur along the river at this point, but the area is probably detached and but of small extent.

Below the forks of the Upsalquitch, several dykes of felsite are seen cutting the Silurian slates; these are, however, quite distinct in character and mode of occurrence from the great felsite areas already described. They are, from their position, subsequent to the Silurian beds, and probably of the same age as the trappean ridges of Dalhousie and the lower part of Restigouche, as felsite areas of small size occur among the trappean rocks as an integral portion.

Felsite dykes.

Dolerites.—These rocks are extensively developed about the lower portion of the Restigouche from a point four miles below the mouth of the Metapedia River to Dalhousie, and also at intervals along the coast southward almost to Bathurst. They are of varied character; sometimes dense, dark green, hornblendic traps, frequently amygdaloidal, and at other times brecciated, and frequently resemble the Triassic traps of Nova Scotia. Their age, however, is pretty well determined. At many points they are seen in the form of dykes cutting through fossiliferous Silurian rocks, and changing the character of the slates in contact to hard quartzites or porcellanizing them, while the fossiliferous limestones are sometimes converted to a crystalline marble, in which, however, the fossiliferous nature is clearly distinguishable. On the

Distribution and character of the dolerites.

Their age.

other hand, they do not alter the Lower Carboniferous beds, which frequently are superimposed directly upon them, nor the Devonian rocks of the lower part of the Restigouche, and pebbles of the trap are frequent in the latter. Further, the Devonian beds of this locality seem to have been deposited after the trappean hills had received their present outlines, as they can be seen to sweep around the base of the trap hills, and to conform in strike with their irregularities. At one or two points, however, small dykes of trap of subsequent date to the main body of the rock are seen penetrating the Devonian beds as at Point la Lime, where a dyke forms a roof for a bed of carbonaceous shale. The contact of the trap or doleritic rocks with the Silurian and their relations can be well studied at the point below Dalhousie. The intrusions here seem to have been injected along the bedding planes of the slates and limestones, and at first glance would appear to be an integral part of the Silurian system. Examination, however, shows the limestones and slates to be highly altered to a distance of several feet from the contact, while in one place the trap has caught and inclosed in its mass a small portion of Silurian fossiliferous limestone. At Dalhousie it occurs along the shore in a number of ridges, five distinct ones being counted along the road from Dalhousie down to the Eel River flat, about two miles by the road. These ridges are in every case separated by lenticular areas of highly fossiliferous Silurian rocks, which, however, do not apparently extend westward from the shore more than a couple of miles.

On the road leading west from Dalhousie towards Campbellton the doleritic rocks present many of the characters of stratified beds. They lie in broad sheets like freestones, dipping N. 40° W. < 35°, but on examination are found to be compact, highly crystalline rocks. They have here been extensively quarried for the construction of railroad bridges; and they occur in a similar manner alongside the post road to Campbellton, about four miles west of Dalhousie station, but the rock at this point is brecciated. The general extension of the trappean ridge along the south side of the Restigouche may be said to be from Dalhousie westward to the Glenlivet road, about ten miles west of Campbellton. A break, however, occurs near Dalhousie station, where a depression, partly filled with Devonian and Lower Carboniferous sediments, affords a passage for the Intercolonial railroad from the flats of Eel River to the waters of the Restigouche. The breadth of the trap ridge, west of Dalhousie station, is about three miles, with elevations of 1,000 to 1,200 feet in height. Its southern limit is just at the most southerly of the two roads through the settlement of Dundee, whence Silurian slates extend southwards. Trappean ridges of undefined extent, however, occur, associated with the Silurian rocks along the Eel River, but the

Minor dykes in
the Devonian.

Bedded struc-
ture of the
dolerite.

impassable nature of the country prevents the tracing out of the different belts.

At Campbellton a conspicuous mountain, called the Sugar Loaf, rises abruptly about one mile south of the station to a height by aneroid, of 1,000 feet above the river. The mountain consists of hard, reddish, grey crystalline felsite, resembling much of that in the southern part of the province, weathering a dirty reddish grey. No trappean rocks were seen in this peak, which rises like a huge wedge-shaped cone from the felspathic ashy rocks around its base. The mountain is narrow, its crest being only a few feet in width, but elongated, with steep, nearly perpendicular sides for several hundred feet from the top, and a long, gentle slope at the eastern end, the western extremity being much more abrupt. The direction of the crest is about ten degrees north of west magnetic. A magnificent view is obtained from its summit, not only of the Restigouche from below Metapedia and far down the Bay Chaleur, but also of the surrounding country to the north and south. High ranges of hills can be seen rising on the Quebec side for a long distance inland, while to the south the view is interrupted by a high ridge of trappean rocks. To the west a succession of rounded peaks of felsite and trap extends as far as one can see, while the pretty town of Campbellton lies spread out at its base. The volcanic character of many of these hills is apparent both from the nature of the rock constituting them and from their peculiar cone-like shapes. This is especially noticeable in some of the peaks on the north side of the Restigouche and about the Scaumenac River, where side cones often exist, jutting up from the otherwise sloping sides of the mountains. In the Sugar Loaf at Campbellton one can almost detect a dipping of the felsites from both extremities of the mountain towards the centre.

Sugar Loaf Mountain.

On the Upsalquitch River a large area of trappean rocks is seen about seven miles above the forks, with a breadth along the river in a direct line of about three miles. They are frequently very amygdaloidal, and contain amethysts and agates, with heulandite and other zeolites. Zeolites and amethysts of considerable beauty are also found among the trap rocks in the vicinity of Dalhousie.

Trappean belt in the Upsalquitch.

Along the coast, between Dalhousie and Bathurst, frequent exposures of doleritic rocks are seen, some of which have already been alluded to. Many of these are of but small size and are well defined dykes, while others are of considerable extent, having a breadth of several miles. The most important of these occur along the line of the Intercolonial, between the Tête à Gauche River, north of Bathurst and Belledune station. A very good cross-section of these rocks, shewing their varying character, is seen on the road running almost north from Peter's River, about one mile north of the Tête à Gauche to Dunlop settle-

Section north of
Peter's River.

ment. At the road crossing Peter's River is a moderately high hill or low ridge of dark, greenish-grey trap, moderately fine-grained, and amygdaloidal in places, with small zeolites and thin veins of red hematite, already alluded to, associated with veins of bright red jasper. Ascending from the river, the following traverse over these rocks was made:—

	PACES.
Ascent over ridge mentioned above.....	512
Purplish or dark grey trap.....	297
Dark greenish trap, mottled with light green and slightly porphyritic in places, in others amygdaloidal, with calcite, giving the rock a scoriaceous aspect on weathered surfaces.....	85
Dark flesh-red felsite, highly crystalline, and cut by dykes of dark fine-grained diorite, rock rubbly.....	217
Dark grey felsite breccia, the brecciated pieces being in size from half an inch to one foot.....	77
Purple ash-rock, filled with small crystals of calcspar.....	300
Dark greyish ash-rock conglomerate.....	130
Purple and reddish-grey felspathic breccia, very rubbly and weathering a reddish grey.....	15
Dark green fine diorite, with small specks of yellowish green epidote.	21
Brecciated conglomerate, pebbles, nearly up to a foot in size of flesh-red felsite, sometimes porphyritic, and with a scoriaceous look on weathered surfaces from the presence of small amygdules of calcite probably. This may be the concretionary rock described as occurring along the line of the railway.....	210
Hard greenish-grey, highly crystalline diorite, moderately coarse.....	137
Very scoriaceous purple grey trap, with calcite and small veins of red hematitic, rock often very ashy in texture.....	166
Purple ash-rocks, apparently schistose in places or a schistose conglomerate, containing pebbles of red hematite and purple ash-rock, with an apparent dip of S. 20° E. < 75°.....	118
Green schistose rock, a conglomerate in places, in others rubbly and rusty, to cross roads in Dunlop settlement.....	770

Several cuttings in these rocks are visible along the railroad, and the concretionary and scoriaceous character of some of the beds is well seen.

These rocks are associated with the so-called Cambro-Silurian group already described. As they are not in contact with Silurian rocks, their relative ages cannot be determined so well as in the case of the trappean beds farther north, but it is very probable, from the similarity of composition and general character, that they are contemporaneous.

The second area of doleritic rocks of large extent begins near the railroad bridge over the Elm Tree River, and is well seen in the various cuttings and snow sheds for several miles, or nearly to Belledune station. In the sheds at the Elm Tree River the rock is hard, com-

Doleritic rock
of Elm Tree
River and
vicinity.

compact and greenish, with minute reticulating veins of white calcite and some quartz, and contains pyrites in small specks. As exposed in the sheds at this point the breadth of the dyke is 1,000 paces, and contains at one point a thin band of soft red slate. At the contact with these the wall of the dyke is well defined, and the slates appear to have been altered for an inch or two into a shaly, greenish, talcose-looking rock, though the rest of the bed does not seem to have been greatly affected. An interesting secondary dyke, from five to eight inches thick, is seen cutting the main belt of irruptive rock. Thence for a distance of about five miles along the railroad similar greenish dioritic or doleritic rocks are seen at intervals. In places these have the same concretionary structure as noted in the traverse above; frequently they are epidotic and chloritic, and contain a good deal of calcareous matter disseminated. At several points these bands of reddish or blackish slates and hard conglomerate, some of which appear to be altered by contact, are observed, but the area occupied by such rocks is very limited.

Between Belledune Point and Jacquet River several dykes of dolerite, generally amygdaloidal, though occasionally crystalline, are seen. These are, for the most part, small, and never more than a very few yards in extent. They are seen cutting the Silurian rocks, but not affecting the Lower Carboniferous beds, which cap them unconformably, and the trap pebbles often enter largely into the composition of the basal conglomerate of the latter. Beautiful sections are afforded along this shore of the Silurian, the Lower Carboniferous and the trappean rocks, and the relations of the three are very nicely defined. At Black Point, however, nearly opposite the lower end of Heron Island, the dolerite appears again in considerable force, cutting as usual through Silurian beds, and being intimately associated with the hard, dark brown conglomerates of this part of the coast. At Beaver Point also, about one mile further north, they again appear, and have a breadth of several miles; or to the mouth of New Mills Brook, where they are met by the heavy dark brown conglomerates in force. Other and larger areas also occur south of Charlo River, associated with fossiliferous calcareous beds. The western extension of these various bands of eruptive rocks has not been traced. The settlements in this part of the province are confined to a strip along the coast of scarcely more than a mile in width, and in the dense and swampy lowlands or the rough and hilly wooded portions further back, progress is almost impossible. They do not, however, extend probably to any very great distance, as they are not seen on the Upsalquitch, but may possibly assume the aspect of lenticular areas of greater or less extent, which have burst through probably at the close of the Silurian. Slices of these rocks will be prepared for examination under

North of
Jacquet River.

Charlo and
vicinity.

the microscope, and be reported on. They seem to be very similar in character, and probably do not differ much in age.

North side of
the Lower
Restigouche.

On the north side of the Restigouche, in the province of Quebec, the western limit of the trappean ridges has been fixed. It is directly opposite the limit of the trap, on the south side of the river, but the northern limits and its extension eastward have not yet been determined. It is, however, evident that the valley of the Restigouche was clearly defined at this period, as the Devonian beds now occupy its basin, and the doleritic rocks probably extended then as now in two lofty and tolerably regular ridges along its two sides. Evidently no disturbance of any importance has occurred in this vicinity since the deposition of the Devonian fish-bearing beds, as in nearly every case they lie nearly in a horizontal attitude or inclined at low angles, forming a shallow, synclinal trough between the two ranges of hills, and occupying the beds of the river and harbor between Campbellton and Dalhousie.

SURFACE GEOLOGY.

In the report of Dr. Gesner to the New Brunswick Government (1843) the surface deposits of the coast between Bathurst and the Restigouche are well described. They are there divided into the "Upper and Lower Tertiary." In the former he includes the white marls, and in the latter the grey, blue and brown clays containing marine shells.

Shell marl.

Of the former, or white marls, several deposits of considerable value exist. One of these is near Belledune Point, the thickness of which is about two feet, overlaid by some five feet of peaty soil. It is nearly a pure carbonate of lime, with several species of fresh water shells. A second deposit occurs in a road leading back from the shore about two miles north of Charlo station, where it is seen occupying the bed of a small lake or overflow of a brook, the character being similar to that just described. These marls are used locally to a slight extent, but the abundance of lime in the soil from the decomposition of the Silurian calcareous slates and limestones obviates the necessity for its application in any considerable quantity.

Marine clays.

Along the line of railway north of Bathurst frequent cuttings are observed in the grey and blueish-grey Post Tertiary marine clays. The first of these is seen a few rods north of Bathurst station, where dark brown-red clays, overlaid by several feet of gravel, contain abundance of shells of *Mya arenaria* and *truncata*, *Tellina Grælandica*, *Astarte Laurentina*, *Saxicava rugosa*, a *Natica* and a *Venus* (*Mercenaria*). A larger cutting is seen just above the Tête à Gauche bridge. Here the overlying gravel, generally fine, has a thickness of about fifteen feet,

the clay also has about the same thickness, and shells of the same species are seen in abundance in the latter. The height of this cutting above the sea level is about eighty feet. Other cuttings of considerable extent are seen on the railroad in the vicinity of Jacquet River, as well as between this locality and the Eel River; and at the forks of this stream, in Shannonvale settlement, the clays occupy large areas, with a thickness of ten to fifteen feet, often covered by a thick stratum of sand and gravel.

At several points along the Upsalquitch and Restigouche, terraces of considerable extent are observed and have been already alluded to. On the former stream four very perfect ones are seen on the west bank. At the Chain of Rocks Brook, on the Restigouche, about eight miles above the Upsalquitch, three perfect and one irregular one were noticed, and at the forks of the Kedgewick two well-defined are seen. The general height of these terraces is about ten feet.

Peat bogs exist in large areas in the eastern part of Gloucester and Northumberland counties, especially near the shore of the Gulf of St. Lawrence. At Point Escuminac and on the south side of the Miramichi harbor they have a depth in places of over thirty feet. They are also found in the vicinity of Shippegan and in the Island of Miscou. Quantities of walrus and other bones are found on this Island at a considerable distance from the shore.

Striæ or ice-grooves were observed at several points; on the Peter's River, north of Bathurst, they have a nearly east and west course (N. 85° E.), as also in the vicinity of the Elm Tree River, but the great thickness and wide extent of the superficial drift renders the exposures of striæ rare.

ECONOMIC GEOLOGY.

Although in the area examined during the past two seasons minerals in considerable variety were observed, some of which have been mined quite extensively in former years, the greater part appear to exist in quantities so small and under conditions so unfavorable that the prospects for their successful development are not promising. They were, however, carefully sought for, and a brief description is herewith appended.

Gold.—The occurrence of gold has been reported from a number of localities. Professor Hind, in his report to the New Brunswick Government (1865), mentions the discovery of gold in small quantity at several points in the Nipisiguit in the drift, but in no case did the washings indicate its existence in paying quantity. Quartz veins are very numerous throughout the whole extent of the metamorphic rocks, many of which were broken up and carefully examined,

Barren quartz
veins.

but no visible gold was observed in any of them. The great majority of these veins are small and irregular, and often of the nature of short, gash veins. Washings at various points frequently disclosed the existence of black sand, with which the gold is often associated, but gold was not found, though many persons have been deceived by the occurrence of small scales of yellow mica and minute particles of yellow pyrites. Explorations have been carried on irregularly by various persons for a number of years, apparently without any satisfactory results. A company, during the summer of 1879, however, profess to have found quartz in one of the branches of the Nipisiguit that yielded gold at the rate of \$5.00 per ton. This company subsequently carried on operations on the Millstream, about eight or ten miles from Bathurst, in rocks of presumed Cambro-Silurian age, the result of which has not yet been learned. On some of the streams in the county of Northumberland good specimens of gold-bearing quartz are reported to have been picked up several years ago, and the number and aspect of the quartz veins at several points renders the occurrence of this metal probable. On the Little South-west Miramichi a fine specimen of gold is said to have been found, about three miles above the North Branch, and not far below a heavy rapid known as Main's Ledges, while on the Main South-west several small pieces have been obtained a few miles above Boiestown, but the exact locality from which these were originally derived, has not as yet been ascertained.

Mispickel. Mispickel and other forms of pyrites occur in considerable quantities in these rocks, and in places the quartz veins look promising. A few specimens were examined in the laboratory of the survey, but without affording any trace of gold. It seems probable that, if it occurred in any considerable quantity, the various explorations would have revealed some trace of its existence. The equivalents of the gold-bearing slates of Nova Scotia have not been discerned in this portion of the province, and though from the large area which has not yet been examined, owing to the difficulty of access, further explorations may be more successful, the conditions do not seem to warrant the expenditure, in so far as seen, of any very considerable amount of capital in that direction.

Mispickel.

Copper occurs in very limited quantity at several points and in different formations. The deposit formerly worked at Bathurst, in the Lower Carboniferous rocks, has been already described under that formation. Other localities where mining has been carried on are the Falls of the Tête à Gauche and the Baldwin Mine, on the Nipisiguit, about twelve miles from its mouth. In both these localities the amount of copper was very small, and the results exceedingly unsatisfactory. The extension of the belt in which the Baldwin Mine is situated can

Copper mines
of the Nipisi-
guit and Tête à
Gauche.

be readily seen on the North-west Miramichi and in the Big Sevogle further south, and at both these places copper pyrites and red oxide or cuprite was seen in small quantity, and the indications are quite as favorable in one locality as the other. None of them, however, contain sufficient copper ore to warrant any expenditure of money, and do not equal in value many of those seen at various points along the coast of the Bay of Fundy.

Manganese was formerly mined at the Tête à Gauche Falls. Its Manganese of Tête à Gauche. mode of occurrence in the Cambro-Silurian red and black slates in the form of small nodules has been already described. The slates were crushed in a stamp mill, and the ore separated by washing. No large deposits similar to those of the southern part of the province were found, the Lower Carboniferous limestones and conglomerates, in which they usually occur, being wanting in this part of the country. Many of the rocks of the Cambro-Silurian are deeply stained from the presence of this mineral, but no well-defined veins have anywhere been seen. The company which worked the mine at the Tête à Gauche are reported to have extracted a large quantity of the ore, but the results were evidently unsatisfactory, as the works have long since been abandoned.

Galena, said to be rich in silver, has been reported as occurring in Galena reported on the Nipisiguit. detached masses of considerable size at several points along the Nipisiguit; no deposit of it has ever been seen on this stream, but traces of it were found by us in some of the rocks in the area under examination. Such rumors are frequent in various parts of the province, and but small reliance can be placed upon them. It is possible, however, that in connection with the graphitic and sub-crystalline limestone bands seen on the Tête à Gauche, and which probably cross the heads of the Nine-mile brook, a tributary of the Nipisiguit, as well as on the head waters of the Millstream, and the streams in that vicinity, deposits of this mineral may occur, but as these localities are accessible only with great difficulty or on snowshoes, the discovery of such, if ever made, will doubtless be due to accident. On the Nigadoo, however, near the Galena (Argentiferous) of the Nigadoo River. contact with the Silurian rocks, indications of galena were noted, and at the Forks of this stream, about eight miles from its mouth, a deposit of considerable extent occurs, which bids fair to be of some importance. Since our visit to this place in 1879, mining operations have been commenced, the samples of the ore obtained being of good quality, but the extent of the vein has not yet been fully determined.

Molybdenite has been known to exist in small quantity in the quartz veins cutting the schistose rocks at the mouth of Burnt Hill brook, a tributary of the main South-West Miramichi, and has been alluded to

in the report of Mr. Chas. Robb (1869) on that region. It cannot be said to possess any economic value, as the amount is very limited.

Gypsum of the Tobique.

Gypsum or Plaster is not known to exist in the area bordering on the Gulf of St. Lawrence. The only deposit of the kind in the northern portion of the province is found on the Tobique River, near the mouth of the Wapskehegan, in rocks of Lower Carboniferous age. This has already been described in previous reports by Messrs. Hind, Gesner and Robb. Within the last few years a considerable demand has sprung up for it in the vicinity of the Upper St. John, and a mill for grinding it for agricultural purposes has lately been erected on the Tobique.

Coal.

Coal is known to occur at various points throughout the great extent of the Carboniferous system in eastern New Brunswick. At Clifton, sixteen miles below Bathurst, a small seam of a few inches only is seen in the cliffs, and underlies the grindstone quarry at this place. It is stated by Mr. Read, owner of the quarries, to have a total thickness in places of eighteen inches, but the greater portion of this is black carbonaceous slate, and the hard or coaly portion does not exceed six to eight inches. Coal of considerable thickness is also reported from the Island of Shippegan, at Pigeon Hill, but owing to the lateness of the season when visited and the unwillingness of the owners of the land to disclose its outcrop, nothing definite could be learned of its extent. Samples of the coal, however, seem to be of very good quality, and if a workable bed could be found in this locality it would be of great value from the convenience of shipping. It would be an easy matter to test this place by boring, and the prospects are such as to warrant a moderate outlay in solving the question of its occurrence.

Clifton.

Shippegan Island.

South-west Miramichi.

Thin seams also are found in the vicinity of the South-West Miramichi and between this river and Shediac, but these outcrops have not yet been carefully examined. They may be, and probably are, on the extension of the seam which has been worked at Grand Lake, and if so, would show that the formation, as developed in this province, is very thin. The judicious expenditure of a few hundred dollars would prove the point, and determine whether, as the coal fields approach the productive measures of Nova Scotia, thicker and more profitable seams may not occur. The measures lie in such a horizontal attitude that superficial examinations do not yield much information on this point.

Probable extension of the Grand Lake bed.

Grindstones.

Grindstones and building stones of excellent qualities are found at various places throughout the Carboniferous area. The former are extensively quarried at Clifton, about sixteen to eighteen miles below Bathurst, whence they are exported largely to the upper provinces and to the United States. Grindstone quarries are also worked at several localities on the North-West Miramichi, as well as below the town of Newcastle. Building stone has been quarried for local purposes in the vicinity of

Tracadie, in the eastern part of Gloucester county, and the fine Roman Catholic churches of Caraquet and Tracadie, as well as several other fine buildings, were constructed from stone obtained in their vicinity. Many of the beds are quite free from pyrites, and are equal in quality to the fine stone obtained in the south-eastern part of the province.

Limestone occurs throughout the greater part of the Silurian sys- Limestone.
tem. It is especially abundant in the vicinity of Elm Tree River and Belledune, and is quarried to some extent for burning. The local demand, however, is not great, and the distance from a profitable market such as to interfere with its regular production. The marble in the vicinity of Petite Roche and Elm Tree would be a valuable stone were it not so shattered, probably by the intrusion of the trap dykes of this locality. It is, however, frequently burned for lime. The alteration of the limestone to marble is only local, and the deposits are not likely to prove of value, save for calcination. The ordinary limestone of this vicinity was extensively quarried, and used in the building of the bridges along the line of the Intercolonial railway.

Granites.—The rock in the vicinity of Bathurst is of equally good Granites.
quality, with much of that in the southern portion of the province as a building stone, and has been largely employed in the construction of many of the immense bridges along the line of the Intercolonial railway. Several quarries have been opened in the vicinity of the Nipisiguit River, but except for use on the railroad, no attempt has been made to work them. The expense of shipment is against its successful working as compared with the quarries on the St. John River and in Charlotte county. A limited out-crop of this rock occurs on the Benjamin River about four miles from its mouth, and has been locally used for mill-stones.

Slates.—Some of the bands of slate along the lower part of the Tête Slates.
à Gauche River seem to be fairly adapted for the manufacture of roofing slates, but the expense of opening quarries would be great, and the demand so limited that their economic value may be considered as small.

Peat.—The extensive beds of peat in the vicinity of Point Peat.
Escuminac are often of good quality, and when properly prepared this material burns well. The proximity of the Pictou coal fields, and the cheapness of coal, is at present such as not to warrant the expenditure of capital in the preparation and manufacture of peat fuel, though for local purposes it might possibly be advantageously employed.

