GEOLOGICAL SURVEY OF CANADA.

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

REPORT

ON

PART OF THE COUNTIES OF

Richmond, Inverness, Guysborough and Antigonish,

NOVA SCOTIA,

1881

BY

HUGH FLETCHER, B.A.

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

Director of the Geological Survey of Canada, Ottawa.

SIR,—I beg to present herewith a report of the work of the Geological Survey in eastern Nova Scotia during the season of 1878 and 1879.

A preliminary reconnaissance of the northern part of Cape Breton Island from St. Ann's to Cape North, and thence along the west coast to Margaree, was likewise made in 1878 by my assistants Messrs. William Fletcher. B.A., and D. Christie, the details of which are, however, reserved pending further examination of that interesting region. This will be effected during the present summer.

I have the honor to be,

Sir,

Your obedient servant,

HUGH FLETCHER.

OTTAWA, 1st May, 1881.

ADDITIONAL ERRATA.

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LIST OF PLATES.

PLATE 20. Bald Mountain, looking up Nipisiguit River, N.B. Page 35 D.

REPORT A. (I.)

Page 5, *line* 8 *from bottom, for* "Appendix II.," *read* "Appendix I."

REPORT

ON

PART OF THE COUNTIES OF

RICHMOND, INVERNESS, GUYSBOROUGH AND ANTIGONISH, NOVA SCOTIA.

BY

HUGH FLETCHER, B.A.

In continuation of the work of previous years in eastern Nova Scotia a geological survey was made during the summers of 1878 and 1879 of portions of Richmond, Inverness, Guysborough and Antigonish counties, bounded on the south by Chedabucto and St. Peters Bays, and on the north by Judique and River Denys Basin; as well as a preliminary examination of the country between Judique, Mabou and Whycocomagh, the result of which will be reserved for a future occasion. Area examined.

It is impossible to lay down geological lines without an accurate map, and no maps of this district having yet been published, except the Admiralty charts of the coast and Church's county maps of Antigonish and Guysborough (on which the roads only are correctly shown); and Crown Lands plans being also exceedingly fragmentary and imperfect, it was necessary to make close and careful surveys of nearly all the roads, streams, lakes and a large part of the sea-shore, which were plotted on a scale of twenty chains to an inch, and afterwards reduced by the eidograph, with the Admiralty charts as a basis, to one mile to an inch. Accuracy was the more important because within the region is included the Richmond coalfield, in the exploration of which about $100,000 have probably been expended, yet with regard to which very little is definitely known. Map.

All the courses were taken by prismatic compass. In 1878 the distances were determined on the roads by chaining and pacing and on the streams and shores by pacing; whilst in 1879 most of the roads were measured by means of an improved odometer, made under the direction of Mr. Wallace Broad, B.A., by E. Chanteloup of Montreal, by the use of which additional accuracy was attained and a greater distance surveyed, with singular ease, by one person than could be accomplished by two or three with the chain. Method of surveying.

Acknowledgement of assistance.

In the fieldwork I was assisted as in former years by Messrs. William Fletcher, B. A., of Toronto, Hartley Gisborne of Ottawa, and John McMillan of East Bay, Cape Breton, to whose indefatigable exertions, often in an unsettled country and in inclement weather, I am greatly indebted. Among others, our thanks are specially due to Messrs. J. E. Burchell of Sydney, John and Allan McDonald of Soldier Cove, Donald John McDiarmid and Alexander McCuish of Lochside, E. G. Millidge, C. E., E. J. Barclay, C. E., Charles Palmeter and J. D. Matheson of St. Peters, James Morrison of River Tillard, George Shaw, J. J. Robertson, C.E., Thomas Jean, George Andrew, William Creighton and E. P. Flynn, M.P. of Arichat, W. J. Morrison and Angus Ferguson of McLeod's Bridge, Captain John Stapleton and Captain Angus Grant of Hawkesbury, N. J. Brown and J. G. McKeen of Hastings, William Wylde of Mulgrave, Allan McQuarrie of Dorton's Bridge, Rev. Archibald Chisholm and Rory Chisholm of Judique, Samuel Campbell of Southwest Mabou, Dr. Honeyman, Edwin Gilpin, M.A., and James H. Austen of Halifax, Alexander McBean of the Vale Colliery, Pictou County. To the kindness of W. A. Hendry, Esq., of Halifax, we owe the Richmond and Inverness county line.

Character of the country.

In a general way the country is similar in physical features to that described in the Reports for 1875-78. In the vicinity of St. Peters Inlet and towards the head of West Bay and the Strait of Canso no

Hills.

hills of importance occur, and a great part of the land is unfit for agriculture. The hills of Madame Island, nowhere exceeding 250 feet in height, are separated from the Sporting Mountain (630 feet) by a wide valley which includes Lennox Passage and the low land to the northward, and these are in turn separated from North Mountain (768 feet) by West Bay, whilst the valley of the rivers Inhabitants and Denys lies between North Mountain and the Craignish Hills (1000 feet). The slopes of these hills are steep towards West Bay and the Gulf of St. Lawrence but gradual inland. In Guysborough and Antigonish counties, on the south side of the Strait of Canso, a range of hills of which the highest is Cape Porcupine (640 feet) rises abruptly along the Strait

Scenery.

and presents "in the solitude of rocky streams and leafy trees" many romantic scenes, one of the best known of which is Hartley's waterfall at Pirate Harbor, more interesting perhaps to the botanist than the geologist because of the occurrence of certain rare species of ferns. Views of striking beauty abound on West Bay in the more imposing Sporting and North Mountains, whose greater picturesqueness, however, entails rough walking and toilsome climbing. Marble Mountain is one of the most charming places on the Bras d'Or Lake. Here firm, extensive beaches afford safe and excellent bathing.

Brooks.

The streams are long, considering the nature of the country. River

Inhabitants rises, seventeen miles from its mouth, within three miles of the Long Point shore; and north of Glendale another branch has its origin near the sources of Denys, Graham and Southwest Mabou Rivers. These rivers originate among the hills in innumerable tiny streams from marshes and lakes or bubble out clear and cold from the foot of some rocky cliff; rush down the rugged and precipitous sides of the mountains, plunging over rocks or hurrying through dark and gloomy ravines; and unite to stray in the lower reaches among rich meadows and farms, at different seasons as clear winding rivers or turbid, swollen, irresistible floods, sweeping to destruction bridges, hay and other obstacles. Diogenes Brook, a tributary of River Inhabitants, affords one instance of a stream disappearing beneath a cliff of limestone to emerge again as a strong spring; and another example of this phenomenon on a smaller scale is seen where a brook flows through a gypsum cliff into the pond at the head of Plaster Cove. The streams flowing from the steep sides of the hills that look towards West Bay and the Strait of Canso are short and rapid: those on the opposite slopes are longer and less turbulent.

Lakes. Lakes abound in the southern part of this district, but are rare in the north owing to the more elevated character of the country. In the mountainous districts few lakes occur; on Madame Island and in Guysborough county, which is comparatively level, most of the rivers take their rise from the lakes. Grant, Summers, Buchanan and Paddy's Lakes have each two distinct outlets, whereas the water of some of the plaster ponds has no visible means of egress. Their surface is often specked with flocks of waterfowl—ducks, geese and loons—and in many of them trout, salmon and gaspereaux abound.

Sea-shore. The sea coast east and south of the Strait of Canso is greatly indented and guarded by far-extending rocks and islands which render the approach to the harbors perilous and difficult; whilst between the strait and Judique it is unbroken, often flat and without harbors. The cliffs seldom descend sheer into the water, and can therefore be examined; but long stretches of the shore are devoid of rock outcrops.

Villages. Scattered everywhere along the sea-shore are villages and hamlets inhabited by fishermen, usually surrounded by sterile and unproductive land covered here and there with stunted trees. Farming is prosecuted in the rich valleys of some of the rivers and around the Bras d'Or Lake. The settlements on Madame Island and at River Moulin, Seal Cove, River Bourgeois and Beaver Island are chiefly French; with these exceptions the population of the north side of the strait is of Highland Scotch descent, that on the south side of mixed origin.

General geological structure. As in Cape Breton county, the hills are composed either wholly or in part of precarboniferous, and the valleys, of softer, carboniferous

Carboniferous basin.

rocks, forming anticlines and synclines respectively. The general form is that of a great basin of carboniferous strata, interrupted by the older rocks of the Sporting, North and Craignish Mountains. The rim of this basin follows St. Peters Inlet, Lennox Passage and the Strait of Canso; and its highest rocks are found about two miles north of Inhabitants Basin. Underlying these upper rocks are the plaster and limestone of Little River together with the coal seams of the Richmond coalfield and River Inhabitants, extending down to the belt of plaster and limestone of Plaster Cove or Hastings, which is probably equivalent to that of Lennox Ferry and St. Peters and may be regarded as the base of the carboniferous system. Unconformably beneath the limestone come the slate, sandstone and conglomerate of Madame Island, McMillan Point and Guysborough, which are cut in many places by dykes and masses of diorite and trap, probably irrupted after the deposition of the limestone, at least in the neighborhood of St. Peters. Then follow the George River limestone and the felspathic group. The strata being greatly faulted and contorted their relations cannot be unravelled with as much ease as in Cape Breton county.

These formations will be described as follows:

Groups of rocks

Precambrian. { Syenitic, Gneissoid and other Felspathic Rocks. / George River Limestone.

Devonian Metamorphic Rocks.

Carboniferous Rocks.

PRECAMBRIAN.

Syenitic, Gneissoid and other Felspathic Rocks.

These as already remarked, occupy well-defined areas in the south-eastern part of Madame Island near the county town of Arichat, at Cape Porcupine on the Strait of Canso and in the Sporting, North and Craignish Mountains. On Madame Island they consist chiefly of felsites like those of Louisburg, resembling sometimes also the intrusive rocks near St. Peters. At Cape Porcupine, slates are associated with coarse syenite* and Louisburg felsite; in the Sporting Mountain the felsites occur with red syenite; whereas the North and Craignish Mountains consist principally of reddish syenite, overlaid here and there by crystalline limestone and other rocks of the George River series.

Arichat Felsites.—At Shaw Point on Rocky Bay is a small patch of purplish and greenish diorite, felsite and quartz-felsite, often vesicular and amygdaloidal, containing much chlorite, epidote and calcspar in

* The term *syenite* is applied in this as well as previous reports on Cape Breton, to a mixture of quartz, potash- or soda-felspar and hornblende; *diorite*, to a mixture of felspar (usually soda- or lime-felspar) and hornblende.

veins. At Fourgier Point, dark-green, light grey and red porphyritic felsite, stained with hematite, appears from beneath devonian strata; and at the head of Bewes Pond a finely laminated, compact, splintery porphyry dips N. 19° E., running thence along the south shore of the pond on a coast of the character usually formed by these rocks—rough, and indented, with outlying points and submerged rocks. These change from compact to granular and at the eastern point dip N. 10° E. Ranteleau Point exhibits huge blocks of a black mixture of hornblende and felspar. The hornblende predominates and occurs also in large porphyritic spots. Epidote is found in the joints and as minute veins.

Around Petite Anse bright flesh-red felsite, quartz-felsite and dark diorite underlie the devonian grey conglomerate. Further south is a curious outcrop of greenish and reddish calc-veined, compact rock with a northerly dip, only a small portion of which is bedded. Generally it resembles a compact felsite of the Louisburg series, but in places an altered form of the sandstone and conglomerate, or a hard coherent argillite. A bluish-grey variety is seen at low water, full of calcspar with traces of gypsum; it contains masses of bluish limestone, and is not unlike a doubtful felsite seen near Grand River bridge. Perhaps it should be regarded as intrusive and post-devonian or as a part of the conglomerate which it appears both to overlie and underlie.

Petite Anse.

Calcareous rock.

On the north-west corner of Green Island is a dark bluish-grey compact quartz-felsite, containing mica in very fine specks and black splendent hornblende in waving bands one to two inches in thickness. This rock is very heavy and has a metallic ring when struck. Chlorite ramifies in all directions through it; and quartz veins also occur, some of which are an inch and a half thick, run regularly for ten or twelve feet and carry specks of iron and copper pyrites with an iridescent tarnish. On the highest point of the island where the lighthouse stands, the same hornblendic quartz-felsite is seen, while conglomerate blocks prevail on the slopes. Quartzites, containing only patches of felspar, dip steeply northward at the south-west corner. On the south they are much contorted and dip N. 20° W. The dip at the south-east corner is the same, at the east end, S. 40° E., and on the north and north-east, S. 20° E. at a high angle.

Green Island.

Quartz veins.

Copper ore.

On the north side of Mackerel Cove green, bluish, purple and grey, porphyritic felsite, quartz-felsite and diorite, with films of hematite in joints, are exposed with buff compact quartz-felsite and mottled fragmentary felsite, probably belonging to this series. On the south side felsites of many colors are intimately mixed. A compact salmon-colored variety appears in lenticular masses throughout green chloritic felsites, which are veined with calcspar and mixed with dark-green diorite and fine waving, contorted quartz-felsite and felsite-breccia.

Mackerel Cove porphyry.

Breccia.

Iron ore. Small quantities of hematite occur in threads and films. These rocks extending to Presquile Cove are there overlaid by conglomerate.

Crid Islands. On the most easterly of the Crid Islands, a patch of dark bluish-green dioritic felsite, interbedded with light and dark salmon-colored, compact, hematitic and chloritic felsite, becoming coarse-grained, extends about forty yards from the eastern point and is capped by conglomerate.

Arichat. Two parallel bands, of varying width, of rocks precisely like those just described extend from near the shore of Rocky Bay to the westward of Arichat.

Sporting Mountain Felsites.—The second ridge of these rocks forms the Sporting Mountains, which run from the vicinity of St. Peters Inlet close to the shore of West Bay as far as Black River. An outlying spur forms the nucleus of Ballam Head, while another extends to the rear of McPherson's on the St. Peters road. Outcrops are everywhere displayed in the brooks, and a brief description will here be given of the principal ones, beginning at the north-east extremity of the hills near Scott Brook.

Morrison Harbor. In one of the streams flowing into West Bay east of the Morrison road is a greenish porphyritic felsite, with a few grains of hornblende, mica and quartz and films of hematite, which weathers in places bright flesh-red. In another of these streams, greenish and grey compact and granular quartz-felsite, with a little hornblende, passing into syenite, diorite, felsite and imperfect gneiss, is met with near the shore road, associated with soft greenish, pearly, aluminous slate, apparently irregularly bedded, and with coarse-grained quartz-felsite in layers one to six inches thick, which breaks along planes covered with films of hematite. These have a striking resemblance to the Capelin Cove strata (Report for 1877-78, p. 9 F.) and, although massive-looking in the cliffs, closer examination shows a strike up stream of the fine interlocking laminæ of the rock. The brook runs in a continuous gorge above the road.

In the brook just west of the Morrison road, similar rocks are well exposed in gorges and cataracts. They comprise:

1. Reddish, fine syenite with very little hornblende and streaks of chlorite.
2. Nearly compact felsite and diorite with films of hematite. In places the hornblende and felspar are distinct, forming a fine, granular, black and variegated rock.
3. A breccia like that of Louisburg and Cape Rhumore.
4. Greenish and reddish fine diorite, passing into coarse syenite.

Copper ore.

5. Reddish quartz-felsite or chloritic syenite containing minute traces of copper carbonate.
6. Greenish, soft, calcareous, soapy, granular, shaly rocks, containing felspar and hornblende together with a serpentinous mineral. Dip S. 38° E. $<$ 80° but variable.

7. Diorite dipping as above.
8. Greenish, grey and whitish Louisburg shales, passing into granular diorite and syenite. Calcspar often present.
9. Diorites and altered diorites with chloritic, very calcareous, soft rocks.
10. Soft and hard, soapy shales, containing granules of quartz. Sometimes they resemble the whitish altered felsite of McKeagan Brook (Report for 1875-76, p. 424) assayed by Mr. Hoffmann and found to be suitable for the manufacture of fire-bricks.
11. Bright variegated breccias like those of Louisburg, or of more sober tints, with close-set oblique interlocking plates. Most of the rocks are friable and often soft, but others consist of pure felspar and are hard and splintery.
12. Near the source of the brook, shales and diorites are associated with grey or reddish, jointed, massive syenite, coarse and epidotic, containing also mica and iron pyrites.

This brook, rising from a mossy marsh, runs into a glade along which grow maple, beech and birch. Between its source and the Morrison road is a wet, brown, mossy barren, underlaid by felspathic and dioritic rocks.

Hill's Brook.

In Hill's Brook, near the post-office, diorite in well-defined layers strikes S. 60° E., with massive and granular or laminated, porphyritic, felsite. In the adjoining brook is a quartzo-felspathic rock in which quartz greatly predominates and is also abundant in the form of veins; associated with grey and reddish granular syenite and compact felsite, and succeeded, higher up, by bottle-green epidotic diorite.

The large beautiful brook east of Robert Morrison's is bordered by rocky overhanging cliffs surmounted by birch and maple, whose leaves are painted in the dark water of the pools in which the brook rests for a moment after dashing over the jagged rocks in white foaming cascades or small vertical falls. The following succession is displayed above the road:

1. Purplish, compact, epidotic, massive felsite, not well exposed.
2. Purplish finely laminated felsite.
3. Coherent, fragmentary, nearly compact Louisburg felsites, with pearly planes. Blotches of quartz and vugs containing large crystals of that mineral. Dip S. E. $< 60°$.
4. Epidotic fragmentary felsites with all the bright colors of the Coxheath and Louisburg series. Small cubes of iron pyrites, also traces of hornblende and chlorite.
5. Compact felsites and fragmentary rocks in great variety containing much quartz; often finely crystalline and mixed with chlorite.
6. Light-grey and greenish, pyritous, rather massive felsite containing many granules, blotches and veins of quartz and hornblende.
7. Dark diorite and grey and light-green felspathic shales and compact pyritous felsite and quartz-felsite, variable in color and texture, passing into one another. Such changes are common among the laminated rocks, the lamination being preserved through all the changes. In some of the

mixtures the quartz gradually predominates and a quartzite results. Dip south-easterly.

8. Granular syenite and diorite, passing into syenite which occupies the brook and forms gorges and rapids. One cascade is very beautiful being about ten feet high and triangular.
9. Beautifully mottled, fine Louisburg felsite-breccia, granular in structure. The brook rises from a marsh full of small frog-ponds.

Prihgle Brook. Near West Bay, reddish and grey syenite, felsite and diorite strike across the Pringle road. In the large brook crossing from Pringle Lake similar rocks are seen, blotched with quartz. The stream is wild and rocky, black and turbulent, running between rugged cliffs in gorges and foaming falls. From Pringle's mills westward the road skirts the boundary between the felsites and carboniferous rocks, the former being well exposed in all the brooks. In one of these, at a

Trap. shingle mill, purplish trap-like rocks, greenish and purplish, compact, porphyritic, massive felsite and aluminous shales, one-eighth of an inch thick and upwards, occur with greenish fine diorite in which felspar and hornblende are well mixed. Above the fork, in the left branch, Louisburg felsites of every shade of color and accompanying soft calcareous pearly slates, alternate with syenite and granular diorite; and interesting transitions from one variety to the other are frequent.

Quartz veins and epidote. Quartz veins, often an inch thick, run irregularly in the bedding, and epidote is also present. In the east branch of this brook, a compact purplish and bluish felsite shows white porphyritic spots of felspar; it is obliquely jointed, thick-bedded and associated with a white compact

Large crystals felsite and dark purple porphyry, containing crystals of felspar an inch in length. Among other varieties are red syenite and dark-purple, finely-laminated, soapy, contorted, aluminous shales.

In other brooks to the westward and on the shore road, reddish-brown and dark purple felsite, with white, black and yellow spots and streaks, jointed and with hematite in some of the joints, is mixed with grey and coarse syenite. Fine black glittering specks, perhaps of

Magnetic iron. magnetic iron, occur in some of the purple felsites.

The outlier south of Ballam Head consists of dark bluish-grey compact felsite well seen in the brooks that follows the northern boundary between the precambrian and carboniferous rocks. In several branches of Black River the western outcrops of these felsites are met with. The southern spur of the hill was traced across the Grand Anse and Grandique roads to its termination near McPherson's. In one of the Grand

Gneiss. Anse brooks is a fine-grained hornblendic gneiss containing a few specks of mica associated with a compact mottled syenite presenting the appearance of Castile soap.

River Tillard. In the western branch of River Tillard below Mountain Lake, under-

lying the conglomerate, sandstone and shale comes blue, green, white, purple and mottled porphyritic felsite breaking into small pieces, succeeded higher up by coarse grey diorite and syenite in which the constituents are well mixed. The felsite appears to dip to the south-east, but no lines of bedding are visible in the syenite. A deep pool and celebrated series of falls occur in this brook in the syenite which is curiously inclined on either side to the running water.

In more easterly branches of River Tillard, which cross the Morrison road, these rocks are also seen in contact with newer strata, and consist of greenish, granular and porphyritic, chloritic diorite, mixed with greenish and reddish rather friable syenite, and with mottled greenish, red and purple, soft, soapy shales. Syenite and aluminous shales.

North of the road to Malcolm Ross' house, grey and rusty, pyritous, somewhat pearly, laminated felsite and diorite dip S. E. $< 70°$ at the junction of a coarse and coherent carboniferous conglomerate.

Guysborough Felsites.–These may be regarded, for the most part at least, as an extension of the felspathic rocks of the Craignish Hills, from which they are separated by the Strait of Canso. Their greatest development is at Cape Porcupine, a hill which rises abruptly from the strait between Auld Cove and Port Mulgrave, having in its centre a series of slates surrounded by syenite and felsite. Cape Porcupine

South of the old cable-landing, epidotic porphyritic felsites, of grey, bluish and other colors, veined and blotched with quartz and calcspar in a direction S. 3° E., which seems also to be that of bedding, are close to the slates. Further from the contact there is great variety in the color and texture of the rocks, some beds being obscurely gneissoid like those of Capelin Cove. The last of the slate series to the southward are bluish-grey flinty quartzo-felspathic sandstones or compact quartzites, full of quartz and resembling the cambrian rocks of Framboise and the vicinity. (Report for 1877-78, p. 15 F.) Further inland the slates are greenish-grey and soft, cleft across the bedding, jointed and pyritous, silky and containing serpentine in irregular planes. They are essentially argillaceous but include compact quartz-veined quartzites, which, however, do not appear to be persistent. On the north side of the slates, near the end of the path from Auld Cove, syenite and soft calcareous diorite are irregularly mixed on the shore. A light bluish-grey quartzite or quartzose grit, like that of Framboise, abuts against the syenite, which is here full of small veins of quartz and calcspar, and intersected by dark-green diorite. The contact is peculiar. On the west side a band of grit and quartzite, varying from ten to sixteen feet, runs S. 10° E. into the hill as far as seen, the separating bed being a reddish compact quartzose felsite, full of white veins and probably belonging to the syenite series. On the east side the line of contact is curved and the Felsite. Quartzite. Slates. Contact of quartzite and syenite.

quartzite appears to lie as it were on the dark quartz-felsite and porphyry that succeed. Another band of quartzite is found among the felsites at no great distance, mixed with patches of silky quartz-veined bluish-grey slate. Then comes a large exposure of these rocks, succeeded by a greenish, rough, compact and fine-grained, soft, calc-veined diorite dyke which converts the slates in contact into flinty felsites. The slates are perhaps most like those of River Denys, which accompany the mica-schists and crystalline limestone. The felsites may be older, but are more probably of contemporaneous or subsequent igneous origin; they appear to be both bedded and intrusive and with the syenites quite surround the slates which seem to rest upon them in basin, form, as shown on the map. There is no question of all being older than the Clam Harbor or devonian rocks, both from their appearance and stratigraphy, but that they are precambrian can only be inferred from their resemblance to the rocks of the other side of the strait. The slates being often twisted, the quartz and other hard bands sometimes assume a "barrel" shape; and in other ways they resemble the gold-bearing rocks of Nova Scotia, as well as the doubtful rock found on the French road near Gabarus and the strata of Shenacadie. Slaty cleavage is always more distinct than among the devonian rocks. They contain traces of iron pyrites and are greatly contorted. Sometimes they are silky, hard and coherent, assuming the character of felsite, veined with milky quartz, like that of River Denys cross roads, in common with which they have been supposed to carry gold.

Dyke.

Barrel quartz.

Slates supposed to be auriferous.

Stewart Pond.

Not far west of Stewart Pond is an outcrop of rock which may belong to this series but is perhaps newer and intrusive. As the neighboring rocks are generally felsitic conglomerates and the felsites appear to be at no great depth, they may, in the absence of more definite information, be placed in this position. They comprise trap-like and felspathic rocks of various colors, sometimes compact sometimes coarse or fine grained. In general they are like the trappean hematitic rocks of Gregwa Brook. (Report for 1876-7, p. 412.) The surrounding shales are purplish like those of Salmon Creek district. (Report for 1877-8, p. 23 F.)

Another outcrop of syenitic, probably precambrian, rock is met with in Goose Harbor River above the shore road.

Craignish Felsites.—Nearly the whole mass of the Sporting Mountain is composed of Coxheath felsites, whereas only the southern portion of the Craignish Hills is so constituted, the northern part being made up chiefly of coarse syenite and granite capped by the crystalline limestone and gneiss series.

Port Hastings.

Immediately east of McMillan Point near Port Hastings, beneath the metamorphic rocks there met with, is a small exposure of bright green

chloritic and calcareous felsite and coarse syenitic rock. It would perhaps be rash to assert that this is not an intrusive rock belonging to the devonian metamorphic series, the actual contact of the slates not being seen; yet, taken in connection with the fact that felsites of the Craignish Hills are not far distant and that a similar rock underlies the slates and sandstones at Cape Porcupine opposite, it seems more probably a knob of the pre-cambrian group.

Long Pond.

North of Long Pond at the shore road, is a larger similar outcrop of greenish calcareous felsite with a few small veins of calcspar and specks of iron pyrites, jointed in every direction and containing hematite in the joints; associated with a dark-grey calcareous rock.

Horton Brook amygdaloid.

In two places in Horton Brook below the lake, are roughly bedded or jointed dark-purplish, granular felsite and amygdaloid with amygdules of calcspar and chlorite, which may also belong to the devonian series rather than to this. On the north shore of the lake are outcrops of massive, splintery, greyish and bluish, granular and compact felsite and quartz-felsite, which look in places like altered syenitic and felsitic grits. In the hills north of the lake, conglomerate and grit appear unconformably spread over felsite and diorite. Near the Lake Horton road, coherent grit and conglomerate are underlaid by dark purplish fragmentary and amygdaloidal, epidotic felsite, vesicular on the surface, and by coarse diorite. In the brook above the lake is a grey amygdaloid, yielding easily to the knife, the grey grit in the neighborhood being nearly horizontal. It has no bedding, is greatly broken and often resembles argillite. On the track from the head of Horton Brook to the General Line road, grey coarse syenitic rock occurs. An outcrop, probably continuous with those in Horton Brook, is first seen to the eastward of Long Pond and thence trends northward towards Craignish. It consists of greenish-grey fragmentary felsite, blotched with quartz, overlaid by grey conglomerate. In one of the little brooks to the northward grey coarse syenite is in place, overlaid by coherent conglomerate. At Craignish, grey and violet epidotic felsite and quartz-felsite occur with fine-grained, dirty brown jointed diorite, in which the felspar and hornblende cannot be distinguished, and an amygdaloid with amygdules of calcspar, felspar and quartz. On the shore road, diorite and quartz-felsite occur, and in one of the small brooks north of the chapel greenish, soft, pearly, laminated cleft Louisburg shales strike N. 33° W. with dark-green finely crystalline amygdaloidal diorite. On the Craignish road near the shore, are the followlng varieties:

Craignish.

1. Dark-green fine diorite and light-reddish compact and granular felsite and quartz-felsite, sometimes with minute vugs lined with crystals of quartz.
2. Yellow-spotted compact felsite, usually with a tinge of red or purple.

3. Compact or nearly compact felsite or diorite mixed with light-reddish, very epidotic quartz-felsite, more or less granular.
4. Light and dark-greenish felsite, quartz-felsite, diorite and syenite, compact and coarse-grained. When the felspar predominates the rock is compact; fine-grained when hornblende is abundant, and distinctly granular when there is much quartz, although patches of compact quartzite also occur. There are masses of twisted, obscurely laminated rocks, like those of Louisburg, but as a rule the bedding is not plain and the rocks are for the most part syenitic.

Age of the Coxheath felsites.

The distribution of the Coxheath and Louisburg felsites here lends strength to the assumption that they belong to the syenite series and are older than the crystalline limestone series which appears at no great distance from them and distinctly overlies the syenite into which these felsites insensibly merge.

North-west arm of R. Inhabitants.

North of the General Line road in the North-west Arm of River Inhabitants are fragmentary felsites, generally grey, resembling those of Louisburg, and possibly, igneous rocks invading the metamorphic strata. It is never difficult to distinguish between the felsites and the carboniferous rocks; and there is also very little doubt that the great mass of the felsites is older than the metamorphic rocks of the neighborhood instead of the cause of their alteration. But these rocks are all so much altered that it is hard to prove that the felsites are not intrusive in certain cases, where they are not themselves bedded. Further examination of some of the principal doubtful points of contact is necessary to determine this question.

Brown's Brook.

In Brown's Brook above the General Line road are purplish, grey and reddish, porphyritic, fragmentary rocks, sometimes soft and with difficulty distinguishable from argillites; but further from the contact hard and coherent. They resemble the rocks of Cape Rhumore, are calcareous and hematitic, having an oblique slaty cleavage in addition to a variable northerly vertical strike. In the bed of the brook is a three-feet band of whitish, spotted, calcareous rock, so soft as to be easily ground to powder by the fingers and full of minute crystals of quartz, standing between two walls of red felsite, not persistent but disappearing both ways on its line of strike. Higher up the brook are cliffs of greenish granular diorite, compact and fragmentary, porphyritic felsite of different colors, and other rocks of the series, including a reddish-grey granular quartz-felsite.

Heffernan Pond.

About the farm road crossing from Heffernan Pond to the General Line road, the coherent grits, slates and conglomerates are underlaid by greenish felsite and dark diorite. Not far from the brook, coarse syenite, with grains of quartz about the size of split peas, weathers whitish-grey and appears again in other brooks of the neighborhood associated with quartz-felsite and felsite.

The prevailing rock of this series about Queensville (The Ridge) is a reddish or grey coarse syenite, often containing little hornblende and passing into felsite, quartz-felsite and diorite, cut in various directions by many dark-green dykes. One of these dykes is distinctly marked off from the syenite by jagged edges. It is not easy to determine whether the appearance of bedding often seen in the syenite is a system of jointing or obscure gneissic foliation. Queensville.

In the upper part of Queensville Brook, felsite and syenite are intermixed and all the brooks of the region show similar transitions from one rock to the other.

The Rough Brook of River Inhabitants is, as its name implies, a hard brook to follow, owing to the large rounded blocks, dangerous slippery outcrops and the cascades and rapids which frequently occur in its bed. Near its source it flows over light pink syenite with an apparent dip of E. $< 45°$, associated with quartz-felsite, containing a little hornblende and passing into a mixture of quartz and hornblende. The syenite is sometimes compact and veined with dark-green calcareous, pyritous, epidotic diorite, but also very coarse; it contains many specks of a light-green soft mineral. Below the path at Donald McIsaac's, coarse reddish-grey syenite is cut by many small dykes of greenish-grey diorite and by a blue massive fine-grained, crystalline mixture of hornblende and felspar, with blotches and veins of epidote. One of these dykes is about twenty-five yards wide. In places there is a passage of the syenite into compact felsite and quartz-felsite, intersected by irregular lenticular veins of barren quartz, about an inch in thickness. Rough Brook. Dykes. Quartz veins.

The first precambrian rock seen above the Victoria road in McMaster Brook is a bluish-grey, pyritous, fine diorite and splintery quartzite, probably belonging to the George River series. This is succeeded by reddish-grey syenite the surface of which is rough with small prism-pyramids of vitreous, colorless quartz. Similar syenite, containing little hornblende, alternates with occasional exposures of diorite for some distance. McMaster Brook.

The hills about Glendale consist principally of coarse and fine syenite, passing into reddish and grey felsite, veined with milky quartz. In one of the brooks below River Inhabitants road is an example of the passage of a fine, jointed syenite into red felsite, quartz-felsite and diorite. Similar rocks occur in River Inhabitants below the red bridge, and in the brook behind McGillivray's, at the graphite mine, a very coarse red syenite is full of specks of graphite. Perhaps the graphite of the shales at the mine (Report for 1878-9, p. 2 H.,) was derived from this source. Glendale. Graphite.

Passing up McPherson Brook from River Inhabitants road, red and McPherson Brook.

dark steel-grey, fine and coarse syenite and diorite are met with, containing minute crystals of iron pyrites. Sometimes the grains of felspar appear on the surface as large white spots. Crystalline limestone rests upon the syenite which also occurs beyond. The syenite is very coarse, quartz and felspar predominating. The latter is in large flesh-red crystals; the quartz in crystals sometimes as large as a pea, the hornblende often in semi-crystalline pockets. The syenite dips doubtfully N. 20° E., and is followed up stream by a rock consisting almost wholly of hornblende, and by various other rocks, including a crystalline limestone, which seems to dip in the same direction as the syenite. The occurrence of hornblendic, coarse, porphyritic and gneissoid rocks in the neighborhood of the George River limestone has been frequently noticed and may have some bearing on the question of its metamorphism.

Contact with limestone.

South-west Mabou River.

In the branches of South-west Mabou River which flow from River Denys road, red syenite is met with for some distance down; and is then overlaid by grey, hard, quartzose sandstone. The brook near Squire McDonald's shows only grey, greenish and reddish syenite and granite mixed, whereas in the adjoining branch of River Denys slaty and well stratified rocks are seen. On the River Denys road hematitic syenite succeeds laminated rocks.

Graham River.

After passing the marshes and meadows, near the source of the main branch of Graham River, rapids and cascades are met with in syenite, sometimes imperfectly granular, fine crystalline diorite, and a gneissoid rock probably connected with the crystalline limestone of the neighborhood. The syenite is often epidotic, and cut by dykes of quartz-veined, calcareous, hornblendic rock, probably of the same age as those which penetrate the overlying grits and conglomerates. The number of diorite dykes is somewhat remarkable; thin bands run in the syenite and large masses stretch across the brook. In one place a fine diorite surrounds a small piece of syenite.

Dykes.

Chisholm Brook.

In the north branch of Chisholm Brook, pink quartz-felsite, dark bluish-grey, compact, yellow-streaked diorite and syenite underlie a quartzite. Perhaps the succeeding diorite is like those just described a newer intrusive rock. Syenite is found on the hills farther north, but need not here be referred to.

North Mountain Felsites.—The rock which generally underlies the crystalline limestone series in the North Mountain is, as before stated, a syenite. This is first seen near the road which runs from Big Brook road near the chapel to the head of West Bay, where dark-grey, ringing, compact syenite and diorite are overlaid by carboniferous sandstone. The syenite, composed almost wholly of felspar and quartz, passes also into a felsite as seen in some of the brooks, which exhibit fine

Passage of syenite into felsite.

falls. On the hills behind Mrs. Archibald Kennedy's, near the school, red sandstone detritus gives place to red coarse syenite which extends far back, although traces of carboniferous rock are found in some of the clearings on the top. In the north branch of McLeod Brook flesh-colored, fine-grained, slightly crystalline felsite is associated with an intimate mixture of quartz and hornblende, dark-blue felsite, containing small clear grains of quartz, and red coarse granite, in which the mica is golden and the felspar in large flesh-red grains. Diorite dykes occur in the red granite. Large blocks of crystalline limestone were also found, but none in place. On the road from West Bay to Big Brook, near the crossing of the south branch of McLeod Brook, and again nearer Big Brook, grey and reddish sandstones are succeeded by syenite, granite and quartz-felsite, generally reddish, in which the grains of quartz and felspar are often as large as marbles, and the mica is in small bronze-yellow, scattered plates. Descending the brook from the road, coarse flesh-red granite is met with, having an obscure south-east vertical trend, in thick layers, penetrated by greenish dykes. It forms several cascades, massive mural cliffs thirty feet high, and small caves. Lower down it is overlaid by bluish-grey, carboniferous, argillaceous shale with a high northerly dip. The brooks of the neighborhood, rising from cold, clear springs, soon cut deeply into the granite and syenite, increase rapidly, and rush into the carboniferous lowlands. In Ross Brook, exposures of dark porphyritic felsite are seen, with white and grey syenite, in which the quartz greatly predominates. Sometimes the different constituents run in streaks or are separated in patches. In the same neighborhood mottled white and yellow marble, in thick beds, interstratified with white quartzite containing mica, abuts against a quartzite.

McLeod Brook.

Ross Brook.

Marble.

On the shore of West Bay at Ross Creek red syenite crops from beneath a limestone and conglomerate, being, near the contact, strongly seamed with hematite. It is sometimes compact but usually granular, the grains being often as large as peas. On the roads over the hills between this creek and Big Brook, these rocks are also met with. Among the more interesting varieties is a light-grey granite, consisting of flesh-red felspar, the grains of which are as large as walnuts, pure white quartz and very little mica. A brownish-grey compact felsite also appears with bluish-grey coarse syenite and an intimate mixture of quartz and hornblende.

Ross Creek, West Bay.

The path from John McInnes' to John McCuishpig's passes over syenite and diorite, the latter sometimes coarse and grey, with grains of felspar as large as peas. In the south branch of Ross Brook below this track, are dark-green diorite, fine-grained syenite, hard quartzose felsite, grey granite, gneiss and calcareous quartzose felsite. A vein of six inches of quartz runs in a northerly direction.

North Mountain.

In all the brooks between Ross Creek and Little Harbor these rocks are found beneath the crystalline limestone. In a brook near the North Mountain church, grey and reddish granite, usually coarse but sometimes fine or nearly compact, containing bronze or black mica, reddish and whitish felspar, white quartz and, occasionally, grains of hornblende, strikes apparently up stream. Syenite occupies most of the country near Marble Mountain, associated with the crystalline limestone, as shown on the map.

River Denys.

On the River Denys side of the mountain good exposures are also everywhere present in the brooks, all of which have been examined. A few points of interest with reference to these may be stated. The syenite is sometimes cut by porphyritic dykes and passes into granite containing golden mica. Sometimes the rock is felsite, sometimes it contains a large proportion of quartz, and thin seams of hematite often occur. In the gorges of McKenzie Brook is a reddish, coarse, jointed syenite, running into a granite with grains of milky quartz as large as hazelnuts, reddish felspar, silvery mica and greenish-black hornblende. Irregular joints are stained with hematite.

McKenzie Brook.

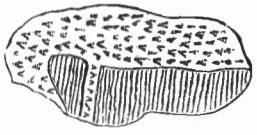
McIntyre Brook.

Some distance above the old mill in McIntyre Brook near River Denys, red coarse syenite, containing mica, is the prevailing rock, although greenish pyritous diorite also appears. A good many small falls occur between the lake and the road, all exhibiting these rocks, which are also exposed in the neighboring hills.

Search for coal!

In the millbrook, a tributary of Big Brook further south, the reddish and grey syenite contains much mica and calcspar in seams. In this syenite a hole has been dug to search for coal, pieces of which are reported to have been found here. At the mill, greatly contorted gneiss is mixed with coarse syenite, one block presenting the appearance shown in the annexed figure. The syenite seems to be part of

Gneiss mixed with syenite.



a vein cutting the gneiss, yet in places there is a distinct passage of the gneiss into syenite.

In one of the branches of Princeville Brook the syenite is composed chiefly of greenish-black hornblende and felspar with pink patches of felspar and quartz, jointed in every direction, and with a yellowish-green mineral in the joints. It is pink and grey in color and passes

into a pure quartz-rock. Near the marble which occurs in the brook it becomes a quartz-mica rock, and also a quaternary granite with streaks or veins of barren milky quartz. In a more southerly branch of this brook a coarse reddish mixture of felspar, quartz, hornblende and mica is associated with greenish, coarse, talcose granite and dykes of compact, porphyritic diorite.

Mabou Felsites.—Red, grey and greenish Coxheath felsites, often porphyritic, occur on the roads down the right bank of Mabou River below Mabou, but need not be noticed at present.

Precambrian or George River Limestone.

The description of the crystalline limestone series of the St. Anns and Boisdale Hills (Report for 1875-6, p. 381, et al.) is equally applicable to the more widely distributed rocks of this formation in the region under consideration. The opinion already expressed that this forms an overlying, unconformable group of precambrian age is greatly strengthened by the results of recent investigations, the limestones in every case capping the felsites, with which, however, they often seem to blend near the contact as if by a common metamorphism, such as that referred to by Dr. Honeyman in the Transactions of the Nova Scotian Institute of Natural Science, Vol. III., Part III., page 197. That the felsites were subsequently intruded or contemporaneous volcanic deposits seems less probable. Unconformability.

In the North Mountain and northern part of the Craignish Hills the rock underlying the limestone series is granular syenite, whereas in the southern part of the Craignish Hills it is in contact with the Coxheath felsites. No less than ten or twelve distinct outliers occur in the North Mountain and seven on the Craignish Hills, the limits of which have been defined with a considerable degree of care. Blocks are also found in other places, as for example near Craignish, perhaps indicating the occurrence of other outliers; and possibly the slates and quartzites of Cape Porcupine (p. 9 F) may belong to the series. A vivid contrast is often observed between the brilliant green of the foliage of the trees which grow on the crystalline limestone and the more sombre tints of the evergreens of the felsitic areas. Distribution.

Crystalline Limestone of North Mountain.—The most southerly outcrop of this group on the North Mountain is found in several streams near the source of Big Brook and on the road to West Bay, where whitish-grey crystalline limestone appears among the syenite, granite and quartz-felsite of the district. In the neighborhood of another outcrop of whitish marble, intimately mixed with felsite and with quartz which also contains serpentine, mica and a fibrous mineral, the syenite passes into micaceous and talcose granite and quartz-mica rock. A similar passage First outlier.

Benacadie Glen.

was observed in Benacadie Glen (Report for 1876-7, p. 411), except that there the limestone was not found in place; and it is likely that some of the laminated rocks of that district should be regarded as of the George River series, more especially as crystalline limestone containing traces of copper ore is said to have been discovered there.

Ross Brook outlier.

The second outlier is found in and to the eastward of Ross Brook, where, near John McCuish's road, grey syenite with very little felspar, contorted quartz and hornblende rocks are associated with quartz-felsite containing hornblende and quartz in veins and succeeded by white crystalline limestone about nine feet wide, which seems to abut against the syenite, dipping N. 25° E. The constituents of the syenite run in streaks, and in places a pure crystalline quartz results. On McCuish's road, red soil is seen near the water, but further inland, blocks of white marble appear, although syenite is the only rock found in place. On the tracks about McCuish's, a mixture of quartz and hornblende occurs with flesh-red quaternary granite, rather compact, with the quartz and felspar, hornblende and golden mica in small grains; and with compact, light-colored, subcrystalline or crystalline limestone, weathering white or dull grey, dipping N. 43° E. at a high angle, and of various shades of white, green and blue, spotted with some black extraneous matter. Seams of golden mica in fine scales run through the limestone, the layers of which are often less than an inch in thickness. On a neighboring track, thin and thick bedded limestone dips N. 64° W.; it is of a mottled greenish-yellow and white color and contains specks and streaks of black and silvery mica, so plentiful in places as to constitute the greater part of the rock. With the limestone is associated dark-greenish-grey and bluish felsite, seamed with greenish-yellow quartz and passing into white quartzite with a few specks of felspar and hornblende.

Relative position of the limestone and syenite.

Several brooks to the eastward of McCuish's exhibit only syenite, whereas limestone is present on the adjoining hills, apparently always overlying the syenite, the latter being cut into by the brooks in wearing out the gorges in which they run. Unless the limestone is newer than the syenite the latter must be intrusive, whilst the former represents patches of a series that has been lifted up and altered by it. But the syenite appears rather to be a more highly metamorphosed form of the felsites and gneisses upon which the limestone has been laid down, and in common with which it has afterward been altered. The proximity of the limestone may have influenced the products of metamorphism and have given rise in some way to the gneisses and coarse porphyritic mixtures usually found along the line of contact.

Dallas Brook outlier.

Another mass of these rocks occupies the shore of West Bay about Dallas Brook, and stretches westward towards the valley of River

Denys. In Dallas Brook at the bridge on the shore road, greenish shaly felsite dips about N. 25° W. $< 60°$. On the shore to the eastward, greenish-grey, compact, flinty felsite, jointed, massive and veined with quartz and calcspar occurs with cream-colored pyritous limestone, often epidotic, bringing to mind the rocks of Benacadie and Shenacadie. For some distance up stream, blocks of limestone abound. From the brook to the track to Kenneth Campbell's, the rocks are fine, massive, compact and felsitic, passing into contorted gneiss, some of which resembles highly altered argillaceous shale. Between Campbell's and the shore road similar rocks occur, perhaps more altered. In Campbell Brook, calcareous felsite succeeds the syenite and is accompanied by bluish-grey crystalline limestone and argillite, containing veins of quartz and specks of iron pyrites. Similar alternations are exposed in other brooks of this interesting region.

In the clearings to the eastward of Dallas Brook, behind the house of Mr. Norman McKinnon, layered felsite, limestone and slate are met with, whilst on the top of the hill limestone occurs, and further back, syenite, displaying a curious admixture of finely foliated gneiss. In some examples the syenite begins abruptly, as if cutting vein-like across the strike of the gneiss; in others the transition from syenite to gneiss is gradual. As at George River, the gneiss is associated with large masses of white quartzite. On a wood road where it crosses a small branch of Dallas Brook is a massive felsite like that of River Denys, whilst above the road the brook exposes a light-grey, pearly, twisted, quartz-veined slate. Pieces of coherent sandstone are also found in this vicinity but belong of course to a higher formation. On the same wood road a graphitic limestone forms a number of funnel-shaped pits, and gra- Graphite.
phitic slates are not uncommon in other areas of these rocks.

In the brook north of Dallas Brook bluish calcareo-felspathic slate appears below the bridge. Above it, vertically, light-greenish slates, the softer varieties cleaving into small pieces, strike S. 63° W. Higher still, a rusty-weathering mixture of compact quartz, felspar and calcspar, the first two predominating, dips south at a high angle and is succeeded by a bluish, fine, crystalline limestone which has been quarried. This contains large masses of white calcspar, which shine Quarry.
like burnished silver in the sun, in bright contrast with the dull lustre of the limestone. One branch of this brook comes from a spring over- Spring.
shadowed by a large beech tree and immediately beneath the syenite hill. Higher up in the main branch, grey and reddish syenite, the joints of which run up stream and across, passes into compact felsite, quartz-felsite and quartzite, rusty on the surface, cut by small veins of calcspar and resembling certain Boisdale rocks. With these are asso- Graphitic slates mistaken for coal.
ciated soft, friable, graphitic slates, dipping down stream at a high

angle, which have been mistaken for coal. Marble and diorite are found nearer the fork of the brook from the spring, and on the neighboring hills an amygdaloid with whitish soft spots is followed, near the syenite, by quartz-felsite. In other brooks flowing into West Bay from this outlier, contorted, layered limestone is interstratified with dark splintery felsite of varying color, texture and purity.

Amygdaloid.

Grey soft granite occupies the shore of West Bay near the church, but in the fields are many huge blocks of marble. Between two bands of compact felsite is an outcrop of bluish and greenish botryoidal felsite, veined with white crystalline quartz, waving and shaly, with serpentinous matter in some of the joints, which gives the rock a soapy feel. In one place it is so contorted as to form a series of small synclines and anticlines not more than an inch and a half wide at their base. Whitish and bluish-grey marble is exposed in many quarries in the fields; and near the church a graphitic limestone has been burned.

Contorted beds.

Graphitic limestone.

Campbell Brook.

Succeeding the syenite in the branch of Campbell Brook that flows from Donald McMillan's on the track to River Denys, are the following strata in order as they are met on descending the brook:

Talc-granite.

1. A coarse granular mixture of quartz, felspar and soft, light-canary-colored talc, from among which the particles of quartz can easily be cut. Lower down the brook this passes into a nearly pure quartzite, the grains of which cohere so strongly that it is only on weathered surfaces that the granular structure becomes evident.
2. Pyritous limestone-breccia.
3. Obscurely granular calcareous rock and whitish and bluish crystalline limestone with spots of clay.
4. A great variety of calcareous talcose and argillaceous shale or slate, dipping about S. 20° W., nearly vertically.

In a branch of this brook running from the road nearer River Denys, a coarse and fine, friable talc-granite, with white silvery mica, is associated with an impure, rusty, compact felsite followed by syenite cut by a lenticular, trap-like dyke, succeeded in turn by bluish-grey, pure, fine limestone and whitish pyritous, rusty-weathering, coarse limestone.

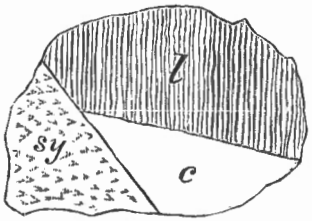
Gneiss and slates.

Between Kenneth Campbell's and the shore is a fine grey granite often twisted and gneissic. Something like a passage towards the shaly and felsitic rocks is often observed in the gneiss. At another outcrop in the vicinity, limestone is succeeded by a cliff of syenite and porphyritic diorite in contact with fine mica-schist or gneiss. Gneiss, mica-schist and quartzite follow the eastern boundary of this outlier behind Alexander McDonald's (Wild Sandy), the gneiss containing small veins of coarse syenite, and the syenite, fragments of gneiss. Further up, other patches of whitish crystalline limestone appear, some beds of

which are covered on the surface with large knobs of light-greenish and white serpentine; but the hills are composed mainly of syenite. The gneiss dips or strikes into the syenite veins as the case may be, but the contact of syenite with limestone was not here seen. Serpentine-limestone.

An imperfectly bedded, rough gneiss occurs on the hills behind Christopher Campbell's, syenite and crystalline limestone being also in the neighborhood. Another outlier is seen on the shore of Sydenham Lake to the northward. Sydenham Lake.

On the left bank of the Church Brook syenite is exposed for some distance above the shore road, succeeded by crystalline limestone intermixed with compact porphyritic felsite or quartz-felsite, like that of Benacadie Pond (Report for 1876-77, p. 408), and perhaps volcanic. In one place the syenite and limestone show an irregular contact. In a mass imbedded in the ground the calc-schist (*l*) seems to strike into Church Brook.



a syenite (*sy*) or in other words to be cut obliquely across the bedding by the syenite, the rock at (*c*) being concealed. If the mass is in place, as seems likely, the schist forms a boat-shaped outcrop between syenite on the north, south and east sides. Similar contacts are found on the large scale, and masses of syenite, gneiss and mica-schist are everywhere in the neighborhood associated with coarse, crumpled limestone.

The small outlier at Rory McLeod's quarry is worthy of notice, as being the first marble wrought by Mr. Brown. Here the relation of the syenite to the marble is well seen. Syenite everywhere adjoins the latter and seems in places to pass unconformably beneath it. The line of contact is very irregular, the limestone running in long tongues into the syenite. The syenite may be intrusive, but the absence of veins or dykes in the limestone seems to contradict this supposition. Or the limestone may fill deep, irregular hollows in the syenite, to which, however, the frequent vertical nature of the contact might be considered as opposed. Unlike the crystalline limestone elsewhere, the whole mass is homogeneous, not shaly nor even clearly bedded; it has been quarried to some depth and is white and good. McLeod's quarry.

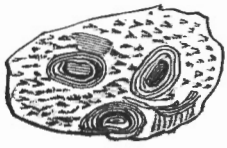
Marble Mountain.

The shore of the Bras d'Or Lake, from Marble Mountain westward, is low and the beach is covered with blocks, chiefly of coarse syenite or granite, probably sometimes in situ. Then come crumbling banks of rusty, compact felsite, weathering to clay, and bluish-grey and greenish argillaceous shales or slates like those frequently associated with the George River limestone, mixed with felsite, quartzite and limestone, in thin contorted layers. The whole series is like that of River Denys, hereafter to be described. The relation of the syenitic rocks to the limestone is interesting. In one instance a few bands of fine gneiss traverse a large block of coarse syenite, while a little further west flaggy and shaly limestone with a somewhat jumbled dip is underlaid by dark blue argillaceous slates. On the road in the vicinity syenite is in place, so that these strata seem to fringe the syenite like the cambrian rocks at Eskasoni. (Report for 1876-7, p. 428.) Still further west a compact, rusty white quartzite, passing into dirty calcareous rock and into a cream-yellow mixture of quartz, felspar and limestone, like that found at Queensville and Craignish, is on the shore, blocks of limestone lying along the waterline; and this with felsite forms a rocky shore.

Marble Mountain.

Foliated rocks.

The upper part of the steep brook immediately south of the post-office at Marble Mountain is occupied by grey coarse syenite and granite. Near the road, bluish-grey, graphitic crystalline limestone has been largely quarried. Just above the limestone, on the hill side, a curious block was seen among others of coarse syenite, consist-



ing of a coarse syenite in which three pieces of greenish fine diorite and gneiss lie like pebbles in a conglomerate. Around them the syenite is finer and foliated, as well as in other parts where they do not occur. This foliation does not completely surround the diorite and the transition from it to the syenite in two cases is abrupt. Below the road, limestone is in high cliffs, succeeded near the shore by layered, greenish and grey, calcareous and felsitic rocks, greatly broken. The limestone near Marble Mountain dips sometimes northerly, sometimes southerly.

Rocks at the marble quarry.

It has been already described in the Report for 1877-78, p. 30 F., but has since been carefully traced and the different outcrops and workings marked on the map so as to show the irregular manner in which the limestone and syenite are associated. The tunnels and pits display the

character of the limestone. The yellowish crumbling rock referred to, p. 31 F., at the Grand quarry, consists of layers of limestone, rusty clay and soft, spotted, soapy rock, yielding easily to the knife.

On the shore north of Marble Mountain, a greenish-grey coarse syenite or talcose diorite, with very little quartz, is seen to pass into a dark rock, containing, besides hornblende, only a few specks of felspar, and finer than the syenite into which it again passes. It is in close proximity to a very coarse, greenish and whitish, spotted mixture of felspar and hornblende, with scales of mica. This gives place to greenish-grey contorted gneiss and massive, foliated rocks, in which bedding and jointing may easily be confounded. A thick bed of crystalline limestone crops out on the shore beyond.

McKenzie Brook.

Near a small lake on a branch of McKenzie Brook, and again below the lake, are other exposures of crystalline limestone, surrounded on all sides by syenite.

Cave and quarry.

A cave three feet high and ten square occurs in another outlier of bluish-grey limestone, which has been quarried to a small extent by Squire McDonald, west of the track from Marble Mountain to McKenzie Creek. The dip is S. 50° W. $< 25°$, but irregular. Syenite is in place to the eastward. In the small brooks near Squire McDonald's, on the shore, greenish laminated felsite, jointed, and dipping S. 70° E. < 80, or grey, compact and massive, is associated with light bluish-grey, granular, pyritous diorite and grey, crystalline, imperfect syenite or felsite. Between this and the brook at Little Harbor post-office, outcrops of crystalline limestone also appear.

McDonald's millbrook.

In Squire McDonald's millbrook, the first rock seen above the road is a compact felsite, striking about west vertically, succeeded by grey compact quartzite and quartz-felsite, dipping south-easterly. This is followed by bluish-grey, fine, layered felsite, hornblende-schist and quartz-felsite; and these by hornblende-schist, splintery schistose quartzite and mixed rocks, micaceous and sometimes resembling the diorite about Chisholm's mill, River Denys. Mixed gneissic and granitic rocks follow; then very coarse syenite. After a long interval of syenite, bluish-grey and whitish crystalline limestone, perhaps continuous with that in which the cave occurs, is met with at a minute pond at the head of one branch of this brook. In the other branch all the outcrops seen were of syenite.

Little Harbor.

Near Little Harbor, crystalline limestone is exposed in many of the fields, as indicated on the map. Nearly half a mile south-east of Little Harbor, on the shore, is a cliff, about ten feet high, of crystalline limestone and rusty, jointed breccia, the fragments being apparently of bluish-grey crystalline limestone, with a few of grey felsite. The dip

Limestone-breccia.

is greatly contorted. The breccia runs into limestone, and at the north end of the outcrop is a bluish-grey hematitic, jointed felsite, and dark bluish-grey, graphitic, argillaceous rock.

Crystalline Limestone of the Craignish Hills.—Turning now from North Mountain, we may enumerate the most important points in connection with the crystalline limestone and associated strata of the Craignish Hills.

Queensville.

The most southerly of the outliers of these hills is west of the Victoria road, and between Queensville and McMaster Brooks. It consists of bluish, semi-crystalline, quartzose limestone, associated with contorted, dioritic shale, seamed with a dark-grey pearly mineral and alternating with banded, contorted felsites; succeeded by coarse red syenite, banded felsite and bluish and whitish crystalline limestone, veined with white calcite. It has been used for lime, but is said to be hard to burn. Two other bands lie to the north-westward of this, at Queensville.

Queensville Brook.

Underlying the coherent grits, argillites and conglomerates of Queensville Brook is a series of obscure rocks, probably mixed with volcanic matter. They comprise the following strata, in the order seen on ascending the brook:

1. Dark steel-grey hornblendic felsite, very compact, and with greatly contorted bedding.
2. Quartzite in bands, dark-grey, flesh-red, hard and compact.
3. Dark-grey, pearly, argillaceous shale, greatly contorted.
4. Alternations of argillites and felsites.
5. Dark-grey calcareous rock, fine-grained or compact, passing into pearly, calcareous argillite, presenting a fantastically contorted appearance on the exterior. Blotches of white quartz.
6. Hornblendic felsite or diorite, and calcareous quartzite, sometimes finely laminated, talcose and slaty. The diorite is probably intrusive.
7. Thick-bedded felsite, streaked with hematite.
8. Reddish coarse syenite.

Superposition of the limestone.

North of the brook a band of limestone is met with on the road, and occasional exposures are seen on the south bank. Higher up, near the east branch of this brook, coarse syenite is in contact with bluish contorted crystalline limestone, often containing an admixture of quartz and felspar, succeeded by diorite and brownish-white semi-crystalline quartzite, seamed with calcite. The limestone is shown to belong to a series overlying the syenite by its occurrence in the low hills adjoining the brook, whereas the brook bed is of syenite. Some of the associated rocks may be of volcanic origin, and the diorite dykes which cut the syenite in this district are probably the same as those which penetrate and affect the calcites to a much greater degree. The passage from this series to the coherent devonian grits is abrupt, and

the latter appear to contain pebbles of the former. On the General Line road is a limestone intersected by white quartz, which runs in irregular gash veins, or forms a large part of a mixed rock. Quartz veins.

Between the source of Lamey Brook and the Northwest Arm of River Inhabitants, a mass of white and light-reddish quartzo-felspathic grit has been metamorphosed into a compact and fine-grained, seldom coarse quartzite, full of quartz veins. This is accompanied by reddish-grey, porphyritic, fragmentary felsite, and knobs of grey compact felsite. The Cape Porcupine grit is the nearest ally of this quartzite, which in texture resembles the jasper-conglomerate of Lake Huron. It is certainly not an altered form of the conglomerate and grit of the lower part of the brook. Both here and at Cape Porcupine, the felsite may be an igneous rock (the apparent lines of bedding at Cape Porcupine being like those of a furnace-slag). It has been clearly shown that the syenite of the cape is older than the conglomerate and grit, which are the same on both sides of the strait; but that it is associated with the felsite and quartzite as part of the same series, is not so clear. One might be laurentian the other huronian, or an upper portion of the laurentian series. Lamey Brook quartzite. Origin of the felsite.

Another of the curious mixtures of quartz, felsite and calcite, so characteristic of this formation, is found in another outlier at Queensville, with a band of white and grey, crystalline, calc-veined limestone. It is bluish-white, reddish, mottled and semi-crystalline, cut by dykes or irregular intermixtures of dark-green diorite, and surrounded by syenite and felsite.

On the hills behind Craignish several doubtful outcrops of limited extent are met with, and blocks of limestone abound. No other outcrops are known south of Glendale, where this formation again appears and stretches to Whycocomagh, presenting a much greater variety of rocks than at any of the other localities. Fine exposures occur in McPherson Brook, above River Inhabitants road, as follows: Craignish. Glendale.

1. Red and grey, coarse, pyritous syenite, dipping apparently in the same direction as the succeeding rocks. Strike N. 70° W.
2. Dark-grey and pure white crystalline limestone, containing bands of diorite and crystals of calcspar, and associated with light yellowish-green quartzose rock, containing small masses of quartz, and passing into dark-grey quartzo-felspathic rock, coherent and compact. McPherson Brook limestone, felsite, and syenite.
3. Steel-grey hornblendic quartzite, red and grey syenite, and hornblendic felsite, seamed with crystalline limestone, forming the western boundary of the limestone, and the same as the syenite of the other wall.
4. Alternations of syenite and limestone, the strike changing, higher up the brook, to north-west. The contact in the brook shows blocks lying against a bed of coarse syenite, the syenite being jagged and jointed. Higher up, the limestone strikes N. 25° W.

5. Dark-green felsite, underlaid by limestone.
6. Syenite, passing into yellowish and red, spotted, pyritous felsite, then back again into coarse greenish syenite, this into crystalline limestone, and then into coherent, semi-crystalline, fine-grained felsite. Some of the limestone is colored a brilliant green on the surface. The rocks are roughly mixed in patches, having no definite arrangement.
7. After an interval, red syenite strikes N. 75° W., and is followed by dark, fine-grained felsite, holding quartz, hornblende and iron pyrites.
8. Limestone, felsite and syenite are occasionally seen higher up.

After a long period of syenite, just below the road to Long Point the brook falls over dark and light-grey crystalline limestone, flanked by syenite and passing into sea-green felsite, together with light and dark-brown, compact, coherent quartzite, striking about N. 25° W. Near a fork of the brook is an exposure of bluish-grey and white crystalline limestone. Above the road is a dark greenish-grey diorite, then red syenite, and above it bluish-grey banded calcite; followed by very fine-grained red syenite and dark-grey felsite, passing into quartz-hornblende rock, sea-green felsite, or yellowish-white, compact, banded, waving limestone, striking N. 60° W. The contact of the rocks appears to be somewhat sinuous, but the faces are even, not jagged. Other outcrops which occur on the road present no features of interest.

Glendale Brook.

In the various feeders of Glendale Brook, east of River Inhabitants road, crystalline and semi-crystalline, shaly, often impure limestone of whitish, grey and other colors, in places stained bright-green, dips as shown on the map. Sometimes it consists of a mixture of quartz, with a little limestone and grains of pyrites, and seems to be intimately associated with a coarse diorite containing a few grains of quartz. This runs into grey quartz-felsite and friable felsite, containing serpentine in the joints. Underlying the carboniferous rocks above the post-office, is a bluish-grey and purple quartz-felsite, with hematite in the joints, associated with a rather impure, rusty, hard limestone, stained with hematite, and containing small veins of calcspar. Besides the limestone there belong to this series in the region, a dark bluish-grey, or black, graphitic argillaceous rock, with serpentine in the joints, and a quartz-felsite or quartzite. A passage is often observed of one of these rocks into the other. The dips observed are recorded on the map.

Graham River gneiss and limestone.

Near the source of Graham River, and a short distance above the bridge on the old River Denys road, is a gneissic quartz-felsite, jointed, and dipping about N. 65° E. $< 45°$. On the right bank, for at least a hundred yards above the bridge, banded calcite occurs, the brook perhaps forming its western boundary. But syenite is in place both

above and below the bridge, and the outlier cannot be extensive. The brook is wild, rocky and full of cascades, running between steep banks and forming a prominent feature in the country. In one of its tributaries from the right bank, a whitish and bluish-grey finely crystalline calcite, with canary-yellow spots, strikes N. 56° W., near the syenite, but more northerly higher up stream. Sometimes it is a compact, beautiful, ringing stone. Much chlorite and soapy matter occur irregularly, with some layers, and the whole rock is a mixed one, with a roughened, dirty, weathered surface. Occasionally it contains minute specks of iron pyrites, and sometimes shows an obscure oblique slaty cleavage. Some parts are coarsely saccharoidal. It is usually finely laminated, although the laminæ cohere so strongly as to give it a massive appearance. Higher up the brook banded calc-felsite occurs with a more calcareous rock, succeeded by milky quartzite and bluish, compact, felsitic, banded rock. Then limestone blocks, beyond which nothing appears in the brook.

Mixed rocks of River Denys road.

In the same neighborhood, and near the River Denys road, a group of mixed rocks of considerable interest occurs. Large blocks of a conglomerate, which might be carboniferous or a concretionary form of the limestone, are associated with others of epidotic rock and coarse coherent conglomerate, without limestone pebbles. The concretionary limestone is intimately mixed with quartz and felspar, and is massive like that of Arichat and Queensville. It may belong to a newer series, altered with the grits and conglomerates of the neighborhood. It has a striking resemblance to that found on the shore of the Bras d'Or Lake at Matheson's quarry, North Mountain. (Page 23 F.) But the grit blocks of the neighborhood are very different from it, and perhaps it is a volcanic mixture. At Queensville, as at Graham River, the limestone is associated with much altered grit and conglomerate, which may point to their common origin. That they may be altered carboniferous strata is not impossible; and in places they do not resemble the George River series. The limestone is said to be hard to burn. Blocks of very compact quartzite occur with it, as well as crystalline limestone mixed and veined with felsite.

Victoria road.

The last area of these rocks to be mentioned is that which extends from the neighborhood of Glendale along the Victoria road, to Whycocomagh. They are well displayed on the road from Glendale to River Denys chapel and the adjoining brooks; in the east and west branches of McLennan's millbrook, and in another brook south of River Denys cross-roads. In addition to the calcite, they consist here of dark-grey, laminated felsite, streaked and veined with quartz; fine-grained, coherent petrosilex, calc-veined, jointed, in thick and thin beds, with purple and green blotches; argillite, waving and contorted; granular diorite, containing large masses of white quartzite.

In the brook north of McLennan's mill, contorted and slickensided mica-schist, associated with semi-crystalline quartzite in layers of a quarter of an inch to an inch in thickness, and with petrosilex containing blotches of white quartz, underlies the carboniferous conglomerate. By the addition of silvery mica, the quartzite and petrosilex pass into mica-schists, often pearly, greatly waved and contorted. A seam of light-brownish micaceous quartzite, four inches thick, runs through the schists, some of which contain large flakes of golden mica and much hematite. Alternations of these rocks occur as far as the source of the brook.

Schistose rocks at River Denys chapel.

On the River Denys road, between the source of the South-west Mabou River and River Denys cross-roads, calcite and mica-schist are well displayed in a curiously broken country. At the top of the hill, near the chapel, branches of the South-west Mabou, Denys and Inhabitants Rivers take their rise, deepening rapidly in their several directions into beautiful glens. Springs are, as usual, abundant in the limestone.

Diogenes Brook.

In the west branch of Diogenes Brook, which flows from the chapel, greenish-grey jointed quartz-felsite is found, but below the road to Glencoe the brook loses itself beneath a cliff of crystalline limestone fifteen or twenty feet high, coming out again as a large spring several hundred yards distant. Near this spring, a grey and reddish quartzite forms a succession of falls; and below these falls is a mixed quartz-calcite, together with a yellowish and bluish-grey limestone, which appears in the tributary flowing from the spring. In this tributary, also, syenitic rock is associated with crystalline limestone; and for some distance down the united brook indefinite outcrops of felsite and argillaceous shale and calcite are found.

In a brook which flows to this one from the River Denys road, and not far above the junction, dark greenish, crumbling, dioritic and felsitic rocks, full of soft matter, partly calcareous, occur, with impure limestone, plainly bedded and mixed with granular and compact hematitic felsite and quartzite, and with thick-bedded, whitish, reddish and bluish limestone, containing streaks of soft greenish matter. These rocks continue as far as a fork of the brook, where red friable syenite is in place at a fall. They dip off this syenite to the eastward; but among them appears syenite of the same kind, with which they are either lenticularly interbedded, or which may be a transformed portion of the other rocks. The massive syenite of the fall may belong also to this series, or the impure limestones may be shallow water deposits on the older syenite. The line of junction at the fall is also that of strike. Above this fall, in the north branch of the brook, huge masses of limestone form an outcrop in the bank, resting apparently on a floor of compact, splintery felsite and quartz-felsite, as on the syenite at

Junction of limestone and syenite.

Queensville. Hematitic syenite succeeds, and extends to the road. In the south branch of this brook, soft, soapy, obscurely bedded rocks occur, near the road, followed lower down by compact, splintery felsite or petrosilex, with many large blotches of milky quartz. After this comes syenite. Then crystalline limestone occupies the right bank, the syenite being in the left bank and bed, the brook following a gorge between the two, and descending steeply at the same time. There is nothing to indicate the bedding of the limestone, which often comes in between a quartz-felsite and the syenite. It seems to be about eighteen feet thick, and looks like a great vein. Near the junction with the other brook is a dark, compact, friable felsite, breaking into minute pieces, every one of which is surrounded by films of calcspar. This distribution of the felsite, syenite and limestone resembles the condition of occurrence of the similar rocks in the main branch of River Denys, which will be again referred to.

In the same brook, at Colin Chisholm's mill, greenish and bluish slaty quartz-felsite dips obscurely up stream. In a tributary which enters from the north, above the dam, white compact quartzite appears, with massive quartzo-felspathic rock and bluish-grey, soft and hard, argillaceous and felsitic slate. One of these rocks appears to be a greatly altered quartzo-felspathic sandstone, interbedded with slaty argillite, breaking into pieces of every shape. Massive, reddish-white quartzite, very coherent and nearly compact, having the appearance of a grit so altered that the grains are well-nigh obliterated, is associated with very coherent, cream-colored and whitish quartzite and compact vitreous quartz in high falls, above which comes a bluish-grey, rusty-weathering, very pyritous, splintery quartzo-felspathic rock ; a dark, calcareous felsite; a flinty felsite or petrosilex, with softer, more or less argillaceous, bluish rocks. Roughly bedded felsitic, jointed rocks, with bands of different colors, and probably altered argillites, occur above a fork of the brook, in a series of cascades. They extend to the source of the brook, whereas in an adjoining stream, which flows to South-west Mabou, syenite alone is met with. In Diogenes Brook, not far above the feeder just described, is a cliff of whitish-spotted crystalline limestone, underlaid by greenish and reddish, friable, coarse syenite, dipping about N. $<$ 70°. Higher up come quartzites and a compact mixture of felsite and quartzite, also a cream-colored mixture of quartz and calcite. Ascending the next large feeder from the north, we come to a cliff of fine crystalline limestone, in thick beds, or massive and with blotches of white or colorless quartz, up to a foot in length. It is generally whitish, with a tinge of yellow, but varies in color and texture. Among others is a bluish-grey variety, containing films of graphite and serpentine in the planes along which it

Quartzites.

Quartz veins.

breaks. It is followed by a greenish-grey, compact, impure, pyritous limestone, underlaid by mixed rocks containing chlorite and pyrites, passing downward into a pyritous felsite. Grey, bluish-grey and whitish compact quartzite follows, massive or in thin layers, and often containing felspar. Syenite then intervenes, and continues to the branch of South-west Mabou, to the northward. For some distance the brook follows close along the syenite on the north, as this rock appears in several of the tiny streams from that side. In a branch of this brook which enters not far above the Victoria road, at Finlay McPhail's, greenish-grey calcareous felsite, impure limestone and quartzite run into and are interbedded with one another. Eastward from Diogenes Brook, a tiny stream crosses to the north side of River Denys road, which follows its glen to the cross-roads. Below the road this brook displays :—

Syenite.

Gneissic rocks of River Denys cross-roads.

1. Foliated gneiss.
2. Finely laminated mica-schist, with small veins of quartz, and full of silvery mica. Dip, N.W. $< 16°$, but greatly folded on the strike.
3. Masses of grey granite also appear among the foliated rocks. Small lenticular veins, sometimes six inches thick, of a somewhat oily quartz, bluish-grey and white, occur in the bedding, showing specks of iron pyrites.
4. Schists, passing into crumpled quartzites, including bands of light-colored and white, thin-bedded limestone, underlaid by a dark, compact mica-felsite.
5. Massive, yellowish-white, finely crystalline limestone.
6. Mica-schist, associated with reddish-grey quarternary granite, massive and cut by quartz veins. Sometimes the crystals of quartz and felspar in this granite are two inches in length. Shows no bedding.
7. Banded mixture of quartz and limestone resting upon the granite.
8. Less schistose, crumbling rocks, full of mica.
9. Foliated mica-schist, dipping N. 30° E. $< 58°$.
10. Grey and bluish-grey, finely crystalline hornblende rock or diorite, showing no bedding, yet perhaps, as well as the granite, bedded with the other rocks, because a limestone seems to dip regularly N.E. from it. Contains long, delicate crystals, perhaps of andalusite.
11. Crystalline limestone.
12. Light bluish-grey, somewhat massive quartzite, passing into mica-schist. In a small tributary from the north, very quartzose rocks, with masses and irregular veins of quartz, holding large flakes of mica, are followed by massive quaternary granite and quartz-mica rocks, with a north-easterly dip.
13. Light-blue and greenish-grey mica-schists, dipping S. 65° W. $< 55°$, quartz-veined, and full of crystalline mica, with a vein of light, compact calcite, the rocks in the vicinity of which are greatly contorted. An obscure, slaty cleavage. The dip is again north-easterly.
14. Thin bands of limestone, interstratified with thin-bedded quartzites, which contain no mica.

15. Similar quartzites, containing felspar, and occasionally mica, with many cross quartz veins. Some of these quartzites have been supposed to contain gold, and a quartz-mill was erected some years ago on this brook to crush them. Quartzites supposed to carry gold.
16. Quartzites, with fewer quartz veins, and more mica in very small specks, greatly broken by cross joints.
17. *Carboniferous conglomerate*, composed of pebbles of the foregoing strata.

In other small brooks near River Denys cross-roads, quartzite and mica-schist underlie the carboniferous rocks. In one of them is a compact granite, containing much mica, and breaking into small angular pieces, together with a breccia composed of pieces of this rock, with quartzite; also, greenish-grey, laminated argillites, with concretions; quartzite, with red patches of felsite and blotches of white quartz; red-banded and jointed micaceous quartzite, overlaid by the carboniferous conglomerate.

In a brook crossing the Victoria road, further north, near J. R. Morrison's, above the plaster and other carboniferous rocks, which are not well seen, come bluish grey felsite and argillite; grey, whitish and colorless, vitreous quartzites, massive or finely interlaminated with felsite, and resembling a half-formed gneiss; purplish, thin-bedded, greatly altered argillites; a massive mixture of fine felsite and quartzite. Higher up are cliffs of greenish-grey, massive, nearly compact, porphyritic felsite, and grey, fine-grained, pyritous, calcareous and felsitic rock, weathering like a breccia, and mixed with impure crystalline limestone and fine porphyritic diorite. Similar outcrops of layered rock occur in all the branches of this brook and others of the neighborhood. Argillites. Felsite

McPhail Brook, the next important stream, exposes plaster for some distance, underlaid by felsitic rock, containing calcite, quartz and serpentine, and passing into altered argillite. These are associated higher up with crystalline and semi-crystalline limestone, containing felspar and quartz, in waving, contorted bands. Higher still, crystalline limestone is more abundant. The usual alternations and mixtures continue over great areas. Argillite-felsite. quartzite-felsite, limestone-felsite, all occur. The quartzites are often fantastically contorted, as well as the limestones and mixed rocks. The greater part of this brook rises from springs near the road to Glencoe, on which, also, many exposures of crystalline limestone were seen. McPhail Brook.

The next brook is the main branch of River Denys, which exhibits the following succession above the Victoria road, the rocks being much mixed:— River Denys.

1. Brown, coherent, fine-grained quartzite.
2. Red and greenish fine and coarse syenite.

3. Bluish-grey, fine crystalline limestone. The actual contact of the syenite is here seen.
4. Dark, bluish-grey, highly altered argillite and felsite, compact, jointed, broken, contorted; veined with quartz, calcspar and felspar; talcose in the joints. Its contact with the limestone is sinuous, and the two seem to be intermixed, and pass into each other. Thick or thin-bedded.
5. Diorite, limestone and quartzite.
6. Steel-grey quartzite and petrosilex, passing into finely laminated felsite.
7. Laminated quartzites, chiefly of greenish, grey and whitish colors, occupying a great distance in the brook above the first feeder.
8. Above the quartzites, in one of the branches, are laminated felsites, resembling the quartzites in color and texture, and mixed with or passing into pearly mica-schist. Innumerable details concerning such mixtures might be given, but would be of no use. The chief feature is that no great mass of limestone appears in the lower part of this brook and its branches, mixtures being very frequent.
9. Limestone and dark grey felsite. The former is often serpentinous.
10. Mixed rocks, with serpentine in the joints; sometimes epidotic.
11. Contorted mica-schist, passing into argillite, containing veins of quartz and calcspar.

Blue's mills.

Near the branch of this brook, which comes from springs near John McDonald's (Gray), mica-schist and pearly argillite, petrosilex and other rocks occur; and on the road from his house to Blue's mills, grey, slaty detritus prevails.

Mull River.

In a tributary of the Mull River, adjoining the source of the southern branch of the last-mentioned stream, similar rocks appear; argillite, quartzite, felsite and a mixed quartz-limestone being among the first seen on descending the brook. These are succeeded by a grey, coarse syenite, overlaid in tu rn by carboniferous strata of the Mull River valley.

Kewstoke and Skye Mountain.

Crystalline limestone, diorite, felsite and other rocks of the River Denys series are met with on the roads about Kewstoke and Skye Mountain. Near Judson's, a grey conglomerate, which extends towards Mabou, is unconformably underlaid by bluish laminated felsite or argillite. On the Victoria road, towards the head of Whycocomagh Bay, laminated felsite and quartz-felsite, compact and fine grained, have a northerly dip. Nearer the bay, blocks of limestone occur in the road, followed by mica-schist. The calcites of Whycocomagh have been carefully studied and described by Dr. Honeyman.*

Devonian (?) Metamorphic Rocks.

Extent.

Rocks similar to those described as devonian in the Report for 1877-78, page 16 F., are met with in Madame Island, occupy nearly the whole of Guysborough county between the Strait of Canso and Chedabucto Bay, and again appear on the north side of the strait, west

* Transactions of the Nova Scotian Institute of Natural Science.

of Plaster Cove, stretching thence north-westward towards River Inhabitants. Probably also part of the country between the Craignish felsites, and the shore is underlaid by this formation.

Unconformity of devonian and carboniferous strata.

Although the unconformity between these rocks and the carboniferous is less marked than that which exists between them and the precambrian series, there are several localities where it cannot be overlooked, as for example near Arichat, at Lennox Ferry and Guysborough Harbor, where the carboniferous rocks, little altered, come in contact with and contain pebbles of the metamorphic rocks. At Lennox Ferry a carboniferous conglomerate seems to hold pebbles of limestone as well as of quartzite, etc., so that unless these be concretionary, the limestone at the quarry may be regarded, as it was near St. Peters, as the highest devonian bed. But as it appears, also, to be equivalent to that of Arichat, and as this rests unconformably upon the underlying conglomerate, it is perhaps better to regard the limestone as the lowest carboniferous bed, altered by the volcanic rocks of St. Peters, which thus belong to lower carboniferous time.

Possibly more than one group.

Fossils.

Many or all of these strata may belong to an older period than the devonian. Dr. J. W. Dawson found in the strata of Rocky Bay, east of Arichat, specimens of a somewhat obscure species of Rhynchonella, which he would refer to the silurian formation, on the analogy of other parts of eastern Nova Scotia. Nor has the region been so well examined as to make it certain that several groups of rocks have not been included under this division. That there are more than one is rendered probable by the occurrence of numbers of pebbles of quartzite in the conglomerate of Arichat. These pebbles, it is true, may be cambrian, but are probably in part newer. This question can perhaps be settled by the fossils which occur in many parts of the district, although for the most part the rocks consist of shallow water deposits in which fossils are few and obscure.

Thickness.

The thickness of the strata is no doubt considerable, although greatly obscured by the changing dip, and the impenetrable nature of the country, which will not admit of close examination. Between Rocky Bay and Lennox Passage alone, there seems to be a vertical thickness of at least 10,000 feet, and other sections indicate no less. In general characters the formation is similar to that part of it which is developed about Loch Lomond and Grand River. The rocks, including the limestone, are for the most part greatly contorted, which is perhaps another reason for placing the latter at the summit of this formation, rather than at the base of the carboniferous; but a crumpled limestone is seen elsewhere, as on Boulardrie Island, where there can be no question of its age; besides, the overlying sandstones and shales near River Bourgeois are equally crumpled.

Devonian rocks of St. Peters.

Before proceeding to describe these rocks as they occur along the Strait of Canso, a few additional references to those east of St. Peters may not be out of place.

In Detter Brook, below the St. Peters road, good exposures of shale, sandstone and quartzite, with a variable dip, are followed, near the shore, by the limestone of McNab Cove. Between Lochside and McNab's Lake, the same slaty, blue limestone is in place, whereas in the neighboring barrens small pieces of reddish sandstone are met with. Similar red sandstones in many of the cultivated fields of the vicinity sometimes strikingly resemble carboniferous rocks. No physical feature marks the division between the supposed carboniferous outliers and the devonian, perhaps because the former lie in shallow, limited patches, protected by the latter; nor is it quite certain that the quartzite pebbles of the carboniferous conglomerate were derived from the devonian series. Yet there can be little doubt that we have here two unconformable groups, as already described.

Mistake in map for 1878.

To the eastward of the schoolhouse at Lochside, the soft red carboniferous rocks do not extend far, pieces of quartzite being in the road. This will lessen somewhat the supposed area of these rocks as shown near the margin of the map for 1878, before they had been so well studied. The limestone near the schoolhouse is that of River Tom and McNab Cove. It dips at a high angle.

Loch Lomond devonian and millstone grit formations.

On the McCuish road, between the lakes of the Loch Lomond chain and immediately beyond the mill, the rusty soil of the millstone grit begins, accompanied by blocks of grey, rusty-weathering, fine and coarse sandstone. The point to the south is a barren, covered with innumerable wintergreen plants. In places, blocks of very compact quartzite lead to the supposition that the country is underlaid by it. Along the shore of the next lake millstone grit is scattered in great abundance. On the road back to the Loch Lomond road from the church, the blocks of wrinkled, veined and slaty limestone, like that of River Tom, may unconformably overlie the quartzite of the point.

A cursory examination of these devonian and millstone grit strata where they approach so close together, might lead to the inference that the quartzite of the former was but a highly altered development of the latter. A closer study of the rock, however, apart from the stratigraphical relations, leaves the impression that the quartzites cannot be altered carboniferous sandstones, any more than the conglomerate of L'Ardoise is an altered form of that of the Bras d'Or Lake. It is not improbable that the unconformity of the various series at Loch Lomond is complicated by faults, the steep strike of the millstone grit along the East Bay Hills, and other facts lending countenance to this conclusion. About Black River, above Grand River bridge, and also

near Loch Cailean, quartz-veined quartzites are in places, with reddish, purplish and greenish slates and conglomerates. Blocks of carboniferous conglomerate occur, however, near the bridge, and on the Soldier Cove road is a probable outcrop of carboniferous rock. Loch Cailean.

The devonian rocks have been followed already from Loch Lomond to Jerome Point near St. Peters. Here they are cut off by the sea, to emerge again on Madame Island, where they are largely developed. On Cap le Rond, the nearest point, red and green, veined, slaty argillites dip N. 14° E. $<$ 35°, and a short distance to the westward, a grey, quartz-veined felspathic sandstone, with patches of conglomerate forms reefs. At the head of Goulet Pond outcrops of white-weathering compact quartzo-felspathic sandstone are seen at intervals. Between the Goulet and Descousse the following descending section occurs, the dip being S. 33° E. $<$ 10°: Madame Island. Goulet Pond.

	FEET.	INCHES.
1. Green, pearly, argillaceous rock, with red blotches	8	0
2. Red, pearly, argillaceous rock	7	0
3. Green argillaceous shale	2	0
4. Red and green mottled argillaceous shale	13	0
5. Greenish and red, somewhat sandy, coherent rock	5	6
6. Greenish crumbling sandstone	1	6
7. Bluish-grey, flaggy sandstone	4	6
8. Grey quartzo-felspathic sandstone, in rough, jointed, often nodular beds	9	0
9. Greenish areno-argillaceous somewhat crumbling rock, with patches of red	5	6
10. Red argillaceous rock, with large green blotches	15	6
11. Red and green, nodular, arenaceous rocks, forming rounded protuberances on the reefs	18	6
12. Grey, compact, quartzo-felspathic sandstone, full of veins	2	6
13. Red and purple argillaceous rock with small green spots	8	6
14. Quartz-veined quartzite, with green blotches	25	0
15. Measures concealed; probably the same as 14	4	0
16. Quartzite like 14	19	0
17. Measures concealed	..	..
Total thickness	149	0

At Descousse, one of the largest villages of the island, grey, greenish and whitish-grey, white-weathering sandstone, breaking into small irregular, angular pieces, and like that of L'Ardoise, occurs east of the chapel and near the mouth of Descousse Brook. Further west this is associated with reddish, micaceous, argillaceous sandstone. In Poulament Brook, greenish, bluish and purplish, coherent, quartzo-felspathic sandstone and argillaceous shale are finely displayed. To the westward, on the shore, rocks are seldom exposed, but the plaster of Lennox Ferry has been traced to Benoit Creek, whence it probably passes to the Descousse. Poulament.

southward of Janvrin Island, or is thrown there by a fault, the rocks of this island being apparently the same as those seen on the shore between Hawkesbury and Port Hastings.

Glasgow Point. At the root of Glasgow Point the sandstones are very coherent, and perhaps of devonian age; and a short distance to the southward dark-grey agillaceous shales and quartzites in alternate layers dip S. 31° E. $<$ 80°. The latter occur also in the road to Le Blanc Harbor,

The Ruisseau. and on both sides of the Ruisseau. At the head of tidewater the dip is seaward at an angle of 20°. On the road to Benoit Creek quartzite barrens abound as far as Grand Lake, followed by somewhat better land, underlaid by dark shale, and quartzites like those mentioned above. The country towards the head of Martinique Cove is doubtful. Between Benoit Creek and Lac Sec, quartzite comes to the surface among the

Lac Sec. marshes and barrens through which the creek flows. About Lac Sec, ridges of conglomerate and sandstone are also abundant, resembling those seen near Shaw Lake on the Grandique road. Grand Lake, West Arichat, and the bays of the neighborhood, show the same rocks. The country from West Arichat to the lakes south of Grand Lake is, for the most part, devoid of trees, rocky or marshy, and chiefly occupied by white-weathering, nearly compact quartzo-felspathic sandstone or quartzite, like that of the Grand River barrens, purplish coarse conglomerate, and grey, coherent, pebbly grit. Near the village of

West Arichat. West Arichat, white quartzite, dark-grey argillite, conglomerate and reddish, waving, calcareous, quartzose sandstone, with green spots exhibit a variable dip.

Creighton Island. On the eastern shore of Creighton Island reefs of grey quartzite alternate with others of indian-red or purple conglomerate, and purple and greenish, flaggy and shaly calc-veined sparkling sandstone and grit, passing into the conglomerate, with vugs lined with quartz-

Picard Reef. crystals. To the eastward of Picard Reef they are broken through by dark-green or bluish, finely crystalline, soft diorite, four feet wide and under, which runs in a general way with the bedding, but crosses at times from one layer to another. The conglomerate and quartzite are not materially altered by this intrusive rock, which is not unlike some of the rocks to the eastward of St. Peters. Nearer Picard Reef, a larger, black, trappean mass occurs on the beach. To the westward the following section is exposed:

	FEET.	INCHES
1. Grey nut- and egg-conglomerate	60	0
2. Bluish-grey fine argillaceous shale	4	0
3. Grey, sparkling, quartzose sandstone	40	0
Total thickness	104	0

A short distance further west, bluish-grey sandstone, grit and con-

glomerate accompany quartzite and bright-red shale. Near Arichat Head, finely laminated bluish-grey argillo-arenaceous shales and flags, full of small coaly impressions and pyritous nodules, in thin layers, waving and greatly contorted, appear to strike into the conglomerate with which they are in contact. They are about sixty feet thick, spotted with calcspar and jointed at irregular intervals both at right angles and obliquely to the bedding. It is probable that these correspond with the Arichat dark shales. Arichat Head, dark shales.

On the eastern Crid Island conglomerate caps a bluish and buff, bedded precambrian felsite, whereas on the western island conglomerate is the only rock found. Crid Islands.

At the Jerseyman Island lighthouse, a red and grey conglomerate runs into bands of red sandstone. To the westward, thick-bedded greenish-grey argillaceous sandstone, veined with calcspar and passing into red shaly sandstone, dips N. 2° E $<$ 20°. Large blocks of dark-bluish limestone are found among the boulders of the point. On the western point, a thick-bedded, light greenish-grey, jointed, quartzose sandstone contains numerous seams and patches of calcspar and passes in places into coarse grit and conglomerate. Jerseyman Island.

On Irish Point, north of Crid Islands, are red and light-green sandstone, conglomerate and grit, often calcareous, with light-grey and greenish limestone running into grit and fine conglomerate, and thin bands of black limestone, seamed with calcspar, dipping steeply eastward in waving beds. Irish Point. Limestone.

To the north and west of the felsite bands at Arichat, conglomerate is well exposed, and with quartzite forms the bold shores of the lakes of clear water south of Grand Lake. On the south side of the head of Arichat Harbor, light bluish-grey fine sandstone is succeeded in a high bank by bluish and blackish, polished, micaceous, graphitic shales, dipping about S. 25° E. $<$ 45°. These shales contain minute entomostracans and strike down the harbor in contorted, nearly vertical bedding. On the roads in the vicinity conglomerate crops out in mounds twenty-five or thirty feet high. It consists of pebbles of red, purple, grey and white quartzite, sandstone, argillite and felsite. At Ranteleau Point it contains large pebbles of Louisburg felsite, and is succeeded by grey, calcareous, flaggy, fine sandstone striking N. 75° E. vertically and often assuming the form of grey limestone of various degrees of purity, sometimes nodular, with calcspar veins. A little further east, copper-green or purplish conglomerate is again in place, including large blocks of quartz-felsite and quartzose sandstone or grit. This extends as far as Grosnez, where it dips N. 22° E. $<$ 30°. Quarter of a mile past Flat Point the dip is N. 18° E $<$ 45°, the greenish conglomerate forming a bold rocky coast on which the waves are lashed Arichat dark shales. Fossils. Conglomerate. Ranteleau Point. Limestone. Grosnez.

into foam and spring high into the air. Long valleys run parallel to the strike, some of them as inlets or minute fiords. In the first broken cove beyond, finer rocks are associated with the conglomerate, greenish, whitish and reddish sandstone or quartzite dipping N. 25° E. < 60°; and similar rocks, with the addition of argillite, continue as far as Cabbage Cove. Cabbage Cove, where the coast is lower, somewhat less rocky and has more beach.

Little Anse. Near Little Anse, bright flesh-red felsite and granular quartz-felsite again appear from beneath the conglomerate which is almost wholly composed of their ruins. This conglomerate occupies the coast as far as Jersey Point; it is bluish and greenish-grey, occasionally reddish, very coherent, veined and blotched in every direction with calcspar, the quantity of calcspar being as remarkable as in many carboniferous conglomerates. It is associated with small and apparently lenticular patches of soft, veined, calcareous rock and grey compact quartzite.

Petitdegrat. The mossy and rocky barrens of the greater part of Petitdegrat Island are occupied by these strata. On the shore near Big Arrow, red, purple and greenish, calcareous, fine, coherent rocks are found with greenish and grey, veined, felspathic and quartzo-felspathic sandstone and conglomerate.

Rocky Bay. The interesting deposits of Rocky Bay alone remain to be noticed. North of the outlet of Shaw Lake, at the shore, coherent grit and fine conglomerate, with thin, irregular veins of quartz, dip steeply N. 25° W., and are followed by purple, greenish and grey grits, indian-red, flaggy and shaly, arenaceous, coherent, harsh, jointed, cleft and waving rocks, like those of Salmon Creek and L'Ardoise (Report for 1877-8, p. 17 F), sometimes friable and pearly, with quartz in films, blotches, and veins which contain much chlorite. The different varieties seem to be confusedly mixed, the sandstone passing on one hand into fine granular quartzite and on the other into compact sandstone, often almost replaced in the bedding and across it by veins of quartz and calcspar. The slates break into their component interlocking plates, giving the beds a waved appearance. They do not seem to contain fossils. Quartzose and felspathic rocks, usually very compact, prevail to the

Fossils. village of Rocky Bay and on the road to Petitnez, some of the finer beds yielding carbonized plants.

South of the outlet of Shaw Lake a good section of these rocks is presented, in descending order, as follows:—

SECTION OF DEVONIAN ROCKS AT ROCKY BAY.

	FEET.	INCHES.
1. Conglomerate, greenish-grey and reddish, rough, and similar to that of L'Ardoise; containing pebbles of every size in a paste of different kinds, but chiefly of fine grit composed		

	FEET.	INCHES.	
of felsite and quartz; often rusty, with a purplish or reddish tinge pervading the cleavage planes. The pebbles are of quartzose sandstone and quartzite—derived from rocks like those of Framboise and Fourchu, but perhaps silurian—together with granular and compact, felsitic and syenitic rocks of the Louisburg series. Dip N. 29° W. < 47°	22	0	
2. Grey and bluish-grey, often flaggy, quartzo-felspathic, micaceous, rippled shales, seamed in all directions with films of calcspar, and containing broken fragments of *Cordaites*	7	0	Plants.
3. Greenish argillo-arenaceous shale, rippled and containing *Cordaites*; full of calcspar streaks and veins which run across the bedding and in it, and also in the joints and cleavage planes. This passes downwards into coherent pebbly grit. In places rusty on the surface and greatly waved. Dip N. 38° W. < 47°	11	9	Calcspar veins.
4. Indian-red and purple, argillaceous, flaggy sandstone, with green calcareous blotches and beds	13	6	
5. Light-green argillaceous shale	0	2	
6. Light-green argillo-arenaceous shale	1	4	
7. Argillaceous, shaly, crumbling rock	0	8	
8. Greenish, argillaceous, flaggy sandstone	1	3	
9. Indian-red and purple, green-spotted argillo-arenaceous rock	13	6	
10. Argillo-arenaceous flaggy sandstone. All are greatly waved but not sufficientiy to interrupt the continuity of the bands	1	4	
11. Measures concealed	4	0	
12. Light greenish-grey, calcareous, argillaceous and arenaceous shale, containing plants in great profusion; serpentine on some surfaces; seamed with films of calcspar. Dip N. 39° W. < 52°	16	0	Plants.
13. Grey and blackish-grey, shaly, argillo-arenaceous rocks, full of plants	36	0	
14. Light-grey, brown-weathering sandstone, passing into fine-grained conglomerate	14	0	
15. Indian-red argillaceous sandstone. In the red rocks no plants were seen	18	0	
16. Measures concealed. Dip N. 19° W. < 34°	38	0	
17. Dark-grey argillaceous shale, full of plants; calcspar veins. A calcareous concretion two inches in diameter	5	6	Plants.
18. Light greenish-grey, flaggy, argillaceous sandstone. Plants	7	0	
19. Light-grey sandstone, passing into conglomerate	4	6	
20. Red, purple and green sandstone	1	10	
21. Red and green, crumbling, shaly sandstone	2	6	
22. Red, purple and green sandstone	0	8	
23. Red and green, crumbling, argillaceous shale	1	9	
24. Bright green argillaceous shale	4	0	
25. Light greenish-grey, flaggy, argillaceous sandstone, with plants in great profusion. Becomes thick-bedded and green below	5	1	

	FEET.	INCHES.
26. Purple and green, mottled, argillaceous sandstone	1	8
27. Purple, spotted, argillaceous sandstone, shaly and thick-bedded, seamed with calcspar	9	0
28. Greenish-grey, argillaceous sandstone, full of calcspar	2	2
29. Grey clay and sandstone in alternate layers	3	6
30. Light-grey, fine-grained conglomerate	1	8
31. Argillaceous shale passing into sandstone	6	6
32. Light-grey grit, with plants. Not all seen	1	6
33. Measures concealed. Dip N. 23° W. $<$ 42°	8	0
34. Bluish argillaceous shale with large concretions	2	0
35. Dark bluish-grey, waving sandstone, with occasional patches of conglomerate; seamed with calcspar	20	0
36. Lighter sandstone passing into shale, pebbly, waving, sometimes brown	7	0
Fucoids. 37. Red, purple and green, rippled, argillaceous, shaly sandstone, with doubtful markings of fucoids	7	0
38. Bright-green shaly argillite	1	6
39. Red and purple calcareous sandstone, shaly in part	3	6
40. Dark grey and blue, flaggy and shaly, argillaceous sandstone, seamed with calcite. Impressions of broken plants	20	0
41. Greenish-grey conglomerate, passing into flaggy sandstone	6	0
42. Conglomerate, passing into and alternating with sandstone and shale, of red, green, purple and other colors. Thickness indefinite	..	..
43. Measures concealed by a sand beach, beyond which felsite is exposed near Fourgier Point, unconformably overlaid by rocks similar to those just described	..	..
Total thickness	332	4

Rocky Islets. The Rocky Islets are of conglomerate, which at the eastern end of the main islet dips N. $<$ 60°. At the western end, the dip is N. 4° W. $<$ 45°. Although slightly bent in places, the strike is always well defined, running along the islets.

Guysborough Devonian Rocks.—The stratigraphical continuity of the devonian strata of Madame Island is interrupted by Janvrin Island and the waters of Chedabucto Bay, but they reappear on the shores of Guysborough county opposite. Immediately south of the pond, at Eddy or Sand Point, red and green, mottled, argillo-arenaceous, compact rock dips N. 19° W. $<$ 45°, underlaid further south by bluish and greenish argillaceous shale, with coherent, jointed, micaceous, arenaceous shale and flaggy sandstone, full of ironstone nodules and blotches and small veins of calcspar, alternating with thick bands of bright red shale. South of Red Head, grey, fine, compact, quartzo-felspathic sandstone occurs, succeeded, on the point north of Cape Argos, by

Eddy or Sand Point.

grey, reddish and purplish conglomerate, somewhat friable, having a northerly, moderate dip. These rocks are not unlike the finer beds of Madame Island, but the proportion of fine to coarse sediments is here reversed. On the shore, westward from Eddy Point, bluish and grey, and mottled red and green, ripple-marked, argillaceous shale, with more coherent, thicker, beautifully waved, arenaceous layers, form steep cliffs, striking parallel to the water for a great distance. In a brook flowing from a lake, about a mile and a quarter west of Eddy Point, bright indian-red and greyish argillite is exposed on and above the shore road. At the mouth of Melford Creek are reddish, grey and rusty, fine sandstones, in thick beds, followed a short distance above the road by grey, white-weathering, quartz-veined, quartzose sandstone, passing into conglomerate, and associated with indian-red sandstone and argillite. The dip is variable. Several falls, ranging from eighteen or twenty feet downward, occur in the grey sandstone. In the north branch, bluish-grey felspathic shale dips westerly, at an angle of 50°, above the bridge, on the Middletown road In the east branch, grey argillaceous sandstone, with indian-red and bluish, shaly argillite, form cascades of considerable beauty. Near the confluence of the north and south branches are other falls over hard, grey quartzose, argillaceous sandstone with variable dip. In the south branch, similar rocks prevail, and near the Middletown road indian-red argillaceous shale dips N. 70° W.

Melford Creek.

Greenish-grey quartzose sandstone and argillaceous shale, the latter marked with vegetable impressions and a shell, like *Modiola*, occur with conglomerate, grit and quartzite between Melford and Steep Creeks. Above the falls of Byers Brook, near the road, the following strata are cut, with a steep easterly dip :—

Fossils.

Byers Brook.

1. Grey, coherent, quartzo-felspathic, coarse grit and conglomerate, with patches of greenish and purplish, fine, micaceous sandstone, streaked with calcspar, and broken by joints.
2. Purplish, fine, micaceous, argillaceous rock and reddish sandstone.
3. Grey and whitish, sparkling, coherent, quartzo-felspathic sandstone and grit, with large blotches of milky quartz. Like the rocks of the Grand River barrens and Arichat.
4. Purple, coarse sandstone, grit and conglomerate, forming falls.

At the source of the brook a wood-road runs through marshy spruce-land, underlaid by rocks like those of Lynch Creek near St. Peters. Rocky pasture-land, wet spruce-land and mossy barrens extend back some distance from the shore, and between the wood-road and Steep Creek, long, parallel ridges of conglomerate form a country scarcely less barren than Petitdegrat.

Steep Creek.

In Steep Creek and on the roads of the neighborhood similar exposures occur. The Middletown road, near Melford, ascends a hill of white-weathering, quartzo-felspathic grit, conglomerate, and greenish, coherent, somewhat pearly, splintery, argillaceous shale, which are seen at intervals as far as Middletown. Between this settlement and Birchtown, dry, rocky barrens exhibit blocks of conglomerate and sandstone, precisely like those of the barrens of Grand River and Loch Lomond. Thick beds of these rocks are seen in the beds of all the streams, and will be more fully described hereafter.

Middletown road.

Pirate Harbor.

The East Pirate Harbor Brook, a mountain stream, affords good exposures in the following descending order, above the shore road :—

1. Grey, fine, very coherent, quartzo-felspathic sandstone, like that at the foot of Loch Lomond.
2. Grey, fine, micaceous sandstone, soft and shaly, or hard and splintery, greatly jointed.
3. Grey, fine sandstone and grit, weathering light-red and purple. Much calcspar in the joints. The coarser grit seems wholly composed of syenite *debris*.
4. Purple and greenish, sometimes mottled, fine and coarse rocks, in a gorge.
5. Greenish-grey rocks, of every degree of texture, veined with quartz. A narrow, beautiful, woody valley, contained by high, green banks.
6. Various coherent rocks, chiefly more or less conglomeritic, continue for a great distance.
7. Greenish and grey slate and quartz-veined, quartzo-felspathic sandstone.

Parallel ridges, like those before described, of conglomerate, grit and sandstone, run along the shore between Pirate Harbor and Steep Creek, separated by small valleys. Some of the cliffs are mural; sometimes they run and rise on the bedding-planes. The clearings in the vicinity are exceedingly rocky, coherent blocks lying about in great profusion.

In the West Pirate Harbor Brook, light-bluish-grey felspathic sandstone is often present. Near the shore occurs a succession of beautiful falls over quartzite and sandstone, in flaggy or thick beds. Still nearer, grey sandstone and grit are associated with argillaceous shale and conglomerate. In the north branch, similar rocks give rise to falls of considerable height. As the hills on the south side of the Strait of Canso rise abruptly to a height of from two to six hundred feet, the brooks usually rush down in steep rapids, gorges and cliffs.

Limestone quarry.

At Pirate Harbor, a limestone, probably the same as that found at St. Peters and Plaster Cove, is underlaid by whitish, often shaly quartzo-felspathic sandstone. About a mile to the northward, at McLean's quarry, the limestone rises into a high cliff, and is succeeded towards the shore by plaster and soft rocks. Behind the limestone, and apparently dipping in the same direction—E. $< 50°$—is a bed of

grey, fine sandstone, underlaid by pebbly sandstone, grit and conglomerate, succeeded by dark-bluish micaceous slates, enclosing thin bands of sandstone. North of the brook, ledges of grey, fine conglomerate produce rocky pasture-land.

Wylde Cove flags.

At Wylde Cove is a fine, greenish sandstone, which might make good flags. On the road from this cove to the New Glasgow road, at a mill, grey, pebbly or conglomeritic grit, coherent, and composed of syenite detritus, or friable and reddish, veined with quartz, brings to mind certain rocks of Madame Island. On the New Glasgow road, near the fork, bluish-grey shales occur, which follow the road for a great distance. They are argillaceous, and include bands of light-grey, quartz-veined, quartzo-felspathic sandstone and grit, which may be examined in the adjoining brook. Further up this brook, grey, massive grit appears, accompanied by barrens, on which weathered blocks are everywhere present. The hardwood hill on the right bank displays cliffs of bluish-grey, somewhat crystalline limestone or impure clay-rock, in half-inch layers, weathering soft, and producing excellent soil. At the foot of the hill is a hay-marsh. On all the wood-roads in the neighborhood, and around Grant and Summers Lakes and their feeders, blocks or outcrops of quartz-veined, jointed, rough, felspathic sandstone and grit occur, thick-bedded or massive, occasionally passing into more argillaceous rock, the country being for the most part barren or covered with small spruce and uninhabited. Further west, on the New Glasgow road, quartzose sandstone is associated with greenish-grey, micaceous, jointed, finely laminated, slaty argillite, full of minute veins and blotches of milky quartz. Near a small settlement and post-office, greenish and bluish shaly rocks have a southerly dip.

Dyke on the line between Guysborough and Antigonish counties.

On the railway, and a short distance south of the county line a dark-green, calcareous diorite cuts bluish-grey, quartzo-felspathic, flaggy sandstone and splintery argillite. It is generally finely crystalline, with the grains of hornblende and felspar distinct, but like many of the Salmon Creek dykes, passes into compact felsite, and contains cubes of iron pyrites. The joints are coated with calcspar and a soft, chloritic mineral, and some of the planes are slickensided.

Contact of devonian and precambrian rocks.

At Auld Lake, the lowest rocks of this series are greenish-grey, fine, felspathic sandstone and grit, quartz-veined, and interstratified with conglomerate, forming rocky and often barren land, with cliffs and hills. Blocks of red syenite also occur along the road, rolled from the adjoining hill, which runs out to Cape Porcupine. In Auld Brook, a short distance above the mill, near the shore road, is a light-red quartzose conglomerate, the pebbles of which are quartzite, felsite

and reddish fine quartz-felsite. It weathers whitish-grey, and passes into quartzo-felspathic sandstone, quartzite or grit.

Cape Porcupine

In a brook at the south end of Cape Porcupine, not far above the road, bluish-grey, laminated, earthy, streaked limestone dips about N. 75° E. $<$ 20°, succeeded immediately by high cliffs of dark-bluish-grey quartzo-felspathic sandstone or quartzite, nearly compact, dipping S. 50° W. $<$ 75°, associated with softer, bluish-grey, fine, micaceous, jointed sandstone, slickensided, and full of joints, stained with calcspar. In the neighboring fields are fine, light-grey, quartz-veined grit and quartzite, with white-weathering, very coherent conglomerate, grit and argillite, rough, and veined with quartz, beneath which is the syenite of the hill.

North of the cable landing, at the north end of the felsite boss, the shore exposes fine, whitish and bluish-grey, flaggy and thick-bedded quartzo-felspathic sandstone and grit, sometimes soft, argillaceous and calcareous, but generally compact and coherent. These are unconformably underlaid by flesh-red, compact and granular felsite, quartz-felsite and syenite. The lowest beds of grit are very calcareous, and often obscurely nodular. In other cases syenite is overlaid by syenitic conglomerate and grit, with thin beds of argillaceous shale. Further north are bluish-grey and reddish, fine, argillaceous and sandy shales, like those of Rocky Bay, full of small, rounded, concretionary forms, with a calcareous spot in the centre, simulating coprolites or encrinites. Mica is abundant, and doubtful markings of plants are frequently seen. Rough cliffs of grit and finer rock often contain a great deal of calcspar; and some of the rocks are concretionary, and show obscure lines of cone in cone, or have the small. bright-green, calcareous spots so common in concretionary limestones. The concretions are often pure limestone, and the rock itself an impure limestone or strongly coherent marl. It is associated with fine, syenitic grit and splintery sandstone, sometimes arranged brick fashion by joints at right angles to the bedding.

Havre-au-Bouche.

On the shore, between Havre-au-Bouche and North Canso, rocks resembling those of Eddy Point are met with in the following descending order:—

1. Bluish-grey sandstone, with a tinge of red, compact, micaceous and felspathic, often passing into rippled and waving arenaceous shale, sometimes purplish and bright green, with a few thin calcspar veins.
2. Reddish, grey, bluish-grey and greenish argillaceous and arenaceous shales, full of broken plants. Traces of coaly matter, one or two obscure ferns, and a small, doubtful *Modiola*. Vugs of calcspar and quartz, and lenticular layers of bluish-grey limestone, in rolls six inches thick, or in layers of uniform thickness, which overlap one another. There are also bands, two

feet thick and downward, of grey, fine, coherent, calcareo-felspathic sandstone.

3. Crumpled and rippled, calcareous shales, with thin layers of calcareous sandstone. Some of the rocks weather into globular masses, but are otherwise like the rest.

4. The most important member of this section is a limestone, light-bluish-grey, flaggy and shaly, veined and drused with calcspar, crumpled, of every degree of purity, but seldom quite pure; highly bituminous, but seems to contain no fossils except obscure plants. About twenty-five feet of this limestone were seen. Perhaps it is a depauperated form of the plaster and limestone of Plaster Cove and Pirate Harbor, in which case the rocks just described will also be carboniferous. Beds of limestone seem often to change into gypsum, and the plaster reported to have been found in digging wells at Havre-au-Bouche, on the strike of this limestone, may be of this nature.

5. Greenish-grey and grey quartzo-felspathic, massive sandstone or quartzite, like that of Loch Lomond, full of veins of quartz and calcspar, underlies the limestone. It passes on the one hand into L'Ardoise conglomerate, and on the other into fine, dark-bluish, argillaceous rock, crumbling into long, narrow pieces, and containing lenticular masses of limestone.

Trap of McDonald Brook.

Near the mouth of McDonald Brook is a dark-green, calc-veined trap in contact with dark-bluish quartz-felsite, very fine in texture, probably an altered quartzo-felspathic sandstone, but not well seen. Above the road this brook displays dark-grey argillaceous shale, compact, felspathic sandstone, and conglomerate, containing pebbles of red and white quartzite and felsite. Beyond the brook, towards the mouth of Archie Pond, are many outcrops of conglomerate, like that seen on the backlands roads up the rocky hills in the vicinity, associated with reddish and bluish shaly sandstone and conglomeritic grit.

Pirate Harbor.

The Guysborough road, near Pirate Harbor, passes over quartz-veined, white-weathering, often micaceous, quartzo-felspathic sandstone and shale, underlying rocky barrens, and interstratified with nut and egg-conglomerate, very like that of Arichat; and at Pirate Harbor these rocks form a steep, rocky hill. Around the Goose Harbor Lakes, on both sides of this road, similar rocks appear, crossed in every direction by a net-work of veins of milky quartz, with, in one place. an indian-red argillaceous shale. On the road from these lakes to Middletown, greenish quartzose grit is met with, as well as blocks of argillaceous shale and sandstone. At the outlet of the lakes, greenish quartzose sandstone dips N. 45° W. $<$ 53°. Beyond Clinton, grey and bluish, somewhat pearly, coherent. often papery, splintery shales, and massive bluish-grey, white-weathering quartzo-felspathic sandstones, form a country like the Grand River barrens. As usual, the sandstones are full of quartz-veins and blotches, and associated with nut and egg-conglomerate, containing pebbles of whitish quartzite and felsite.

Guysborough road.

Between Clinton and Boylston are occasional outcrops of greenish and purplish argillaceous shale and sandstone, as well as quartz-veined conglomerate. The road from Guysborough to Tracadie displays greenish coherent slates and quartz-veined quartzites.

Unconformable contact of devonian and carboniferous strata at Guysborough Harbor.

On Guysborough Harbor, north of Star Point, rocks in general like those of the rest of the country—quartzo-felspathic sandstone and slate, pebbly and conglomeritic grit, grey, white-weathering sandstone, full of quartz—have a high, obscure, easterly dip. Many small quartz-vugs exhibit drusy crystals of quartz and chlorite. At Star Point, these rocks are overlaid by carboniferous strata, containing pebbles, evidently derived from them. Near Star Point, similar rocks are again unconformably overlaid by carboniferous conglomerate. On the road which runs eastward from this point there is a hill composed of white and grey-weathering, fine sandstone or quartzite, grit and conglomerate, resembling quartz-felsite or Louisburg breccia, for which they might be mistaken. They are full of veins and blotches of milky quartz, holding chlorite and grains of magnetic iron ore.

Near the carboniferous limestone of Guysborough Harbor is an outcrop of grey quartzose sandstone, grit and conglomerate. The conglomerate, like that of Arichat, coarse and fine, forms rocky hills about Marshall Point. In some places it resembles a quartz-felsite; in others it has large pebbles of red and grey syenite and felsite, and is veined by quartz, containing much chlorite. At Hadley Cove, near the mouth of Guysborough Harbor, are greenish-grey, quartz-veined, micaceous sandstones and shales, rather soft and crumbling, with purplish and greenish, mottled, hematitic, rippled sandstones, showing obscure fucoidal markings, and strongly resembling the rocks of McNab Cove and Rocky Bay. Some of the shales contain veins and blotches of calcspar, which often bursts asunder their planes of jointing and bedding, so as to give them the appearance of calcareous breccia or conglomerate. Similar rocks of the hardest and most coherent kind are present in all the roads and fields of the neighborhood.

Stewart Pond.

A short distance west of Stewart Pond, shale and conglomerate surround a hill of trappean and felsitic rock. Nothing was seen to determine whether this is older or newer than the shales; but its composition leads to the strong presumption that it is a boss of precambrian rock.

Ores of iron and copper.

On the shore, good exposures of the devonian rocks occur, in contorted cliffs, thirty feet high, holding large masses of iron ore. They comprise bluish, grey, greenish, purplish and reddish, shaly and thick-bedded, quartz-veined, fine, quartzo-felspathic sandstones or quartzites, with

Plants.

blackened impressions of minute plants. Traces of hematite and green carbonate of copper occur in the joints, of which there are many, in quartz-veins and in thin sheets of quartz in the bedding planes,

These are precisely like the strata of Rocky Bay. The sandstones pass into grit and fine conglomerate, associated with shales full of beautiful veins of calcite of various colors, sometimes mixed with quartz. One banded vein, two feet or more in thickness, with interlocking crystals, chiefly of dog-tooth and calcspar, has a north and south trend, a high and variable dip, and many branches or side-veins. Another vein, three feet thick, is formed of large interlocking crystals of dog-tooth spar, sometimes an inch in diameter, with drusy cavities lined with the same mineral. Some of the veins, also, are brecciated or contain pieces of the enclosing rock. Calcite veins.

But nowhere can these strata be studied to better advantage than in the rivers that run in a southerly and south-easterly direction into Chedabucto Bay, all of which can be followed from the sea to their sources. Owing to the undulating nature of the beds, no estimate can at present be given of the thickness of the strata, which will nevertheless be described in a general way. It will be noticed, on reference to the map, that long stretches of the rivers run on the strike.

In Clam Harbor Lake, bluish-grey sandstones of the usual character are seen, and near the outlet are curiously knobbed and wrinkled by the water. The brook which flows from Sundown Lake forms a series of rapids and falls over soft argillaceous shale and grey conglomerate, composed of pebbles of syenite and felsite in a paste of fine quartzose grit. At the head of this lake, greenish, very hard, coherent sandstones, interstratified with greenish, fine shales, include masses of milky quartz. In Clam Harbor River, above Sundown Brook, greenish, coherent, vertical, felspathic shales or slates strike N. 6° W., and in the west branch similar rocks give rise to wild rapids. Nearer the Guysborough road, felspathic sandstones and shales, sometimes papery, contain blotches of milky quartz. Mossy marshes, reaches of still water bordered by roses, and wet fernland, interrupt the rocky rapids of the upper part of this river, but in many places it is more picturesque, the banks high, the bed clean and shingly, overshadowed by hardwood trees. Above the Middletown road, the prevailing rocks are bluish, greenish or bright-green, rough, pearly, slaty argillites, often greatly contorted, interstratified with thin layers of pyritous quartzo-felspathic sandstone. These often pass into hard, felspathic rock, with large veins and blotches of highly crystalline quartz, including chlorite, iron pyrites (which may have led to the search made in them for gold) and aggregations of quartz-crystals in small druses or large prism-pyramids; or wherever the slaty structure is obscure, into very evenly bedded shales. Just above Birchtown, a large colored settlement, they form a fall or series of falls, twenty-five or thirty feet high, and are hard, pearly, smooth, polished and papery, having sometimes a pur- Clam Harbor River. Search for gold.

plish or reddish mottled tinge, and containing whitish-grey chert in rusty, concretionary nodules. The slaty cleavage is easily detected when the rock is broken.

Below the Middletown road, Clam Harbor River cuts through greenish-grey and bluish quartzite and coherent shale or slate, with a tinge of purple. The rock called quartzite is here, as elsewhere, often a quartzose or quartzo-felspathic sandstone, with veins, sometimes eight inches thick, which appear to be always barren. Lower down, indian-red quartzite, passing into argillaceous sandstone, is associated with light-green and bluish shale These rocks extend in gorges and cliffs to the shore road, below which greenish slate and indian-red argillite are sometimes seen in a cultivated intervale.

On McPherson, Carey, Round and Welsh Lakes, and the brooks and roads of their neighborhood, similar shales, quartzites and conglomerates, stained with hematite, are abundant.

Iron ore of Ragged Head.

Ragged Head exhibits a salmon-colored jointed conglomerate, not unlike that of Arichat, associated with grey grit and conglomerate in variable bedding, and underlaid by fine, hard, indian-red sandstone and argillaceous shale. The paste is of quartz-felsite, and the pebbles—which range in size from cocoanuts to peas—of greenish and salmon-colored felsite and quartz-felsite. Hematite occurs in these rocks.

The banks of reddish boulder clay, between Ragged Head and Oyster Pond, show only blocks of fine quartzite, indian-red argillaceous sandstone, and hard, greenish-grey conglomerate, with pebbles of red syenite, quartz and quartzite.

Goose Harbor River.

Goose Harbor River displays, below the Welsh Lake road, the following strata :—

1. Greenish, felspathic, shaly sandstone.
2. Greenish and reddish, shaly, micaceous argillite, grit and fine conglomerate. The foregoing rocks were seen in a small branch, quarter of a mile below the road.

Plants.

3. Quartzo-felspathic, compact sandstone, coarse grit and conglomerate, with shaly and thick-bedded rocks, like those of Rocky Bay. Many finely comminuted plants. The surface is often covered with knotty, calcareous concretions, and the sandy shales are rippled.
4. Argillaceous shale, with an approach to slaty cleavage.
5. White quartzite and fine grit, with purplish streaks; full of small quartz veins, in which are chlorite and calcite; interstratified with beds of soft, contorted argillaceous shale.

Probable boss of syenite.

6. Grey grit, resting upon what appears to be red, coarse syenite, but may be only a syenitic grit. The conglomerates previously seen contain pebbles chiefly of quartzite, and the felsite pebbles in them are not of this bright red variety. On the right bank of the river, ordinary bluish, greenish-grey and reddish quartzo-felspathic grit and sandstone are in place. Other grits and

conglomerates succeed lower down, formed chiefly of red syenite, a boss of which probably comes to the surface here.

7. Quartzite, arenaceous and argillaceous shale and coherent grit, full of quartz and calcspar veins. Reddish and purplish, greenish and grey shales, often mottled, extend a considerable distance, forming a beautiful valley, surrounded by rocky cliffs. The river widens into a small pond, about three quarters of a mile above the bridge on the shore road.

Above the Welsh Lake road, Goose Harbor River exposes fine felspathic sandstone, grit, conglomerate and allied rocks; and just below the Middletown road, cliffs of nearly compact quartzite, like that of Grand River barrens, is interstratified in massive beds, with bluish-grey, coherent argillaceous shale, and somewhat soft, quartz-veined, coherent sandstone. Above the bridge the river is very rapid and rough, or lies in long stretches of creek, the country being rocky as at the head of McNab Brook. Higher up, grey conglomerate also occurs. Cascades and gorges often exist where the brook runs along the strike of these rocks.

In the Meadows Brook, a short distance below Dorsay's, outcrops of these strata are found, as follows:— Meadows Brook.

1. Fine quartzo-felspathic, quartz-veined sandstone and greyish argillite.
2. Light green and purplish, often mottled, somewhat soft, though coherent, splintery, slaty argillite, dipping N. 50° E. $< 45°$.
3. Bluish and reddish argillite, in thick beds, with quartz-veined sandstone. Very like the rocks of Lynch Creek.
4. Bluish-grey, micaceous argillite, about eighteen feet thick, in flaggy bands, easily separable into shales. Sometimes the layers are sandy rather than argillaceous, but very fine. There is no slaty cleavage, but the rocks are greatly jointed and traversed by small veins of calcspar and pyrite. Diligent search detected a few small pyritised markings of plants, the broadest of which measure only one-twentieth of an inch, and are longitudinally striated. Others are much finer, branching at an acute or right angle from a central stem. They bear a strong resemblance to certain parts of *Psilophyton*. Rusty-weathering calcspar veins abound, small and irregular, white and broadly crystalline, holding traces of iron and copper pyrites, as well as chlorite and minute grains, perhaps of talc. The shales break with a conchoidal fracture. The lowest are light green, soft, rough on the surface, passing into sandy rock, with quartzose masses and veins. Plants. *Psilophyton?*
5. Greenish and grey contorted shales and soft sandstones extend to the shore road, with red, thick-bedded sandstone and argillite, and purplish and greenish, mottled, coherent argillite. In the joints are sparkling, drusy crystals of quartz. Sometimes imbedded masses and lenticular layers of brown-weathering, compact, bluish-grey, pyritous ironstone appear; also doubtful organic forms, one of which resembles a broad *Cythere*, and a few obscure fucoids. Some of the rocks are brecciated.

On the shore road, near the Oyster Ponds, are ridges of greenish Oyster Ponds.

areno-argillaceous shale, with blotches of quartz, and occasional outcrops of light reddish-grey quartzo-felspathic grit, or very compact quartzite. Above the road, in the Oyster Pond Brook, is a dark-grey, micaceous, argillo-arenaceous shale, seamed with calcspar and with a soft, serpentinous substance between the layers. This contains *Naiadites* (*?*) and probably fish-spines.

Fossils.

Devonian Rocks of Inverness County.—Returning to the east side of the Strait of Canso, we find rocks very like those of Guysborough, underlying the limestone of Plaster Cove.* They consist of greenish, fine, spotted quartzo-felspathic sandstones, wholly different from those seen between Hastings and Hawkesbury; associated with dark-greenish, veined, very coherent shale and sandstone, Arichat conglomerate and black shales, containing markings of narrow stems of plants. A little further north, grey, very micaceous, somewhat coherent sandstone and coarse grit are underlaid by crumbling, grey, slaty, argillaceous shale, jointed and broken, very much altered; underlaid in turn by grey sandstone. The dip is variable, easterly and south-easterly. Grey and bluish-grey slates succeed, followed by a concealed interval, after which felsitic and syenitic rock is on the beach. Beyond the felsite, dark-purple, coherent, slaty argillite, like that of Rocky Bay, occurs. The actual contact is concealed, so that it is uncertain whether the felsite is intrusive or precambrian. Conglomerate, like that of Madame Island and Cape Porcupine, now forms a rocky point, with sheer cliffs. It is associated with veined, nearly compact, grey sandstone and grit, and extends to Long Pond. In the fields, behind this pond, these rocks, with reddish-grey, fine, coherent sandstone, overlie felsite and diorite.

Felsite.

McMillan Point.

Heffernan Brook again displays the contact of the felsite and conglomerate. The latter is grey, with a tinge of red, very compact; the pebbles nearly all consisting of felsite and quartz-felsite. There is also a very coherent, grey and greenish-grey, jointed grit a compact, hard, slaty rock, stained with hematite, and a quartzite, with veins of quartz and bright-green streaks. Associated with these, in intervals between the older rocks, is a dark-grey, soft argillite, with hematite in the joints. The dip varies, as will be seen from the map. The alternation of altered and less altered beds is noticeable.

Limestone quarry.

Beneath the limestone at the quarry, a mile and a half from Hastings, on the Victoria road, are outcrops of whitish, coherent grit and conglomerate, with many veins of quartz, apparently overlying the felsite of the hills. On the same road, near Brown's mill, and on Lake Horton road, quartz-veined, compact, coherent, splintery grit and sandstone

*Dawson's Acadian Geology, p. 390.

occur. North of the mill, the rocks more closely resemble those of Salmon Creek, being purple and grey quartz-veined grit, conglomerate and sandstone, often very rough, forming barrens. Rusty-weathering, friable, micaceous rocks, full of broken, carbonized plants, in one place dip steeply S. E. $< 45°$.

Queensville Brook.

On the General Line road, near Queensville Brook, are rocks probably also of this age—light-purplish, quartz-veined, compact, fine grit and conglomerate, the pebbles consisting largely of quartz. Bluish-grey, fine, friable, shaly sandstone occurs in one of the brooks, not far above the road, and blocks are found in the country adjoining.

Horton Brook.

Near the shore, at Horton Brook, coarse, coherent, grey quartzose sandstone, conglomerate and fine grit, jointed so as to obscure the dip, form a rugged country. Higher up, massive outcrops overlie hills or knolls of felsite in the fields. The distribution of the felsite is very irregular. Near a tributary from the Victoria road, an amygdaloidal variety occurs near greenish and grey, fine, micaceous, felspathic sandstone and quartzose grit; but its relation to them was not clearly made out. Another equally indefinite outcrop of fine diorite occurs above the tributary. In a brook flowing into Lake Horton, one quarter of a mile north of the outlet, is an outcrop of grey, fine quartzite, with perhaps a westerly dip, associated with ledges of grey grit. Around the lake, coherent, coarse grey conglomerate and quartzose grit form a rocky shore. In the large brook flowing into the west end of the lake grey fine grit, with a westerly dip, and greenish-grey, coherent, micaceous sandstone are followed by grey amygdaloid. It is possible that the latter may be part of the series, but it does not appear to have metamorphosed the surrounding rocks, and is probably older. Massive, fine, micaceous, grey and reddish, friable or coherent sandstone, grit and conglomerate rest upon coarse syenite on the path from the head waters of this brook to the General Line road.

Contact of devonian and precambrian rocks.

Brown's mill.

Below Brown's mill, on the north-west arm of River Inhabitants, there is a transition from the shales which prevail at Dorton's bridge to the following strata:—

1. Reddish-grey, rusty-weathering, fine quartzose sandstone, in layers three to nine inches thick, broken into blocks by joints. The dip is S. 42° E. $< 43°$.
2. Coarse, greenish-grey, conglomeritic grit, with specks of bright, silvery mica and veins of quartz and calcspar, so crumbly that it can be reduced to sand by gentle blows of the hammer. It dips apparently N. 65° E. $< 35°$, but is very massive.
3. Still ascending the brook, we next find grey flinty quartzite, dipping N. 65° E. $< 56°$, and passing into reddish quartzite, as much veined as any of the Guysborough rocks.
4. Dirty, greenish-grey, rusty, slaty argillite.

5. Quartz-veined quartzites occur at the mill, somewhat contorted, the country being very rocky.

6. Above the mill-pond are greenish-grey, fine conglomerate and grit, with argillaceous rocks of considerable variety, generally grey, greenish or bluish. Occasionally the grit is so compact that the grains are hardly distinguishable, and some of the finer varieties form a compact quartzo-felspathic rock that might belong to the Louisburg series.

7. Somewhat soft, though coherent sandstone, with Arichat conglomerate, grey, argillaceous shale and quartzo-felspathic grit. A few pieces of ordinary carboniferous sandstone are found in the boulder-clay.

8. Greenish-grey, friable, silvery, micaceous grit, like 2. These rocks continue to the first bridge on the General Line road.

9. Greenish-grey grit, with specks of silvery mica; compact quartzo-felspathic grit; greenish, grey and reddish, fine, micaceous sandstone and grit.

Doubtful intrusive rocks.

10. Just above the Louisburg felsites of the brook is a bluish-green, flinty, compact rock, perhaps an altered argillite, with very compact quartz-veined quartzite, grey coherent grit and splintery argillaceous rock.

11. Above the old road, from the Victoria to the General Line road, is a bright-red, slaty, coherent argillite, followed by fine grey diorite.

Beds resembling carboniferous.

Brown Brook, not far from the fork, cuts through a grey, fine, friable grit; and higher up, an indian-red argillaceous shale, not very coherent, with friable, fine conglomeritic grit, more nearly resembling a carboniferous rock of other districts than that usually seen. Above a path to the school, fine, reddish conglomerate is associated with a coarse syenitic variety. The comparatively small degree of alteration is remarkable, but not more so than that of certain little-altered portions of the primordial strata of the Bras d'Or Lake. Bright-red, slates of the Louisburg series succeed the rocks just described, and are sometimes with difficulty distinguished from them. Perhaps the conglomerates and other red rocks of this vicinity owe their color and softness to having been formed out of their ruins, although the grains and pebbles distinct enough to be identified consist of syenite and felsite, which have resisted abrasion better. Fragments of the soft clay-rock mentioned in the description of the felsite series (p. 12 F) appear, however, in the red grit and conglomerate.

Contact with felsite.

Sugar Camp Brook.

Sugar Camp Brook displays, above the Sugar Camp road, a greenish and reddish-grey quartzose sandstone, somewhat like that near Hartley's waterfall, Pirate Harbor. With this are associated fine reddish sandstone and micaceous, argillaceous shale. Similar rocks extend to the Victoria road, in the brook and fields. Descending Lamey Brook from this road, the first rock met with is a greenish-

Lamey Brook.

grey, coherent, fine, micaceous, white-weathering sandstone, with veins of milky quartz, interbedded with greenish-grey argillaceous shale, containing fragments of plants. The rocks are much jointed. Lower down is a fall over fine quartzose grit and sandstone. The latter is very variable, being sometimes very compact, at other times quite soft, and in color changing from greenish-grey to almost white. Just above a bridge, on the road below, are indian-red argillaceous sandstone and grit, composed almost wholly of quartz; and associated below the bridge with greenish-grey quartzose sandstone and conglomerate, containing pebbles of light colored marble. Grey shale is interbedded with the sandstone, which passes into quartzite, and is succeeded by purple and green mottled calcareous argillite, veined with calcspar, and containing a few geodes with crystals of calcspar. This is succeeded by the Plaster Cove limestone. Geodes.

In Lamey Brook, above the Victoria road, near the little lake, bluish-grey and brownish, grey-weathering, micaceous, thick-bedded sandstone dips S. 44° E. $<$ 57°. Outcrops of greenish-grey, micaceous, argillaceous sandstone are seen as far as the old road.

A good many exposures occur in the neighborhood of the Sugar Camp road, of grey, laminated, micaceous, argillaceous shale, with calcspar in the joints; fine purplish argillaceous sandstone; greenish-grey quartzose sandstone; mottled micaceous, argillaceous sandstone, which are often veined with quartz and highly altered. The dip varies as shown on the map. Sugar Camp road.

At Donald McQuarrie's, near Dorton's bridge, hard, grey conglomerate is overlaid by shaly limestone. Blocks of purplish, softer grit and sandstone, and of grey argillaceous shale, also appear near Donald McKinnon's. Dorton's bridge

Overlying the crystalline limestone, in Queensville Brook, above McInnes' mill-pond, are beds of coarse and fine, coherent, light-reddish-grey, slightly micaceous, felspathic grit, containing seams and blotches of pure, white quartz, and pebbles of reddish felspar and quartz. This alternates with indian-red, fine, argillaceous, micaceous sandstone, and light-red, compact, jointed quartzite, grit and argillite, calcareous, and seamed with calcite. With these is found reddish, very coherent conglomerate, with pebbles chiefly of quartz. The lowest bed of this series is a grey and greenish quartzite, without evident bedding. Below the Victoria road these rocks present the following varieties in descending order:— Queensville Brook.

1. Grey and purple conglomerate and grit.
2. Coherent, purplish and greenish argillite.
3. Red-purple marl, with greenish and grey spots of lenticular, concretionary limestone.

4. Reddish coherent grit.
5. Bright indian-red, fine, crumbling sandstone and grit of ordinary carboniferous aspect, dipping S. 53° E. $<$ 42°.
6. Grey, coherent, coarse grit, and reddish, rather friable conglomerate, like that seen in the north-west arm of River Inhabitants, near the contact with the red slaty felsite.
7. Grey, coherent, quartzose sandstone.
8. Whitish, fine, jointed, quartzo-felspathic grit, with specks of silvery mica.
9. Slaty, greenish shale, like that seen near Dorton's bridge.
10. Whitish conglomerate, sparkling as if wholly composed of quartz; veined, slaty, micaceous, coherent argillite, grit and conglomerate.
11. Greenish-grey, fine, micaceous, coherent sandstone and slate, with a tendency to break into regular pieces. Dip S. 64° E. $<$ 45°.
12. Light-grey and bluish limestone, compact, and more or less impure, 2 feet 6 inches.
13. Greenish, slaty argillite, crumbling into knife and needle-shaped pieces, 4 feet.
14. Red coherent grit, 3 feet.
15. Quartz-veined, quartzose conglomerate, forming the north wall of a cliffy gorge.
16. Very coherent conglomerate and grit, quartz-veined and jointed, extend to the Victoria road.

Some of the rocks north of Craignish may also be devonian, but as they appear rather to be carboniferous, they will not be referred to here.

Carboniferous Formation.

Character.

The rocks of this formation are generally much less altered than those just described, although in this respect there is great variety. For while the sandstones and shales overlying the limestone at Plaster Cove are nearly as much altered as those beneath it, some of those of River Inhabitants are little more than hardened sand and mud. The

Subdivision.

separation into groups of the great mass of sediments comprised in this formation, within the region to which this report refers, is extremely difficult. It is probable that there are at least two unconformable series as suggested by Mr. E. Gilpin, Inspector of Mines for Nova Scotia; but the unconformity is not so pronounced, and even more difficult to trace, than that between the devonian and lower carboniferous rocks. To the lower of these groups, may belong both the coal seams which have been wrought in the Richmond coalfield and those of Upper River Inhabitants, in which case the limestone of Glendale is that of Plaster Cove; the coal seams are identical, and the shale in River Inhabitants containing *Leaia leydii* is on the same horizon as that on the Strait of Canso holding the same fossil. Moreover, if the assumption that the St. Peters limestone is also that of Lennox Ferry be correct, a similar *Leaia* shale should occur at River Bourgeois and Seal Cove, unless uncomformably overlapped. Then the "coal measures" of

Scott Brook would represent those of the Richmond coalfield; and the highest rocks in the field occur in the syncline between Inhabitants Basin and West Bay. There are difficulties involved in this hypothesis, however, connected with the apparently merely local development of the plaster, limestone and coal of Little River, which must be explained before it can be accepted.

Several faults traverse the region, but their position and amount cannot yet be accurately stated. One of these throws down the Janvrin Island strata, and is perhaps continuous with that indicated by the steep dip along the Strait of Canso, about Bear Island. Another runs from the south-western extremity of the North Mountain felsites to the westward of McIntyre Lake, thence down Little River south of the mine, passing to the shore either in the low land at the mouth of the river or on Carleton Head. The Carleton Head fault is probably also a continuation of that which strikes the Strait of Canso north of Ship Point. These are all downthrows on the west side. Minor faults are indicated at other localities as in White Brook; and in tracing the coal seams, several are stated to have been met with. Faults.

The thickness of the strata is about 22,000 feet; and this, perhaps, represents the entire section of the several groups into which the carboniferous formation is divisible in other districts, although the strata are somewhat different and the coal seams of less persistence than those of Sydney, Port Hood and Pictou coalfields. Enormous thickness.

On Madame Island few rocks of this formation appear. On the shore of Rocky Bay, south of the outlet of Shaw Lake and on Fourgier Point, blocks of gypsum are met with. Near the head of Arichat Harbor is an outcrop of light-grey, thick-bedded, dirty, pebbly limestone, drused and veined with calcspar, dipping N. 16° W. $<$ 30°. No fossils were detected. A deposit of gypsum, which has been quarried to some extent, shows about ten feet high in the bank, and dips every way from the centre of the quarry outward. It is of white, bluish, mottled-white and grey, red and other colors, selenitic and finely crystalline. The deposit seems to be surrounded on all sides by conglomerate belonging to the older series. The soil in the back streets of Arichat, here about, is carboniferous, although no rocks are met with. Further west the gypsum forms mounds and behind the chapel an exposure of dark-grey, pure or sandy, compact limestone, sometimes nodular, seamed with calcspar, containing encrinite stems, but apparently no other fossils, lies between dark, bluish-grey felsite on the north, and conglomerate on the south. It is seen for about sixty yards striking indistinctly S. 75° E. That this does not form a part of the conglomerate series, cannot be confidently asserted. Too little of these exposures was seen to determine their relations, but probably the limestone and plaster of Madame Island

Limestone and gypsum of Arichat.

Age of the limestone.

Arichat are of the same age as those of Lennox ferry; on the other hand, the limestone north of the Crid Islands, may be newer than devonian. The two are different, however, the latter being reddish and lenticular, that of Arichat bluish, highly crystalline, and very like that of St. Peters.

Limestone and gypsum of Lennox ferry.

Near Lennox ferry is another important outcrop of plaster and limestone, associated with reddish conglomerate and light indian-red, soft, argillaceous sandstone. The plaster forms mounds and pits, breaking the ground up in a remarkable manner. It is generally white, bluish and pink, good, often selenitic, and associated with greenish and reddish marl. The dip at the quarries seems to be N. 5° E. $< 25°$. Barrens surround the pits, on which no rocks are seen. Limestone is also largely quarried in the neighborhood. It is a bluish-grey and grey, dark, bituminous rock, full of whitish calcspar in veins and crystals, and containing innumerable fossils, chiefly encrinites and brachiopods, but also polyzoa and *Conularia*. Crystals of iron pyrites and dog-toothspar also abound. The conglomerate contains a great number of pebbles of the Arichat devonian series—coherent sandstone, quartzite and softer shales, not so compact as the quartzite pebbles of the devonian conglomerate, but evidently derived from rocks like those of Descousse and Grand Lake. It is also of the usual carboniferous aspect, little altered, rather crumbly, and very calcareous. One remarkable circumstance may be mentioned: it appears to contain pebbles of the limestone worked in the adjacent quarry, which would make this also of devonian age. Perhaps, however, these are concretionary, and were formed in the rock during or subsequent to its deposition. The concretions are compact and splintery, like the limestone of Robinson Cove and St. Peters.

Fossils.

Limestone conglomerate or concretions.

Martinique.

Between Lennox ferry and Martinique, only pink soil is displayed, with blocks of grey sandstone, containing plants sometimes of large size, and purplish and indian-red grit passing into conglomerate. The character of the country is the same all around Glasgow Point. For a short distance along the Martinique roads towards West Arichat, rocks similar to those between Scott Brook and St. Peters are present, succeeded by the underlying slates and quartzites. Limestone and gypsum are reported to occur on Glasgow and Thorn Points, but their being in place is doubtful.

Janvrin Island.

The rocks of Janvrin Island are interesting, because of their resemblance to those of the north side of Lennox Passage, although they are on the strike of the devonian rocks, a position they appear to occupy from the interposition of a fault. Near Dory Point huge blocks of shaly limestone and gypsum lie on the reefs and in the banks of the outer shore of Le Blanc Harbor. The reefs of Peninsula Point consist

of grey, shaly sandstone, apparently carboniferous. On the south side of Janvrin Point red and green, crumbling, sandy shales, with flaggy more coherent layers, dip about N. 13° W. $<$ 50°, and extend in fine cliffs to the beginning of the beach at the head of Janvrin Bay. Just beyond the beach, and at Thomas Head, similar rocks again occur.

The highest rocks appear on the north shore, about two-thirds of a mile east of Thomas Head. From this point they strike both ways for some distance along the shore, the section to the westward being as follows in descending order: Section on the north side of Janvrin Island.

	FEET.	INCHES.	
1. Reddish and greenish, waving, rippled, calcareous, concretionary, fine sandstone and argillaceous shale. In cliffs for about a quarter of a mile on the most northerly point. Dip N. 21° W. $<$ 77°	107	0	
2. Grey and bluish-grey, shaly and thick-bedded sandstone, marked with glacial striæ. Comminuted carbonized plants	30	0	Plants.
3. Reddish, greenish and grey argillaceous shale and sandstone.	56	0	
4. Grey and greenish-grey sandstone with broken plants	18	0	
5. Grey, greenish and reddish argillaceous shale	12	0	
6. Grey sandstone	122	0	
7. Reddish, soft, argillaceous shale, with hard red and grey bands	94	0	
8. Greenish-grey and reddish waving sandstone	18	0	
9. Reddish sandstone and argillaceous shale. Dip S. 57° W $<$ 67°	281	0	
10. Grey, greenish and bluish-grey sandstone, sometimes shaly and waving, with concretionary, calcareous patches. Often rusty, crumbling and broken. Irregular layers of greenish argillaceous shale. Remains of plants	69	0	
11. Red argillaceous shale, with hard calcareous sandstone bands	55	0	
12. Measures concealed by a marsh and beach. Dip N. 20° W. $<$ 67°	552	0	
13. Measures concealed. Occasional reefs of red sandstone and argillaceous shale	147	0	
14 Reddish sandstone and argillaceous shale, with greenish bands. Ripple marks. Dip N. 20 W. $<$ 70°	103	0	
15. Measures concealed by a large pond	650	0	
16. Occasional exposures of reddish and greenish argillaceous shale on the reefs	140	0	
17. Measures concealed	188	0	
18. Greenish-grey and reddish, waving, shaly sandstone	15	0	
19. Measures concealed	50	0	
20. Red, greenish and grey, finely laminated, argillaceous shale, like that of the brook near the chapel at Inhabitants Basin	56	0	
21. Reddish and greenish, dirty, argillaceous shale and sandstone	52	0	

22. Reddish, greenish and purplish argillaceous and arenaceous shale, with harder sandstone bands	174	0
23. Measures for the most part concealed. Reddish and purplish argillaceous shale and sandstone occasionally seen. Dip N. 13° W. < 65°	435	0
24. Measures concealed by Janvrin Harbor. Dip N. 17° W. < 60°	1316	0
25. Reddish and greenish mottled, friable, micaceous, argillaceous and arenaceous shales or flags, jointed and cleft; seamed with calcspar, with bands of coherent flaggy sandstone. Seen on Janvrin Head	147	0
Total thickness	4887	0

The upper part of this section at Thomas Head differs somewhat from the above.

4. Grey sandstone seen for a considerable distance on the rocky coast	52	0
5. Greenish, crumbling, argillaceous shale	19	0
6. Grey, greenish and bluish-grey fine sandstone full of broken plants, large calamites, etc	103	0
7. Reddish and greenish fine argillaceous shale (No. 7 above)	94	0
Total thickness	268	0

To the eastward of the reddish sandstone (No. 1) of the first section, the measures are repeated in descending order, as follows:

	FEET.	INCHES.
1. Reddish shale and sandstone (No. 1)	107	0
2. Grey, waving sandstone. Plants. Rain prints?	57	0
3. Grey shaly sandstone with large concretions and broken plants. A fern ten inches long	12	0
4. Greenish, bluish and grey argillaceous shale, full of seaweeds and ripple-marked	8	0
5. More arenaceous rock, holding rootlets, and passing into a grey rusty sandstone with roots of trees often converted, two inches through, into coal and pyrite. Grey, conglomeritic, calcareous patches. The lowest beds have an overturned dip	12	0
6. Reddish and greenish argillaceous shale	45	0
7. Grey sandstone	15	0
8. Reddish and greenish argillaceous shale and sandstone	97	0
9. Measures concealed	..	..
Total thickness	353	0

The dip turns more to the south-eastward and gives a great thickness of red rocks the order of which is ascending, unless the dip is overturned. The first exposure is about 328 feet from No. 9.

	FEET.	INCHES.
1. Reddish-grey sandstone	48	0
2. Measures concealed by a small pond	290	0
3. Red rocks; not well seen	183	0
4. Alternations of red, greenish and purple argillaceous shale with bands of sandstone. Dip S. 60° E. < 70°	870	0
5. Grey sandstone	12	0
6. Alternations as in No. 4	505	0
7. Greenish, reddish and grey sandstone. Dip S. 62° E. < 61°.	70	0
8. Reddish rocks, not well seen	52	0
9. Measures concealed. Dip S. 53° E. < 61°	670	0
10. Reddish and greenish argillaceous shale and sandstone, obscurely seen	383	0
11. Grey sandstone	30	0
12. Reddish and greenish argillaceous shale	52	0
13. Measures concealed. Dip S. 55° E. < 56°	1285	0
14. Red rocks obscurely seen to the southward of Strawberry Point, dipping S. 55°E. < 52° at the beginning, and S. 60° E. < 70° at the end of the exposure	1014	0
Total thickness	5464	0

There is nothing distinctive about the strata of Janvrin Island but an indefinite mass of variable sediments, probably at the horizon of those between Port Hastings and Hawkesbury, but deposited for the most part in a deeper sea, the dark shales of the Strait of Canso being absent or concealed.

Campbell Island shows only gravel banks with large blocks of carboniferous sandstone. Campbell Island.

Guysborough Carboniferous Rocks.—At Star Point, on Guysborough Harbor, is a reddish and whitish conglomerate, which if found on the Bras d'Or Lake would at once be pronounced carboniferous. Of this it may unhesitatingly be said that it is newer than the quartzites and slates of the vicinity, seeing that it contains many pebbles and blocks of these latter, with their characteristic quartz-veins and aggregations of specular iron ore. The pebbles vary in size from peas to blocks nine inches in diameter, and comprise chiefly greenish, soft, argillaceous shale, green and red mottled rocks, like those examined on the coast at Stewart Pond, and grey, greenish and bluish quarzites, often quartz-veined and ferruginous. But the greater part of the rock consists of a limestone of various colors, banded and waved, which looks as if derived from a pre-existing limestone, but is more probably another example of the concretion-forming agency so often alluded to in connection with calcareous strata as producing masses of limestone breccia. Some portions consist altogether of this breccia, and in one of the Guysborough Harbor. Limestone.

pebbles was found a beautiful little crystal of quartz. The binding agent of the whole mass is limestone, limestone-grit and very calcareous sandstone, sometimes fine and crystalline, but often coarse and mixed with pebbles of older rock. Dipping steeply northward, further down the harbor is a bluish limestone-breccia, enclosing a few large quartzite blocks, overlaid by shaly, jointed, light-colored limestone. It has been burnt for lime, and is like that of St. Peters. Close behind these rocks come the quartzites. In a brook between Star and Katon Points the limestone forms a high cliff, dipping nearly vertically about N. 18° E. At Katon Point, similar rocks occur, and at Marshall Point a light-colored, reddish or bluish-grey hematitic, shaly limestone, veined with calcspar, sometimes brecciated and contorted, bears a strong resemblance to the cambrian limestone about Boisdale. In the cliffs it is often highly crystalline, but somewhat impure, and traversed by a network of calcspar veins. It comes boldly to the water, where it is hollowed into small caves. Being so much veined, broken and twisted, the chance of finding fossils in it is small. North of the ferry at McCaul Island are red, coherent, calcareous rocks, with contorted limestone breccia or conglomerate. The soil is bright indian-red.

Martin Pond.

Immediately west of Martin Pond, on the shore, is a nut and egg-conglomerate, to all appearance carboniferous, containing pebbles of quartzites in a calcspar paste. Then follows a concealed interval, after which are occasional outcrops of red, crumbling conglomerate, associated with an indian-red and grey sandstone, easily reducible to sand under the hammer, but containing small, hard pebbles. Bright-red and grey colors appear in irregular bands, and certain grey or whitish-green spots are hard and coherent. The dip is about N. 50° E. $< 25°$. Where washed by the waves, these red and green rocks are finely carved, owing to the unequal hardness of different parts, and where calcareous matter abounds in nodular patches, rough knobs cover the weathered surface. Further south the dip is S. 50° E. $< 15°$. The sandstone is everywhere pebbly, but the pebbles are small. Just before the section is interrupted by Hadley Beach, grey and red friable sandstone dips S. E. $< 20°$.

Ragged Pond.

A short distance below the shore road, at the head of Ragged Pond, a small watering brook cuts through another outlier of carboniferous rock, consisting of bright, crumbling marl, fine shaly sandstone, coarse grit and fine conglomerate with green blotches, precisely like strata of this formation on the Bras d'Or Lake and other parts of eastern Cape Breton, but unlike those seen about the Strait of Canso or Chedabucto Bay. The dip is south-easterly, at an angle varying from

5° to 20°. Some of these rocks can be easily crushed between the fingers.

Above the road, at Steep Creek, on the Strait of Canso, is another small indefinite outlier of soft limestone and shale, probably carboniferous. Steep Creek.

Behind the post-office at Pirate Harbor, and just west of the road, is a long line of pits, some of which are full of water. The country is also greatly broken. This is almost certainly due to the presence of gypsum, which has also been found in small pieces further north, near the limestone quarry. Greenish and bright-red soft marl, with traces of gypsum, appear in the valley leading to McNeil's quarry. The question of the age of the quarry limestone has already been discussed; it seems, where it comes in contact with the underlying conglomerate, to rest conformably upon it, nearly vertically, but in its general mode of occurrence appears to strike in a somewhat different direction. Gypsum and limestone of Pirate Harbor.

At the south end of Cape Porcupine, on the shore, is a piece of lowland exhibiting traces of reddish soil, pits full of water, and probably plaster pits, and an outcrop of limestone. Cape Porcupine.

On the shore, west of Havre-au-Bouche, the detritus is bluish and reddish shale and sandstone. On the western point, a few pieces of gypsum and grey fossiliferous limestone occur, showing plants. A quarter of a mile from the harbor, greenish-grey fine sandstone, with impressions of plants, thick-bedded or shaly, and underlaid by reddish, jointed, calcareous, waving, ripple-marked shale, dips N. 7° E. $<$ 30°. At Cape Jack, reddish and purplish shales are overlaid by dark-red, finely laminated, soft, argillaceous shale, with bright-green spots, including harder layers of sandstone and arenaceons shale, often in lenticular masses. These are overlaid by limestone, apparently about ten feet thick, of various shades of bluish-grey, coherent but finely laminated and waving. These rocks have a decidedly carboniferous aspect, and are less altered than their probable equivalents on the north side of the strait, where they have been crumpled and compressed. It would be interesting to trace them past Tracadie to see how far they resemble the rocks of the strait, and to ascertain under what circumstances the "coal measures" occur here. Havre-au-Bouche. Cape Jack. Limestone.

At Blue Cape, bluish, layered, veined limestone, twisted, variable and sometimes in concentric circular masses three feet or more in diameter, is underlaid by purplish, fine, soft, micaceous sandstone and arenaceous shale containing fucoids, succeeded in turn by indian-red, soft, crumbling marl, with several beds of soft, red and green-mottled sandstone. The limestone contains *Conularia:* it is often oolitic, always much veined, and fifteen or twenty feet thick, resembling that seen on the Blue Cape. Oolitic, fossiliferous limestone.

shore east of Havre-au-Bouche. A little further up the bay, beyond Blue Cape, indian-red, soft, carboniferous shales, and fine flaggy sandstones dip N. 80° W < 10°, which is the attitude of the rocks as far as the salt pond at the beginning of Little Tracadie inlet.

Carboniferous Rocks of Richmond and Inverness.—Returning again to Richmond and Inverness counties, we may remark that mention was omitted in last report of an outcrop of limestone, probably carboniferous, that occurs in the quartzite region, on the shore at the south-eastern end of Loch Ćailean. It is a bluish or grey, rusty-weathering, white-spotted, vesicular variety. Below Smith's mill, too, near the Black Brook, a tributary of Grand River, blocks are found of a red calcareous conglomerate, strikingly unlike that of L'Ardoise, blocks of which are also near; and on the Soldier Cove road north of this brook, reddish, crumbling detritus, seemingly indicating a small outlying patch of this formation, appears for a few yards. The limestone of River Tom is so folded among the underlying quartzites, that it seems impossible to completely separate the two series on a map. This folding is perhaps accompanied by a fault extending along the anticline of the East Bay Hills, and perhaps passing into it. The attitude of the strata to the eastward along this ridge, and the steep dip of the millstone grit away from the hills, no lower rocks being present, seems to confirm this supposition.

Limestone at Loch Cailean.

River Tom.

Peter's Mountain.

The limestone at Peter's Mountain, Loch Lomond, described as carboniferous in a previous report, is the same as that of River Tom, and would appear here also unconformably to overlie the quartzite series, unless the blocks found about the lake are boulders.

The mineral character, geological position, and fossil remains of the lower rocks of this formation in the district of St. Peters, towards the Strait of Canso, and in the valley of River Inhabitants, resemble those of Horton Bluff, described by Dr. J. W. Dawson in Acadian Geology, p. 252. There is an alternation of marine, estuary and dry land conditions of deposition indicated by the beds which compose the series. At the base is the great marine deposit of limestone and plaster found at St. Peters, Lennox Ferry, Pirate Harbor and Plaster Cove, followed by a great thickness of coherent shales containing *Leaia leydii* and other fossils, and by reddish and grey sandstones containing plants. Then a series of "coal measures" exhibits black shales, full of *Naiadites, Cythere, Spirorbis*, fish remains and plants, including upright trees. Ironstone nodules abound, and in several places coal seams have been discovered and wrought.

Five basins.

These rocks lie in five synclines or basins. The first extends from the shore of the Bras d'Or Lake to Couteau Inlet; a second fringes West Bay; a third occupies the country between Couteau Inlet, Plaster

Cove and the Long Stretch bridge; another lies between North Mountain and Craignish Hills; whilst the fifth, to the westward of Craignish Hills, contains the Port Hood coalfield.

Scott Brook. From St. Peters to Scott Brook there are few rocks, either on the road or on the shore, and wherever seen they consist of grey and reddish, fine, somewhat coherent sandstone. In Scott Brook, however, there are good exposures. At the shore road the brook flows among meadows and broken marshes, but higher up, in a wide valley with high, rocky banks, the country being for the most part, barren and the soil clayey. Pieces of rusty-weathering, rippled sandstone occur not far above the road, and immediately beyond this rock is in place, dipping S. 60° E. $<$ 13°, in an exposure which possesses the highest interest. The sandstone is fine, bluish and grey, friable, shaly and flaggy, containing carbonized plants, leaves and obscure *Stigmaria*. Its surface is covered with impressions of *Naiadites elongata*, *Cythere*, *Spirorbis carbonarius* and *S. arietinus*.* It passes into and is interstratified with highly bituminous, bluish or light-grey, green-spotted, crystalline, concretionary or sandy limestone; this, too, contains the same fossils, being in places wholly made up of entomostracans. Beautiful palatal teeth of a new species of *Psammodus** spot the surface in great numbers. They are a quarter of an inch in length, rhomboidal or broad leaf-shaped, brown and polished. Higher up the brook are cliffs of grey, black-streaked, argillaceous shale and flaggy, fine sandstone, dipping almost horizontally to the northward, finely ripple-marked, micaceous and covered with minute carbonized plants, fucoids and fish scales. Small patches of fine conglomerate also occur. The sandstone is overlaid by grey marl and limestone in thin beds, the latter predominating and being sometimes made up of shells, fish spines and *Naiadites*. The dip is variable and the thickness uncertain. Similar rocks higher in the brook accompany a bluish or black soft shale, often a mass of *Naiadites*, as closely packed together as in the bituminous shales of the Sydney coalfield, and abounding in *Cythere* and coprolites. The limestone is sometimes in lenticular layers in the marls. As in the Sydney coalfield, the shales contain the fossils in varying numbers, being sometimes a mass of them, at other times showing every separate shell distinctly imprinted on the stone. Sandstone and arenaceous shale succeed, with bluish marl containing ironstone nodules in layers. The sandstone is indian-red and light sea-green, in distinct beds or mottled patches. Many impressions of calamites and other plants occur, covered with films of coal. Some of the beds are fine and beautifully waved, breaking out in large blocks varying from half an

Fossils.

New species of Psammodus.

Bituminous shales.

Fossils.

* Determined by Dr. J. W. Dawson.

Ironstone nodules.

inch to three inches in thickness. Below this lie bluish and black, argillaceous, *Naiadites* shale, holding a few scattered nodules of light-grey ironstone as large as cocoanuts, some of which are filled with beautiful crystals of various minerals, including a blackish radiating mineral. Alternations of reddish and greenish marl and sandstone follow, with a few coherent beds of impure limestone, a greenish, rusty, crumbling, argillo-arenaceous underclay, three feet thick, full of *Stigmaria* and rootlets, underlaid by three feet of rather coarse, coherent, rusty sandstone, containing few *Stigmaria*. Purplish and greenish rocks then alternate, but are only seen at intervals as far as Malcolm Ross'.

Underclay.

In a tributary flowing into Scott Brook in Malcolm Ross' clearing, the following descending section is presented:

	FEET.	INCHES.
1. Grey and bluish, brown-weathering, sandstone, with blotches of coaly matter Indefinite.....		
2. Grey, ripple-marked sandstone in layers.....	1	6
3. Reddish sandstone.....	2	0
4. Bluish arenaceous shale with markings of carbonized plants.	1	0
5. Red arenaceous and argillaceous shale.....	8	0
6. Bluish argillo-arenaceous shale.....	1	0
7. Grey, nearly compact, calcareo-micaceous sandstone, dipping N. 25° W. $<$ 22°.....	3	0
Total thickness.....	16	6

Few outcrops are seen higher up, the brook flowing in low ground.

Rocks, probably the same as those just described, are again found in a tributary of Scott Brook above the shore road, as follows:

	FEET.	INCHES.
1. Bluish and greenish argillaceous underclay, with rootlets, impure ironstone nodules and bright rusty streaks. Sometimes this rock is so full of *Cordaites* as to assume the character of black shale.....		
2. Limestone and fine, rippled, calcareous sandstone in thin beds more or less nodular. Perfect spheres of sandstone have been found in these beds.....		
3. Argillaceous shale containing *Naiadites*, with layers of compact sandstone and nodules of limestone.....	6	0
4. Grey and bluish, flaggy, nearly compact sandstone, dipping N. W. $<$ 8°.....	6	0
5. Marl and limestone in thin and thick crumbling layers, containing *Spirorbis*, *Cythere* and *Naiadites*.....	12	0

Black shale.

Shells.

Junction of carboniferous and precambrian strata.

In another branch of Scott Brook grey, fine, flaggy sandstone in cliffs containing red and green spots, dips S. E. $<$ 60°, and is underlaid by greenish, crumbling, calcareous, soft, talco-felspathic, pearly, contorted Louisburg shales, dipping steeply about S. 80° E.

Cranberry Lake.

On the barrens of the Cranberry Lake road, greenish and grey fine sandstone, marked with plants and resembling that seen on the Grand River and Loch Lomond barrens, although less altered, is associated with reddish sandstone and purple grit, sometimes shaly, like the devonian rocks of Salmon Creek. Mossy barrens, marshes and spruce-land occur about Cranberry Lake. In a brook flowing into the lake, a grey fine sandstone dips doubtfully S. E. $< 60°$. Near the outlet, greenish and grey, fine, shaly sandstone full of minute fragments of carbonized plants, dips N. 25° W. $< 45°$. In the presence of grey sandstone full of carbonized plants, and in the small seams of coaly matter found among them, they are also very like the millstone grit in the Sydney coalfield, an analogy noticed by Mr. Brown. The only rocks of greater age which resemble them are the coal-bearing strata of McAdam Lake. (Report for 1876-7, p. 441.)

Carbonized plants.

Likeness to millstone grit.

George Creek.

In a brook near George Creek, blocks of grey or greenish-grey, fine, shaly sandstone appear just above the road. The lakes from which it flows are sometimes marshy; the shore is, however, often stony, wooded chiefly with small spruce, Indian pear, *Amelanchier*, and hazel bushes, which in places overhang the water. The country is, like that described as millstone grit in other districts, covered with blocks of grey and reddish-grey fine sandstone. Blocks of conglomerate, lime-stone and gypsum occur on the shore of St. Peters Inlet, but as no rocks *in situ* indicate the dip, and the brooks being few, small and slow flowing, it is difficult to ascertain the structure in this piece of country.

Carboniferous strata form a fringe around the precambrian rocks of West Bay, from Cape George to Ross Creek, being sometimes seen on the brooks and shore, but more frequently concealed by boulder detritus. On the shore of West Bay, near Morrison Harbor, white, grey and reddish plaster is associated with limestone composed of shells. Huge blocks of limestone occur to the westward, where several lime-kilns are in operation.

Morrison road.

On the Morrison road, sandstones, interstratified with conglomerate, argillaceous shale and a small patch of plaster, rest upon the felsites.

Contact of carboniferous and precambrian strata.

In the main branch of River Tillard, flowing from Mountain Lake, reddish argillaceous sandstone and grey and red argillaceous shale passing into fine conglomerate and sandstone, holding pebbles of felsite and quartz, overlie the precambrian rocks, and are overlaid down stream by thick-bedded, micaceous, argillaceous sandstone, associated with bands of light-grey jointed argillite, containing a soft, soapy mineral in the joints and bedding planes. The dip is south-easterly. Below the bridge on the Morrison road, grey and greenish, fine, rough-weathering, flaggy, ripple-marked sandstone dips N. 21° W. $< 14°$. At the

River Tillard falls.

falls, similar sandstone has joints running S. 14° E. and S. 33° W. Ill defined outcrops of greenish-grey sandstone extend to the head of tidewater, a short distance above the St. Peters road. The blocks of grey sandstone, covered with carbonized plants, which occur on the road from River Tillard bridge to the shore, there give place to others of grey and reddish fine sandstone and conglomerate. Only blocks and pebbles imbedded in clay are found as far as the entrance of River Bourgeois.

River Bourgeois.

Coherent purplish conglomerate, grit and argillite detritus abounds about River Bourgeois; and sandstone on the road from this village to River Tillard bridge, past Sutton's. Near the shore between River Tillard and St. Peters, no rocks are seen in place, although the land is covered with blocks of shaly and thick-bedded reddish and grey sandstone, very like the millstone grit strata of Mira Bay, which contain a larger proportion of red beds than those of Sydney Harbor.

The country between the St. Peters road and River Bourgeois shows no outcrops, yet there can be no doubt concerning the nature of the underlying strata, as the surface is rendered literally barren by the number of huge blocks of fine greenish-grey and reddish sandstone that encumber it. It is precisely like the millstone grit areas of the Sydney coalfield, but the soil is pink rather than rusty, owing to the greater number of red beds. The district has been devastated by forest fires, and wherever trees occur they are of second growth. The St. Peters road may be taken as a fair sample of the whole district. The brooks are small and flow in valleys of greater depth of soil than is to be seen on the neighboring hills. A strip of good cleared land runs along River Bourgeois.

River Tillard.

In the east branch of River Tillard, reddish-grey fine sandstone, with layers of fine, pebbly, calcareous grit or concretionary limestone and mottled-red and green, jointed and shaly or crumbling argillaceous rock dips N. 24° W. $< 45°$, and lower. Above the footpath to John McNeil's, red and grey fine argillaceous sandstone somewhat coherent, dips N. 30° W. $< 30°$, in flaggy beds, succeeded by cliffs of fine, micaceous, red and grey sandstone, shaly, jointed and crumbling, with nodular argillaceous rock, red or mottled-red and green, fine, concretionary, and passing into impure, brownish, compact limestone. Similar rocks, with irregular beds of calcareous conglomerate, continue nearly to the bridge at McNeil's. Above this bridge a few outcrops of reddish fine sandstone dip N. 25° W. $< 25°$. Much of River Tillard consists of intervales and hay marshes full of broken ponds.

In a brook flowing into River Tillard from the Morrison road, jointed, reddish and grey sandstone, fine grit and concretionary limestone in

conglomeritic patches, with dark spots of argillaceous matter, contain much calcspar, often aggregated into veins with vugs lined with dog-tooth spar. These are interstratified with soft red and green rocks and with a calcareous grit, having a north-westerly, nearly vertical dip. Similar concretionary, calcareous rocks form occasional small exposures in the brooks of the neighborhood, with varying dip. In another branch below the Morrison road, cliffs of blackish-grey and red argillaceous flags dip S. 30° E. $< 45°$. Nearer the road these rocks are associated with red sandstone and friable calcareous conglomerate, containing large pebbles, and rest upon the felsites of the hill. In the first large brook north of William Urquhart's, grey, coherent, calcareous, rusty-weathering sand stone dips S. 68° W. $< 45°$.

It will be remarked that the limestone of St. Peters and Lennox ferry is absent on this side of the basin, only the higher rocks being present. Possibly this may be due to a fault, but this is unlikely, as a conglomerate or basal rock seems to pass into the argillaceous and arenaceous strata found further from the hills. It is more probable that this limestone was overlapped by the newer rocks, as the hills, existing then where they do now, were slowly sinking beneath the sea.

Indian Creek.

In Indian Creek, below Lauchlin McLean's carding mill, on False Bay Lake, and also in a brook flowing into it from Grand Anse post-office, grey and red sandstones are associated with grey nodular limestone, argillite and conglomerate. At tidewater, the low banks display grey sandstone resembling millstone grit.

On the St. Peters road, near McPherson's, reddish-grey argillaceous sandstone, containing calamites, dips S. 43° W. $< 60°$.

Grandique ferry.

On the road to Grandique ferry, pieces of broken sandstone occur, and east of the ferry road, reddish and grey, calcareous, false-bedded sandstone and argillaceous shale dip S. E. The dip is greatly contorted on a sharp anticlinal axis running south along the Grandique road.

2nd Syncline or Basin —In the north branch of River Moulin, west of McPherson's, purplish, reddish and greenish, mottled, very micaceous, arenaceous shale and fine flaggy sandstone dip S. 45° W. $< 45°$, waving and covered with innumerable black fragments of plants and fucoidal markings. On the slope of McDonald Mountain, reddish calcareous conglomerate overlies the precambrian felsites, and in the brook flowing from Buchanan Lake, flaggy, apparently vertical, argillaceous rock strikes north. A fault is perhaps indicated by the high dip here, and also at McRae's mill and White Brook. On the wet barrens between McFarlane's, at the St. Peters road, and McRae's grist mill, on which sundew plants abound, sandstone and shale are indistinctly seen. Near the mill, grey nearly compact sandstones, full of streaks of coal

McDonald Mountain.

Faults.

derived from carbonized plants, and not unlike some of the strata of Salmon Creek, sometimes coarse, with specks of mica, dip S. 62° E., nearly vertically. Near the spring above McIntyre Lake, fine, reddish and grey, shaly and flaggy, micaceous, arenaceous and argillaceous rocks dip N. 85° W. $<$ 18°, forming cliffs.

McIntyre Lake

Just below the bridge, near the settlement at River Moulin, is a ridge of flaggy, smooth-bedded, grey sandstone, dipping S. 70° W. $<$ 52°; and on the shore, reefs of grey and greenish-grey, fine and coarse, rusty-weathering sandstone, with a three-feet bed of impure, concretionary or conglomeritic limestone dip N. 85° W. $<$ 50°, associated with finely laminated shales. Grey sandstone occurs occasionally on the beach between River Moulin and Seal Cove; whilst further west, rusty-weathering and reddish sandstone dips inland and forms rocky barrens. Where the rock is not exposed on the shore it is not necessary to go far inland to find it. Above tidewater the south branch of River Moulin is generally low and swampy, flowing in ponds and creeks, through a barren, but occasionally cutting through light-grey and bluish sandstone and grit, sometimes with small cavities on the surface from which some soft substance has weathered out.

Seal Cove.

Rocky land.

Near Black River, on West Bay, reddish and grey argillaceous shales occur, and many outcrops of limestone, plaster and conglomerate are cut by the brooks of the neighborhood. At the mouth of the river, on the eastern bank, red conglomerate, composed of the ruins of the underlying felsites, is in place. On the shore is an exposure of white gypsum with dark streaks. In the millbrook which enters from the west, dark-bluish, thick-bedded, compact limestone is associated with white and grey plaster, light-grey sandstone and reddish argillaceous shale. Just below the road to the mill, the following descending section is presented:

Limestone and gypsum.

	FEET.	INCHES.
1. Grey, greenish and reddish argillaceous shale. Thickness indefinite	10	0
2. Grey and bluish-grey argillaceous shale, with thin, harder, calcareous bands, nodular masses, and vugs full of calcspar	9	0
3. Green crumbling shale	40	0
4. Red and grey mottled shale	7	0
5. Grey shale with a few spots of red	18	0
6. Grey, more coherent and harder argillite	7	0
7. Bluish, crumbling, soft argillite	7	0
8. Grey, fine sandstone or sandy argillite	13	0
9. Occasional exposures of red and greenish, crumbling, micaceous sandstone, grey, reddish and greenish, ripple-marked, arenaceous and argillaceous shale, with a somewhat variable westerly and north-westerly dip. These rocks continue as far as the Grandique road	..	..
Total thickness	111	0

Below this road, shales and flags of grey, bluish and reddish colors, often calcareous, are succeeded by reddish and grey compact porphyritic felsite with veins and grains of quartz, overlaid by a conglomerate formed of pebbles of this rock. In the brook, further down, conglomerate prevails, overlaid at one point by a bluish-grey limestone full of broken shells, in thick and thin beds. It is fourteen feet thick, and overlaid in turn by light-grey coarse grit. Small calcspar veins run at right angles to the bedding or in the planes of jointing. The dip is here N. 10° W. $<$ 85°. Still further down, conglomerate and crumbling argillaceous shale are associated with bands of nearly compact sandstone; and at George Murray's, where the stream ceases to be navigable for boats, gypsum is met with. About ten years ago a landslide blocked the river at this point and forced it into another channel. Lower down, a conglomerate is on the right bank, while on the left, salt springs occur.

Precambrian rocks in Black River.

Limestone.

Landslide.

On the shore road from the head of West Bay to Ross Creek, barrens abound, the country being underlaid by bluish shale and fine sandstone, probably as far as Ross Creek, where syenite comes to the road and is overlaid on the shore by fine sandstone, conglomerate and limestone. In Cameron Brook bluish shale and flaggy, micaceous, argillaceous sandstone, jointed into rectangular blocks, dip S. 48° W. $<$ 5°, and contain a few minute *Naiadites*. Higher up, grey and greenish, fine, jointed, nearly compact limestone with north and east joints, ripple-marked, flaggy and broken by lines of bedding and jointing into rectangular blocks a foot and a half by a foot square and three inches thick, is associated with red and green, mottled, fine sandstone and shale.

Contact of carboniferous and precambrian at Ross Creek.

Fossils.

On the eastern shore of Floda Island are many blocks of gypsum. The Crammond Islands are low and the soil good; the central one is inhabited and cultivated.

Islands of West Bay.

3rd Syncline or Basin.—Excellent exposures are found on the outer shores of Inhabitants Basin, where all the long parallel points and islands are on the strike of the hard grey sandstones composing them. At the mouth of Coal Brook, near Morash's, grey, rusty-weathering, fine sandstone, thin-bedded and full of impressions of calamites and other plants, dips about N. 24° W. $<$ 30°. Similar rocks, affording little variety, are seen in the cliffs to the southward, the angle of dip being always high, though somewhat variable. They strikingly resemble the millstone grit of the Sydney coalfield. Occasionally, as on the western point of Rabbit Island, the sandstone is argillaceous and ripple-marked; and in some places the beds are coarse, as on the small island between Evans and Rabbit Islands. Lenticular patches of calcareous conglomerate occur in the sandstone on the south

Inhabitants Basin.

Coal Brook.

Evans and Rabbit Islands.

shore of Rabbit Island, with prostrate trees in abundance, the bark of which has become transformed into coal. Near the western end of Evans Island, sandstone of the same character dips N. < 38°, whilst on the western point are large blocks of gypsum from a bed apparently overlying, which is probably identical with that of Little River, Freeman Island and the small island to the westward. Coal is stated to occur on the south side of Freeman Island.

Coal reported.

Coal Brook displays contorted shales and sandstones, together with small seams of coal which will be described elsewhere. In White Brook many outcrops occur of light-grey, coarse and fine sandstone, and argillaceous shale, sometimes carbonaceous, with variable dip. On the lake from which the brook flows, pieces of sandstone are seen. On the track from Rory McDonald's to McMillan Lakes, indian-red, fine, argillaceous, micaceous sandstone occurs, and on one of these lakes is a doubtful exposure, perhaps belonging to an unconformable upper formation. The Chapel Brook shows fine cliffs of grey sandstone with calamites, dark-bluish, soft, argillaceous shales, sometimes brightly polished between the laminæ, and approaching impure limestone in composition, unfossiliferous, and somewhat coherent, but less so than the shales of Dorton's bridge. These are precisely like the shales seen in the large brooks which cross the River Inhabitants road between McLeod's and Long Stretch bridges.

White Brook.

Chapel Brook.

Near the mouth of this brook, on the shore, a small seam of coal is reported to occur containing, according to Mr. McBean, fifteen or eighteen inches of coarse coal and shale. A pit was sunk sixty-six feet at the road, but struck no coal.

Coal reported.

Shaft.

Blocks of grey and reddish sandstone, grit and conglomerate abound on the roads down the right bank of River Inhabitants below McLeod's bridge, and an outcrop of fine sandstone occurs near the end of the mines road, with purplish, reddish and grey shale. Pieces of sandstone and argillaceous shale occur also on the mines road between Hawkesbury and River Inhabitants, and on all the other roads of this region, the country being exceedingly rocky. On the banks of River Inhabitants, below McLeod's bridge, laminated, greenish-grey, purplish and reddish, argillaceous, waving, fine, ripple-marked sandstone, grit and conglomerate, containing fragments of plants, have a south-easterly dip at the rapids and elsewhere. Lower down, on the left bank, grey, greenish and purplish, false-bedded and flaggy sandstones are interstratified with a layer of grey, concretionary, calcareous rock, which also appears at the mouth of the millbrook. Broken sandstone banks occur lower down. In the millbrook above the post road to the basin, a few outcrops of reddish-grey sandstone are met with, succeeded by cliffs of grey, rather massive, rusty-weathering, fine sand-

McLeod's bridge.

River Inhabitants.

stone, with a variable dip. Rectangular joints run parallel with the bedding and across it. There are also outcrops of fine or compact, greyish-white, or impure limestone very calcareous, micaceous sandstone decomposed into hollows and knobby reefs. Above the winter road, grey and greenish sandstones have a westerly dip, and in a branch flowing from the St. Peters road, the dip is about north.

Kemp Brook.

In both branches of Kemp Brook, immense cliffs of reddish sandstone and argillaceous shale appear above the St. Peters road, and in Ferguson Brook fine, grey, micaceous sandstone forms a fall sixteen feet high. In a small brook on the right bank, at J. Mack's, near the mouth of the river, reddish and greenish argillaceous shale dips N. 86° E. $< 12°$; and on the left bank, nearly opposite, indian-red, fine, argillaceous, micaceous, shaly sandstone is associated with impure concretionary limestone.

Little River mine.

On the shore of Inhabitants Basin, near the post-office at Walker's, greenish-grey and reddish argillaceous sandstone is met with. Blocks of this sandstone also occur on the roads and tracks about Little River coal mine, much of the country being barren or half-barren; and the same remark holds good of the region to the southward. At the mouth of the river is said to be an exposure of gypsum, and this has been found in many places higher up, as shown on the map.

Little River.

Above the shore road in Little River, blocks of grey and greenish, coarse and fine, flaggy sandstone occur; and near the tramway bridge this rock is in place with a dip S. 34° W. $< 78°$. A little higher, the strike is N. 60° W., vertically. In the western branch no rocks are met with above the mines road for a considerable distance, although blocks of reddish and grey sandstone are numerous, and the soil is clayey and often reddish. In the eastern branch, just above the mines road, at the first turn, reddish sandstone and argillaceous shale strike S. 71° E., vertically. Higher up, past the first pits, grey rusty sandstone, marked with plants, strikes about S. 67° E., with a slight dip upstream, succeeded by indistinct exposures of rocks like those of Caribacou—dark and greenish shales, underclay, with much coaly matter. Then comes a cliff of grey and greenish-grey rusty sandstone, with a moderate easterly dip; followed by rocks dipping S. 40° E. Not far above these are occasional outcrops of sandstone and shale, after which a light and dark-grey bituminous limestone, more or less concretionary, with calcspar crystals and rusty spots, of no great thickness, strikes along the bank. Higher still, greenish and grey calcareous shales, well exposed, dip S. 60° W. $< 70°$. In a tributary not much further up, grey, red and green shales appear with a more moderate north-easterly dip. The high angle of dip in the vicinity of the coal

Coal.

Limestone.

Fault. mine is probably due to a fault, a supposition still further strengthened by the attitude of the limestone and gypsum on McVicar's farm near the St. Peters road. This is a down-throw on the west. From McVicar's the limestone has been traced two miles northward, where it is covered by higher strata or interrupted by a fault. It is dark-bluish, bituminous and fossiliferous and runs in mounds and ridges with gypsum.

Above the St. Peters road, Little River exhibits frequent exposures of grey, greenish and reddish, rusty, fine sandstone and shale, full of plants, as far as the Big Brook road. Occasional outcrops of sandstone McIntyre Lake also occur in the brooks about McIntyre Lake and over the whole surface of the country. North of the lake is an outcrop of shale, containing *Naiadites* and indistinct markings of plants.

Seacoal Brook. In Seacoal Brook, above the shore road, fine, argillaceous, micaceous sandstone is again met with, succeeded, higher up, by a dark, bluish-grey variety, sometimes shaly and streaked with iron-rust. At the crossing of the new road, rocky barrens are formed by thick-bedded sandstone, which is also seen around Landrie Lake.

Below the road the brook comes to tidewater in a rocky gorge, showing reddish and grey fine sandstone. On the left bank, below the confluence of a small brook, the following vertical or nearly vertical strata are exposed, striking N. 67° E.:

SECTION IN SEACOAL BROOK.

	FEET.	INCHES.
1. Greenish and bluish argillaceous shale	9	0
2. Reddish and brown " "	3	0
3. Greenish " "	3	0
4. Bluish and greenish, papery, argillaceous shale	9	0
5. Reddish sandstone	1	6
6. Brown and purplish, micaceous, argillaceous shale	12	0
7. Bright-green argillaceous shale	2	0
8. Bluish and greenish argillaceous shale with harder bands, passing into dark-bluish argillaceous shale, like that of Hawkesbury	15	0
9. Greenish and bluish argillaceous shale in the small brook	10	0
10. Greenish, more friable, argillaceous shale	7	0
11. Greenish and bluish, more coherent, argillaceous shale	5	0
12. Reddish, micaceous, arenaceous shale with greenish bands, passing into sandstone	3	6
13. Reddish and greenish micaceous sandstone	10	0
14. Brown argillaceous shale with green streaks and sandstone bands	105	0
15. Bright-greenish argillaceous shale	4	0
16. Reddish argillaceous shale with sandstone bands. Forms the waterfall below the bridge	7	0

17. Similar rocks, indistinctly seen, extend to the bridge, and below the fall are seen beyond the first point, where the pond widens. They are again met with in an adjacent brook, dipping steeply S. 23° E., and apparently associated, higher up, with dark-bluish argillaceous shale containing thin bands of limestone.....	..	..
Total thickness.....	206	0

On the shore twenty-seven yards north of the bridge, at the mouth of the brook in which the mine is situated, the following strata are exposed in ascending order, the dip being S. 13° W., nearly vertical and overturned: Seacoal Bay.

SECTION AT SEACOAL BAY.

	FEET.	INCHES.	
1. Dark shale and underclay.....	15	0	
2. Coal; thickness not seen but said to be.....	4	0	
3. Black shale full of *Naiadites*, *Cythere*, fish remains and *Spirorbis*, with bands of greenish shale and thin, nodular layers of ironstone.....	48	0	Shells and ironstone.
4. Greenish argillaceous shale with layers of ironstone half an inch thick and downward in the lower part	23	0	
5. Greenish-grey rusty sandstone.....	3	0	
6. Greenish argillaceous shale.....	2	6	
7. Greenish-grey flaggy and shaly sandstone.....	3	6	
8. Greenish argillaceous shale.....	3	0	
9. Black shale, very coaly and coherent in places, but passing into ordinary dark shale.....	10	0	
10. Greenish-grey, fine, argillaceous shale.....	1	6	Carbonaceous shale.
11. Black or dark shale as before.....	12	0	
12. Greenish-grey argillaceous shale, in part very coherent.....	7	0	
13. Measures concealed.....	6	0	
14. Dark coaly shales.....	2	6	
15. Measures concealed, with occasional outcrops of greenish crumbling shale.....	18	0	
16. Bands of grey, coaly, flinty sandstone and shale.....	20	0	
17. Measures concealed.....	24	0	
18. Dark shale, succeeded by greenish argillaceous shale, with small layers of ironstone; not well seen.....	17	0	
19. Measures concealed.....	..	..	
Total thickness.....	220	0	

Between 18 and the next brook to the northward, a few blocks of conglomerate are met with.

At the eastern corner of Seacoal Pond, on the shore, greenish sandstone, possibly in place, seems to dip N. 20° E. $<$ 55°; but the outcrop is obscure. A short distance further east, sandstone, full of plants,

has a similar dip, also very obscure. Beyond this, no rocks are seen as far as Malcolm's wharf, near which greenish-grey, coherent, fine, glistening sandstone, about one hundred feet thick, dips N. 38° E. $<$ 80°. Eastward for 170 feet no rocks are met with; then grey and bluish-grey, coarse, rusty sandstone, false-bedded, with markings of plants, strikes about N. 18° E., and is about eighty feet thick. For 650 feet no rocks are seen, and those next met with display another dip N. 15° W. $<$ 75°, but contorted. A fault is near this spot, but that the first of the following series belong to the south-east side of it is not certain. If they do the sequence is all ascending:

Fault.

SECTION OF CARBONIFEROUS ROCKS AT CARLETON HEAD.

	FEET.	INCHES.
1. Red and greenish argillaceous shale with hard bands; also bluish-grey, contorted, areno-argillaceous shale smoothly polished on the surface. A great deal of calcspar in the bedding. The hard bands are sometimes concretionary and calcareous. Contains a six-feet bed of greenish-grey, flinty, sparkling, broken, quartzose sandstone or quartzite	220	0
Quartzite underclay. 2. Greenish and grey, fine, compact, flinty sandstone, full of broken plants, pyritized and carbonized, and in part resembling underclay	25	0
3. Reddish, purple and greenish mottled shale; strike N. 61° E.	40	0
Iron ore. 4. Alternations of rusty, greenish, grey and reddish flinty sandstone and thin bands of shale, full of plants and like the sandstone of Grant Point. Much brightly polished hematite in the joints. Slickenside grooves run about S. 65° E. $<$ 15°; the dip is obscurely N. 25° W	50	0
5. Reddish and greenish argillaceous shale	25	0
6. Measures concealed	90	0
7. Reddish and grey sandstone	3	0
8. Measures concealed	50	0
9. Grey and greenish fine sandstone, with a few argillaceous bands	160	0
10. Measures concealed	20	0
Fault. 11. Grey sandstone. Here in a distance of 450 feet going eastward, the strike changes from S. 65° W. to S. 60° E., the dip being inland	120	0
12. Measures concealed	10	0
13. Grey sandstone	46	0
Ironstone. 14. Greenish argillaceous shale, with a few ironstone balls	45	0
15. Greenish argillaceous shale, not well seen, sometimes rough and concretionary	60	0
16. Measures concealed	40	0
17. Grey thick-bedded sandstone, striking S. 52° E	40	0
18. Evenly bedded argillo-arenaceous shale	25	0
19. Greenish argillaceous shale, not well seen	5	0

20. Greenish and reddish argillaceous shale with harder bands...	22	0	
21. Reddish-grey concretionary or conglomeritic limestone, one to three feet.....	2	0	Concretionary limestone.
22. Mottled red and green rocks. Dip N. 20° E. $<$ 45°.....	78	0	
23. Greenish, grey and reddish concretionary limestone or conglomerate	1	0	
24. Green flaggy sandstone.....	1	6	
25. Conglomeritic limestone and sandstone mixed.....	2	9	
26. Reddish, greenish and purple mottled argillaceous shale.....	3	9	
27. Grey rusty conglomerate, full of coaly matter, plants and *Stigmaria*.....	2	6	Underclay.
28. Grey and bluish-grey fine sandstone, broken and jointed, full of rusty spots and concretions, often spherical. Becomes more shaly and false-bedded at top.....	36	0	
29. Bluish areno-argillaceous shale, passing into sandstone.....	4	0	
30. Sandstone, passing into arenaceous shale.....	3	0	
31. Rusty concretionary, calcareous band; local.....	0	9	
32. Grey, rusty, thick-bedded, jointed sandstone; prostrate trees; concretions. Passes into shale.....	35	0	Prostrate trees.
33. Reddish sandstone, the lower part calcareous and concretionary. Thickness indefinite.....	18	0	
34. Red gypseous marl forming a high bank; nodules of reddish and white, fibrous, crystalline gypsum, with blocks of whitish gypsum, often porphyritic and containing limestone nodules. Not well seen. Dip N. 14° E. $<$45°. Carleton Head, from which the French are said to have obtained plaster.....	106	0	Gypsum.
35. Greenish-grey, waving and contorted areno-argillaceous shale, dipping N. 7° E. $<$ 45°.....	39	0	
36. Measures concealed. Traces of bright red marl.....	163	0	
37. Greenish-grey waving sandstone.....	4	0	
38. Measures concealed.....	..	..	
Total thickness.....	1596	3	

The rocks of this section are unlike those between Bear Island and Plaster Cove, and are probably, therefore, higher. Whether the gypsum of Carleton Head is the same as that which overlies the coal at Little River is doubtful.

About 180 feet further east the dip is reversed, and small reefs of greenish-grey sandstone and argillaceous shale, with prostrate trees and concretionary masses of limestone, dip S. 10° E. $<$ 30°. The appearance of blocks of gypsum on the beach soon afterward, seems to indicate a small fault or syncline. Gypsum.

Between Carleton Head and the next brook to the eastward, blocks of sandstone abound, with others of dark limestone. On the eastern side of the point, on the right bank of Little River, is a large quantity of bright greenish clay.

The shore between Seacoal Bay and Plaster Cove presents very interesting exposures of these rocks, and the following sections have been measured, beginning at the ferry-wharf (Emery's) north of Hawkesbury.

SECTION OF STRATA NORTH OF EMERY'S WHARF, HAWKESBURY, IN DESCENDING ORDER.

		FEET.	INCHES.
1.	Measures concealed	113	0
2.	Purplish and reddish-grey, micaceous, fine, friable argillaceous shale, flecked with green	4	0
3.	Reddish-grey sandstone with dull greenish spots	1	4
4.	Reddish-grey, crumbling argillaceous shale	3	6
5.	Reddish-grey sandstone	0	8
6.	Reddish-grey, argillaceous shale, with green streaks and blotches. Passes into sandstone	7	0
7.	Reddish-grey, friable, arenaceous shale, with bands of impure limestone	5	10
8.	Reddish and greenish-grey, calcareous, very coherent, fine sandstone, passing into arenaceous shale	1	9
9.	Reddish argillo-arenaceous shale	1	3
10.	Greenish-grey, rough argillaceous shale	1	3
11.	Dark, greenish-grey, crumbling argillaceous shale	10	0
12.	Bluish-grey, very fine calcareo-argillaceous sandstone	0	10
13.	Bluish-green, micaceous, calcareo-argillaceous shale	1	6
14.	Fine sandstone and arenaceous shale irregularly mixed. False bedding	2	4
15.	Greenish-grey and rusty argillaceous and arenaceous shale	2	0
16.	Very coherent, fine sandstone, thick-bedded, flaggy and shaly, grey and rusty, passing in places into grey concretionary limestone, like that near McLeod's bridge, River Inhabitants (P. 70 F) — Concretionary limestone.	4	11
17.	Reddish argillaceous and arenaceous shale	2	9
18.	Reddish argillaceous shale, not well seen. Dip N. 71° E. $\lessdot$ 47°.	7	3
19.	Reddish, waving, argillaceous shale with sandstone bands	6	6
20.	Measures concealed. Occasional red bands; about	66	0
21.	Grey coarse sandstone	1	0
22.	Measures concealed	4	0
23.	Reddish argillaceous shale	3	0
24.	Measures concealed	3	0
25.	Reddish-grey sandstone	1	6
26.	Measures concealed	3	0
27.	Greenish-grey argillaceous shale with carbonized plants	2	3
28.	Measures concealed	1	6
29.	Greenish-grey, fine, coherent sandstone	5	0
30.	Reddish, fine waving sandstone	1	6
31.	Measures concealed	8	4
32.	Crumbling argillaceous shale	5	2
33.	Reddish, crumbling, argillaceous sandstone, with small patches of nodular, impure, micaceous limestone — Concretionary limestone.	2	0

34. Measures concealed	2	6
35. Reddish, crumbling, argillaceous shale	3	6
36. Reddish shaly sandstone, with green marks	1	2
37. Measures concealed. Dip S. 63° E. < 43°. It is assumed that the thick coherent sandstone of Grant Point is in the concealed interval, instead of striking the shore south of Emery's wharf. If such is not the case, some of the estimates of thickness here given are too great	136	0
38. Reddish-grey, fine, shaly sandstone	12	0
39. Greenish-grey and red argillaceous shale	3	0
40. Coherent sandstone	0	9
41. Measures concealed	3	0
42. Red shaly sandstone	1	3
43. Measures concealed	1	6
44. Reddish argillaceous shale	4	10
45. Measures concealed	3	8
46. Reddish argillaceous shale	30	0
Total thickness	488	1

Then follow these beds on Grant Point in reverse order to 40:

SECTION AT GRANT POINT.

	FEET.	INCHES.	
1. Coherent sandstone (No. 40)	0	9	
2. Measures concealed. Dip N. 78° E. < 46°	80	0	
3. Greenish argillaceous shale	1	0	
4. Friable, argillaceous, shaly sandstone	5	0	
5. Reddish-grey, shaly sandstone, with small concretions of grey compact limestone; also calcspar	7	6	
6. Measures concealed	10	0	
7. Reddish, crumbling, argillaceous shale	7	6	
8. Reddish shaly sandstone	0	1	
9. Red, crumbling, argillaceous shale	4	3	
10. Reddish-grey, shaly sandstone	1	3	
11. Reddish argillaceous shale	8	10	
12. Measures concealed. Grant Point	7	0	
13. Grey, fine, flaggy and shaly, jointed sandstone, with fragments of plants; quartz crystals in joints. A small fault, a downthrow of six inches on the east side along an open joint lined with quartz	11	2	Small fault.
14. Grey flinty sandstone, full of broken plants	3	3	Plants.
15. Dirty, soft and hard, broken, carbonaceous and graphitic argillaceous rock	0	3	
16. Grey flinty sandstone	5	0	
17. Dark-blue argillaceous shale	0	4	
18. Grey thick-bedded sandstone with druses of quartz in the joints, sometimes rusty, shaly and crumbling. Lenticular patches of shale	23	8	
19. Measures concealed, but probably the same as 18	7	9	

	20. Grey, fine, coherent sandstone in thick and thin beds	11	6
	21. Reddish fine sandstone with a green layer	1	2
	22. Reddish-grey and grey, fine, coherent sandstone, curiously jointed, the joints being never more than a few inches apart	6	0
	23. Dark-grey argillo-arenaceous shale	1	6
	24. Reddish-grey, waving shaly sandstone	2	3
	25. Reddish argillaceous shale with plants	4	3
	26. Rusty and cream-colored, crumbling and compact sandstone, full of broken plants, rootlets and *Stigmaria*	5	3
Underclay.	27. Whitish-grey quartzite in thick layers, drused with quartz. Becomes reddish at top	8	7
	28. Alternations of reddish arenaceous shale and quartzite	0	11
	29. Reddish, bluish and greenish-grey crumbling argillaceous shale	13	0
	30. Reddish fine sandstone	0	6
	31. Reddish areno-argillaceous shale	4	7
	32. Reddish, compact, somewhat soft sandstone	0	7
	33. Reddish argillaceous shale	0	4
	34. Reddish argillaceous sandstone	1	0
	35. Reddish argillaceous shale with harder lenticular layers	6	9
	36. Reddish, fine, argillaceous, micaceous sandstone in thick layers; threads of calcspar. Shaly at top	15	4
Underclay.	37. Rusty, somewhat coherent sandstone, full of broken plants and doubtful rootlets. Runs into quartzose sandstone and into a concretionary rock	3	5
	38. Grey and bluish-grey, jointed, flinty sandstone. Probably No. 9 of next section	14	0
	39. Bluish-grey, flaggy, argillaceous rock	9	6
	40. Light, bluish-grey coherent sandstone	1	0
	41. Bluish-grey argillaceous shale	2	6
	42. Light-grey flinty sandstone	2	7
	43. Bluish-grey, argillaceous and arenaceous shale and sandstone, with hard bands	7	6
	44. Reddish-grey and greenish, micaceous, argillaceous sandstone, with a greenish tinge in places. Passes into shale	7	0
	45. Reddish-grey, flaggy, micaceous sandstone	5	6
	46. Reddish, finer, argillaceous shale and sandstone	3	0
	47. Greenish-grey and red, crumbling, argillaceous shale	2	10
	48. Measures concealed	5	0
	49. Reddish-grey quartzose sandstone	2	3
	50. Reddish-grey argillaceous shale	3	0
	51. Red and greenish sandstone	0	4
	52. Reddish argillaceous shale. Some of these rocks are rippled; others contain fragments of plants	4	3
Plants.	53. Measures concealed by Emery Pond	..	..
	Total thickness	341	9

Immediately beyond the pond these rocks are again repeated in descending order, as follows:

Section of Carboniferous Strata beween Emery Pond and P laster Cove.

	Feet.	Inches.	
1. Reddish argillaceous shale. Dip N. 86° E. < 46°	205	0	
2. Reddish coherent rock, with green blotches	1	8	
3. Reddish-grey coherent sandstone	2	0	
4. Reddish argillaceous shale, with sandstone bands and greenish streaks	28	0	
5. Reddish argillaceous sandstone, with greenish patches and shaly layers in the lower part	7	6	
6. Alternations of reddish and greenish argillaceous shale and sandstone	3	10	
7. Greenish argillaceous shale, with layers of sandstone	1	7	
8. Grey, fine, crumbling, argillaceous sandstone, passing into shale	4	8	
9. Grey flinty sandstone, rusty and full of quartz in the joints; dark manganese stains; broken plants. Probably No. 38 of the preceding section	32	8	Plants.
10. Reddish, purplish and greenish, crumbling, argillaceous rock, with small nodules	25	0	
11. Grey, shaly and thick-bedded sandstone, with rusty spots; quartz crystals in the joints	7	8	
12. Purplish, crumbling, argillaceous shale, with small green patches. Harder bands towards the bottom	32	0	
13. Reddish sandstone, with grey, micaceous, nodular spots	3	10	
14. Greenish-grey argillaceous shale	2	6	
15. Grey and greenish-grey arenaceous shale, with rusty spots; passes into waving, micaceous sandstone, full of broken plants	19	2	
16. Greenish and purplish argillaceous shale	15	0	
17. Greenish-grey, rust-spotted, argillaceous and arenaceous shale, with sandstone bands, passing at the bottom into sandstone	11	6	
18. Rusty-grey crumbling underclay, full of broken plants and rootlets	4	0	Underclay.
19. Flinty, quartzose sandstone, with quartz crystals in the joints	7	8	
20. Reddish shaly sandstone	4	6	
21. Grey, flinty, micaceous sandstone	4	0	
22. Reddish-grey sandstone, with greenish irregular layers	5	0	
23. Grey fine sandstone with quartz in the joints	4	0	
24. Dirty, greenish-grey, crumbling, argillaceous shale	5	6	
25. Reddish and purplish, crumbling argillaceous shale, with layers of waving sandstone	25	0	
26. Greenish, finely-bedded argillaceous shale, passing into shaly sandstone	18	6	
27. Grey, slightly calcareous, micaceous shale and sandstone, with rusty spots; broken plants; quartz crystals in the joints	20	0	

28.	Reddish and purplish crumbling argillaceous shale, with green streaks and patches	34	3
29.	Reddish, flaggy, jointed, micaceous, fine sandstone, with green patches	1	10
30.	Greenish argillaceous shale	0	2
31.	Reddish and brown, crumbling, argillaceous shale, with green patches and small harder nodules	17	6
32.	Reddish-grey, flinty, quartzose sandstone, passing downward into grey, rusty, flinty sandstone, with bands of shale	33	0
33.	Reddish argillaceous shale, with sandstone layers	6	0
34.	Measures concealed by the beach at the temperance hall	210	0
35.	Reddish, crumbling, argillaceous shale with sandstone bands	11	0
36.	Grey and reddish-grey, fine, thick-bedded sandstone; plants	64	0
37.	Reddish-grey fine sandstone	2	2
38.	Reddish, crumbling, argillaceous shale, full of hard concretions at top	8	4
39.	Greenish argillaceous shale, passing below into sandstone	20	0
40.	Bright brown, crumbling, argillaceous shale, with green harder patches and layers of sandstone	24	0
41.	Greenish and reddish, very coherent sandstone	1	9
42.	Brownish, micaceous, argillaceous shale and sandstone, mixed	10	6
43.	Greenish and reddish sandstone and argillaceous shale in lenticular beds	8	6
44.	Dark greenish-grey argillaceous shale	0	9
45.	Grey, rusty-weathering, flinty, micaceous, quartzose sandstone, with quartz crystals in the joints; markings of plants. Plants.	17	6
46.	Measures concealed. Dip N. 86° E. $< 45°$	700	0
47.	Red and green, mottled, micaceous, areno-argillaceous shale	8	0
48.	Greenish-grey flinty sandstone	2	6
49.	Indian-red, crumbling, argillaceous shale	3	6
50.	Brownish and greenish argillaceous shale, with bands of sandstone. Quartz crystals in the joints; calcspar veins and blotches	19	0
51.	Greyish-red quartzose sandstone	1	1
52.	Reddish argillaceous shale with green streaks which run in the bedding or joints, and probably originated after the deposition and consolidation of the beds	10	0
53.	Indian-red argillaceous shale and sandstone, streaked with veins of quartz and calcspar	3	10
54.	Reddish and greenish argillaceous shale and sandstone	16	0
55.	Indian-red argillaceous shale with greenish concretionary limestone	0	5
56.	Reddish, brownish and greenish, mottled, fine, argillaceous sandstone	1	9
57.	Measures concealed. Dip N. 82° E. $< 40°$	32	0
58.	Greenish and brownish, mottled, argillaceous shale, with concretions and thin bands of fine, coherent sandstone. The brownish shales are most abundant, the greenish occurring in thin layers or lenticular streaks	66	0

59. Reddish, coherent, fine sandstone, with vugs and threads of quartz and calcspar	11	0	Veins of quartz and calcspar.
60. Reddish-grey, jointed and broken sandstone, veined with quartz	8	0	
61. Measures concealed, probably reddish, crumbling, argillaceous shale	4	0	
62. Greenish-grey, waving, coherent sandstone with quartz veins in the joints	2	0	
63. Measures concealed, probably reddish argillaceous shale	6	0	
64. Reddish, crumbling, argillaceous shale, with layers of coherent sandstone	30	0	
65. Measures concealed. Occasional reefs of sandstone	58	0	
66. Reddish argillaceous shale	80	0	
67. Greenish argillaceous shale	2	6	
68. Reddish argillaceous shale with green blotches and sandstone layers	23	0	
69. Reddish coherent sandstone	2	9	
70. Brownish argillaceous shale	1	6	
71. Greenish argillaceous shale	4	0	
72. Brownish argillaceous shale	3	0	
73. Measures concealed. Dip N. 84° E. $<$ 43°	57	0	
74. Greenish and bluish-grey, fine, coherent sandstone, with threads of quartz	23	0	
75. Measures concealed. Dip S. 82° E. $<$ 44°	119	0	
76. Rusty-grey, shaly and thick-bedded, fine micaceous sandstone, often beautifully rippled; broken plants; quartz crystals in the joints	10	0	Plants.
77. Reddish argillaceous shale mixed in lenticular beds with greenish argillaceous shale. Bands of sandstone	16	0	
78. Greenish-grey very coherent sandstone, rippled and waved, rust-spotted and marked with broken, carbonized plants	15	0	
79. Brown argillaceous shale	8	0	
80. Measures concealed. Mouth of a small brook	13	0	
81. Bright brown shale with greenish and reddish harder bands.	14	6	
82. Reddish sandstone	2	10	
83 Bright green, reddish and brown argillaceous shale	84	0	
84. Dirty greenish and reddish, micaceous, more arenaceous shale, crumbling and containing a few harder concretions	36	0	
85. Measures concealed. Dip S. 87° E. $<$ 50°	368	0	
86. Greenish-grey, reddish and brown sandstone and shale	20	0	
87. Grey and greenish sandstone	8	3	
88. Bright indian-red, crumbling, argillaceous shale	5	0	
89. Reddish and greenish sandstone and argillaceous shale with a few brighter bands, full of quartz-films in the joints	30	0	
90. Bottle-green sandstone with films of calcspar and quartz	7	10	
91. Grey, compact, calcareous sandstone	0	6	
92. Reddish, greenish and bright brown sandstone and shale, with minute films of quartz and calcspar	74	8	
93. Grey and greenish-grey, coherent, fine sandstone and argil-			

	laceous shale, jointed in the direction of the bedding..	16	7
	94. Reddish argillaceous shale with streaks of green.....	7	9
Dark calcareous shales with fossils.	95. Greenish and grey argillaceous and arenaceous shale and sandstone, with thin, rusty, calcareous layers.....	7	10
	96. Dark bluish-grey and grey evenly-bedded shales with lenticular layers of limestone, containing numerous small *Naiadites* and entomostracans. *Leaia Leidyi* was found in loose pieces of rock apparently derived from this bed.....	13	2
	97. Greenish, harsh, micaceous, argillaceous rock	4	9
	98. Reddish and greenish-mottled, beautifully rippled sandstone and argillaceous shale, with thin layers of limestone at bottom.....	32	2
	99. Bright red argillaceous shale.....	2	1
	100. Greenish, reddish and bluish argillaceous shale and sandstone; broken plants.....	11	8
	101. Reddish, greenish and bright indian-red argillaceous shale and sandstone, with veins of quartz in the joints, sometimes an inch and a half thick.....	161	4
	102. Greenish-grey argillaceous shale and sandstone, with a few red bands. Passes into a very coherent, grey or rusty sandstone, with plants.....	43	6
	103. Brown and indian-red argillaceous shale with lighter bands..	13	9
	104. Reddish and greenish argillaceous sandstone with greenish blotches and layers of shale.....	12	6
	105. Bright brown, crumbling, argillaceous shale.....	5	2
	106. Greenish and grey, fine, rippled sandstone, full of quartz and passing into argillaceous shale.....	31	0
	107. Reddish jointed sandstone, full of quartz. Passes downward into brown and reddish argillaceous shale, with thin bands of rusty, coherent sandstone.....	38	0
	108. Grey, greenish and rusty sandstone, with broken plants.....	5	9
	109. Dark and light-bluish, evenly-bedded argillaceous shale....	4	2
	110. Greenish and greyish, more crumbling argillaceous shale....	6	1
	111. Reddish, greenish and bluish argillaceous shale.....	15	9
Fossils.	112. Bluish and grey, evenly-bedded, fine shales, full of *Modiolæ* or small entomostracans.....	57	9
	113. Greenish and greyish, less shaly rocks, with coherent layers. Small, grey calcareous beds.....	45	7
	114. Light greenish-grey, harsh, flaggy or thick-bedded rocks, with films of quartz and calcspar.....	11	0
	115. Bluish-grey, evenly-bedded, argillaceous shale, with thin bands of limestone.....	9	3
	116. Greenish-grey crumbling rocks, succeeded by fossiliferous shales.		
	117. Reddish and greenish, mottled, crumbling, argillaceons shale	38	0
Fossils.	118. Dark bluish argillaceous shale containing entomostracans; thin bands of sandstone and limestone; quartz and calc-		
Veins.	spar veins.....	64	6

119. Greenish and grey, harsh, crumbling, argillaceous shale.....	6	0	
120. Dark bluish shales holding entomostracans.....	3	0	
121. Greenish, fine, rippled sandstone.....	7	0	
122. Dark bluish, fine, rusty shales	2	6	
123. Greenish-grey argillaceous shale	4	0	
124. Black or dark-bluish argillaceous shale, sometimes papery...	15	9	
125. Greenish and bluish, fine, nodular argillaceous shale, with thin bands of limestone.....	51	6	Limestone.
126. Greenish and reddish argillaceous shale and sandstone, passing in places into dark shales.....	105	0	
127. Bright red, reddish and greenish, argillaceous, friable and harder rocks.....	150	0	
128. Dark bluish and greenish-grey micaceous shale, with broken plants.....	11	10	Plants.
129. Greenish-grey argillaceous rock, with rusty harder bands....	15	6	
130. Bright red, reddish and greenish, crumbling, argillaceous shale. Some layers are full of greenish nodules.....	121	0	
131. Measures concealed.....	27	0	
132. Reddish and greenish sandstone.....	28	0	
133. Bluish-grey argillaceous shale.....	12	6	
134. Greenish argillaceous shale, full of concretions	7	7	
135. Dark shales with hard, rusty bands.....	29	6	
136. Greenish-grey sandstone, full of blotches of quartz.....	7	9	
137. Greenish and bluish, coherent, argillaceous shale.....	14	6	
138. Brown argillaceous shale, with greenish layers and bands of sandstone.....	80	0	
139. Dark argillaceous shale, with hard bands.....	25	0	
140. Greenish argillaceous shale	8	0	
141. Red and greenish argillaceous shale, with hard bands.....	121	0	
142. Measures concealed. Dip S. 87° E. $<$ 53°.....	170	0	
143. Greenish sandstone reef.....	15	0	
144. Broken land soon succeeds, probably underlaid by plaster and limestone. Assuming that the rocks dip as before, there is to the small brook on the south point of Plaster Cove a thickness of.....	754	0	
145. The distance from this brook to the top of the limestone is about 725 feet. Assuming that the angle of dip is 60° and that the strata are not crumpled, this will give a thickness of 628 feet, the greater part being occupied by gypsum, limestone and gypseous marl. One bed of the gypsum is estimated by Dr. J. W. Dawson (Acadian Geology p. 392) as 150 feet thick.....	628	0	
146. Limestone, described in Acadian Geology, p. 391; thickness indefinite	30	0	Devonian rocks
147. Flinty quartzite, sandstone and conglomerate (*Devonian?*) seen between Plaster Cove and McMillan Point.....	..	..	
Total thickness.....	6102	5	

Between Emery's wharf and a point on the beach south of the cross

roads at Dominion wharf, a thickness of about 824 feet, is concealed with the exception of occasional bands of grey sandstone. Rocks are then again seen on the beach which perhaps represent the millstone grit. These are in ascending order as follows:

SECTION AT HAWKESBURY HARBOR.

		FEET.	INCHES.
1.	Measures concealed between Emery's wharf and the shore east of Dominion wharf. Dip N. 75° E. < 53°. A few indistinct beds of grey sandstone	824	0
2.	Measures concealed	117	0
3.	Grey, flaggy and shaly sandstone, passing upward into reddish, shaly, crumbling sandstone	34	0
4.	Reddish and greenish argillaceous shale, not well seen	19	0
5.	Reddish sandstone	8	0
6.	Measures concealed	51	0
7.	Reddish sandstone and argillaceous shale	10	3
8.	Greenish-grey argillaceous shale and sandstone	5	2
9.	Dark bluish-grey crumbling shale	2	6
10.	Greenish-grey, nodular, argillaceous shale	3	9
11.	Dark bluish-grey, crumbling, papery shales	6	10
12.	Greenish-grey, crumbling, argillaceous sandstone	3	11
13.	Measures concealed	110	0
Plants. 14.	Rusty-grey sandstone, false-bedded, with markings of plants. (No. 11 of next section)	61	9
15.	Measures concealed. Dip N. 64° E. < 57°	173	0
16.	Dark bluish-grey, crumbling, argillaceous shale	59	0
17.	Measures concealed	67	0
18.	Grey, very coherent sandstone	8	0
19.	Measures concealed	34	0
20.	Dark bluish argillaceous shale	4	0
21.	Greenish-grey sandstone	4	0
22.	Dark bluish, fine, argillaceous shale	7	0
23.	Grey impure limestone	0	10
24.	Dark bluish argillaceous shale, with bands of dirty limestone and rusty sandstone. Greatly contorted	61	0
25.	Measures concealed	11	0
26.	Grey sandstone	17	0
27.	Dark bluish shale, like 24	8	4
28.	Grey rusty sandstone	2	0
29.	Grey and bluish-grey argillaceous shale	7	6
30.	Light grey sandstone	1	9
31.	Bluish-grey argillaceous shale	5	0
32.	Light grey sandstone	1	3
33.	Bluish-grey, micaceous, argillaceous shale	4	6
34.	Light grey rusty sandstone	0	8
35.	Bluish-grey argillaceous shale	4	5
36.	Light grey, rusty, micaceous sandstone, jointed and broken, marked with plants	4	6
37.	Measures concealed	8	0

38. Bluish-grey argillaceous shale	6	3	
39. Light grey waving sandstone	0	8	
40. Grey and bluish-grey argillaceous shale, with thin limestone bands. *Naiadites*	92	8	Shells.
41. Grey and bluish-grey, thin and thick-bedded, flaggy sandstone	21	6	
42. Grey and bluish-grey argillaceous and arenaceous shale	9	6	
43. Greenish, waving, micaceous, shaly sandstone	6	3	
44. Dark bluish argillaceous shale	3	11	
45. Light grey thick-bedded sandstone; broken plants	2	0	
46. Bluish-grey argillaceous and arenaceous shale, with thin bands of sandstone	11	9	
47. Grey sandstone; ripple marks at top	1	4	
48. Grey areno-argillaceous shale with thin bands of sandstone	12	5	
49. Light grey flaggy sandstone, with broken plants	3	11	
50. Grey and dark bluish-grey, argillaceous and arenaceous shale, with thin bands of sandstone	8	6	
51. Light grey sandstone	1	11	
52. Bluish and grey argillaceous shale	8	8	
53. Light grey, fine, flaggy and shaly sandstone, with minute veins of calcspar. One of these veins contains black and honey-colored zinc blende	5	5	Zinc blende.
54. Bluish-grey argillaceous shale	4	7	
55. Sandstone, in thin and thick beds	12	0	
56. Dark bluish argillo-arenaceous shale	2	6	
57. Calcareous sandstone	2	6	
58. Dark bluish argillaceous shale	10	6	
59. Flaggy sandstone and argillaceous shale	31	5	
60. Light grey sandstone	2	7	
61. Dark bluish argillaceous shale, with thin layers of sandstone, the latter usually waving or rippled. Toward the top the beds become more sandy. Fine impressions of fucoids	160	0	Ripple-marks: fucoids.
62. Measures concealed. Dip N. 53° E. < 54°	57	0	
63. Greenish argillaceous shale	3	0	
64. Greenish waving sandstone	2	0	
65. Bluish argillaceous shale	..	..	
66. Measures concealed to the middle of the bridge on the road at the head of the harbor	76	0	
Total thickness	2311	8	

Above these rocks lie grey sandstones and argillaceous shales, with occasional red bands. For about sixty-seven chains the angle of dip varies from 40° to 60°, then it becomes nearly vertical. This gives a thickness of about 3387 feet. Then comes an indefinite thickness of dark-bluish, black and grey argillaceous shale, with great bands of sandstone which form barrens. If no fault intervenes, assuming the

Strata above those of Hawkesbury Harbor.

angle of dip to be 75°, and the gypsum to begin at the small ponds near Little River, the distance is one hundred and forty chains, and the vertical thickness 8826 feet. All of this is then overlaid by the coal, gypsum and limestone of Little River.

Then follow the reddish strata occupying the country between Little River and the highest beds of the basin east of McLeod's bridge. The dip seldom exceeds 15°, the distance is about a mile, and the thickness probably less than 1350 feet.

Combining these sections, we have the thickness of carboniferous rocks in the region as follows:

Total thickness of carboniferous rocks.

	FEET.
1. From the highest beds seen at the syncline east of McLeod's bridge, to the gypsum of Little River	1350
2. Little River gypsum, limestone and coal, underlaid by dark shales and sandstones	8926
3. Grey sandstone with occasional red bands, as far as the bridge at the head of Hawkesbury Harbor	3387
4. Strata between Hawkesbury bridge and the highest rocks north of Emery Pond, as given in the section on p. 76	2195
5. Rocks between Emery Pond and Port Hastings, as in the section on pp. 79 to 83	6102
Total thickness	21960

On the south side of Hawkesbury Inlet the beds are repeated in descending order:

SECTION ON TUPPER POINT.

	FEET.	INCHES.
1. Measures concealed from the bridge (No. 66 of last section.) Dip N. 53° E. < 54°	858	0
2. Bluish-grey, wrinkled, argillaceous and arenaceous shale, with thin bands of sandstone	10	0
3. Alternations of bluish-grey and greenish, fine, ripple-marked sandstone and shale	54	0
4. Ripple-marked sandstone, with some bands of shale	65	0
5. Measures concealed	10	0
6. Grey sandstone and shale	9	0
7. Measures concealed	9	0
8. Flaggy sandstone	4	0
9. Measures concealed	45	0
10. Greenish argillaceous shale and sandstone	4	0
11. Greenish and grey sandstone. (Probably No. 14 of next section)	58	0
12. Measures concealed. Dip N. 65° E. < 50°	608	0
13. Reddish and greenish argillaceous shale	10	0
14. Greenish, fine, crumbling, argillaceous shale	9	0

15. Grey and greenish-grey fine sandstone, spotted with broken, carbonized calamites and other plants. Certain rusty spots show traces of green copper carbonate	63	0	Carbonized plants. Copper ore.
16. Measures concealed. N. 65° E. < 55°	20	0	
17. Reddish and greenish-grey sandstone	10	0	
18. Measures concealed. Dip N. 60° E. < 51°	23	0	
19. Sandstone	6	0	
20. Measures concealed	92	0	
21. Reddish and greenish flinty sandstone or quartzite, with concretionary conglomeritic patches	6	0	
22. Reddish argillaceous shale and sandstone	32	0	
23. Reddish coherent argillaceous sandstone	1	8	
24. Calcareous, concretionary, nodular sandstone	16	6	
25. Red, coherent, argillaceous rock	13	6	
26. Measures concealed	33	0	
27. Grey irregularly-bedded sandstone	48	6	
28. Measures concealed. Dip N. 54° E. < 52°	38	0	
29. Greenish and bluish-grey, flaggy and thick-bedded rusty sandstone	76	0	
30. Measures concealed	314	0	
31. Grey, calcareous, concretionary sandstone, mixed irregularly with conglomerate and limestone; like that of Grant Point	12	0	
32. Reddish, greenish and grey sandstone	36	0	
33. Measures concealed at the marine slip, but wherever seen consisting of red and purple sandstone and argillaceous shale. Dip N. 66° E. < 47°	387	0	Marine slip.
34. Alternations of reddish argillaceous shale and sandstone, with a few thin layers and blotches of green	249	0	
35. Reddish micaceous sandstone, irregularly bedded	36	0	
36. Measures concealed, except occasional reefs of mottled red and green argillaceous sandstone and shale; ripple marks	242	0	
37. Reddish or brown, micaceous, calcareous sandstone and shale, with greenish layers and blotches. Concretions of impure limestone	33	0	
38. Brown sandstone and shale 1 foot to 2 feet 3 inches	1	8	
39. Greenish nodular sandstone 9 inches, passing into nodular limestone 1 foot 1 inch, and grey flinty sandstone 4 inches. Like the red beds generally, these measures are extremely variable	1	1	
40. Alternations of brownish argillaceous shale and sandstone, principally the former	13	0	
41. Reddish sandstone	0	7	
42. Reddish argillaceous shale, with bright-green pipes. All the beds are more or less nodular, bright-green in places, and often well rounded by ice	4	0	
43. Alternations of reddish sandstone and shale	6	0	
44. Greenish calcareous shale	0	2	
A fault running N. 29° E. throws these beds down two feet and a half to the south.			Small fault.

45. Greenish-grey, impure, nodular limestone	0	6
46. Red or brown argillaceous shale with one or two thin layers of sandstone; reddish limestone nodules	12	0
47. Reddish-grey sandstone	1	0
48. Reddish shale	3	0
49. Reddish shaly sandstone	3	0
50. Reddish argillaceous shale, with thin, hard, limestone layers and nodules	17	0
51. Greenish-grey argillaceous shale with lenticular layers and nodules	6	0
These are the lowest beds seen on Tupper (Stapleton) Point, where they are well exposed in the cliffs.		
Total thickness	3610	2

Half a mile south of Tupper Point, on the shore toward Bear Island, some of the beds of this section are again repeated in ascending order.

	FEET.	INCHES.
1. Reddish sandstone and shale. (No. 37 of last section)	33	0
2. Measures concealed. Dip N. 66° E. < 46°	44	0
3. Greenish-grey sandstone	10	0
4. Measures concealed	58	0
5. Mottled greenish and reddish, coherent, shaly and waving sandstone	12	0
6. Reddish and brown argillaceous shale	9	6
7. Reddish sandstone	1	9
8. Brown argillaceous shale	4	0
9. Reddish sandstone 6 inches to 1 foot 6 inches	1	0
10. Reddish argillaceous shale with greenish layers	8	0
11. Reddish and greenish mottled sandstone	1	6
12. Brown argillaceous shale with small greenish nodules and thin layers of sandstone	10	0
13. Greenish nodular limestone	..	4
14. Brown argillaceous shale and sandstone, including a green layer	14	0
15. Measures concealed. There is some doubt about the estimate, because no rocks are seen for four fifths of a mile and the dip changes in direction in that distance from N. 62° E. to N. 38° E	308	0
16. Reddish grey sandstone. Dip N. 38° N. < 40°	6	0
17. Occasional reefs of reddish and greenish sandstone and shale.	12	0
Total thickness	533	1

Peebles Point.

On Peebles Point these strata should be repeated in reverse order, but no rocks are seen. Below the last mentioned bed (No. 17) there should be a thickness (Dip N. 15° E. < 45°) of 1832 feet; or, in

other words, the section should represent the strata for 1230 feet below the lowest rocks seen at Tupper Point (No. 51 of above section). Below this again is a thickness (Dip N. 23° E. < 38°) of 468 feet to the top of the first bed of next section. It begins at a wharf n Peebles Cove, and is as follows in descending order.

SECTION OF STRATA FROM PEEBLES COVE SOUTHWARD.

	FEET.	INCHES.	
1. Grey and greenish-grey rusty sandstone, sometimes flinty, sometimes crumbling	316	0	
2. Reddish argillaceous shale	9	6	
3. Measures concealed. Dip N. 34° E. < 40°	19	0	
4. Mottled, reddish and greenish, waving, flaggy sandstone	11	6	
5. Light-grey and rusty sandstone with markings of plants	9	0	
6. Measures concealed	5	9	
7. Shaly and flaggy sandstone	5	6	
8. Measures concealed	5	0	
9. Fine arenaceous shale	3	6	
10. Reddish, fine arenaceous shale	2	6	
11. Measures concealed	16	6	
12. Dark calcareo-argillaceous shales and flags	4	0	
13. Measures concealed	2	9	
14. Dark, fine argillaceous shale	11	6	
15. Measures concealed, with occasional layers of dark calcareous shale, containing large masses or a bed of black earthy pyritous limestone full of encrinites and small shells; traversed by netted veins of calcspar	31	0	Limestone Shells.
16. Greenish calcareo-argillaceous sandstone	2	0	
17. Occasional outcrops of dirty, shaly limestone and black calcareous shale	60	0	
18. Dark-bluish or black calcareo-argillaceous shale	8	0	
19. Greenish and bluish-grey, micaceous, calcareous sandstone, passing into calcareous shale	13	4	
20. Brownish and greenish argillaceous shale and sandstone	..	..	
21. Measures concealed. Dip N. 30° E. < 40°	75	0	
22. Dark calcareo-argillaceous shale	33	0	
23. Measures concealed by a shingle beach	202	0	
24. Measures concealed. Large blocks of sandstone and conglomerate on the shore and rocky sandstone land on the line of section	334	0	
25. Measures concealed by boulder clay, the bank being broken as if by landslides, and a good many blocks of dark limestone appearing on the shore. The estimate of the thickness assumes that the rocks still dip N. 30° E. < 40° as far as the mouth of the small brook at the end of the road to Caribacou between Wright Point and Ship Point. This is somewhat doubtful, because at this brook the strata are vertical, striking N. 64° E., or have a northerly dip. There is a fault here	366	0	Fault.
Total thickness	1266	4	

The general agreement of the beds of these sections with those between Hawkesbury and Port Hastings is remarkable. The dark shales (Nos. 15, 17 and 19) are probably those which contain *Leaia* near Plaster Cove.

The position of the following beds with relation to those just described is problematical. At 500 feet south of the little brook the dip is S. 62° E. $<$ 75°; 200 feet further, S. 76° E. $<$ 75°; immediately beyond, N. 68° E. $<$ 75°; 400 feet further south, N. 37° E. $<$ 75°; and this last dip continues thence far along the coast. If all the strata from the brook are on the south side of the fault, the succession in ascending order is as follows:

	FEET.	INCHES.
1. Greenish argillaceous shale and sandstone	34	0
2. Brown argillaceous shale and sandstone	3	6
3. Greenish and grey sandstone	12	0
4. Measures concealed	125	0
5. Grey and dark-bluish argillaceous shale	30	2
6. Measures concealed. Probably dark shale	21	9
7. Dark bluish-grey argillaceous shale	18	6
8. Measures concealed. Probably dark shale	28	0
9. Brown and greenish argillaceous shale	3	8
10. Measures concealed. Dip S. 62° E. $<$ 75°	179	0
11. Greenish and grey rusty sandstone, much broken	63	0
12. Measures concealed	77	0
13. Sandstone	6	0
14. Measures concealed	10	0
15. Grey sandstone in flaggy and thick beds, coarse in places; broken plants and upright trees. Thickness somewhat indefinite. The unlikeness to the beds of last section proves the fault indicated by the dip	148	0
Total thickness	759	7

The thick sandstone follows the shore for a great distance to the southward. It is just possible that this is the same as No. 11.

Overlying it at a vertical distance of about 200 feet, all of which seems to be sandstone of the same kind, the strike of the lower beds being from point to point on the shore, is another band of sandstone. The relation of this to the underlying measures is as follows:

SECTION NEAR BEAR ISLAND.

	FEET.	INCHES.
1. Grey and greenish-grey rusty sandstone, passing in places into dirty grey concretionary limestone or calcareous sandstone. It contains prostrate trees (*Calamites*, etc.) and root beds. Some layers are fine and smooth, waving, with a reddish tinge, others coarse and rough. Toward the bottom it contains patches of grey, calcareous, concretionary, rusty conglomerate. Seen on the shore at intervals for more than a mile	200	0

2. Sandstone similar to No. 1	450	0	
3. Black shale containing *Cordaites* and *Neuropteris* in abundance	4	0	Black shale. Plants.
4. Greenish-grey, crumbling, dirty argillaceous shale	15	0	
5. Measures concealed	40	0	
6. Greenish argillaceous shale, containing nodules of light-grey clay ironstone as large as cocoanuts, with streaks of hematite and traces of coaly matter	5	0	
7. Grey rusty sandstone	9	0	
8. Grey rusty sandstone with carbonized plants, shaly, flaggy, and thick-bedded, greatly contorted	47	6	Plants.
9. Measures concealed	6	0	
10. Reddish and greenish, friable, argillaceous shale	8	0	
11. Grey, jointed and broken, rusty, friable and coherent sandstone, generally fine and in thick beds; carbonized plants	10	6	
12. Bluish-grey, micaceous, areno-argillaceous shale or sandstone	11	6	
13. Measures concealed	21	0	
14. Light-grey and rusty thick-bedded sandstone	27	0	
15. Measures concealed; perhaps reddish rocks	18	0	
16. Greenish-grey sandstone, the lower half indistinctly seen	12	0	
The dip is overturned to about S. 5° E. $<$ 80°.			
Total thickness	884	6	

The next rocks seen about half a mile further and near the west side of the cove north of Bear Island, have a very different dip N. 65° E. $<$ 85°. If no fault intervened, therefore, No. 16 would be overlaid by about 600 feet of concealed measures, and among them the thick sandstone (1 and 2.) That this should remain unseen is improbable, and the next rocks are of a different character—softer and reddish. These are on the western side of Bear Point, and are in ascending sequence as follows: Bear Island.

	FEET.	INCHES.
1. Greenish-grey, argillaceous, micaceous, waving sandstone	..	..
2. Reddish-grey, argillaceous, waving sandstone	6	0
3. Measures concealed. Probably like the foregoing	70	0
4. Greenish-grey and reddish sandstone	20	0
5. Greenish, reddish and brownish, rippled, waving, micaceous sandstone and argillaceous shale in alternate layers. Dip N. 67° E. $<$ 74°	432	0
6. Measures concealed	..	..
Total thickness	528	0

Similar rocks are seen to overlie the preceding at many points on the peninsula between the Strait of Canso and Seacoal Bay, the dip turning further to the south at a lower angle. The thickness thus

Flat Head.

present to the easternmost point of Flat Head would be about ($< 50°$) 4045 feet, the distance across the strike being one mile.

Hawkesbury black shale.

On the St. Peters road, about a mile and a quarter from the chapel at Hawkesbury, black shale containing *Naiadites* is in the road which follows it on the strike about half a mile as far as a road turning off on the left at a small brook. In this brook below the road, grey argillaceous sandstone dips S. 70° E. $< 72°$, whilst lower down the dip is N. 81° E. $< 65°$, and half a mile above the mines road N. 84° E. $< 70°$.

Mines road.

From the crossing of this brook along the mines road to the next brook to the eastward, reddish, fine sandstones, with conglomerate in patches, form rocky barrens, and similar rocks continue as far as the right branch of Little River, where they are compact and coherent. Blocks of quartzose sandstone, grit and conglomerate appear on the track from the mines to McVicar's.

River Inhabitants.

On the St. Peters road from McLeod's bridge to the Kemp road post-office, reddish and purplish, argillaceous, shaly sandstone is abundant, and prevails also on the roads to Inhabitants Basin and toward Black River, with light greenish and grey, coherent, fine sandstone.

Buchanan's.

Near Buchanan's, grey and bluish-grey argillaceous shales occur. Fragments of coal are reported to have been picked up in a brook on the east side of the road to the basin, but its occurence here is very doubtful. Blocks of bright reddish and purplish sandstone and shale occur towards McRae's mill and the Grandique road. A descending section near the mill is as follows:

Section at McRae's mill.

	FEET.	INCHES.
1. Greenish-grey, more or less sandy, argillaceous shale	20	0
2. Greenish and purplish, mottled, somewhat sandy argillaceous shale	25	0
3. Greenish and grey, rusty, shaly and flaggy sandstone	40	0
4. Reddish argillaceous sandstone	10	0
5. Grey, greenish-grey and purplish argillaceous shale	10	0
6. Reddish, crumbling, argillaceous sandstone	15	0
7. Grey, greenish-grey, reddish and purplish argillaceous shale, sometimes sandy and containing broken plants. At a driblet near the top of the hill the dip is N. 60° W., nearly vertical	120	0
8. Bluish and greenish argillaceous shale	15	0
9. Reddish and purplish argillaceous shale; not well seen	30	0
10. Greenish-grey papery shale	10	0
11. Reddish, crumbling, more or less sandy argillaceous rock	15	0
12. Similar alternations badly exposed	45	0
Total thickness	355	0

West Bay.

In the brook flowing along the Grandique road north of Neil McPhail's, these rocks are well exposed and also near the head of West Bay, where they are greatly contorted in some of the brooks.

Grey and reddish sandstone and argillaceous shale are seen in many of the brooks and roads between Bear Island and Hawkesbury, dipping as shown on the map. Bear Island to Hawkesbury.

Emery Brook is full of cascades and rapids. Below the small lake, the following rocks occur, the exposed thickness not being very great because they are cut on the strike: Emery Brook.

1. Reddish-grey, fine, flinty sandstone and argillaceous shale.
2. Dark-bluish, nearly black, micaceous, argillaceous shale, containing lenticular masses of limestone and sandstone, not slaty nor altered. Probably part of the section seen at the town of Hawkesbury. The interbedded sandstone is very coherent and not unlike that of Rocky Bay. Impressions of *Naiadites* quarter of an inch in length occur in some of the soft, argillaceous shales, and the limestones contain *Spirorbis*. Shells.
3. Grey, micaceous, often nearly compact, quartzo-felspathic sandstone, with bluish-grey argillite and bands of rusty-weathering, dark limestone, with obscure plant-markings.
4. Dark fine shales, interstratified with grey and blackish quartzites, with specks of iron pyrites. Between the layers of the shales are thin bands of calc-spar. The quartzites are as compact as any of those of Arichat. The shales on the contrary are soft, but sometimes coherent and contorted.
5. Grey ripple-marked quartzite and quartzo-felspathic sandstone appear at the head of tide-water in Emery pond.
6. Grey, ripple-marked quartzites overlie these rocks in the adjoining brook as far as the Crandall road.
7. Coarse and fine grey sandstone of the same brook east of the Crandall road. Crandall road.

In another branch of this brook which crosses the Crandall road further north, the dark shales are again well exposed with a two-inch band of rusty limestone, the dip being S. 68° E. $< 55°$. Up stream they are overlaid by grey, fine, coherent rocks forming cascades. Lower down are reefs of dark-bluish, finely laminated, argillaceous shale, patches of rusty limestone and grey crumbling shale, ripple-marked and containing globular concretions of more coherent argillite and bands of sparkling, rusty-weathering, compact sandstone and quartzite. Frequent outcrops of reddish-grey coherent strata, resembling those of Kemp Road and West Bay, form rapids and cascades in the Tannery Brook between Hawkesbury and Port Hastings, and on many of the roads toward the Big Brook road, barrens too stony for cultivation.

Extension of the Rocks of Plaster Cove.—The limestone, marl and gypsum of Plaster Cove are easily traceable back from the shore by pits, ponds and cliffs in the brooks flowing into the cove and on the Victoria and Big Brook roads. On the Victoria road the limestone has been quarried and burnt. It is bluish-grey, com-

pact or oolitic, banded or waved and full of veins of white, yellowish and pink crystalline calcspar, holding specks of iron pyrites. The joints contain soft, clayey matter, sometimes faintly tinged as if by oxide of iron or manganese. The resemblance to the Pirate Harbor or Blue Cape limestone is very striking, and there is every reason to suppose that they are identical. Associated with it are carboniferous marl and conglomerate, beneath which are the altered devonian rocks. Green marl is also seen in the Big Brook road near the second brook east of the fork of the Victoria road. Below the plaster ponds in one of the Plaster Cove brooks a grey, vesicular, rusty limestone, often dark and bituminous, containing rusty vugs of calcite, is accompanied by occasional outcrops of reddish-grey and greenish, soft, argillaceous marl, and followed by the plaster at the head of the pond.

Plaster Cove brooks.

In the most easterly of these brooks at the foot of the twenty-five feet fall, just above tidewater, are greenish-grey and reddish, micaceous sandstone and shale, quartz-veined across the bedding, very coherent and dipping steeply N. 70° E. Higher up are dark, coherent, argillaceous shales, succeeded by flaggy, fine, coherent sandstone or quartzite. Nearer the source of the brook, reddish-grey argillaceous sandstone occurs.

Limestone quarry.

In the branch flowing from the Victoria road at the limestone quarry, a greenish-grey, fine, coherent sandstone occurs just below the road, nearly vertical, with a southerly strike; followed by red and green soft clay rock. Further down is a cliff of bluish-grey, veined, compact limestone, like that of the quarry, followed by red and grey, mottled, micaceous, argillaceous shales and flags dipping S. 80° E. $< 85°$, and overlaid by thirteen feet of dark, bluish-grey, rusty-weathering, bituminous limestone, with a few specks of iron pyrites. It has the aspect charcteristic of all the carboniferous limestones from Sydney to Gabarus, but which is wanting in those of St. Peters, Arichat, Guysborough and Hastings, perhaps owing to alteration. It is, moreover, full of encrinite stems and other obscure fossils, besides brachiopods, of all sizes, up to a third of an inch in length, which show on weathered surfaces the general form mineralized by crystalline calcspar. The limestone seems of fair quality throughout, and would probably make a good strong mortar-lime, although certain layers are rusty and sandy. A little further down it is associated with plaster.

Shells.

In a brook crossing the Victoria road further north, mottled, red and green, crumbling, argillaceous shale and sandstone are succeeded up stream by bluish and grey limestone, sometimes so pyritous as to weather bright yellow. The upper beds are impure, argillaceous or arenaceous. Fossils are not numerous although by no means absent,

Fossils.

It seems to be thicker than that described above and forms a succession of small falls.

In McQuarrie's fields, north of Dorton's bridge, is a light-colored, semi-crystalline limestone, probably overlying unconformably the conglomerate and quartzite of the vicinity and of Brown's mill. In the brook entering the north-west arm of River Inhabitants from the east, below the mill, it is whitish-grey and impure. It is variable in dip as well as in color and texture, being hard, coherent, calcveined, shaly or even slaty, bluish-green, weathering into ridges and furrows, perhaps on account of the layers of argillite and sandstone which it contains. In general it may be said to resemble the limestone of Guysborough, St. Peters and the quarry at the Victoria road. Below it occur huge outcrops of coherent, grey conglomerate, the brook following for some distance the line of contact. Dorton's bridge. Northwest arm.

Limestone and plaster are first met with on ascending from the confluence of the north-west arm with River Inhabitants. The former is here light-grey, nearly compact, with white calcspar in veins, streaks and vugs, sometimes twisted and obscurely laminated, concretionary, and like that just described. The dip is south-easterly but obscure. A little higher up plaster occurs, as well as in the fields below the limestone on the right bank. Then a few blocks of friable conglomerate, probably carboniferous, occupy the brook, succeeded, higher up, by a conglomerate more like that of Arichat and by other very coherent rocks. A grey, jointed, coherent, rusty-weathering argillite follows; and higher up is a cliff of bluish and greenish-grey, micaceous, smooth, argillaceous rock, not always splitting into shales but having the lamination of the thicker layers distinct. It resembles the shales of Eddy Point and, like them, is generally unfossiliferous, although certain layers yield obscure specimens of *Leaia* and brachiopods, and some of them are also covered with small knots like rain-prints or fucoidal impressions and traversed by minute cracks, perhaps of recent origin. At one point the shales form the end of a small basin or plication. They have a jointed, slaty, ancient aspect, and are in all probability the rocks which overlie the gypsum at Plaster Cove. Up stream, bluish, light-grey and greenish, papery, micaceous shales are interbedded with coherent, compact, calcareous sandstone, and mottled red and green somewhat coherent argillite, covered in places by large, greenish, knotty, coherent concretions, full of iron pyrites. Certain drab beds are covered with broad ripple-marks. Dirty, greenish-grey, micaceous, flaggy argillite; jointed, coherent, light-grey, nearly compact, quartzo-felspathic sandstone; and reddish compact rock divided by joints into blocks the sides of which are sometimes nine inches in length, follow the Crandall road. Above Shells.

this road, mottled, grey, reddish and greenish argillaceous shales and sandstones in texture like the rocks of L'Ardoise, and continuous with those just described, form a cliffy, rocky brook and are well exposed as far as Dorton's bridge. Above the bridge bright-green, coherent shales and ripple-marked flags dip S. 5° E. $< 30°$ with considerable regularity for some distance. The shales are not seen in contact with the gypsum and limestone here, but near a small tributary from the left bank a bright-green marl perhaps indicates their proximity. The shales are more crumbly than those of Guysborough and have fewer quartz veins. In the immediate neighborhood, grey, coherent, Arichat conglomerate appears.

Rocks above McLeod's bridge on River Inhabitants.

In the large brook flowing into River Inhabitants from the eastward between McLeod's and the new bridge, reddish-grey argillaceous sandstone is first seen above the road, succeeded by indian-red, purplish, and mottled argillaceous and arenaceous, ripple-marked, contorted, jointed shale and sandstone, containing obscure plants and shells. Similar rocks are often met between River Inhabitants and West Bay. Interstratified with these in the next brook to the northward is a bluish-grey argillaceous shale and concretionary rock, sometimes an impure limestone, cross-jointed at irregular intervals parallel to the dip and strike. Good outcrops are seen in the lower part of this brook. Some of the sandstones are grey and very fine, with small carbonized markings; they have been quarried for rough work in building.

Long Stretch bridge.

In the large brook near the Long Stretch chapel, dark-grey, fine, micaceous, argillaceous shale and reddish and greenish sandstone, contorted and waving, dip in various directions, associated with a dark-grey, compact, bituminous, contorted limestone, containing minute crystals of calcspar. This is probably identical with the limestone seen in the fields near Mr. Archibald McDonald's house.

On the right bank of the river near the Long Stretch bridge, plaster pits are numerous, the country being as usual greatly broken, and the ground wet and clayey. Large hemlock and hardwood trees grow in the neighborhood of the pits. Above the road, light, reddish-grey argillaceous sandstone is occasionally seen, succeeded by flaggy argillaceous rock, bluish-grey and calcareous, or mottled, bright-red and green, coherent or crumbly, with layers of greenish impure limestone.

Lamey Brook limestone and gypsum.

Lamey Brook, below the Crandall road, exposes a bluish or light grey limestone about fifteen feet thick, in layers varying from three inches to two feet, strongly resembling that of Plaster Cove and full of encrinites and brachiopods. It contains dark films of free bitumen, is often earthy, rusty-weathering, vesicular, intersected by numerous veins of light pink and white calcspar a foot thick and downward, which also penetrate the underlying soft purplish and grey marls. Separated from

it by a concealed interval is grey gypsum with red concretionary streaks. Nodular masses of a dark, more or less crystalline limestone also appear, sometimes surrounded by a thin framework of gypsum; and a great part of the rock is spotted with the limestone which stands out on the weathered surfaces. The gypsum is associated with light-green gypseous marl. At the next turn in the brook below, the limestone again appears, containing patches of a concretionary conglomeritic variety. Below McMaster's sawmill a hard quartzose grit is interstratified with reddish and greenish shale and sandstone.

McMaster Brook.

A carboniferous outlier occurs among the felsites in the south branch of McMaster Brook, consisting of red soft marl and highly bituminous limestone, apparently vertical with a south-west strike. On the road above, red and greenish marl are in contact with the syenite.

Princeville Brook.

4th Syncline or Basin.—The North Princeville Brook in the falls and wild valley above River Inhabitants road displays fine exposures of red, purple, greenish and grey sandstone and shale, ripple-marked and micaceous. Higher up and in the neighboring roads and brooks these rocks are also seen.

The South Princeville Brook affords good outcrops at many points between the Big Brook road and River Inhabitants. Below this road, grey and dark-bluish, ripple-marked argillaceous shale, showing a considerable thickness with a low inclination, is mixed with flaggy, soft sandstone.

Coal measures of the River Inhabitants syncline.

The rocks of River Inhabitants above the red bridge, and less than three quarters of a mile from the precambrian hills, are of great variety and interest and probably represent those which overlie the gypsum and limestone in Plaster Cove. They contain the "coal measures" of the source of River Inhabitants, and occur in ascending order as in the following section, which is, however, only approximate, most of the strata being measured in the bed of the river:

SECTION OF CARBONIFEROUS ROCKS IN THE BASIN BETWEEN GLENDALE AND BIG BROOK.

	FEET.	INCHES.
1. Precambrian syenite and felsite of the hills	..	..
2. Measures concealed for nearly three quarters of a mile to the red bridge over River Inhabitants. On the strike are the Glendale limestone and conglomerate	3320	0
3. Measures concealed above the red bridge. Dip N. 89° E. $< 60°$	300	0
4. Greenish-grey coherent grit and fine conglomerate	50	0
5. Greenish-grey, argillaceous and arenaceous shaly and flaggy beds, with layers of fine, coherent, micaceous sandstone	265	0
6. Reddish-grey sandstone, sometimes almost flinty	0	0

		FEET.	INCHES.
	7. Grey, fine, quartzo-felspathic sandstone or quartzite, in thick beds, forming a cascade. Dip S. 85° E. < 70°	15	0
	8. Alternations of rocks similar to the foregoing	253	0
	9. Reddish-grey, fine, argillaceous rock, not well laminated, associated with coherent sandstone, often calcareous and full of minute veins of calcspar	25	0
	10. Frequent outcrops of reddish-grey coherent rocks, including a fine calcareous conglomerate. Dip N. 85° E. < 65°.	485	0
	11. Grey, greenish and bluish, soft argillaceous shale and sandstone, with a nearly vertical dip	330	0
Fossils at Glendale.	12. Dark-bluish shale and coherent grey marl with impressions of a minute bivalve shell and of *Leaia Leidyi*. Seen in small layers of limestone in the river just behind Glendale chapel	10	0
	13. Soft, red and grey argillaceous shale	2	0
	14. Reddish-grey, crumbling, argillo-arenaceous rock, like that of West Bay	10	0
	15. Bluish-grey argillaceous shale, with fine layers of calcareous sandstone, or impure limestone, somewhat contorted; followed by waved and contorted shales with polished, graphitic surfaces, sometimes as bright and smooth as glazed crockery. Seen only at intervals	390	0
Fossils.	16. Grey and greenish, evenly bedded, micaceous, argillaceous shales, containing fucoids and *Naiadites*. Dip S. 75° E. < 47°	114	0
	17. Measures concealed to the bridge on the road to John McInnes' house. Dip S. 80° E. < 40°	1500	0
	18. Reddish and greenish-grey, shaly, fine, micaceous, argillaceous, soft, rippled sandstone, like that of West Bay. Dip S. 80° E. < 30°	80	0
	19. Reddish, crumbling, argillaceous shale, lenticularly bedded and enclosing bands of fine, coherent sandstone, sometimes rippled and waved. In cliffs and reefs. Dip S. 60° E. < 37°	390	0
	20. Reddish-grey, grey and greenish, fine, soft sandstone, in long reefs, breaking into large blocks which might be used for rough work in building. Several cascades, with a few concealed intervals. Dip S. 58° E. < 25°	648	0
	21. Grey and reddish, fine, jointed sandstones, like those of St. Peters and River Bourgeois. Seen occasionally in rapids and falls	368	0
	22. Measures concealed	38	0
	23. Sandstone and argillaceous shale; not well seen	75	0
	24. Measures concealed. Two rusty springs about half-way	315	0
	25. Reddish and greenish argillaceous rocks	120	0
	26. Measures concealed	87	0
	27. Reefs of reddish, greenish and grey fine sandstone	100	0
	28. Measures concealed	85	0

	FEET.	INCHES.	
29. Argillaceous shale and sandstone in reefs	40	0	
30. A few exposures of rocks similar to the foregoing	25	0	
31. Measures concealed. Dip S. 48° E. < 18°. Occasional reefs not well exposed	500	0	
32. Bluish-grey, crumbling argillaceous rock, full of plant impressions and often a rich *Cythere* marl. Dip S. 43° E. < 10°	27	0	Plants.
33. Black calcareo-bituminous wrinkled shale or limestone, in rhomboidal blocks of variable length and breadth, *Cythere, Spirorbis, Naiadites*	0	9	Shells.
34. Dark, crumbling, argillaceous marl	0	6	
35. Bluish, compact, splintery, concretionary limestone	0	2	
36. Bluish, soft, argillaceous shale, with ironstone balls	15	0	
37. Indistinct outcrops of grey and greenish argillaceous rock, with thin bands of coherent quartzose sandstone	63	0	
38. Rocks not well seen	30	0	
39. Brick-red, earthy, argillaceous rock, traversed by green vein-like streaks	25	0	
40. Underclay or crumbling bluish argillaceous shale, with two or three thin coaly layers. Shells	7	0	Coal seam of Upper River Inhabitants.
41. Black coaly shale, passing in places into coal	1	0	
42. Black soft shale	1	3	
43. Coal	1	8	
44. Dark argillaceous shale full of shells	4	0	
45. Dark shale, very coherent and calcareous, full of *Cythere*	1	3	
46. Dark-bluish or blackish, well laminated argillaceous shale, crowded with *Cythere, Spirorbis, Naiadites*, and a few leaves and stems of *Cordaites*	9	0	
47. The overlying shales are exposed in the bends of the river south of Neil McCuish's, being nearly or quite horizontal. It is probable that the rocks overlying the coal in this basin do not exceed 200 feet. The quantity of available coal in the basin, even if the seam were much larger, would be extremely small	200	0	
Total thickness	10326	7	

Dark bluish and blackish shelly shales and sandstones occasionally appear as far as McIntosh's clearing, including a grey shale full of rootlets and ironstone balls. In one of the brooks in Neil McCuish's clearing is a thin band of bluish-grey pyritous limestone nearly horizontal or with a slight southerly inclination. Above the road to Big Brook, reddish and grey sandstone and shale are frequently exposed. Possibly other seams of coal may occur on this section. If so they can be found in the river or by boring, the strata being nearly horizontal and the surface not deep.

Overlying the banded felsitic rocks in McLennan Brook are indian-

red sandstone and grit, slightly micaceous, soft, fine-grained and seamed with calspar, associated with micaceous, reddish conglomerate, containing small pebbles of white vitreous quartzite, greenish felsite, crystalline limestone and mica schist. These rocks pass into one another. Falls occur, as is the case in all the brooks of the neighborhood, at the contact of the carboniferous and precambrian systems. Above these rocks comes a grey, thin-bedded limestone, about six feet thick, seamed with calcspar and containing obscure brachiopods. Just above the Victoria road is a dark-grey argillaceous shale. Below the road, dark and light grey and indian-red shale and sandstone with obscure *Naiadites;* and bright-red, greenish and grey, mottled, ripple-marked marls often occur.

Fossils.

In the next brook north of the mill similar strata are displayed, including beds of limestone-conglomerate. If this limestone be the same as that of Plaster Cove, a great change in the character of the rocks is indicated, those of McLennan Brook, especially the lowest, being much more friable than those of the red bridge not far distant. Such changes will, however, generally be noticed in tracing strata on the strike for a great distance.

Glendale.

In the brook at the Glendale post-office, soft, greenish-grey argillaceous shale, dark-grey calcareous shale containing *Naiadites* and fragments of plants, reddish and grey, micaceous, mottled sandstone, and arenaceous, laminated limestone, dip S. 57° E. $< 65°$. The limestone sometimes passes into grey shale. Higher up, purplish conglomerate and sandstone are underlaid by precambrian strata. In the brooks near Donald Smith's, a similar passage of a reddish argillaceous lime stone into fine sandstone is seen. It thus seems to be variable and perhaps does not occur near the red bridge on the line of the section last given. Other brooks exhibiting these rocks need not be referred to, nor need the exposures on the O'Hanley and Big Brook roads be mentioned.

Irregular occurrence of the limestone.

River Denys.

The various branches of River Denys expose carboniferous rocks, none of which are altered like those further south, nor differ in any respect from rocks of the same age about the Bras d'Or Lake. Gypsum and limestone are of frequent occurrence, the latter being full of fossils including encrinites, corals and brachiopods. Many of the brooks, however, show no outcrops but flow through a wet or barren country in a slow winding course. Near the older rocks there is no obscurity on this account, but in the low land the dip is hard to discover. The Tannery Brook, at River Denys cross-roads, displays equally well the carboniferous rocks and precambrian mica schist and quartzites, from which they are largely made up. Immediately above the schists come reddish-grey, fine, friable sandstone, grit and conglomerate forming a

Gypsum and limestone.

Contact of carboniferous and precambrian rocks at River Denys cross-road.

gorge and fall; while further down stream an impure, bluish, greenish-grey and reddish, compact and splintery or oolitic limestone has been quarried.

Diogenes Brook.

Near Colin Chisholm's mill, in Diogenes Brook, is a dark bituminous limestone. Above the mill are blocks of sandstone, and beyond the first outcrop of crystalline limestone a light-grey, friable limestone-breccia, perhaps carboniferous, is mixed with conglomeritic limestone and underlaid by light-red, hematitic clay-rock, passing into pure hematite.

Blue's mills.

On the Victoria road, between the cross-roads and Blue's mills, carboniferous strata are frequently in place, bounded on the west by hills of precambrian rock. Near Blue's mills are pits indicating plaster, and about Ashfield (or Sodom) limestone and plaster also occur.

Big Brook.

Big Brook and its feeders often afford good sections of the gypsiferous rocks, but along the North Mountain the conglomerate so abundant on the Craignish side of the basin is absent in many places, although by no means in all.

In Big Brook, just above the River Denys road, grey, black-spotted, semi-crystalline, friable gypsum is associated with reddish sandstone, dirty limestone and concretionary limestone-conglomerate. The sandstone predominates largely and is of the same character as that found in the coal measures of Inhabitants Basin and St. Peters. In one of the tributaries a false-bedded, light-grey shaly variety passes into argillaceous, slightly micaceous, ripple-marked rock, displaced and broken, and is succeeded by bluish argillite and red sandstone, forming falls.

Precambrian strata.

In the stream near the Big Brook school, similar rocks are underlaid by syenite. Some distance up among the older rocks blocks of concretionary limestone and sandstone frequently show the unconformability of this series to the precambrian. Conglomerate is found in the feeder just above the road at a little log house, underlaid by the prevailing red hematitic syenite. Sandstone and impure, concretionary limestone abound in other brooks along this road.

Brook flowing under ground.

Nearer Denys Basin, at McKenzie Creek and in Little Harbor millbrook, these rocks are occasionally present. At Donald Nicholson's, on the left bank, is a curious valley with mounds and depressions, ending against a cliff of gypsum. About Malagawatchkt pits are frequently seen, even where the plaster is concealed. The road down McKenzie Brook passes through a deep glen, the ponds in which perhaps indicate plaster. But the syenite is never far away, and rises in hills to a height of 760 feet. Unconformably overlying the syenite, in the broken land near McGregor's, is a grey, highly bituminous limestone, associated with bright-red and green marl. On the lake shore to the southward a grey, earthy limestone similar to that just men-

tioned, is succeeded by a high cliff of limestone-breccia or conglomerate, with sandy patches and variable contorted dip. At the western end it resembles the limestone of Plaster Cove, and contains obscure fossils; here it comes against and contains pebbles of dark-greenish massive felsites, compact or fine-grained, often like the rocks of Long Island, and probably trappean. Further west these become still more brightly and variously colored, are mixed with bright-colored limestone, and show lines of bedding like the felsites of Cape Rhumore.

Limestone of doubtful age.

Islands of Denys Basin.

Some of the many islands of the Bras d'Or Lake, near Denys Basin, show limited areas of gypsum and allied rocks. Militia Island and Point might, judging by the soil, be underlaid by plaster; and on the island several blocks were found. Pellier and Malagawatchkt Points are composed of gravel; Grammo Point, of gravel on the cove side; but on the north, white, jointed, broken gypsum about six feet, exposed for 120 yards, dips about N. 30° E. $< 7°$. It contains crystals of selenite. About half a mile from this exposure, and again on the north-west corner of Boom Island, are others of grey and rosy selenitic gypsum, horizontally bedded. Only blocks are seen on Indian, Round, Campbell, McLean, Lewis and Cranberry Islands. McLean Point is low on both sides, but on the south side shows a small deposit of plaster. On Guion Point, an island connected with the shore by sandbars, plaster cliffs twenty-two feet high occur. The dip is variable. Low shores of sand and gravel, swamp and spruce occupy the rest of the basin.

Islands of West Bay.

The islands near North Mountain exhibit pink soil and low banks or flats. Several of them are cultivated. On Green and George Islands are considerable exposures of plaster.

5th Sycline or Basin.—The age of the strata of Craignish, Judique and South-west Mabou, is still involved in uncertainty; the conglomerate and grit of some of the Long Pond and Judique Brooks bearing a stronger resemblance to those of Queensville than the River Denys series; but they may be briefly referred to in this connection.

Craignish.

Near Craignish, indian-red soft argillite and greenish calcareous shale, veined with calcspar, micaceous and jointed, breaking into small irregular pieces, are in contact with a greenish calcareous felsite. Between Craignish and Heffernan Pond, soft indian-red and greenish-grey argillaceous shale and sandstone appear, dipping generally at a high angle and sometimes steepest near the shore, which perhaps indicates a fault running along the coast. To the northward they are greatly contorted, but often horizontal, with broken plants.

Low Point.

On the Low Point shore, greenish, very coherent, brown-weathering, quartz-veined, micaceous sandstone passes into conglomerate containing pebbles of felsite, quartz-felsite and other rocks.

The coherent conglomerates in contact with the syenite and amy-

gdaloidal rocks of the Craignish brooks are perhaps carboniferous. The pebbles and matrix are chiefly of red syenite, purple porphyry and other felsites, the pebbles being often a foot in diameter. On a diorite in one place rests a soft, bright indian-red argillite, overlaid by bright-green grit and coarse conglomerate, containing pebbles of syenite and amygdaloid.

In Chisholm Brook at Long Point, below the shore road, indian-red micaceous sandstone occurs. Near the lower mill is a soft, rusty sandstone, followed by quartzose-conglomerate, quartzo-felspathic sandstone, associated with grey argillaceous shale. These rocks appear in various places. The north branch of Chisholm Brook, where it flows from the Craignish Hills, displays an indian-red somewhat friable grit, with pebbles of quartz and felsite, overlying syenite and diorite. Reddish argillite and quartzose conglomerate succeed, and lower down is a gorge of greenish-grey quartzose sandstone, like that of Pirate Harbor. In one of the branches of the brook lavender grit and indian-red argillite, comparatively hard and coherent, contain pebbles of quartz. In another branch a similar argillite is found with grey or reddish quartzose sandstone and grit, less altered. In the main stream a greenish-grey, jointed argillite, with crystals of iron pyrites, and bluish or greenish-grey, micaceous quartzose sandstone, dip N. 50° W. $<$ 18°. Other soft rocks succeed. Long Point

Near the source of one of the Judique brooks, south of Graham River, indian-red, fine, soft, thick-bedded, argillaceous sandstone occurs, with dark-grey diorite. Lower in the brook is a light-grey, spotted, felspathic grit containing small pebbles of quartzite, schist and felsite, and a dark-grey, fine-grained, jointed, broken diorite, veined with calcspar and holding iron pyrites. Altered grit is above, with red, micaceous, fine conglomerate and sandstone dipping vertically. Felspathic grit is also found near light-grey, soft, coherent felsitic or trappean rock, sometimes argillaceous, containing vesicles, rusty or filled with iron pyrites. Indian-red, soft, micaceous sandstone succeeds, with thick beds of argillaceous shale and more coherent felspathic sandstone. Micaceous sandstones, spotted red and green, and running into mottled marl, grit and conglomerate, sometimes calcareous, extend to the shore Perhaps the lower portion of this section is devonian. Judique. Igneous rocks

Near Donald McPherson's indian-red marl and conglomerate overlie the syenite and stretch towards the shore.

In the brook south of Graham River, ovelying the grits, conglomerates and sandstones which are associated with volcanic rocks, occur red and green marl, sandstone and conglomerate, with dark argillaceous shale, containing a few *Naiadites*. Fossils.

Graham River, not far above the shore road, passes over beds of light- Graham River.

Fossils.

grey argillaceous shale and slightly bituminous, fossiliferous limestone containing encrinites and corals. Higher up is a fine sandstone, light-grey, indian-red and calcareous, jointed across the strike; succeeded by red, marly, thick-bedded sandstone, seamed with calcspar, and red, fine, calcareous conglomerate interbedded with light-grey argillaceous shale. Similar alternations occur as far as the bridge on the old Judique road, where the rocks become more altered and coherent. About half a mile below the bridge, on McMillan's farm on the left bank, is an exposure of thirty feet of light-grey, clear-grained sandstone, which has been quarried for local use. It shows very indistinct bedding and is jointed across, the joint-faces presenting themselves in the cliff. It stands the weather well, and in the blocks used in the foundations of houses at Judique there are no rust-spots.

Sandstone quarry.

Volcanic rocks of Graham River.

Just above the old Judique road, Graham River runs, in a deep valley, over fine coherent argillite and coarse, grey sandstone greatly altered by trap dykes, with large specks of silvery mica. Rough, altered grits and argillites are in contact with diorite at a small fall in the river and again in the branch from the bridge at Allan McDonald's, fine, bluish argillaceous shale, sandstone and coherent quartzose grit in which the quartz sometimes appears in crystals are cut by grey, massive, porphyritic trap.

The intrusive rocks of this neighborhood are of considerable interest. As already remarked, some of the amygdaloids and felsites of the General Line road, Horton Brook and McMillan Point may be of the same age. In certain cases they are clearly precambrian, in others the actual contact is concealed, and, as the extent to which the surrounding strata are altered may not be great, this is doubtful. But in Graham River there can be no doubt of the existence of a number of large dykes which cut not only the precambrian but also the overlying rocks. These vary greatly in color, composition and texture, but are essentially dark, massive, bluish and greenish, granular and compact, chloritic, epidotic and quartz-veined, dioritic and felsitic rocks, which lie above and among the grits and argillites of the brook. At one point of contact red rocks seem to dip into the diorite, without very perceptible alteration; but in general the metamorphism is so great and the blending of the two so complete that no line of separation can be drawn between them. At the fall mentioned above a greatly altered conglomeritic grit is in contact with dark diorite traversed by a vein of epidote; and in one of the small neighboring tributaries dark diorite and compact felsite occur.

Rory Chisholm's Brook.

In Rory Chisholm's Brook, near Rory Chisholm's, and everywhere in the vicinity grey, feebly coherent sandstone, grit and conglomerate, like those of the head of South-west Mabou River, occur in rough out-

crops, seldom continuous. Further down the brook are purplish and reddish fine argillaceous sandstone, like that of Lamey Brook, and reddish-grey conglomeritic grit, succeeded down stream by fine reddish and greenish-grey sandstone and argillaceous shale, often micaceous. Below the mill, near the River Denys road, the exposures are exceptionally good, consisting of reddish and purplish, coherent conglomeritic rocks. Further down is a bed of yellowish-grey, compact limestone, below which the brook flows among meadows and marshes.

Judique. In the brook at Judique chapel grey and red, fine argillite, sandstone, grit and conglomerate are well exposed. One of the conglomerate beds contains a vein of heavy spar, resembling in this respect the slates beneath the limestone at Plaster Cove. Near the school at Ben Noah, indian-red, argillaceous, micaceous sandstone and grit, composed of felspar and quartz, dip N. 72° W. $<$ 31°. The country is broken into irregular hills, meadows and valleys. Grey, coarse, quartzo-micaceous sandstone occurs in many places, as well as indian-red, crumbling argillite, grey sandstone and greenish-grey marl with small veins of pink gypsum.

Ben Noah.

Green marl is seen in a little brook at Judique chapel, and near the stage stables, a light-grey limestone, twelve feet at least, is interbedded with calcareo-argillaceous shale and sandstone, in the vicinity of gypsum.

In Judique Intervale Brook, above the old stone house, outcrops of red and grey sandstone and bluish argillaceous shale, dip as shown on the map. Sometimes the reddish sandstone passes into a grey conglomerate containing pebbles of greyish grits and quartz. Fine grey sandstone and conglomerate, containing pebbles of quartz and syenite, occur higher up, with bluish and reddish argillite. In other branches of this brook the rocks are similar. Below the old stone house a greenish-grey, argillaceous shale, with fragments of plants, dips N. 82° W. $<$ 48°. In a small brook flowing into this, shale is also exposed. Lower down, the brook flows among intervale and ponds, with reddish soil.

South-west Mabou river. In one of the branches of South-west Mabou River, from River Denys road, for a considerable distance down, only blocks of sandstone and syenite occur. Below the junction with a large brook from the right, blocks of grey, soft sandstone appear, followed, below the confluence of the main branch, by grey, coarse grit and conglomerate dipping N. $<$ 10°. Occasional outcrops of friable conglomerate and micaceous grit, grey and often coherent, extend to the bridge at McLeod Settlement. In the main river, below the Barren or River Inhabitants road, grey, coherent, jointed, conglomeritic grit, with serpentinous matter in the cleavage planes, and grey, soft, argillaceous, micaceous

sandstone, sometimes flaggy, extend to the confluence of the brook just described. In the branch which flows from the road between River Denys and Glencoe, near Squire McDonald's, coarse, reddish, friable sandstone, grit and conglomerate, and grey, rusty-weathering, quartzose sandstone have a northerly dip. On the road itself and in the branch of the river which occurs near Glencoe, grey, coherent sandstone, grit and conglomerate abound.

lque harbor

The seashore north of Judique Harbor is interesting, because it displays the various exposures better than any part of the coast between this harbor and the Strait of Canso. The land slopes gently to the shore, with stunted, gnarled spruce and light-red soil. The following sections were measured between Judique and Port Hood:

SECTION OF STRATA ON THE SHORE NORTH OF JUDIQUE HARBOR, IN ASCENDING ORDER.

	FEET.	INCHES.
1. Reddish and greenish, mottled, waving sandstone, sometimes shaly toward the bottom	23	0
2. Greenish and grey, crumbling, argillaceous shale	10	0
Plants. 3. Light-grey sandstone, containing concretionary limestone at the top and covered with broken plants. Ripple-marked. Occasional thin layers of dark shale	8	4
4. Greenish, grey and reddish argillaceous shale	6	6
5. Reddish and greenish, mottled, shaly, waving sandstone	2	4
6. Measures concealed. Dip N. 72° W. $< 50°$	70	0
7. Reddish-grey sandstone	4	0
8. Grey, fine, rippled sandstone, waving, marked with plants; sometimes in large, smooth flags	5	6
9. Alternations of grey argillaceous shale, and thin-bedded, fine, argillaceous sandstone	3	6
10. Light-grey, flaggy, rippled sandstone, with thin layers of shale	3	4
11. Reddish and brown micaceous shales, with bands of reddish and greenish mottled sandstone. A few bands of bluish-grey argillaceous shale, with broken plants. In the brown beds occur fine, coherent nodules	138	0
12. Reddish and light-grey, fine, micaceous, argillaceous sandstone sometimes in thick beds, but usually shaly, rippled and crumbly	18	0
13. Light bluish-grey, argillaceous shale, with thin layers of sandstone and a reddish band	7	6
14. Reddish and brown, crumbling, argillaceous shale, with reddish and greenish rippled sandstone, sometimes marked with broken plants or seaweeds. Irregularly or lenticularly bedded. Coherent, calcareous layers. Greenish and bluish shales predominate toward the top	180	0
15. Light-grey, cream-colored and reddish calcareous sandstone in one or two thick irregular layers, not very coherent	11	0

	FEET.	INCHES.	
16. Reddish and greenish, bluish and grey, shaly, crumbling, argillaceous shale and sandstone in thin alternate layers	10	0	
17. Greenish and bluish crumbling argillaceous shale	8	0	
18. Reddish and greenish, soft, crumbling shale, with layers of micaceous, rippled sandstone. The shales greatly predominate. The top of this is at a point	456	0	Plants.
19. Rusty or dirty cream-colored, crumbling sandstone full of broken plants and trunks of trees, pyritized, carbonized and converted into a black, crystalline, silicious, oolitic rock. Many perfect crystals of selenite occur in the cavities and joints of the sandstone, which is in places broken into small blocks, whilst other parts are shaly. Pyrites and hematite are also present. The top layers are red and greenish, jointed and shaly	54	0	
20. Red and brown shales with greenish and bluish layers and sandstone bands	58	0	
21. Rusty, light-grey, shaly, thick-bedded and flaggy sandstone, often little more than loosely coherent sand, full of broken plants and containing patches of concretionary limestone	17	0	
22. Reddish and brownish shales as before, with a considerable thickness of bluish and greenish argillaceous shale toward the base. Certain layers of sandstone, show rain-marks, seaweeds and broken plants	204	0	
23. Measures concealed. Dip N. 87° W. $<$ 45°. In part, if not all red, rocks	67	0	
24. Reddish waving sandstone	1	0	
25. Reddish and brownish shale with lenticular bands of reddish and greenish sandstone, more or less nodular, with more persistent, waving, shaly bands	110	0	
26. Measures concealed. Dip N. 87° W. $<$ 40°	32	0	
27. Waving sandstone	0	10	
28. Measures concealed	38	0	
29. Greenish-grey, light-grey and reddish, shaly, false-bedded sandstone, full of broken plants, with occasional layers of argillaceous shale	36	0	
30. Measures concealed in part, only a few reefs of reddish sandstone being seen. Probably all red sandstone and shale	87	0	
31. Greenish-grey and light bluish-grey fine sandstone with rusty spots and markings of plants. Passes into red sandstone at top, with green spots	33	0	
32. Measures concealed in a cove in which two fish-houses are at a small brook. Dip N. 79° W. $<$ 40°	170	0	
33. Greenish-grey, waving, sandstone in reefs	10	0	
34. Measures concealed	80	0	
35. Reddish shale and sandstone	16	0	

		FEET.	INCHES.
	36. Measures concealed	679	0
	37. Obscure outcrops of red rocks	233	0
	38. Greenish-grey shaly sandstone, passing into shale; rusty spots; false bedding	30	0
	39. Measures concealed	12	0
	40. Grey, crumbling sandstone, with rusty plant-marks	6	0
	41. Greenish and grey argillaceous shale with bands of light-grey flaggy and jointed sandstone, passing into shaly sandstone at top	50	0
	42. Measures for the most part concealed, but consisting where seen of reddish argillaceous shale and sandstone. Dip S. 88° W. < 88°	82	0
	43. Red shale and sandstone	10	0
	44. Light-grey, fine sandstone in thick beds. Rusty markings of plants. Forms a point as far as an abrupt turn of the shore to eastward to a pond. Thickness doubtful at least	34	0
	Total thickness	3114	10

SECTION OF STRATA ON THE SOUTH SIDE OF LITTLE JUDIQUE HARBOR, IN ASCENDING ORDER.

		FEET.	INCHES.
Gypseous rocks	1. White gypsum full of crystals of selenite	38	0
	2. Gypseous marl	45	0
	3. Whitish gypsum with fibrous veins and selenite crystals	9	0
	4. Gypseous marl, chiefly reddish, but also greenish and grey	140	0
	5. Grey, calcareous, coherent sandstone, marked with plants	40	0
	6. Greenish, reddish and grey marl	50	0
Limestone.	7. Dark-grey, bituminous limestone, weathering light-grey	0	8
Coal.	8. Soft, argillaceous underclay, with obscure coaly matter, succeeded by argillaceous shale and sandstone	45	0
	9. Thick grey sandstone of the usual character, with an irregular conglomerate at the base and at intervals above. Irregular, light-grey, concretionary masses	79	0
	10. Greenish, argillaceous shale with ironstone nodules, including, toward the top, dark, argillaceous shale, lenticularly bedded with sandstone	30	0
	11. Sandstone. (No. 48, p. 110 F)	120	0
	Total thickness	596	8

This sandstone skirts the shore to Cape Susan, where the underlying measures are again displayed in ascending order:

		FEET.	INCHES.
Gypseous rocks	1. Whitish, reddish and greenish selenitic gypsum	6	6
	2. Greenish and grey impure limestone and calcareous sandstone. Local and of varying thickness 9 in. to 1 ft.	0	10
	3. Greenish and reddish argillaceous shale, crossed by gypsum veins	1	0

	FEET.	INCHES.	
4. Greenish, reddish and whitish gypsum, here and there mixed with green and red marl	5	0	
5. Gypseous marl in irregular bedding, of variable color and texture, traversed by plates and veins of gypsum	10	0	
6. Whitish gypsum without much admixture of marl	9	0	
7. Greenish-grey and reddish, compact, impure limestone	5	6	
8. Reddish or brownish marl with greenish streaks	45	0	
9. Grey, rusty-weathering, bituminous limestone, full of shells and encrinites, somewhat mixed with marl	12	0	Fossils in limestone.
10. Red or brownish marl with greenish streaks	36	0	
11. Dark-bluish, bituminous limestone passing into calcareous, compact sandstone	7	0	
12. Brown marl with green streaks	11	6	
13. Dark, nodular, bituminous limestone. Lenticular	1	6	
14. Reddish and grey marl	4	6	
15. Limestone	1	0	Limestone.
16. Reddish and greenish marl, with one or two nodular layers of rusty limestone. Not well seen	25	0	
17. Nodular limestone of varying degrees of purity	8	0	
18. Reddish and greenish marl like 16	40	0	
19. Rusty, very calcareous marl with masses of vesicular limestone	5	0	
20. Light-grey and rusty sandstone, becoming conglomeritic and mixed with bluish argillaceous shale at bottom. Ironstone and calcareous nodules. Traces of coal	5	0	
21. Bluish and greenish argillaceous shale mixed with sandstone	4	0	
22. Grey, thick-bedded, crumbling, calcareous sandstone. The section of these last beds is very variable In places red shale extends to the sandstone, masses of rusty limestone being also present. At one spot a dark argillaceous shale is mixed with red shale, immediately above which comes the sandstone. Again the sandstone seems to come up to the rusty marl. The thickness of the sandstone is doubtful owing to its obscure bedding. It must be remembered, however, that the whole section is only approximate	80	0	
23. Red and green marl with limestone masses	18	0	
24. Rusty, crumbling sandstone	10	0	
25. Grey, argillaceous shale or underclay with large *stigmaria*, dark streaks and ironstone nodules	7	0	
26. Calcareous coaly streak	0	1	Coal.
27. Greenish-grey, rusty, argillaceous shale, with nodules of dark pyritous limestone	0	9	
28. Clay with coal streaks	0	9	Black shale.
29. Wrinkled calcareo-bituminous shale full of *Cythere*, *Modiola* and *Spirorbis*	2	3	
30. Grey and greenish argillaceous shale, with sandstone layers and nodules	5	0	

		FEET.	INCHES.
Coal.	31. Underclay	1	3
	32. Coaly shale and coal with wrinkled calcareo-argillaceous shale, the last being on top	1	7
	33. Grey and greenish argillaceous shale	4	0
	34. Rusty, crumbling sandstone	10	6
	35. Greenish, argillaceous shale, nodular and arenaceous toward the bottom, but coaly and argillaceous with *stigmaria* and calcspar veins at top. Full of long needles of gypsum ¾ inch and downwards	13	9
	36. Grey sandstone like 22	43	0
	37. Greenish, bluish and grey argillaceous shale with ironstone nodules and layers	50	0
	38. Underclay	6	0
Coal.	39. Coal, very pyritous, with much mineral charcoal and a little coaly shale	1	10
	40. Rusty, fine, coherent sandstone	3	0
	41. Shaly, crumbling sandstone	2	0
	42. Dark-blue argillaceous shale	2	9
	43. Black coaly shale	0	4
	44. Greenish argillaceous shale passing into arenaceous shale and sandstone	4	0
	45. Light-grey, shaly, rippled, crumbling sandstone	2	0
	46. Reddish-black wrinkled shale with limestone layers *Naiadites*	1	6
	47. Bluish and greenish fine argillaceous shale	7	6
	48. The thick sandstone of Kate and Susan Points (No. 11, p. 108 F)	..	..
	Total thickness	522	2

Continuation of the above section, southward, from No. 1, p. 108 F:

		FEET.	INCHES.
	1. Whitish, reddish and greenish selenitic gypsum	6	6
Gypseous rocks	2. Reddish marl with waving lenticular layers of greenish and reddish impure limestone and beds composed of nodules	27	0
	3. Conglomeritic rock, apparently nearly all concretionary, of various colors, weathering whitish-grey. The nodules vary in size from cocoanuts downward. It forms a reef dipping S. 65° E	2	0
	4. Reddish marl, sandstone, etc., in confused bedding	160	0
	5. Light-grey flaggy sandstone	3	0
	6. Shales as before	16	0
	7. Grey sandstone passing into grit at bottom	27	0
	8. Bluish-grey argillaceous shale	5	6
	9. Sandstone, passing into arenaceous and argillaceous shale	4	6
	10. Shaly, false-bedded sandstone	40	0
	11. Greenish and reddish argillaceous shale, not well seen	40	0
	12. Reddish sandstone, argillaceous shale and calcareous grit	21	0
	13. Greenish and grey rusty sandstone, passing upward into reddish, shaly, rippled waving sandstone	180	0
	14. Reddish and greenish rocks, seen only on the reefs with calcareous bands	..	..
	Total thickness	532	6

Millstone Grit.

Subdivisions of the carboniferous series.

It has been remarked that part of the series described in the carboniferous sections may represent the rocks referred to the millstone grit and coal measures in the Sydney coalfield. Perhaps the higher rocks of the basin, to the eastward of Inhabitants River, should be separated from the strata containing the coal, as suggested by Mr. Gilpin, and Dr. J. W. Dawson has suggested that the fossils of Scott Brook near St. Peters indicate the possibility of the occourrence there of rocks of his upper coal formation. There are certainly signs of overlapping and perhaps unconformability about McDonald's Mountain, but this may be complicated to the northward by a fault which gives rise to the vertical dip at McRae's mill. Further surveys will doubtless give increased value to the description of the structure of the Richmond coalfield which is at present confessedly incomplete. It is to be regretted that the records of the explorations made in search of coal, which might have been of great assistance, have nearly all been lost.

Surface Geology.

Incidental mention has been frequently made in the course of this report, of the more striking surface features of the region to which it refers. The post-tertiary deposits are vastly inferior in interest and importance to those which have just been described, consisting merely of beds of clay, sand and gravel, enclosing larger rounded and angular blocks, derived either from the rocks *in situ* immediately beneath, or from the neighboring hills. And the transported material seems to constitute only a trifling proportion of the loose detritus that covers the consolidated strata to a greater or less depth, by far the greater part being formed from their ruins. For this reason it is generally easy to affirm from an examination of the soil, the nature of the underlying rock, whether this is a limestone, sandstone, shale, conglomerate, felsite, syenite or what not. This is no doubt owing to the hilly character of the country, and it follows that few of the brooks, however slow-flowing, fail to indicate at intervals the nature of the stony floor. Great dependence can, therefore, be placed on the geological structure as interpreted from a careful mapping of the various outcrops, even where it is as complicated as in the Richmond coalfield. Nor are these superficial deposits usually of great thickness. In many parts of the region the rock crops on the surface and forms large tracts even in the low lands too rocky for cultivation and known as "barrens." Examples occur over the greater part of Madame

Barrens.

Island, on the mainland of Nova Scotia, between St. Peters, Inhabitants Basin and Hawkesbury, in part of the country along the Big Brook and Victoria roads, in the various hill ranges and behind Port Hood and Judique. Among these rocky barrens, however, occur others which might be reclaimed by judicious draining and admixture of other soils, and which will be again alluded to.

Lakes.

Lakes are numerous in the southern part of this field, but are seldom of great depth, and have commonly rocky outlets. Those between the St. Peters road and the shore of Inhabitants Basin are very shallow, covered half-way across with reeds, and surrounded by marsh with large numbers of pitcher plants, hops, roses, lilies and alders. From Summers' Lake two outlets flow independently, one to Tracadie, the other to Little Tracadie. From Grant Lake there is but one brook which, a short distance below the lake, divides into the Auld Cove and Mulgrave Brooks. Ned's Lake is a shallow rush and lily pond, a great resort for ducks. Some of the lakes are very pretty, with hard clear bottom, banks clothed with spruce, intermingled with maple, beech and other trees, and full of trout. Along the shores of some of the smaller ponds in the neighborhood of Loch Cailean is a strip of marsh land with mosses, pitcher plants, white, bushy small bell-flower plants, alders, spruce and tamarac. A great part of the district between this and L'Ardoise is wet, barren spruceland, interrupted by rocky patches covered with purplish sandstone and quartzite, and intersected in every direction by winter woodroads. Near the foot of Cranberry Lake a fine rippled white and cream-colored sand occurs; but usually the lakes of this chain have rocky shores, low woody banks and echelon-jutting headlands.

Sand.

Brooks.

Sluggish brooks flow in the barrens, widening into lakes and black ponds. These are most abundant in Richmond and Guysborough counties. The Black Brook of River Inhabitants flows in a flat country among alders, opening out at intervals into little ponds infested in the month of June with horse and black-flies, and forming in places an almost impenetrable alder-tangle, or when larger trees, such as hemlock, are present, they add to the misery of a Cape Breton "blow-down." Where exposed to the sun the reddish soil of its banks bakes hard white. This is a fair example of other brooks of the neighborhood such as Little River in part, Emery and Seacoal Brooks. Some of the mountain streams about Glendale and River Denys are difficult to ascend owing to the large blocks of rock that encumber their beds. Others are surrounded by marshes bordered by bramble bushes, ivy plants and hops, five or six feet long and interlacing among the trees of the blow-down. It is sometimes a slight recompense for the toilsome traverse of a blow-down to be able to pick the raspberries, blackberries,

"Blown-down."

black and red currants from the bushes before pushing through them. Although the August gale of 1873 raged with less intensity in Inverness than in Cape Breton county, and although the lapse of time has broken down many of the branches of the fallen trees some of the brooks about Glendale and Queensville still give evidence of its power, and if any person wishes to see a sample of its destructive work, let him ascend for a short distance the first brook to the southward of McLennan's mills, on the Victoria road. Slimy pits, bogs, grass and moss-marshes, willows and alders, little ponds and creeks abound between the low banks of some of the sluggish and tortuous brooks about the basins of Inhabitants and Denys. Intervales and marshes occur on the lower reaches of most of the Judique brooks, the banks of which are also low. The Guysborough brooks flow alternately in mossy marshes, pools and creeks, and in rocky rapids, gorges and cascades. Falls of great beauty often occur among the mountain brooks, whose banks are sometimes finely mossed with reddish, yellowish, grey, pink and white mosses. In the lower part of the larger rivers, fed from the mountains and subject to periodical freshets, it might be expected that changes would frequently take place in the direction of the various windings; and that such is the case is shown by the deposits of sand, gravel and entangled trees which have been accumulated in old channels, within the memory of the inhabitants. On River Denys a large tree was seen buried under four feet of sand and gravel, with a thick sod on top. In Black River, West Bay, a large landslide a few years ago changed the course of the river, hurling down trees, soil and stones to fill up the old channel. At Ross Creek another landslide was observed on the shore.

Falls.

Change in the rivers.

Landslidess.

Many of the mountain brooks rise from springs, and even in the lowland springs also occur. Most of the water of the small lake near McRae's mill, Black River, comes from one of these, under a bank. Those of the east or scarped side of North Mountain are numerous, strong and beautiful, generally clear and cold in summer, never freezing in winter. On the north side of Rabbit Island is a strong salt, sulphur spring issuing from the ground opposite a driblet that feeds a pond, and depositing sulphur on the eel-grass of the pond. On Landrie Lake is a spring from which flows water tasting strongly of iron, and depositing a yellow crust plentifully on the ground in the vicinity. Near McMaster's mill, Queensville, is a salt spring the water of which has been analysed by Mr. Hoffmann (page 7 H.) In the limestone formation many brooks rise from springs, and one at River Denys, after running underground for a considerable distance, emerges again a large brook. A spring, strongly ferruginous and salt issues from the side of a slope in

Springs.

Mineral spring.

a marsh near John McNeil's, at River Tillard, covering the ground with iron ochre.

Marshes. Salt marshes of considerable extent occur, along many of the shores, as at McLeod and Ross Creeks, on West Bay, at St. Peters Inlet, Inhabitants and Denys Basins, Judique and elsewhere, the ground near the water being often shaky. Shaking marshes also occur on some of the lakes. Near one of the branches of Princeville Brook is a trembling moss and grass marsh, and similar land is more frequent in the neighbourhood than rock. Wet mossy spruceland of a somewhat similar character is seen in a branch of the millbrook near McLeod's bridge.

In the north-west arm of River Inhabitants layers of peat or impure brown coal occur at the bottom of a high clay bank, and led to the supposition that coal might be found there.

Ice grooves. Glacial striæ were observed at the following localities:

1. A short distance south of Eddy Point, broad and deep ..... S. 77° E.
2. Clam Harbor Lake ..... S. 12° E.
3. Petite Anse ..... S. 67° E.
4. Mackerel Cove ..... S. 75° E.
5. Arichat Head, in regular grooves and polished, rounded mounds, the sides of which are also grooved ..... S. 40° E. and S. 20° E.
6. Morrison Harbor, West Bay ..... S. 56° E.
   This is the direction of the greater number of the striæ, but some larger and deeper grooves run S. 79° E., and other lines are present.
7. North shore of Janvrin Island ..... S. 65° W. < 45°
   They run along the rounded face of a sandstone abutting on the shore. Some of the grooves run nearly horizontally and are deep and apparently newer; others even dip the other way, but this is the prevailing direction.
8. On the Grandique road, east of Buchanan Lake ..... S. 78° E.

Timber, Climate, etc.

Most of this district has suffered from forest fires, which have destroyed the timber and given rise to barrens or a second growth. Timber was in former years largely exported from Cape Breton, and,

Saw mills. although it is now scarce, the number of small saw and shingle mills on the brooks is remarkable. They are used principally to supply the local demand, and none of them are extensive. White and red spruce,

Trees. small pine, tamarac, white birch, alder, poplar, black ash, willow, oak, maple, moosewood, beech, mountain ash, dogwood and elm are

the principal trees. Ironwood is found on the Craignish and North Mountains.

Marsh plants. Marsh plants are abundant, especially on wet barrens, and among others a beautiful *Cypripedium*, in which the upper three divisions of the flower are snow-white, a small one springing from the centre is white at the stalk, yellow at the tip; the boat-shaped petal is pink, with a double lip. But perhaps the most marked feature in the flora of the district is the number and variety of its ferns, which occur in all the barrens, marshes and woods, in the crevices of the rocky walls of the gorges and the creeky stretches of the brooks, and in great profusion in the glades whence the brooks have their origin. The following species are enumerated by the Rev. E. H. Ball as occurring in the district under examination *:—*Polypodium vulgare, Pteris aquilina, Asplenium trichomanes, A. thelypteroides, A. filix-fœmina, Phegopteris polypodioides, P. dryopteris, Aspidium thelypteris, A. noveboracense, A. fragrans* (only one habitat, Hartley's waterfall, Pirate Harbor, Strait of Canso), *A. spinulosum, A. intermedium, A. dilatatum, A. recurvatum, A. cristatum, A. filix-mas* (found at Whycocomagh), *A. aculeatum* (Marble Mountain, Mabou, Mulgrave), *A. marginale, A. acrostichoides, A. lonchitis, Cystopteris bulbifera, C. fragilis, Struthiopteris Germanica, Onoclea sensibilis, Woodsia Ilvensis* (Whycocomagh), *Dicksonia punctilobula, Osmunda regalis, O. spectabilis, O. Claytoniana, O. cinnamomea, Botrychium Virginicum, B. lunarioides, B. simplex.* Ferns.

Animals. The animals are the same as those mentioned in last report. Bears and wildcats are occasionally trapped in the North and Craignish Mountains. Foxes infest the intervales of Rivers Denys and Inhabitants. Many of the lakes are full of trout. Clams frequent the mud, and loons, ducks and geese occur on the surface. Gaspereaux and salmon ascend some of the streams. Salmon are found in River Tom as far as the lake from which it comes. Trout and eels are the only fish of Loch Lomond. In many of the lakes and brooks the fish are netted, dams being constructed to prevent the passage of any except into the net. In the L'Ardoise brooks nets can be counted by the half dozen. Oysters occur in large numbers at Malagawatchkt.

Occupation of the people. Fishing is the pursuit of the greater number of the inhabitants, but good farms occur along the rivers, especially in the intervales of the Inhabitants and Denys. The soil of these intervales or meadowlands is usually pinkish reddish-brown and clayey, and when not cultivated they are overgrown with alder and spruce. They produce excellent hay, although sometimes devastated by floods. The varieties of soil are interesting: the clays are white and dark-bluish, with fragments of

* Transactions of the Nova Scotian Institute of Natural Science for 1875, p. 149.

plants. Soils of a white color are characteristic of coal measures and similar strata. Purplish tints overlie the rocks of some parts of Madame Island, Guysborough and the Strait of Canso; whereas the plaster and limestone districts are reddish or pink. A section of the soil in the bank of River Inhabitants at one point showed:

	FEET.	INCHES.
Loam	4	0
Bluish clay	1	6
Vegetable mould, including leaves, twigs, stems, roots of trees	1	6

Sometimes, however, the banks are of sand and gravel.

There are areas of land about River Denys underlaid by beds of clay which might be drained and rendered productive. These are wet and mossy, sometimes with rusty clay soil. Some of the shallow lakes could doubtless be drained. Mr. Millidge, C.E., has already surveyed Shoal Lake for this purpose, and a scheme is on foot to drain Lake Ainslie, the largest body of fresh water in Cape Breton.

The farms of North Mountain and Malagawatchkt are good, but being on the slope of a steep hill their cultivation is difficult. The situation on the sunny side of the hill, and their being underlaid by calcareous strata, make up for many drawbacks. Still, few of the farms are worked in such a way as to yield a full living for the occupants, who consequently go to sea, fish or seek work elsewhere.

The season is said to be a month earlier on the western coast, than on the Atlantic seaboard and sowing often commences in April. Severe gales frequently visit the coast before or soon after the crops are gathered. One of these occurred on the 29th of April, 1879, and another a month later. Wheat is grown in Inverness county, but not much in Richmond. The rust and weavil spoil it. Squire McDonald, of Hay Cove, planted two bushels in 1878, which yielded about ten. Oats, barley, hay and potatoes are the chief products. One bushel of potatoes sometimes yields fifteen.

Farm products

The scenery of some parts of the district is unsurpassed in Cape Breton, and extensive views may be had from the tops of some of the hills. On a hill not far from Glendale, in an old clearing, is one of these. In the foreground are the ruins of the hut of a former inhabitant of the place, a lover of nature rather than of comparative ease and an intervale farm, or perhaps compelled by necessity to seek the hills. The bright-green color and rounded tops of the birches and beeches present a strong contrast with the dark-green conical form of the spruces. The valley of a small brook, rapidly deepening and carving the hills on either side from where they meet in a tapering

Scenery.

point, opens to view in the distance a wedge-shaped tract of country, flooded with the light and shade of the flying fog-wreaths, and diversified by the clearings and woodlands scattered over its surface. The broad valley of River Inhabitants, stretching seaward, is clearly traceable by the clearings along its intervale and its sloping banks. Chedabucto Bay extends as a silver band, widening toward the east, and backed by mist-enshrouded Canso and a heavy bank of fog. On the left and looking northward, are the blue ridges of Craignish and the headwaters of the Rivers Inhabitants and Denys. Near the clearing is a splendid large spring, the source of all the water in the neighboring brook, and a resort of cattle.

The country opposite Guysborough is also beautiful, groves of hardwood, hedges and fine residences bordering the salt water, with its picturesque islands.

Economic Minerals.

Coal.—It has been already stated that coal occurs in several localities throughout this region in strata associated with marine limestone and gypsum. Further study is required to complete the mapping of the faults and folds that traverse these measures, but it appears probable, as already mentioned, that all the known outcrops of coal and carbonaceous shale are about the same horizon and more or less lenticular. Perhaps this is also the case with the coal of Little Judique, Port Hood and the north, although the underlying strata are different on the western side of the Craignish Hills. Coal more or less irregular.

In the black *Naiadites* shale of Scott Brook, near St. Peters, coal was looked for in vain. A slope was driven on the seam in the bank of the brook, but soon abandoned. The resemblance of the associated strata to the true coal measures is remarkable. At St. Peters, just below Cameron's shop, on the shore a seam of fireclay was followed into the bank by digging, on the supposition that coal would be found. Pits were also sunk near Cameron's on the post road; but no details concerning them could be obtained, and it is doubtful whether the bedrock was reached. Other explorations were made about Anse au Loup, but without result. Scott Brook. St. Peters.

Coal has been largely wrought near Inhabitants Basin at Coal Brook, Caribacou and Little River, but the quantity and quality of the coal have disappointed the sanguine expectations of the explorers. As work had been suspended for many years at the time of our visit, the information here presented is derived largely from Brown's Coalfields of Cape Breton, the Reports of the Commissioners of Mines, and from private letters of Mr. Alexander McBean of the Vale Colliery, Pictou. Sources of information.

The mining work was done principally between the years 1863 and 1868. Since then a good deal of exploration has been carried on by McBean and others, but no systematic mining.

Coal Brook.

At Coal Brook fine grey, greenish and reddish sandstone and shale, containing plants, appear associated with several beds of coal. These have been explored by pits and borings, but the thickness of the seam was not seen by us.

At the most northerly of these pits coal was obtained about ten feet from the surface. Thirty-five yards north of this a boring was made eighty-four feet deep, which struck no coal. Coal is indistinctly seen, with an underclay, in the bed of the brook just below. Only four inches was visible, although the seam is said to be three feet four inches in thickness. A tunnel was driven about seventy-five feet on the seam, and some twenty tons of coal taken out. The roof is crumbling, argillaceous rock, without fine lamination. At another slope further down the brook a seam of three feet mixed coal and shale is said to have been discovered. The shale contains *Cythere*, *Cordaites*, fish teeth, etc. The coal detritus on the bank is not good. Ferruginous water comes from the level. Lower down is another level, driven to meet a shaft which was twenty feet deep and from which eighty tons of coal are said to have been extracted. On the shore a short distance to the eastward of the mouth of the brook a borehole is said to have cut about eight inches of dirty coal. Upwards of $5,000 were spent in exploring at Coal Brook and the neighborhood where, according to McBean, there are a three-feet seam, a four-feet seam and several small seams from six to eighteen inches. In two pits sunk by McBean on the east side of the brook, the coal was poor and irregular on account of an upthrow fault on the east side between the pits. The coal was very good on the west side. The eight-feet seam should crop in the pond to the south of and near the mouth of Coal Brook, and drift coal occurs on the surface at the south side of the pond. If the coal runs regularly with the strata it should be found by boring near the gypsum on Evans or Freeman Island. Between 1863 and 1878, about 8125 tons of coal were shipped from the Richmond mines, at Little River; and about $53,000 spent in building a tramway and sinking shafts.

Fault.

Coal on Evans and Freeman Islands.

A lease was taken out by Mr. Marmaud, who subsequently transferred his interest to an American company. An engine of thirty horse-power was erected for pumping and drawing.

McBean's ssction of the strata at this mine is as follows: Section of coal measures at Little River.

	FEET.	INCHES.
Coal	3	0
Strata	154	0
Coal	4	0
Strata	60	0
Coal 2-4 feet	3	0
Strata	45	0
Coal 2-8 feet	5	0
Total thickness	274	0

Separated from the four-feet seam by five feet of shale, another, ten inches thick, is said to occur by Dr. J. W. Dawson. Of these he says (Acadian Geology, p. 397): "The coal of the principal bed is hard, and very little injured by exposure. Its fractue is uneven and crystalline, with glistening surfaces; and its texture is very uniform, the lamination or reed being rather indistinct, and almost free from dull coal or mineral charcoal. Its specific gravity is 1·38. When burned in a stove or grate, it ignites readily, fuses, swells and cakes, giving a strong flame and a lasting fire. It leaves a rather large quantity of brownish ash. In a smith's forge it works well, its behaviour being similar to that of Pictou coal. On analysis it is found to contain: Remarks by Prof. Dawson on the character of Little River coal.

Volatile matter	30·25
Fixed carbon	56·40
Ash	13·35
	100·00

"Compared with the coals of Pictou and Sydney, the Little River coal is more bituminous than either, or contains more volatile matter and less fixed carbon. It contains about the same quantity of earthy matter with Pictou coal; but in quality and color the ash resembles that of Sydney. Practically it will be found to be a serviceable coal for domestic fires, well adapted for smith's use, and, from the large quantity and high illuminating power of its gaseous matter, probably a good gas coal. There should be little waste in its extraction, and it will suffer little by being banked or kept in the open air. It contains more sulphur than the Pictou coal.

"The coal of the small bed (No. 2) is somewhat similar to that of No. 1, but it is more impure, and contains much bisulphuret of iron."

The two upper seams of McBean's section, which are nearly vertical at the mine, have been opened in several places by slopes and shafts. Mining operations.

*The first shaft was sunk to the depth of fifty feet in the three-feet seam. East from it another shaft was sunk forty feet between the seams. and connected with the first by drifts. From this depth the four-feet seam was worked to the west 250 feet and to the east 750 feet. This shaft was then sunk an additional forty feet, and a drift was put into the four-feet seam. Slopes were afterwards driven to the west of the shafts, 120 feet in the three-feet seam, and in the four-feet seam 150 feet. To the east of the eighty-feet shaft another one was sunk on the three-feet seam also eighty feet; and further east one 130 feet. The first eighty feet shaft was continued in 1866 to a depth of 200 feet, and outof it at that depth a tunnel or stone drift was driven to cut the seam at a distance of 162 feet. On each side of this drift levels were driven.

A modification of the long wall system was adopted in working these seams. The coal was taken by rail to a shipping wharf, distant about $2\frac{3}{4}$ miles. The surface erections consisted of an agent's house and a block containing thirteen tenements. Few of these are now standing.

McBean's explorations.

McBean tried to trace the Little River coal to the north-west of the mine, and found the surface over sixty feet deep. By running the course of the coal about half or three-quarters of a mile to the north-west, the limestone and plaster cross the strike of the coal at the mine. He also ran the course of the seams toward River Inhabitants, crossing the measures for over half a mile with pits and tunnels, close enough to prove every foot of the beds, but found no coal. He does not think he went far enough to the dip.

Mr. Brown's opinion of the prospects of these mines.

Of this field Mr. Brown remarks: "† Any attempts to ascertain the true position, extent and consequent value of the seams will be attended with much expense, as the country is low and there are few cliffs or natural sections. . . . . The outcrops of the strata also are concealed by a thick deposit of boulder clay. The seams all occur in situations favorable for shipment, but it is not likely that, unless they can be found in less highly inclined positions, they can be worked to any great depth, as in addition to the difficulty of working vertical seams, the expense of keeping the mines free from water will be a very serious obstacle and greatly increase the cost of production." If, however, the seams extend in workable form beneath Freeman and other islands, as indicated before, one of these difficulties would be to some extent overcome, as the strata are there less inclined and more accessible. Moreover, the railway lately finished to connect the Intercolonial with the Strait of Canso will render these seams of much greater value.

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* Reports of Commissioner of Mines, 1863-1868. † Coalfields of Cape Breton, p. 42.

The coal measures of Glendale, River Inhabitants are described with the rest of the section at page 97–98. Glendale coal measures.

Pieces of coal are reported to occur in the bank of Queensville Brook below McMaster's mill; but the existence of coal in this vicinity is doubtful.

In the brook that flows into Seacoal Bay near the mine, not far above the bridge, grey rocks have a nearly vertical dip. Coal detritus occurs at a pit near the road, and also a little further up stream, also surrounding many old pits and associated with black calcareo-bituminous shale and limestone, very coaly, with cone-in-cone concretions, veined with calcspar containing fish remains, obscure plants and shells, such as *Cythere* and *Naiadites*. Above the coalpits fine grey sandstone has a north-west vertical strike, and higher up, at a fall, there is a north-easterly steep dip. High up the brook black coaly shale occurs in a pit, said to be twenty-two feet deep. On the hill beyond, huge masses of grey and whitish coarse quartzose grit occur with a southerly dip; and between this and the Strait of Canso or sea shore, only blocks of grey sandstone and nearly vertical outcrops occur. Coal mines of Caribacou.

Only 716 tons of coal were shipped from Seacoal Bay from 1863 to 1865, although no less than $13,000 were spent in exploration and mining.

Principal Dawson* states that the coal of Seacoal Bay is a seam of mixed coal and bituminous shale, eleven feet eight inches in thickness. Mr. Campbell† mentions the occurrence of eight workable seams ranging, in thickness from three to eleven feet, and several beds of smaller size, whilst in a subsequent report it is stated that several seams occur, varying in size from three to seven feet, only one of which four feet thick was mixed. This was entered near the shore by an adit driven across the measures 350 feet till it cut the seam at a depth of twenty feet below the crop. Contradictory statements concerning the coal seams. Mining operations.

An analysis given by Principal Dawson of the best coal, selected from the thick bed, shews:

Volatile matter	25·2
Fixed carbon	44·7
Ash	30·1
	100·0

Iron Ore.—Hematite occurs in the joints of some of the felsites about West Bay as druses or films. It is distributed in minute veins in the syenite of Big Brook and River Denys. At Mackerel Cove, Madame

* Acadian Geology, p. 395.

† Report of Commissioners of Mines for 1863, p. 20.

Island, a small seam of hematite, varying in thickness from a mere line to an inch, runs through the bank for about ten feet. At Ragged Head, Guysborough County, the devonian conglomerates contain numerous blotches and films of specular iron ore, of no economic value, and west of Stewart Pond blocks of specular iron ore, sometimes a foot thick, mixed with quartz, have been picked up in the fields and on the beach. The quartzose sandstones of the shore contain scales and scaly crystals of hematite and green carbonate of copper in the joints, and blackened impressions of comminuted plants in the bedding planes, while the hematite occurs also in small strings in quartz veins. At one place the ore assumes the form of an irregular gash vein from which pieces six inches thick may be obtained, but to the eastward it runs into ordinary films. Several small deposits are in the neighborhood.

Hematite in Guysborough county.

Ironstone is found with limestone in nodules and thin layers in the sandstones and shales of Scott Brook, near St. Peters. Magnetic ore is present in the sand of Rocky Bay, just north of Shaw Brook. The iron ore of Whycocomagh has already been frequently referred to. Other deposits are said to occur in the neighborhood.

Ironstone of Scott Brook.

A visit was made to a pit opened by Burchell and Morrison, in search of iron ore in the tributary of Breac Brook, East Bay, about three-quarters of a mile above Rory McLeod's mill. Much money has here been spent in vain, for the openings have been made in a crumbling carboniferous conglomerate formed from the underlying felsitic rocks of the neighborhood, in which all the iron found is present as a film on the surface of the pebbles, which on weathering gives the characteristic bright red streak of red hematite. A great quantity of ore had been extracted, but from the pile not one solid piece of hematite as large as a hen's egg could be obtained.

Big Pond Iron ore.

Iron ore was again sought for by Ingraham and others near the 21-mile post on the St. Peters road, but no discovery of importance made.

The Gillis and Matheson location was worked during the summer of 1878, and ten or fifteen hundred dollars spent in sinking shafts and extracting ore; but the operations do not seem to have been successful; for although in the pile taken out there is a large proportion of excellent ore, yet this does not form more than one-third of the whole, the remainder being conglomerate, like that of Burchell's pit. The pits had fallen in, so that it was impossible to examine the face of the mine; but we were informed that all the accessible ore had been extracted and that none had been obtained from the deepest shaft. Everything tends to prove that the ore is a deposit at the contact of the carboniferous and precambrian formations, like those seen near McDougall Point and elsewhere; and in mining these deposits this cir-

Gillis and Matheson mine

cumstance should be kept in mind and the ore followed along the line of contact.

Galena.—A considerable quantity of this ore of lead was discovered many years ago in the limestone at the head of Arichat Harbor, and to some extent wrought.

Copper Ore.—Traces of green carbonate of copper were observed in a quartz-felsite in a brook just west of the Morrison road near West Bay, associated with greenish, soft, soapy, calcareous rocks, like those of the Coxheath and Gabarus copper mines. Minute traces were also observed in some of the carboniferous rocks. Copper pyrites is reported to occur at North-east Mabou and also at Skye Mountain; but these deposits were not visited. Some work has been done at the copper mine of the Gillis Lake road (Report for 1877-8, p. 29 F.) by Mr. Burchell; but although the ore has been found in many places, it cannot be said to have improved. Apparently the deposit is like those of Gabarus and the French road. A good deal of yellow and purple copper pyrites, with traces of red hematite, is scattered through a large mass of compact and brecciated felsitic rock, the latter are very calcareous and full of a soft, soapy, talcose mineral. The strike seems to be about N. 40° E., the dip variable. One of the beds has yielded rich specimens; and to test its quality beyond the brook, a tunnel six feet high and four to six feet wide has been driven from the water level about twenty feet (1878), cutting layers containing minute traces of ore; but the bed in which the best indications were seen has not yet been reached. The tunnel costs six dollars a foot advance and passes through a dark, hard, compact felsite, in which are one or two softer bands. At the mouth of the tunnel are several feet of the soft, soapy, calcareous breccia, and at the end, very calcareous strata are met with. Ore has also been obtained much higher in the brook, from other beds; but as far as can be judged there is no regularity in its distribution. Copper ore is also said to have been found in some of the brooks near the Coxheath road at Battleman's, above the mineral spring.

Burchell's Copper mine.

Gold.—At Cape Porcupine and in Clam Harbour River, above the Middletown road, gold is said to have been discovered some years ago in the devonian slates, and some quartz was sent away to be tested. Nothing is known of the result owing to the conflict of testimony, but it was probably unsatisfactory. No traces could be detected in the veins, which are small and irregular.

The quartzite associated with the mica schists at Glendale and River Denys cross-roads, were also believed to be auriferous, and a good deal of money was spent in testing them. A stamp mill was erected to crush the quartz at the latter place, but has been allowed to fall to pieces.

Limestone.—The most valuable deposits of this rock are indicated on the map. Several of these have been largely quarried and may be briefly enumerated.

Arichat. Behind the Arichat chapel is a small limestone quarry in a dark-grey, very compact stone, veined with calcspar and containing encrinite stems.

Pirate Harbor. At Pirate Harbor a limestone, probably hydraulic, has been somewhat largely quarried, both for burning and building. It is of doubtful though considerable thickness, light bluish-grey, shaly or thick-bedded, often minutely banded or waved, brecciated, cut by veins or streaks of calcspar. About a mile north of Pirate Harbor this limestone is again worked at McNeil's quarry, where it is at least fifteen feet thick, highly bituminous, non-fossiliferous, rather earthy, but some beds are more crystalline and probably better. It has been exported, but it is said to be inferior to that of Lennox ferry. Traces of fluorspar were detected. Specimens from this quarry have been examined by Mr. Hoffmann.

Lennox ferry limestone quarries. A limestone which has always commanded a ready sale on account of its excellent quality, has been quarried for upwards of twenty years at Lennox ferry. It is for the most part sent to Prince Edward Island, burnt there and used as a fertilizer. The quarries are owned by Messrs. Clough, Fraser and Shannon. Mr. Shannon states that about 500 tons were shipped last year from his quarry; and that in all 2000 tons have been taken from it since first opened. The selling price at the wharf is eighty cents a ton; at Prince Edward Island it sells for two dollars a ton, the freight costing about sixty cents. It is bought by shipload by agents who burn and retail it to farmers by the barrel. There is also a kiln at the ferry to burn lime for local consumption. From Clough's quarry about 1500 tons per annum are exported, and about 1000 from Fraser's.

Lennox ferry. *Gypsum.*—There is a large bed of excellent plaster at Lennox ferry, from which a large quantity has been shipped, although nothing has been done with it for several years. Before 1873 about 1500 tons are said to have been exported yearly; since then only a few cargoes. The August gale of 1873 having destroyed the wharf and buildings, they were not replaced. Another cause for the cessation is, Mr. Clough says, to be found in the decay of Arichat shipping. Formerly a numerous fleet of small coasting vessels, owned in Arichat, after lying all winter, loaded with plaster which they sold at an advance sufficient to pay. the expenses of their voyage to American ports to seek freight. This fleet is now nearly extinct, and Arichat depends for its existence on fishing and its position as the county-town. The plaster is of two kinds, and as the quarry extended, the best looking alone would be taken by the shippers, who bought it at their own risk and knew

that an inferior article would not sell in the United States. At length it became somewhat expensive to extract and the market was occupied by other quarries more favorably situated.

The gypsum of Plaster Cove, Little River and other localities, has been sufficiently described in the course of this report. None has been shipped lately. Plaster Cove.

Clay.—There is a great variety of clays in the valley of River Inhabitants and elsewhere, some of them, doubtless, fit for making bricks. At L'Anse au Loup, near St. Peters, clay is seen at low water. In the vicinity on Brick Point, there is said to be a good deposit from which the French made bricks. St. Peters.

Fireclay (altered felsite), like that of Coxheath (Report 1875-76, p. 423), occurs in the Sporting Mountain (page 7, F.)

Sand.—On the shore at Campbell Point, Malagawatchkt, is a deposit of fine sand suitable for building purposes, of which 2000 barrels have been used in St. Peters canal. Malagawatchkt

Building Stone.—No large and good deposit of building stone is known among all the sandstones of the region, which are usually too highly tilted and broken to be available. At several places, however, stone has been found to serve local purposes; the best of which is perhaps found in Graham River, near Judique, and described at page 104 F. Some of the sandstones of Inhabitants River and West Bay break into large blocks which are used for rough work in building. Graham River.

Heavy Spar.—In the Judique chapel brook, near John Cameron's a deposit of heavy spar or baryte, in veins in a fine conglomerate, has been opened by Mr. Brown of Port Hastings. No great quantity was found, however. Baryte also occurs in traces in the devonian strata near McMillan Point, on the Strait of Canso. Judique.

Graphite or Plumbago was found by Mr. R. G. Fraser of Halifax, at Glendale, where a considerable quantity of impure graphite, or rather graphitic shale, is seen in large lumps around the mouth of a pit said, to have been twenty feet deep, sunk near the contact of the syenite and overlying sandstones and shales. A specimen analysed by Mr. Hoffmann was found to contain about fourteen per cent. of graphite. (Report for 1879-80, page 2, H.) Glendale.

Marble.—Reference has been made in previous reports to the quarry at Marble Mountain. No work has been done to develop the quarry. Other exposures of crystalline limestone, none of which, however, are so favorably situated, have been mentioned in the description of the George River limestone. Marble Mountain.

Syenite, granite, and other varieties of ornamental stone, might be obtained from some of the hill ranges, but none of them have yet been used.