

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

REPORT

ON

GEOLOGICAL SURVEYS AND EXPLORATIONS

IN THE

COUNTIES OF PICTOU AND COLCHESTER, NOVA SCOTIA

BY HUGH FLETCHER, B.A.



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TO ALFRED R. C. SELWYN, C.M.G., L.L.D., F.R.S.,

Deputy Head and Director of the Geological Survey of Canada.

SIR,—I have the honour to submit herewith a report on work done during the summers of 1887 to 1891 in the counties of Pictou, Colchester, Hants and Cumberland, as described in the Summary Reports of the department for these years.

As in previous years, detailed surveys were made, plotted on a scale of forty chains to an inch and used with supplementary surveys obtained from the Admiralty, the Department of Railways and Canals, the Department of Crown Lands of Nova Scotia and Church's county maps, for the construction of a map on a scale of one mile to an inch on a projection laid down by Mr. Scott Barlow, and, west of Great Village River, mostly drawn by him from his own surveys. Map.

My assistants in different parts of the field work have been Assistants. Messrs. M. H. McLeod, J. A. Robert, D. I. V. Eaton, A. Cameron, John McMillan, W. B. Almon, Fred. Coldwell and Prof. Coldwell; and in preparing the map, Messrs. Robert, Eaton and B. A. L. Huntsman.

To enumerate all those from whom we have received kindness, hospitality, assistance and information would be impossible, but the following gentlemen may be especially mentioned: Henry S. Poole, John Rutherford, J. G. Rutherford and Robert Drummond, of Stellarton; William B. Moore, W. P. McNeil, Jeffrey McColl, H. V. Jennison, Harvey Graham and James F. McLean, of New Glasgow; R. P. Fraser, James Hudson and Robert Simpson, of Pictou; Alex. McBean and T. M. Turnbull, of the Vale; A. McG. Barton, of Pine Tree; James Maxwell, John William Sutherland, James Fraser (Moose), Wm. Maddin and Charles Fergie, of Westville; John A. McKenzie of Lower Caribou River; James Wm. Hogg, of Pictou Island; R. E. Chambers, John Dunbar and Henry McLean, of Hopewell; Donald Fraser of Springville; John A. Cameron, of Bridgeville; Graham Fraser, of Trenton; A. McKimmie and A. Bain, of Riversdale; James Pitblado and J. K. Blair, of Truro; Gilbert Sutherland, of the Falls, Waugh River; John McKay (Ross), Robert Murray and Duncan McKenzie, of Earltown; Timothy McLennan and Dr. E. Roach, of Tatamagouche; Peter McIntosh and Hugh McKay, of

New Annan; G. W. Densmore, of Brookfield; Dr. W. D. McKenzie, Dr. A. S. Townshend, C. E. Day and W. F. Jones, of Parrsboro'; A. H. McKay, James H. Austen, E. Gilpin, Martin Murphy, W. A. Hendry, A. F. Church, T. J. Ritchie, Charles J. McDonald and F. W. W. Doane, of Halifax; R. G. Leckie, W. F. Jennison and Wm. Smail, of Londonderry Mines; P. S. Archibald and Wm. B. McKenzie, of Moncton; R. G. E. Leckie, of Middleton; Professor H. Y. Hind, of Windsor; Sir J. W. Dawson, of Montreal.

I have the honour to be, sir,

Your obedient servant,

HUGH FLETCHER.

REPORT

ON

GEOLOGICAL SURVEYS AND EXPLORATIONS

IN THE

COUNTIES OF PICTOU AND COLCHESTER, NOVA SCOTIA.

INTRODUCTION.

The geology of that part of Nova Scotia which lies in the counties of Pictou and Colchester, west of the district to which Report P for 1886 relates is described in this report. It embraces the basins of the rivers of Pictou and Caribou, Toney River, River John, Waugh and French Rivers, which flow into Northumberland Strait; Salmon, North, Stewiacke and Shubenacadie (in part) which flow into the head of Cobequid Bay; Chiganois, Debert, Folly, Great Village, Portapique, Economy, Five Islands, Moose, Parrsboro' and other rivers that empty into Minas Basin. The northern portion of this district is made accessible by the Oxford and Pictou branch of the Intercolonial railway, the southern portions by the main lines of this railway. The district is all well settled, with the exception of two tracts of mountainous country. The first of these forms the Cobequid Hills which extend from Cape Chignecto to Mount Thom in a belt about ten miles wide which crosses the Intercolonial railway between Greenville and Folly Mountain. In places these hills rise to a height of 1,050 feet above the sea, being probably more than 400 feet lower than the highest summits of northern Cape Breton. The second tract of uninhabited country, from the Pictou branch of the Intercolonial railway between Valley and Glengarry stations south as far as the Stewiacke River settlements is an extension of that between East River of Pictou and the West River of St. Mary's.

The district displays great variety of surface features accompanied by differences in the structure and constitution of its rocks. On Cobequid Bay and Minas Basin there are about 20,000 acres of rich

District described.

Rivers.

Railways.

Mountains.

Character of the soil.

meadowland reclaimed by dykes from the high tides of the Bay of Fundy. Along the rivers and brooks there are large belts of excellent intervale; while the upland, even to the summits of the hills, is fertile.

Harbours.

On the north side is the excellent harbour of Pictou and the smaller harbours of Caribou, River John, Brulé and Tatamagouche, Boat and Little Harbours. Besides the Caribou Islands and several smaller islands near the mainland, Pictou Island, which is about five miles long and a mile wide, lies nine miles from Pictou light. The land

Scenery

along the shores is generally low, but views of great beauty are presented in several places, whilst the hills "exhibit prospects which in richness and variety of sea and land, hill and dale, river and shore, field and forest will compare with any in America."* Lakes add "in some places a pleasing variety to the landscape" and on some of the streams are beautiful cascades and pools.

GEOLOGY.

Geological formations.

The geological formations found in this district are for the most part the same as, and an extension of, those described in the Report P for 1886, above mentioned. Of the large areas of Pre-Carboniferous metamorphic rocks by far the greater part consists of Devonian strata. The Cambro-Silurian is confined to the hills east and north of the valley of the East River of Pictou and between Sunnybrae and Plymouth at the south-eastern corner of the Pictou coalfield where the Silurian also occupies small areas and is not met with again except in limited patches at and near Earltown and in Waugh River. Devonian fossiliferous rocks are largely developed south of the East River of Pictou and thence without interruption run far to the westward of Truro on the south side of Cobequid Bay and Minas Basin. They appear again in Waters Hill, McCulloch's Brook and Mount Thom, and form, with the series of igneous rocks which are everywhere found to cut and alter them, the axis of the Cobequid Hills. They include the iron ore series of Londonderry and are similar to the metamorphic rocks of Antigonish and Guysboro' counties.

Metamorphic rocks.

Carboniferous rocks.

Carboniferous limestone occupies a considerable portion of the basin of Stewiacke and Shubenacadie Rivers. Outliers are also found on Minas Basin, on Penny's Mountain, on the East Mountain of Onslow, resting in small unconformable patches on the Devonian rocks, also underlying the coal measures and millstone grit of the Pictou coalfield. The coal measures occupy an irregular area

*Patterson's History of the county of Pictou, Dawson Bros., 1877.

between the Middle River of Pictou and Sutherland River. A considerable area of Carboniferous rock skirts the south side of the Cobequid Hills; by Dr. Ellis it is supposed to be Lower Carboniferous, while Mr. Barlow considers it millstone grit, and Sir William Dawson, coal measures.

Along the northern part of Pictou and Colchester counties, from Big Island, Merigomish, to Brulé and Tatamagouche, there is a wide belt of Permian rocks, the conglomerate at the base forming Fraser's Mountain, Green Hill, Roger's Hill, Fitzpatrick's Mountain, Dalhousie Mountain, the Biorachin and other highlands on its course. The conglomerate is overlaid by grey sandstones, like those of Pictou and West River, containing one or more thin coal seams; and these are succeeded in turn by brownish and red sandstones and marls with thin layers of limestone. Dark red, crumbly, Triassic sandstone and conglomerate, generally in nearly horizontal attitude, occupy a basin which extends westward from near Valley station, one rim fringing the south side of Minas Basin, the other reaching much further inland on the north side. Two principal intrusions of igneous rock have been determined within the area. In one red syenite, diorite, felsite and similar rocks cut no strata newer than the Devonian, in the other Triassic sandstones are intersected and intermixed with great masses of basalt and amygdaloid which furnish the celebrated trap minerals of the Bay of Fundy.

These strata may be classified as in the following tabular view :—

M. Post-Tertiary.

H. Triassic.

G. 4. Permian { 1—Upper red sandstone and shale group, with thin bands of limestone.
2—Middle grey sandstone and shale group, with small coal seams.
3—New Glasgow conglomerate.

G. Carboniferous { G. 3—Coal measures.
G. 2—Millstone grit.
G. 1—Carboniferous limestone.
G. 1m—Carboniferous conglomerate.

F. Devonian { Upper red slate and sandstone group. Red rocks of Union, on the Truro and Pictou railway.
Middle grey slate and sandstone group. Riversdale and McKay Head rocks,

E. Silurian { E. 6—Lower Helderberg.
E. 3—Niagara.
E. 2—Clinton.
E. 1—Medina.

D. Cambro-Silurian { Upper sandstone and conglomerate of Bear's Brook.
Middle shale and sandstone of Baxter's Brook.
Lower flinty shale and sandstone of James River and Eigg Mountain.

Classification of rocks.

Igneous Rocks. { Of Triassic or Post-Triassic age.
 { Of Devonian age.
 { Of Cambro-Silurian age.

D.—CAMBRO-SILURIAN.

Constant association of the Cambro-Silurian with igneous rocks.

That within the areas marked Cambro-Silurian on the map there may be rocks of Silurian age, and that the boundaries in some cases may be vague, or that greatly altered patches of Silurian may have been mistaken for Cambro-Silurian is quite possible; but there is apparently a distinct series of these lower rocks, often so closely associated with Silurian strata and also with igneous rocks that it is difficult to determine whether they may not be Silurian indurated along the line of contact with igneous intrusions. They belong chiefly to the lower subdivisions especially to the Baxter Brook group. Most of the details regarding them were collected by Mr. Robert.

Park's mills and falls.

The rocks of Park's Falls with associated masses of diorite, have already been described. At twenty paces above the bridge on the most westerly of the two brooks above the mill-dam, they are succeeded by Medina, quite unaltered, which are well exposed higher up the brook. South of the St. Mary's road hereabout are greenish and reddish, rubbly, flinty slates, like those of Baxter Brook, with red flinty grits and siliceous sandstones, succeed the coal measures or Carboniferous limestone, in some of the brooks and include a great variety of trappean rocks. In McLellan's Brook, at and below the falls, one mile below Brookville, trap and diorite, are followed down stream by slightly altered greenish-grey fossiliferous rocks, succeeded, further down stream, by greatly altered grits and bright greenish and reddish slaty argillites, probably Cambro-Silurian. The dip gives no key to the relation of the two series. In the brook which flows from the mountain church into McLellan's Brook, Silurian rocks are succeeded by greenish argillite and fine sandstone, having a much more flinty aspect, splintery, ringing and rubbly, veined with quartz. At the mountain church and on the road towards Brookville are light green, white-weathering, quartz-veined slates, almost certainly of this age. At the foot of the hill, however, and on the road towards Bridgeville, past James Seivright's they are succeeded, as elsewhere stated, by the Silurian; but further south white-weathering, scaly or schistose, fine, granular, felsitic rocks reappear, the Silurian lying, however, not far to the westward. In Mr. Thomas McMillan's fields, white quartzite is largely exposed with reddish grit and green slate. The quartzite contains veins of limonite and is in contact with

Contacts of Silurian and Cambro-Silurian, McLellan's Brook.

Bridgeville.

Iron ore.

greenish felsite and other igneous rocks. The road thence towards East River shows only Silurian. The other rocks of the neighbourhood of Mount Horeb are whitish sandstone, light greenish-grey, soapy, ribbanded slates, cut by diorite, and underlying Medina. At the head of the west branch of Sam Cameron's brook, underlying Clinton slates, are matted or felted, cleaved, greenish slates, but most of the rocks are volcanic.

At Blue Mountain church is a purplish grit; green grit and slate are under the post office, while north of the school is a green flinty slate. Near McLellan's Mountain church are outcrops of greenish, fine, rubbly sandstone and slate, perhaps belonging to the Baxter Brook series; they underlie the Carboniferous limestone and are cut by greenish and dark grey diorite. Below the bridge, half a mile below the cemetery on McLellan's Brook, greenish, thick-bedded argillaceous sandstone, probably Medina, is succeeded by greenish calcareous rocks underlaid by red, massive, soft argillite, breaking into irregular pieces. The lowest green beds are nodular or brecciated, and sometimes splintery, associated with greenish, massive, flinty, fine sandstone and with layers of the peculiar breccia of Hartsborn Brook and Barney's River. A little lower down are outcrops of reddish grit, succeeded again by greenish, well-bedded argillaceous sandstone, sometimes brecciated and nodular, crowded with Silurian fossils; below this, the reddish and greenish rubbly rocks and reddish flinty, coarse grit with quartz veins and blotches, extending to the contact of the Carboniferous. Near McPherson's mill, green, somewhat soft, soapy slate contains yellowish-grey flinty bands. On the road from the head of Cross Brook to Brookville, succeeding Silurian fossiliferous rocks which extend to the north of the brook is a mass of diorite and, close by, white soapy slates. South of the road, the rocks seem to be Silurian, but along it for some distance reddish, flinty grit is close on the left and a diorite hill beyond. The grit is netted with veins of quartz and associated with reddish, flinty, compact slate. In proceeding down McLellan's Brook towards Brookville, the hill recedes on the left leaving the road in Silurian rock as far as the bridge. A little beyond it, however, are masses of Cambro-Silurian grit and conglomerate.

On the East River immediately opposite the mouth of Ogg Brook, the rocks in the road are greenish slates with red layers, probably of the Baxter Brook group, and this is, perhaps, also, the age of the red and green, papery, soft slates cut in mining the iron ore in the tunnel on the west side of William Grant's Brook and also at Fraser's (saddler), although possibly these may represent

Mount Horeb.

McLellan's Brook. Intimate mixture of Cambro-Silurian and Silurian.

East River of Pictou.

Iron ore of Grant's Brook

altered members of the Lower Helderberg. The ore taken out 60 years ago is said to have come from beneath this red slate. On the left bank of Grant's Brook, a short distance higher, dark grey Ariesaig slates are well exposed for some distance. At the upper mine level on the hill, the west wall shows greenish, soft, Silurian rock dipping westward at a low angle, whereas the east wall is a compact, flinty, white quartzite like that of McMillan's and probably Cambro-Silurian. This would seem to indicate a tongue of Cambro-Silurian perhaps joined with that of McMillan's between which and the Silurian the ore has been filled into a fissure; but small veins of limonite also cut the quartzite. A tunnel driven at a lower level into the hill struck a face of light-greenish, earthy, shelly, Silurian rock from which the ore turned sharply to the eastward probably along the contact with the Carboniferous.

Glencoe Brook. In Glencoe Brook, immediately above the school, reddish, flinty rocks, perhaps Cambro-Silurian are followed by cliffs of Silurian as far as the falls. One bed is a flinty, quartz-veined quartzite not unlike that of McMillan's and also like the rocks associated with red hematite at Webster's. Not far above the falls, however, Cambro-Silurian rocks reappear, and it may be that for some distance the brook forms the boundary. The fossils collected from the fall by Mr. Robert and examined by Mr. Ami were Medina. Near the source of the brook, veins of ankerite are found in flinty, splintery, ribbanded slates, associated with reddish-grey and greenish, soft, soapy slates. Lower down are rocks which may be newer and represent those found in the East River above Sunnybrae bridge—greenish and reddish, mottled, flinty rocks with joints full of films and small veins of hematite. They are associated with mottled, micaceous, soapy argillite, followed up stream by rocks more closely resembling the typical Medina. In the gorge, blackish, flinty, pyritous, massive rocks and greenish-grey rusty sandstones holding encrinites and brachiopods are succeeded by the rocks described above.

Blanchard Brook.

In the west branch of Blanchard Brook, near its head, are outcrops of Cambro-Silurian near the Silurian. Quartzites and slates, perhaps of this age, are found also on Irish Mountain, and at the head of Holmes Brook, in Corrimony, greenish compact slates are associated with traps.

E.—SILURIAN.

Description of Silurian rocks. Numerous details concerning nearly all the Silurian localities referred to in this report have been given by Dr. Honeyman and Sir

J. William Dawson in the Transactions of the Nova Scotia Institute of Science, the Canadian Naturalist and Acadian Geology. The subdivisions are those adopted in the report for 1886. No continuous sections like those of Arisaig have been measured, the outcrops being, as a rule, too much disturbed, although many good exposures occur.

by Honeyman
and Dawson.

E. 1.—Medina.

The best exposures of this group, nearly always associated with Clinton and higher strata, are found on McLellan's Mountain, in Sutherland River, Cameron Brook, Holmes Brook, on the St. Mary's road and at Springville* some of which have been already referred to.

Areas of
Medina.

In some of the brooks the alternations of Silurian and Cambro-Silurian are very numerous and the breadth of the various groups of Silurian is necessarily narrow.

In the basin of French River, near Blue Mountain and in the neighbourhood of McPherson's mills there are outcrops of Medina and Clinton rocks. In Glencoe Brook, as already remarked, many of the rocks hold Medina fossils. The whitish fine grit or quartzite, veined with quartz, is, perhaps, of this age and runs out to William Grant's. Other outcrops, some distance above the road in this brook, consist of light grey slate and rusty-weathering sandstone, holding brachiopods and cut by threads of spathic iron. The flinty grit is probably that found at Sunnybrae; it passes near the head of Holmes Brook, not far from the Corrimony road, occurs some distance north of the fork of the roads, is found between McPherson's grist mill and Murdoch Lake and runs towards Blanchard. From McPherson's mills, for some distance on the road towards Glencoe school, the rocks are fragmental felsites. Then, in a steep hill on the right there are exposures of flinty quartzite, like that of Grant's, but a short distance beyond and immediately opposite the first bridge on the brook flowing southward into Glencoe Brook are rocks evidently Silurian.

French River.

Glencoe Brook
to Murdoch
Lake.

The greenish, rusty-weathering, earthy, micaceous shale and massive rock at the head of Campbell Brook and towards Mount Horeb consist of Medina and Clinton overlying the Cambro-Silurian. On the southern slope of Mount Horeb siliceous Medina rocks are succeeded by black Clinton shales.

* Trans. N.S. Inst. Sc., vol. III., pp. 62, 69, 70, 108; vol. IV., p. 464; vol. V., pp. 67, 72, 202, 207, 209, 293.

Iron mines.

At the Blanchard iron mines good outcrops of Silurian slate are found at Ross's and McDonald's and again near Glencoe Brook, at a knoll of diorite containing specular iron, in the unsettled land between the iron mine and Blanchard road and on that towards Webster's. The iron mine at Webster's* occurs among greenish-grey, tough, siliceous rocks associated with a whitish quartzose grit, doubtfully Niagara or Medina, their relation to the neighbouring Clinton slates being obscure. The grit on the east side of the road is possibly Silurian rather than Cambro-Silurian as at first supposed; but at Archibald Fraser's, in the Wentworth Grant, on Sutherland's River† an ore bed forty feet thick seems again to separate the Silurian from the fragmental slates which lie to the north, and at Angus Fraser's the ore is in white quartzite, perhaps also Cambro-Silurian. Again near the little lake at Archie Fraser's greenish, fragmental slate is associated with the ore, which is apparently, therefore, inclosed in Medina rocks overturned. It has been supposed that all these outcrops of red hematite are connected, but this is very doubtful. Between the ore at Webster's and the road to the school at Blanchard road, Clinton slates are found, and still more abundantly in the road. Some of the Silurian rocks of Earltown are, perhaps, Medina, but as they are chiefly higher they will not here be described.

E. 2.—Clinton.

Descriptions
of the Clinton.

Rocks of this formation occur chiefly at Sutherland River, Blanchard, McLellan's Brook, Cross Brook, Cameron Brook, Simon Fraser's Mountain, on the St. Mary's road, and at Earltown.‡ They resemble, lithologically, the rocks of this age already described at Arisaig, presenting dark and light coloured shales with characteristic fossils. Among the dark slates of the neighbourhood of Blue Mountain are crumbly beds, which have been uselessly prospected for coal.

Search for
coal.Cross Brook
igneous rocks.

In Cross Brook|| above the track between Churchville and Johnston's, greenish and dark grey slates of this age are well exposed with a very variable dip, although blocks of trap are in the brook, rolled from the hill to eastward. Higher up, the rocks are more altered and contain quartz veins. On the road to eastward towards Brookville from the head of the brook, greenish Silurian rock is in contact with large masses of diorite, beyond which are slates, pro-

* Trans. N.S. Inst. Sc., vol. V., p. 201.

† Trans. N.S. Inst. Sc., vol. IV., p. 140.

‡ Trans. N.S. Inst. Sc., vol. III., pp. 70, 108, 258, 393; vol. IV., p. 464; vol. V., pp. 64, 65, 205, 207; Acadian Geology, pp. 560, 568.

|| Trans. N.S. Inst. Sc., vol. III., p. 66.

bably Cambro-Silurian; and on the road eastward from Brookville the contact of the Silurian and Cambro-Silurian is again well seen.

In the neighbourhood of Webster's iron mine, Clinton slates are apparently overlaid by greenish arenaceous rocks like the Niagara; and according to Sir J. W. Dawson it is in rocks overlying the Clinton that the iron ores occur.* The slates again appear on the road to the bridge on McLellan's Brook; and for a considerable distance below the mills at this bridge banks of dark bluish-grey, pearly, papery slates with harder lenticular bands carry quartz veins which have been mined. They extend nearly to the road at the cemetery, where they appear to be in contact with Cambro-Silurian, with the intervention of a band of Medina. The light grey, micaceous, earthy shales in the brook below Webster's and in other brooks of this neighbourhood, are perhaps also of this age.

Webster's
iron mine.

Quartz veins
prospected.

Immediately above the bridge at St. Paul's church, Sam Cameron's Brook passes between cliffs of dark, crumbly, rusty-weathering slate, overlying rocks of igneous origin, probably Cambro-Silurian. They are cut by quartz veins, two inches thick and downward, show many fucoidal markings, ferruginous veins and nodules of compact grey limestone. In the little tributary from the eastward are twisted, micaceous, graphitic slates.

Sam Came-
ron's Brook.

In William Grant's Brook, bluish-grey, rusty-weathering slates, shiny and graphitic, showing little variety, except that in places they hold thin pyritous bands or veins and yield graphitized markings of plants, perhaps fucoids. In Holmes Brook, near the Corrimony road, twisted black slates contain minute quartz veins and numerous graphitized markings of minute branching plants.

William
Grant's Brook.

The Silurian rocks of Earltown and the head of Salmon River† may here be described, although many of them are undoubtedly higher. They are everywhere unconformably overlaid by Permian conglomerate. In the neighbourhood of East Earltown and Spiedel Hill they consist of grey, greenish and bluish-grey slates full of fossils. In Waugh River above Gilbert Sutherland's, the bluish-grey, flinty, splintery, compact quartzites, with threads of quartz and calcespar, first seen in irregular, nearly vertical bedding, are succeeded up stream by dark bluish-grey, more argillaceous, rusty-weathering rocks, greatly contorted, exposed nearly to the bridge on the road to Baillie's.

Earltown and
Salmon River.

The cliffs of the brook above the hotel at the village of Earltown show dioritic rock in contact with grey, rusty-weathering, fine

Igneous rocks.

* Canadian Naturalist, vol. IX., No. 6.

† Dawson's Acadian Geol., p. 270; Supplement, pp. 75 and 76; Trans. N.S. Inst. Sc., vol. III., pp. 346 and 393.

Whetstones.

Contact with
Permian.Metamorph-
ism by igneous
rocks.

Wentworth.

Igneous dykes

massive slate, full of shells. In one of the brooks running into Waugh River, some miles below Earltown, are siliceous, greenish and bluish-grey, fossiliferous slates, with quartz veins and blotches. Fine ledges are also found on the road which runs north-west from the post road at Earltown mills of rusty-weathering, massive, grey, argillaceous and siliceous rocks, full of threads of quartz. On the road west from Earltown church, Silurian debris is abundant. At the old mill-dam near John McKay's (Ross) is an outcrop of bluish-grey flaggy argillite which makes good whetstones and is full of shells. Beyond it, however, are outcrops of flinty, red argillite sandstone and conglomerate succeeded by the Permian conglomerate of Matheson Brook. The relation of the red rocks to the Silurian is somewhat obscure. They may be above or below it, but have in the meantime been included in the Devonian. At the cross roads in the Biorachin are greenish, compact, quartz-feldspathic sandstones and bluish-grey, rubbly, striped slates, perhaps Lower Helderberg, in contact with black diorite. Further west are dark slates full of fossils; and on the road from Earltown towards Kemptown are other outcrops. On that which runs west from the county line near William Ferguson's, bluish-grey flinty rock is seen near the Permian conglomerate of the neighbourhood, which is largely composed of its debris. In some places it contains shells which are clearly Silurian, in others it is brecciated, slaty and compact, evidently altered by the igneous rocks of the vicinity so that it might be mistaken for the rocks which have been called Cambro-Silurian at the East River of Pictou. Associated with the hard rocks and bluish-grey slates, are others probably higher, which contain fossils resembling Niagara and Lower Helderberg. Towards Nuttby certain outcrops were found, containing fossils which may perhaps point to the contact of the Silurian with the Devonian of that neighbourhood; but these require further examination.

The Silurian rocks of Wentworth and the vicinity on the north side of the Cobequid Hills have been fully described by Dr. Ellis,* who refers also to a list of fossils determined by Mr. Ami from a part of the series. In the cuttings immediately west of the station, dark green, fine diabase cuts and alters rubbly Clinton slates. In the next cuttings the rocks resemble more closely the siliceous Medina, those first seen being cut by a mixture of dark diorite and reddish syenite or granular quartz-felsite. The sedimentary rocks here are very massive and, near the dykes, rubbly. At the tunnel on Whetstone Brook, between two cuttings, these siliceous

* An. Rept. Geol. Surv., vol. I., 1885, Part E, p. 51; Cf. also Supplement to Acadian Geol., pp. 75 and 92; Trans. N.S. Inst. Sc., vol. III., p. 351; vol. IV., p. 478.

rocks are on the upper side, while at the mouth of the tunnel a mass of granular and fine dark diabase has to north of it a siliceous Medina rock, succeeded immediately by dark Clinton slates. Down stream and overlying come greenish flags, full of shells, probably Upper Clinton, which present a considerable thickness before they are interrupted by Permian? sandstone at the fork of a branch from the south-east. At the tunnel over the branch immediately west of Wentworth the brook shows large outcrops of dark, friable, altered slates. Up stream, dark diorite is succeeded immediately by siliceous Medina, finely exposed in cliffs near the head of the brook.

Other small detached outcrops of sedimentary rocks occur among the igneous rocks of the mountains west of Wentworth, in the Second River, in Bulmer Brook and other streams. From dark shales in a little brook at the road near Farmington, discovered by Mr. Scott Barlow in 1876, were obtained the following fossils determined by Mr. Ami:—

Fossils discovered by Mr. Barlow in River Philip.

PLANTÆ.

1. *Palæophycus* sp. or *Palæochorda* sp.

GRAPTOLITHIDÆ.

2. *Cyrtograptus Grayiæ*, Lapworth, or a very closely related species.

BRACHIOPODA.

3. *Lingula lamellata*, Hall (Cf. *Lingula striata*, Sowerby).
4. *Leptaena transversalis*, Dalman.
5. *Rhynchonella nucula*? Sowerby, or *R. cuneata*, Dalman.
6. *Leptocælia hemispherica*? Sowerby, or allied species.

This is the first time that the genus *Cyrtograptus* has been recorded in America. It is eminently characteristic of the lower half of the Silurian system.

E. 3. Niagara, and E. 6. Lower Helderberg.

Rocks of these formations overlie the Clinton in most of the Silurian areas and are well exposed at Springville, in Sutherland River, Blanchard and other localities.* A list of these is given by Dr. Honeyman in the Transactions of the Nova Scotia Institute of Science, vol. III., p. 393; and a list of the fossils in vol. V., p. 210.

* Trans. N.S. Inst. Sc., vol. III., pp. 8, 63, 66, 68, 71, 107, 393; vol. IV., p. 465; vol. V., pp. 200, 201, 202, 209, 223.

McLellan's
Brook.

In McLellan's Brook, not far above the contact of the Carboniferous limestone, are outcrops of mottled, reddish and greenish Silurian rocks apparently of this age. Higher up in a little brook from the eastward and also in the main stream at a mill and fall, the diorite of the fall (against which the Silurian rocks come nearly or quite unaltered) extends for a little distance and is then succeeded by greenish, massive Silurian rock, rusty-weathering and perhaps Niagara; followed up stream by greenish-grey and bluish massive rocks, and bright red and green, calcareous, slaty, argillite and limestone, dipping steeply down stream and holding Lower Helderberg fossils. Higher still are reddish, grey and greenish flags, crowded with fossils. Immediately above the first clearing on this brook, however, these rocks are succeeded by Cambro-Silurian.

East River of
Pictou.

The earthy, rusty-weathering, micaceous rocks in Campbell Brook east of William Grant's on the East River of Pictou, are perhaps Niagara. The ledges which appear in the fields north of David's Lake are said by Dr. Honeyman to be Lower Helderberg; and similar rocks occur on the hill between that lake and the road. East of the post road between Springville and Bridgeville are great blocks and outcrops of apparently horizontal strata also of this age. On the right bank of the East River of Pictou for some distance above Bridgeville the higher Silurian rocks are exposed. In Holmes Brook, earthy, micaceous flags, containing Niagara brachiopods, are overlaid by Carboniferous limestone, under which the brook runs to appear again at the sluice. A short distance above the contact, fine bluish-grey rocks, spotted with ankerite, are crowded with *Avicula Honeymani*; and, higher still, are succeeded by grey and greenish sand-tones. On Irish Mountain, steel-grey, rusty sandstones and slates of Lower Helderberg age also occur.

Overlap of
Carboniferous

McGregor's
Mountain.

The Silurian strata of McGregor's or Weaver's Mountain* are in part at least Niagara and Lower Helderberg—reddish and greenish, calcareous, mottled, metamorphic slates and limestones, associated with blackish, graphitic beds, veined and blotched with calcspar and passing into limestones.

North Earl-
town.

The rocks that underlie the Permian conglomerate of North Earlton contain, among others, beds of fine calcareo-argillaceous sandstone, in one place nearly pure limestone, greatly resembling Niagara. The outcrops, however, are not extensive, the more common exposures in this district being of flinty reddish argillite and conglomerate, apparently Devonian.†

* Geological Survey Report for 1866-69, p. 5.

† Acadian Geology, Supplement, 1878, p. 76.

F.—DEVONIAN.

As already stated, most of the metamorphic areas of the hills of Antigonish, Pictou and Colchester counties consist of rocks whose geological position is between the group containing marine fossils of Lower Helderberg age and the Carboniferous or Mountain limestone, also characterized by the occurrence of marine types, whereas all the fossils found in the intervening Devonian consist of shells indicative of a shallow-water origin and of plants both drifted and erect indicating land conditions. Between this series and those underlying and overlying there is everywhere the clearest evidence of enormous unconformity, and although from the abundance of their plant-remains they have sometimes been confounded with millstone grit and even higher strata* their relations to the Carboniferous limestone at the East Mountain of Onslow and Penny's Mountain, at Shubenacadie, Stewiacke, Walton, Cheverie, Parrsboro' and wherever the two series are in contact, and the ease with which they can be traced from point to point, shows that they are to be compared rather with the Mispeck and Little River groups of New Brunswick and that the Carboniferous limestone rests unconformably on the slates.

The meta-morphic rocks of the mountains, chiefly Devonian.

Plants.

Relation to Carboniferous

Comparison with New Brunswick.

Some particulars have already been given† regarding the character and thickness of these rocks on the line of the Intercolonial railway between Valley and Hopewell. A close examination of the country both north and south of the railway has since been made.

Intercolonial railway

The conglomerate, or lowest of the three groups into which this series has been subdivided, is here absent. A broad belt of the upper or red slate series lies north of the railway between Glengarry and Riversdale, the boundary passing thence south nearly to the Stewiacke River and the rocks appearing on both sides of Minas Basin; while the grey slate series occupies a large area at the head of the Stewiacke; and areas of both are found in the Cobequid Hills, where they have been examined by Mr. Scott Barlow and Dr. Ellis.‡ The iron ore of the Londonderry mines appears to occur in rocks identical with the reddish, green and rusty slates which, in Antigonish, Guysboro' and Pictou counties contain such a large quantity of specular iron ore which is worked at several places§

Londonderry iron mines

* Acadian Geol., p. 283, line 17, and p. 561; Supplement, 1878, p. 48; Fossil Plants of the Lower Carboniferous and Millstone Grit, 1873, pp. 9, 29, 33.

† An. Rept. Geol. Surv., vol. II., 1886, Part P, p. 64.

‡ An. Rept. Geo. Surv., vol. I., 1885, Part E, pp. 48-51.

§ An. Rept. Geol. Surv., vol. II., 1886, Part P, p. 49.

a horizon intermediate between the two groups. It will be best perhaps to include them with the upper group, as the red strata are characteristic. Like the Cambro-Silurian and Silurian these rocks, generally situated in the mountains, are so contorted that their relations to one another are not always easy to make out.

F. 2.—Middle Devonian.

Character and
distribution of
the middle
group.

This group is characterized by the occurrence of grey sandstone and slate, yielding fossil plants even when nearly in contact with syenite and diorite as so frequently happens. Its general characters have been described in the Report for 1886, Part P, p. 55. It is most largely developed south of the East River of Pictou and the Pictou branch of the Intercolonial railway as far as Riversdale, where it is succeeded by the red rocks. With regard to both this group and that succeeding, we are met by a difficulty in determining the minute geological structure in the absence of distinct layers and in the crumpled and faulted condition of their beds; but, as outcrops are generally abundant, a close examination will usually effect this.

Sunnybrae.

Near Black Taylor's Lake south of Sunnybrae are beds of steel-grey and greyish flinty grit and conglomerate or quartzite and slate. John Macdonald's (Ogg) Brook, above East River road and above a small branch from the west, is occupied by dark graphitic

Igneous rocks.

slates, cut by greenish, massive, felsitic, trappean and granitoid rocks and blotched with veins of quartz and ankerite. In the east branch are interstratifications of the Guysboro' quartzites and flags, including bands of flinty nut-conglomerate, the surrounding country being as usual barren or half barren. At several points small veins of limonite and red hematite have been found.

Iron ores.

Maple Lake.

Near the head of the Black Brook of Centredale and on the wood roads to Maple Lake are light bluish-grey quartzite and slate. The track to the lake from James McKenzie's passes first over black slates, but nearer the lake the slates alternate with quartzites. Similar rocks occupy the upper part of Maple Brook, while above Sam Cameron's mill-dam are fine exposures of black twisted graphitic slate with harder siliceous slate and quartzite.

West Branch,
East River of
Pictou.

On the Trafalgar road near Donald Fraser's, black slates are in place, succeeded, near the road to Elgin, by flinty, Upper Devonian rocks, which are also well exposed in the river. But the West Branch below the lake presents only a few small narrow outcrops of dark slates, quartzites and massive flinty pyritous grits, the river being bouldery and hard to follow. From this formation the slates

quarried in this district are obtained. Some of them are rippled; in the cliffs at the mill near Angus McIntosh's they hold plants. In the rocky barrens bordering West Branch Lake, Speid Lakes, Hood's Lake and other lakes of the vicinity are ledges of Devonian slate and quartzite.

On the road from Lorne to the iron mine at Cullen's, occasional outcrops of black slate are met with succeeding the dark shales of the valley. In the Drug (Truagh) Brook, bluish-grey Devonian slates, rusty-weathering, graphitic and twisted, are well exposed and contain, at the old dam, veins of limonite. In Cross Brook, succeeding the softer rocks near the road, are blackish slates and light grey flinty quartzites, alternations of which are seen to the head of the brook. In the Big Brook these rocks begin immediately below Thomas McDonald's mill, and can be traced along the road from this mill towards Glengarry.

Cullen's iron mine.

Above the railway bridge in Middle River are interstratified bluish-grey regularly bedded flags and slates. Below the fork of the two branches are greenish and grey, fine, ripple-marked, evenly bedded shales and sandstones, breaking into large rectangular blocks which may belong to this horizon, but are succeeded down stream by indian-red, soft, crumbly shales, containing patches of pea-green shale apparently of the upper group. On the roads from Glengarry and Lansdowne towards Stewiacke, black shales are interstratified with white-weathering quartzites as far as John Robert McKay's.

Middle River of Pictou

Lansdowne and Glengarry to Stewiacke.

The first rocks seen in the branch of Middle River which crosses the railway at the big embankment immediately west of Lansdowne are greatly altered slates, interstratified with more quartzose rocks, full of quartz veins. The exposure, however, is small and the other rocks of the neighbourhood look like those of Riversdale and less altered than those of the railway, while in texture and composition they are identical. The grey slates in the fields near the head of this branch of the river hold plants, and their resemblance to those of the railway is remarkable. The Rocky Brook at the head of Stewiacke River, which crosses the road about two miles from the station, falls over cliffs of considerable beauty, composed of more or less sandy slates, dark grey, micaceous, and like certain rocks of Landsburg's. On the whole dark slates predominate, as at Sunnybrae, Drug Brook and Mount Misery. Near the shore of Dryden Lake, however, a quantity of reddish slate debris perhaps indicates an outlier or extension of the upper series to this point. From the fork at the county line at McKay's, dark rocks extend nearly to the head of the settlement of Eastville.

On the old road which runs southward from Gordon Summit, flaggy sandstones, slaty, veined with quartz and interstratified with dark bluish micaceous slates, marked with carbonized plants, extend far towards Stewiacke.

West River,
Pictou.

Above the railway, in the first little brook east of Baillie's Brook at West River station, are dark slates which are again exposed in the next brook near the shanty at the railway. On the road south from the station are blocks of greenish, flinty sandstone; above the bridge on the brook is a quartzite that cannot be distinguished from that of the Stewiacke road, and further out are black slates. In Baillie's Brook, above the railway, grey, fine, soft sandstone and coarse grit, easily split in the bedding, flaggy or thick bedded, perhaps represent the rocks which include the coal. It is possibly Carboniferous, but more probably a portion of the Devonian.

West of West River, the boundary between the red and grey rocks seems to cross the railway about Campbell's Siding and has been already described.* By Dr. Honeyman these rocks seem to be regarded as Clinton.† The grey flags of the barrens north of the railway are associated with quartz-veined quartzites. In the little brook south of the railway at Landsburg's are light grey flinty flags also veined with quartz, and on the blueberry barrens in the neighbourhood of Williamson's Meadow Brook, among low conical hills interspersed with large hay marshes and wet barrens covered with a scanty growth of bushes and a few poplars and spruces, the rocks are apparently also those of the railway.

Riversdale.

Search for
gold.

In the brook, one mile east of Riversdale, the dark slates, grey, micaceous, somewhat soft sandstones and light greenish-grey and grey, compact, flinty sandstone are veined with quartz containing specks of pyrite, which has, no doubt, led to the search made here for gold. East of this brook another, crossing this railway, shows up stream cliffs of light grey, rust-spotted, rusty-weathering, flinty quartzite. In the large brook opposite, which enters Black River from the north-west, grey and reddish, fine, flaggy sandstone and crumbly argillite, marked with fossil plants, either represent the rocks of Campbell's Siding or are possibly higher. The head of this brook comes near the Riversdale road, and near it another rises which crosses this road but shows no rocks.

Fossils.

The flags and slates of the railway immediately east of Riversdale contain *Stigmaria* and the fossil plants collected by Messrs. Weston and Robert.‡ They do not in any respect resemble the

* An. Rept. Geol. Surv., vol. II., 1886, Part P, p. 64; Trans. N.S. Inst. Sc., vol. II., part III., p. 169.

† Op. cit., vol. II., part I., p. 118; vol. III., p. 39.

‡ An. Rept. Geol. Surv., vol. II., 1886, Part P, p. 64.

Carboniferous, but rather, as already stated, the quartzite series of Guysboro'. Even the black shales are slaty and resemble the Pré-Carboniferous rocks of other localities. In Salmon River, above the confluence of Black River, dark shales are apparently overlaid by massive, grey, flinty quartzite or sandstone, and by broken flags.

Although most of the rocks of Calvary Brook belong to the upper and intermediate groups, some of them are dark slates, alternating with whitish, flinty, Guysboro' quartzites indistinguishable from those of the railway cuttings. The dip being very changeable, the separation of the two groups requires the closest examination. The black slates contain nodules of ironstone and are veined with quartz and calcspar. The coarse grits include patches of conglomerate. A short distance above the railway bridge, limestone has been dug.

Calvary
Brook.

In Baillie's clearing, south of West River Station, and in other clearings nearer the station, dark slate is found, although blocks of grit occur near the brook. Further south, in Anderson's old clearing, are bluish-grey slate and white weathering, quartz-veined quartzite. In Calvary Brook, near the track from a hay meadow to this clearing, are outcrops of greenish-grey, rusty-weathering, fine, flinty sandstone or quartzite, interrupted down stream by a concealed interval, at the end of which are whitish-grey flinty sandstones or quartzites, with druses of quartz, sometimes in flags which break into brick-shaped pieces, interstratified with coherent, splintery argillite, breaking into knife-shaped splinters, sometimes 18 inches long. Alternations of flags and shales extend some distance down stream and are overlaid by a thick band of rusty-weathering, whitish, pyritous, Guysboro' quartzite, succeeded near the driving-dam by the red and green rocks.

Above the track in Calvary Brook outcrops are not numerous. They consist of grey, rusty-weathering, flinty shales and flags like those of the railway; of blackish graphitic shales and flags, showing markings of *Cordaites* and other fossil plants; and of whitish-grey sandstone with bright indian-red patches like that of Sutherland Brook on the East River of St. Mary's. Blocks of grey, flinty Devonian sandstone occur on the wood-roads running to West River and in the barrens and rocky woodland between these and the head of Stewiacke River, in all the headwaters of which light grey, slaty sandstone and shale, dark, blackish-grey, massive quartzite or flinty sandstone, micaceous, sometimes netted with veins of crystalline quartz, light and dark grey argillites, in part papery and graphitic and like the Devonian rocks of Sunnybrae, are equally abundant. There is, however, little variety. The more flinty rocks

Fossil plants.

form barrens covered with pieces of stone broken like road metal. In the branch of Calvary Brook from the south, above the driving-dam, flaggy, rippled sandstone or quartzite is overlaid by grey, soft shales, while higher up are cliffs of whitish, brown-spotted quartzite like that of the barrens of Grand River and Guysboro'.

South of the track to Island Lake, the Pembroke road shows grey and reddish, flinty, glistening, red-spotted quartzite, associated with grey argillite or slate like that of the Big Brook of Stewiacke; flaggy sandstone, rubbly, flinty and micaceous, holding plants, and like that north of Riversdale.

Salmon River. Black River below Riversdale exposes rocks which are again seen far up Salmon River. The first of these are greenish-grey argillite, somewhat crumbly shales and sandstone with ironstone, alternating with very flinty flags. Down stream are grey, rusty-weathering, flinty sandstones and a great thickness of black, polished, twisted slates, with a few hard, siliceous bands and intercalated lenticular layers of limestone, one of them eighteen inches thick. Greenish and dark grey, rusty-weathering argillite and sandstone, coarse and very flinty, breaking into irregular bricks, are next succeeded by black shale or slate, with flinty, flaggy bands and irregular layers of rusty limestone, overlaid, near the confluence of Salmon River, by red argillites of the higher series, with lighter reddish and whitish quartzite in great cliffs. Similar alternations occupy Salmon River for some distance above the fork, dipping down stream.

Stewiacke
River.

These rocks are well exposed in many of the brooks flowing into Stewiacke River, but in most of them do not seem to require special mention, the outcrops being indicated on the map. In the Black Brook, from the crossing of the old Stewiacke road, they comprise dark bluish-grey flags and flinty slates, twisted and blotched with lenticular veins of quartz. The dip is always high, often vertical. In the upper part of the brook the slates predominate, while lower down there is a larger proportion of the coarse whitish quartzite of Guysboro'. Similar rocks are exposed to the head of the settlement near Eastville. In the river, about a mile above the first settler, a micaceous, quartz-veined, coarse sandstone or quartzite seen in high cliffs, probably represents the rocks of the Guysboro' barrens and of Speid Lake, is on the horizon of those of Rocky Mountain, and also perhaps of those of Salmon River near the fork of Black River. It shows large hematite-red blotches; certain beds are shaly or flaggy, but it is for the most part thick-bedded; it is full of broken carbonized plants and of impressions of *Cordaites*. Among the finer beds is a band of quartz-veined conglomerate with pebbles three inches in length. A short distance below the bridge a thin band of

Fossil plants.

dark bluish-grey shale is full of stipes and broken leaves of ferns and of *Psilophyton*. Down stream they are succeeded by the upper series.

In the cliffs and fine reefs of Salmon River below the red bridge Salmon River. on the road west of Riversdale, the rocks belong largely to this group, consisting of alternations of dark shales and flags like those of Riversdale. Higher up are blackish splintery shales and thick-bedded sandstones, with dirty greenish-grey argillite, including a band, at least 15 inches thick, of black, coaly, *Cordaites* shale, which Coal. perhaps represents the coal seam of Kemptown. Light grey, fine, flinty, micaceous sandstone, with small quartz veins, in one of which a speck of copper pyrites was found, dirty greenish-grey, rusty- Copper ore. weathering sandstone and shale, light grey, fine, flinty sandstone and dark bluish-grey shale are then found to the saw-mill, above which are dirty greenish-grey argillites and light grey sandstone full of carbonized plants. At the Telegraph road the rocks include red bands. Up stream they are not so well exposed, but grey, flinty, fine sandstones extend to Jacob Fenton's, resembling those of the south branch of North River. Dark bluish-grey shale and flinty sandstone occupy the road from Kemptown to the red bridge, the road from this bridge to Riversdale and all the other roads in the vicinity.

McKenzie Brook, which flows into Salmon River above Valley, McKenzie Brook. exposes, not far above Philip Archibald's house, greenish-grey shales, grey, somewhat flinty, quartzose sandstone, and sandy flags covered with markings of *Calamites*. North of these lie grey, rusty-weathering, coherent slates and papery shales, with alternations of grey fine sandstone, probably of the Riversdale series, with a very high northerly dip. Blocks of grey sandstone are found as far as Abner McNutt's house and also on the road through to the Telegraph road, about a mile to the south-westward. In the west branch, from this road down stream to the fork of a branch from the left, are outcrops of greenish-grey and grey, flinty, jointed sandstone and dark bluish-grey shale; while above the fork in the left branch, and also down stream, are the red rocks of Union.

In Mingo's intervale on the south branch of North River the first North River of Onslow. rocks seen are dirty greenish-grey crumbly argillite, with bands of grey sandstone very quartzose and more or less flinty, full of rusty spots and resembling the Devonian rocks of Loch Lomond. Below Mingo's house the dip becomes nearly vertical and sandy flags are succeeded by a great breadth of black shales, succeeded again down stream by grey and greenish-grey, nearly compact, jointed, flinty sandstone, in thick and in flaggy beds. These extend to an old mill-

Coal. dam, near which traces of coal have been discovered; and frequent outcrops of the flinty sandstone extend down to a bridge on the river, where they comprise flinty, jointed, flaggy sandstone with bands of dirty greenish-grey argillite. Thus far the river seems to show a descending section from the red and green rocks, altered by contact with the syenite, to the massive flinty sandstone of Mingo's, which may be that of the west branch of West River. The sandstone follows thence for a great distance nearly on the strike, the dip being very steep and perhaps indicating a fault complicating the anticlinal. Overlying the sandy flags, below a large brook from the right, appear again greenish and grey and blackish argillites, very ferruginous, including a few flinty bands and followed by massive somewhat argillaceous sandstone. Then, at the head of a piece of good interval, rise cliffs of reddish and greenish shale and sandstone or quartzite of the upper series, striking vertically 211° ; but 200 paces to northward the dip is $3^{\circ} < 80^{\circ}$. The river then turns to the south-westward, showing dark shales and rusty flags, which, 50 yards lower, dip $76^{\circ} < 65^{\circ}$, indicating how much these strata are faulted or broken. Grey crumbly shales and red and grey sandstones and shales, lower down, dip $38^{\circ} < 40^{\circ}$; then alternations of dark grey shales with harder bands, blackish shales with ferruginous plates and nodules, like the black shales of West River, extend to the Jollytown road. On this road to the left, these rocks probably extend to the top of the hill at the road to the left, beyond which the soil is Carboniferous. Most of the rocks of the river from Mingo's to the fork thus seem to be of the lower series.

Iron ore.

Contact with Carboniferous

On the Mingo road, grey flinty rocks continue to the Telegraph road, along which towards Salmon River are large outcrops of massive grey sandstone with a steep dip.

In the brook which crosses the Tatamagouche road about two miles north of the iron bridge at North River, greatly contorted grey and greenish-grey broken shales, containing *Naiadites*, probably the same as that of Riversdale, are succeeded higher up by grey flaggy sandstone, rusty-weathering argillite, and greenish, soft, smooth shales, showing indistinct markings of *Stigmaria*. Some of the grey shales have a purplish tinge. More flinty sandstones are seen higher up the brook, and similar rocks, with layers of ironstone and limestone, extend down the adjacent branch of McCurdy's Brook to the road at the contact of the Triassic. In the west branch of this brook—Turner Whidden's Brook—immediately underlying the Triassic, are, however, purple and greenish, mottled, somewhat sandy shales of the upper series, containing minute fragments of plants, interstratified with compact, thick-bedded sandstones, under-

Fossil shells and plants.

Ironstone and limestone.

laid by light grey and cream-coloured, rusty-weathering, more argillaceous rocks, with the structure of underclay, holding rootlets and plants. In the joints is a film of blackish, shiny limonite; and in one layer of flinty sandstone a *vugg*, one inch in diameter, contains a mixture of red and brown hematite with the characteristic papillæ of the latter; but the rocks are much less altered than most of the iron ore belt. A half inch parting of blackish shale at the top might pass for coal. Up stream are banks of greenish-grey, crumbly, rusty-weathering argillite and flinty sandstone; and above the house, dirty-greenish and grey argillite, reddish, crumbly argillite, containing spherical concretions, and many blocks of light grey somewhat coarse sandstone, resembling Carboniferous rocks. Similar grey sandstones and shales occupy Baird's and Beaver Brooks.

Iron ore and coal.

North of Penny's Mountain the brooks show rocks belonging to both the subdivisions of the Devonian, indian-red soapy shales, dark bluish-grey, contorted, soft shales and rubbly, micaceous, flaggy sandstone producing a barren, rocky country like that north of Riversdale. The shales, as usual, contain rusty-weathering nodules and are sometimes ripple-marked. The contacts of these rocks with the Triassic and the Carboniferous limestone can best be studied from the map.

Penny's Mountain.

Contact with Carboniferous and Triassic.

In the river above the village of North River, greenish and grey, jointed sandstone is succeeded by a great thickness of black shale. Below the confluence of the south branch greenish-grey shales and sandstones with rusty-weathering nodular bands, marked with plants and containing thin layers of ironstone, alternate with dark shales to the confluence of the west branch, below which greatly contorted red rocks are occasionally seen, although the dark shales predominate to the Triassic. Similar rocks are found higher up the river, and below the bridge on the post road, dark shales containing rusty, hard bands of grey flinty sandstone which breaks into small pieces, are full of nodules and thin layers of limestone and ironstone and of shells like *Naiadites*. The dark contorted shales predominate and extend in great cliffs for some distance.

Black shales.

Fossil shells.

The sandstones associated with the coal are strikingly like those associated with the coal of West River and Kempton, seem to be beneath the dark shales further down the river and to be inseparable from them. The limestone of the neighbourhood occupies the same position, apparently, with relation to the other rocks as that of Riversdale and Chiganois.

Coal and limestone.

Nuttby and
New Annan.

On the road from Nuttby, past Tom McNutt's to Waugh River, rocks of this group are found. Near the fork of the road to New Annan the brook shows red argillite, with veins of ferruginous calc-spar and calcareous concretionary masses. Further out are blocks of the grey quartzite of Riversdale. Then, at an old steam mill, grey fine grit is succeeded by coarse syenite and reddish, flinty porphyry, which occupy a considerable breadth and are then followed by a grey and blackish trap of Waugh River and Ferguson Brook.

Igneous rocks.

Middle
Branch of
North River.

Falling Brook is mostly occupied by red syenite and falls into the middle branch of North River over a cliff of that rock 40 or 50 feet high. In the river, sixty yards above the confluence, blackish or dark grey Devonian slates are closely pasted to the syenite, which is mixed with a bottle-green diorite, sometimes the syenite, sometimes the diorite predominating. About eight yards down stream black slate is seen among syenite and diorite which then occupy the river for more than half a mile to a little brook from the west. Here another direct contact is seen. At sixty-five yards above the little brook are the first outcrops of syenite and diorite, some of the latter being coarse breccia or conglomerate, perhaps mixed with sedimentary rock. Sixty-five yards below the little brook is a cliff of massive, grey, rusty-weathering conglomerate and grit, composed of syenite and felsitic debris, with a few layers of grey and dark shale full of minute plants. Dark grey and greenish-grey crumbly shale, with bands of grey sandstone, occur lower down, with others like those of the Coalmine Brook, certain flags being full of rootlets and of broken plants. The rocks are as rubbly as those of Riversdale and are cut by veins of white and dark calcite with siliceous matter like those of Tom McNutt's. Then follow alternations of flinty sandstone or quartzite and dark graphitic shale. There is here, perhaps, an intermixture of slaty rock and soft Carboniferous sandstone folded in among the faults, one band of conglomerate containing pebbles of blackish argillite. Near the head of the intervalle, at the settlement, the dark grey and greenish, compact, flinty rocks contain specular iron which has been worked to a small extent. These rocks are unconformably overlaid by Carboniferous conglomerate.

Contact of
Carboniferous.

Up the west branch of North River from the fork, dark grey or blackish, rusty-weathering shales, with light grey sandstones and a few coherent bands of ironstone or limestone, are interstratified with red beds, with a very high, often vertical, dip, and greatly contorted, and extend nearly to the bridge at the church on the Tatamagouche road. Near this bridge are cliffs of light grey, flinty, rubbly sandstone.

Following the Devonian rocks to the Chiganois River*, they are exposed below the sandstones and conglomerates of the Staples Brook and Delaney settlements. From the Higgins road down Old Sam's Brook to the river, reddish and brownish sandstones and marls, with layers of grey sandstone, are similar to those which overlie the conglomerate in Great Village and Folly Rivers. These extend down the river from the mouth of this brook to the cliff beyond an old barn on the left bank. At the next cliff, however, are rocks from which they appear to be separated by a fault. Those first seen consist of a dirty, greenish-grey, crumbly shale or argillite, like that of Landsburg's; then four feet coherent, greenish-grey sandstone; then greenish-grey more shaly rock; then a faulted band of four feet coherent, greenish-grey sandstone; above which lie twelve feet of dark grey and blackish shales, holding *Cordaite*s, and other fossils; then four feet and under of dark grey, compact limestone, the upper surface of which is covered with plants—*Naiadites*, *Coprolites* and other fossils; then about three feet blackish calcareous shales; then only indistinct outcrops of reddish crumbly sandstone. The limestone is like that cut by igneous rocks in North River, and among the dark shales are other thin bands of limestone. The next reefs consist of red and grey sandstone and crumbly shales which seem to overlie the grey rocks. They include at the base a band of greenish and grey, coherent sandstone, weathering rusty and marked with plants. Reddish, flaggy, jointed sandstone and shale occur again immediately below a large branch into the river from the left; and further down are long reefs of rubbly, reddish-grey sandstone and shale, followed by coherent flags showing green and grey spots marked with carbonized plants. The grey, coherent, fine flags beyond are overturned. A short distance below, at a reef and pool at a sharp bend, is a rock even more flinty than the above, underlaid by dark grey and greenish-grey shales, succeeded below by red and greenish, rubbly argillite, full of rusty nodules, and these by a great cliff of greenish flags full of *Lepidodendron* and other plants. These shales and flags are finely rippled on a great sloping cliff face. The upper part of the flinty band is an underclay. Blackish and dark grey, fine shales overlie it for a thickness of fifteen to twenty feet and are full of plants and *Cythere*. Down stream, and apparently overlying the last, come reddish, coherent shales and argillites, in no way resembling the Carboniferous, and in all probability representing the red rocks of Union. Beneath them are grey and greenish, coherent rocks; then a concealed interval, beyond which the flinty band above described forms a long

Devonian and
Carboniferous
rocks of
Ishgonish.

Fossils in
limestone.

Fossil plants
and shells.

* An. Rept. Geol. Surv., vol. I., 1885, Part E, p. 46.

Cone-in-cone
limestone.

Coal and iron
ore.

wall on the left, passes the river on a reef and rises on the right bank. Down stream and underlying is a great thickness of blackish, greenish and bluish-grey argillite. With these at a dam are many layers of flinty, greenish-grey sandstone. Below the dam the cliffs show blackish, papery, rusty-weathering *Naiadites* shale, with nodules and layers of limestone, one of which, two inches thick, has cone-in-cone structure. Then come cliffs of dirty red, rubbly, flinty sandstone and argillite, with a northerly high dip, underlaid by a strong band of reddish-grey sandstone, with *Calamites* and other carbonized plants; then reddish, flinty flags to the end of the cliffs. Beyond are reefs, chiefly of grey, coherent sandstone; then a long stretch of reefs of red rocks dipping nearly vertically and rising into a cliff on the left near the head of the clearings. To confound these flinty, fine, rubbly rocks with the coarse, flaggy, soft, evenly-bedded strata of the neighbourhood of Old Sam's Brook would be impossible. But that the lower series is equivalent to that classed as Lower Carboniferous at Hastings on the Strait of Canso is almost equally certain. The undulations of these rocks may be seen on the map. After an interruption of Triassic rock of about a quarter of a mile, similar rocks again appear in the river and exhibit a thickness of about 800 feet about a mile and a half above the railway bridge. They consist of dark grey, greenish and reddish, rubbly argillites, with spots of hematite, including a black, bituminous layer, one or two inches thick, containing traces of good coal, overlying a *Stigmaria* underclay, and associated with light grey, fine, flinty, jointed sandstone, with small veins and films of hematite, and bluish-grey, crumbly shales, with layers of light grey shale and dirty greenish-grey sandstone, with another layer of three inches of black shale largely composed of *Naiadites* and *Cythere*, with flinty, rubbly sandstone veined with hematite. There is a red band among the greenish and grey shales, and in one place five black bands in a width of ten feet, the more carbonaceous shales being crushed, polished and shiny.

Contact with
igneous rocks
in Chiganois
River.

Above Higgins' mill, near the igneous rocks which form the celebrated fall of this river, is a compact grit or quartzite, a light grey, fine, flinty sandstone and a reddish, crumbly, fine sandstone with rubbly, flinty rocks, having an obscure dip, in contact with dark reddish, somewhat compact trap, succeeded by coarse syenite. In Higgins' Brook only two small outcrops of sedimentary rock are found among the felsites.

The syenite and associated diorites extend to a point more than a mile below Patterson's old mill. We have then a breadth of a mile of slates. Those nearest the syenite on the south side of the belt

are greenish and bluish-grey, having sometimes a fine tinge of red, papery, flinty and associated with greenish, flinty, felspathic sandstone like one of the gold-bearing series, full of reticulations of quartz and interbedded with whitish, massive, quartz-veined quartzite, so compact that the veins can be distinguished only by a slight difference of colour. Higher up are red, purple and green slates, with layers of crystalline limestone. White, rubbly, banded quartzites are the last of these rocks seen in contact with a pale flesh-coloured porphyritic or obscurely granular quartz-felsite or syenite at Patterson's mill and on the road from this mill eastward to the main road.

Crystalline limestone.

Dr. Ells has described as Devonian* a belt of rocks 434 yards wide immediately beneath the Triassic in Debert River and unconformably overlaid up stream by the Lower Carboniferous. The Triassic rocks near the contact seem to be nearly horizontal, although down stream, near a spring on the right bank, nearly vertical. They are often more coherent than usual and have been used for building. On the left bank of the river, 110 paces above the last of the Triassic, are indefinite exposures of grey and reddish calcareous rock of somewhat coarse texture. On the right bank, 173 paces from the contact, are light grey, rubbly, coherent and heavy quartzose sandstones. On the left bank, about 200 paces from the contact, are similar flinty sandstones with dark bluish-grey shales, resembling rocks of Riversdale, well exposed for thirty-two paces. Then for 175 paces are occasional outcrops of grey and red rocks, nearly vertical, followed by a cliff of dark bluish-grey argillite, full of markings of stems of plants, rusty in the joints; rising, at nineteen paces, into a cliff ten feet high and, at 197 paces to a cliff twenty feet high, which shows layers of nodular ironstone and underclay. How these come against the red rocks seen at 212 paces is not very clear. They dip near the junction $143^{\circ} < 50^{\circ}$, while the red rocks dip $354^{\circ} < 50^{\circ}$ and are slickensided. They may perhaps be cut off by an east and west fault which has also displaced them a little among their own beds. The red rocks resemble Carboniferous in colour and texture, comprising indian-red, fine sandstone and marl, with layers or patches of conglomerate in which the pebbles are sometimes larger than a hen's egg. A few paces up stream, a greenish-grey soft layer is full of carbonized plants; and higher up are reddish-grey, somewhat coherent sandstone and shale. The fault is about 100 paces below the mouth of Totten's or Graham's Brook. The coherent red strata extend up the river to a point less than three-quarters of a

Debert River
Devonian
described by
Dr. Ells.

Fault at contact with Carboniferous.

Coal of Cottenham settlement.

* An. Rept. Geol. Surv., vol. I., 1885, Part E, p. 43.

Fossil foot-
prints.

Igneous rocks.

mile above the bridge at the Cottam settlement and include the coal seams. Above Totten's Brook they include patches of concretionary grit and certain flaggy layers have been quarried. One of the slabs showed, in addition to fucoids, tracks of *Sauropus*. The lower rocks resemble those of Turner Whidden's and the vicinity. When they again appear above Cottam settlement* blackish graphitic slates are in contact with greenish and grey, soft, slaty, volcanic breccia and massive felsite, containing films of red hematite in the joints, succeeded by greenish and grey flinty, porcellanous flags with ironstone bands, followed by gneissic rock and by light grey, granular, fine and coarse diorite or diabase.

In the Millbrook that comes into the river from the eastward at Cottam settlement, dark bluish-grey, light grey and greenish-grey, flinty, quartz-veined sandstone or quartzite, rusty-weathering, whitish, compact quartzite and argillites are associated with dioritic and grey syenitic rocks.

Carboniferous
and Devonian
rocks of Tot-
ten's Brook.

The rocks of Totten's Brook, from the confluence with the river to a short distance above the road through the back settlements, are, like those of the river, Carboniferous. At their contact with the iron ore rocks they are brecciated as if at a fault. These latter consist of light grey sandstone, with rusty-weathering patches and greatly veined with quartz; of black, slaty, rubbly, graphitic argillite, with small veins and lenticular patches of ankerite. Then follow outcrops of igneous rock, above which are the sedimentary rocks holding the iron mine of the Peter Totten meadow†. These extend nearly to the head of the brook and consist of grey, rusty-weathering, rubbly, flinty sandstone, massive or flaggy, with layers of reddish, bluish-grey and greenish, flinty argillite, presenting numerous graphitized markings of minute plants. In the east branch, north-east of the iron mine, greenish and grey, massive and flaggy, rubbly, fine sandstone or quartzite, with minute plates and veins of ankerite and of spathic iron, films of limonite and hematite, like that of Grand Lake and Guysboro', is exposed in fine cliffs. In one place among the sandstones is a spot as if a tree had grown there; no rootlets, however, could be definitely made out, although in certain dark rocks surrounding it fragments of carbonized plants, apparently *Cordaïtes*, abound; and even in the flinty, micaceous flags, where they are not too much felted together or veined, minute plants are observed. Above the quartzite come dark slates and pyritous argillite veined with calcespar, followed up stream by syenite and diorite.

Iron mine.

Plants.

Erect tree.

Syenite and
diorite.

* An. Rept. Geol. Surv., vol. I., 1885, Part E, p. 45.

† Geol. Surv. Progress Rept., 1872-73, p. 22.

The rocks of Pine Brook, from the Triassic up to and for half a mile above the Base-line road, are described by Dr. Ellis as Lower Carboniferous*. Succeeding them are blackish and dark grey, curly, papery, silky, graphitic slates with nodular or lenticular masses of siliceous and calcareous rock. They closely resemble the slates of North River, but are much more altered. Above a mass of volcanic rock a short distance up stream are light grey and cream-coloured siliceous and argillaceous, massive and compact rocks, intersected in all directions by veins of ankerite sometimes two feet thick, on the surface of and in cracks of which specular iron is found in masses six inches thick and downward. Specular ore is also found in separate veins and films in rock precisely like that of Cook's Brook, of which the less metamorphic portions have a strong resemblance to underclay. Higher up are larger veins of ankerite and specular iron; and pieces of limestone like that of Tom McNutt's are found in the slates. Though grey and greenish and cream-coloured rock are associated with purple and greenish porcellanites, certain sandy micaceous flags and argillites show markings of *Cordaites* and other plants which are somewhat obscure; but in the bed of a little brook from the west is an underclay full of rootlets and of impressions of *Calamites* which leave no doubt of the age of these Devonian metamorphic rocks.

Pine Brook.
Specular iron ore near contact with dykes.

Underclay full of rootlets.

Higher up, at the contact of red and green slates with greenish breccia, is an opening on a band two feet thick impregnated with specular iron, the ore having, in one place, a thickness of seven inches, but being lenticular. Above these volcanic rocks, which are of some breadth, sedimentary rocks again appear.

Iron mine.

In Weatherbe, Gory, Slack and other brooks of East Folly Mountain similar rocks yield the iron ores of the East Mines, but they require no special mention. Folly River† next exposes fine alternations of Devonian in contact with igneous rocks. A deep railway cutting at the snowshed immediately south of the siding at the foot of Folly Lake shows whitish and dark fine flags and striped quartzites, with a layer of conglomerate, very greatly altered and resembling the metamorphic rocks of James River and the Atlantic coast. Intermixed with the massive igneous rocks is a chloritic slate or schist. Soon, however, diorites occupy most of the cuttings, and only small patches of sedimentary strata are met with. In Folly River, before the railway leaves it, not far above the east branch, they are again, however, seen full of layers and reticulations of

Londonderry East Mines.

Folly River.

* An. Rept. Geol. Surv., vol. I., 1885, Part E, page 45.

† An. Rept. Geol. Surv., vol. I., 1885, Part E, pp. 47-53 and 56.

quartz. Below the diorite at the fork of the east branch, the rocks are massive, light greenish-grey, quartz-veined sandstones, containing veins of rusty-weathering spathic iron, overlaid by flinty quartzite. Lower down, the river is wide and shows light-coloured quartzose rocks, veined with quartz and ankerite, some of the quartz veins holding also traces of specular iron. Down stream occur grey slates, like the Devonian rock which carries the specular iron in Guysboro' and Antigonish counties, overlaid by black graphitic slates, with threads or plates and masses of ferruginous calcespar, interstratified with red and green, mottled, soft, soapy argillite. Succeeding these slates almost immediately on the left bank is a cliff of reddish coarse conglomerate, with pebbles of the flaggy, flinty quartzites and of light-coloured diorite and syenite, belonging to the Carboniferous. By a fault on unconformity the slates are sent to the right, up a small brook from the river, while immediately north-east of them is a slickensided felsitic rock.

Contact with
Carboniferous

Railway be-
tween Folly
Lake and
Londonderry.

Dykes.

Obscure
plants.

Following the railway, banded, altered argillites succeed a greenish fine diorite, and about 115 yards south of the school near the foot of Folly Lake, are associated with light grey, flaggy quartzite. Mixtures of slate and diorite then extend for some distance, certain whitish quartzose flags including quartz veins supposed to contain gold. In one of the cuttings light-coloured strata are interstratified with blackish, coarse hornblende rock or fine diorite, which follows in the bedding for some distance. The quartzites end at a dyke of red compact quartz-felsite or syenite, five feet wide, which runs up eight feet vertically to meet this diorite. Blackish diorite then comes below the syenite; one of the lenticular veins in it is ten feet wide. The whole section from the siding to the contact with the Carboniferous is about three miles long. For thirty-five chains from the school, sedimentary rocks predominate; then for more than three-quarters of a mile none but igneous rock; then nearly a mile with occasional bands of sedimentary rock among diorites; then twenty-nine chains of sedimentary rock to the 82nd mile-post, where the Lower Carboniferous begins. The sedimentary rocks among the diorite are greenish-grey, rusty-weathering, but with some bands of red argillites, quartzites and flags; greenish-grey and dark grey argillite; fine grits with ankerite in the joints. Certain rusty, shaly layers show abundant traces of graphitic or anthracitic matter; one bed shows obscure rootlets, graphitized marks of plants and stains of copper. Near the 82nd mile-post the rocks are very ferruginous, light grey, cream-coloured, quartzose and soft. The last seen in the little brook at the con-

tact are blackish, soft, crumbly, graphitic slates with light-coloured calcareous and ferruginous nodules and lenticular beds of light grey compact sandstone or quartzite, unconformably overlaid by conglomerate holding pebbles of all these rocks.

Contact of
Carboniferous

McElman Brook empties into Folly River from the west immediately above the high bridge on the railway, displaying, at and for three-quarters of a mile above the river, Triassic coarse sandstone and conglomerate. Up the east branch (Urquhart Brook) for about half a mile are somewhat flinty, red and rusty-grey sandstones and shales, full of fossil plants, rubbly and slickensided, veined by calcite and with films of limonite, of doubtful age, but perhaps Carboniferous, succeeded up stream by coarse beds, undoubtedly Carboniferous. Not far above the railway these give place to dark and light greenish-grey, flinty, brecciated, greatly altered rocks, with nodules and veins of bluish-grey, rusty-weathering calcite, precisely like the Devonian slates on the left bank of the East River at Sunnybrae. They are graphitic and twisted, and are succeeded by light greenish or cream-coloured, rusty, fine rocks and by flinty sandstones and argillite, cut by many rusty veins. Next comes massive quartzite, with dark, plant-bearing flags and occasional purple beds, broken by igneous rocks, above which greatly altered quartzose flags and argillites, apparently underclays with intercalated layers of blackish shale, show markings of plants. Whitish, compact, slaty quartzite, greenish micaceous rock, light grey, flinty and dark grey porcellaneous argillite extend to the head of the brook, but are interrupted in many places by diorite.

McElman
Brook.

Trias and Car-
boniferous.

Devonian.

Fossil plants.

Diorite dykes.

The Triassic rocks of the west branch of McElman Brook (Phillips Brook) come vertically against reddish and greenish-grey strata, probably Carboniferous, holding streaks of coal derived from trunks of trees. They are, however, immediately succeeded by more flinty rocks, which may be lower, but are again succeeded by Carboniferous, at the base of which is a conglomerate, in contact, above the railway, with greenish and bluish-grey Devonian slates, including a lenticular mass of grey, flinty quartzite, interstratified with rusty-weathering quartzite, very like underclay, holding obscure, carbonized plants. Up stream, greenish, soft, papery slates, mottled, purple and greenish or cream-coloured slates, with stains of specular iron, light and dark grey slates veined with ankerite, and flinty, fine sandstone, with a large proportion of red—not unlike the rocks of the other branch, but without igneous intrusions—extend to the head of the brook. Great masses of spathic iron ore have been taken from an opening in this brook.

Fault at con-
tact of Trias
and Carboni-
ferous.

Iron mine.

Saltspring
Brook.

Sedimentary
and igneous
rocks.

Great Village
River.

Above the Base-line road on Saltspring Brook, Carboniferous conglomerate is again seen in contact with grey, flinty sandstone or quartzite, dark shale or slate, with a large proportion of bright red argillite with grey and black blotches, at a little brook from the eastward. Higher up the main branch are good exposures of dark grey and greenish, contorted, flinty and soapy shale and quartzite, with patches of red and purple argillite, of greenish and cream-coloured argillite and of grey, thick-bedded, compact sandstone or quartzite, rusty-weathering and sometimes veined. These extend to a fall, 30 feet high, over greenish, soft and hard chloritic trap or diorite, containing films of red hematite and succeeded by grey or blackish, crystalline diorite, intermixed again with rusty slates and quartzite at the head of the brook. In the pasture lands to the northward are dark, dioritic rocks, associated here and there with patches of sedimentary strata. From these clearings, down the brook which runs westward to Great Village River, nearly all the exposures are of massive, dark, crystalline diorite, red quartz-felsite or syenite, more or less compact, with only one or two patches of obscurely-bedded, flinty rock, which may be sedimentary. The diorite is interrupted by dykes or masses of reddish, compact syenite or quartz-felsite, with blotches or little lenticular veins of quartz.

F. 3.—Upper Devonian.

Distribution.

The upper beds of this formation are most widely distributed in a tract which lies north of Stewiacke River and south of the railway between Riversdale and Truro stations, and in the country south of Cobequid Bay.

Iron ore belt.

A narrow belt of rocks of a lower horizon, including green and rusty ferriferous slates, extends from Sunnybrae to join the large area along the Middle River of Pictou. These will be first described.

Bridgeville.

In Archibald Brook, unconformably underlying the Carboniferous rocks near Bridgeville, are greenish slates cut by soft trap, followed up stream by dark grey twisted slates, veined with calcespar and interstratified with yellowish-grey brecciated quartzite, full of blotches of ankerite. Certain red flinty quartzites and argillites of the neighbourhood are, perhaps, equivalent to those of Union. Running in the bedding of reddish and greenish-grey, flinty, micaceous sandstone or quartzite, twisted slates, greenish and cream-coloured, porcellaneous, flinty, ferruginous rocks higher up the brook, are lenticular veins of ankerite sometimes ten inches thick. Greenish and grey, very flinty, rocks just below the road at Archibald's mill resemble those of

Iron ore.

Roman Valley, while immediately above the mill is a bank of black graphitic slate worked for coal; and up stream the bluish-grey slates of the Mira Falls, like which they are supposed to be fit for roofing*.

Slates prospected for coal.

Roofing slate.

Similar rocks occur in the lower part of John McDonald's (Ogg) Brook, the bluish-grey soft shales of the post-road being succeeded up stream by reddish and greenish calcareous slates, and, 210 yards above the bridge, by dark slates, containing thread-like markings of plants, cut by dykes of trap and diorite and by rusty bands of ankerite, with grey quartzite and other rocks of the lower group, veined with quartz and calcite. The openings in iron ore on the east side of the brook are in grey, rusty-weathering, flinty, quartzose rock. In the brook south of the openings dark slates are well exposed and contain an immense quantity of ankerite in irregular veins, sometimes of great thickness. The rock containing the specular iron ore at John McDonald's (weaver)† is very like the flinty and soft rocks of Londonderry. In the brook above mentioned, at a little brook from the west, rusty rocks of this description on both banks contain small pockets of specular iron among veins of ankerite, and in contact with igneous rock.

Dykes and veins.

Mines of specular iron ore

At the Centredale school, whitish quartzite and black slate succeed the Carboniferous. In a little brook which flows into the East River, between St. Paul's and Bridgeville, red rocks belonging to this group are associated with very flinty, grey quartzite and with grey, fine, calcareous flags and shales, veined with threads of calc-spar, which extend to the road up the river. Near the fork of the Centredale Brook and that from Maple Lake, the purplish argillite and sandstone, grey, greenish and dark, jointed, splintery argillites and quartzites are probably of this age, as well as the reddish and greenish siliceous sandstones and argillites of Elgin, which hold minute ferruginous veins. Here, as in the west branch, they are overlaid by Carboniferous limestone.

In the West Branch, above the bridge at Elgin, are reddish, flinty, jointed rocks; sparkling, fine quartzite, with layers of greenish and purplish, slaty argillite; dark slates; greenish, soapy slates veined with quartz; blackish, graphitic slates, sometimes flaggy, including bands three inches thick and downward of ferruginous limestone or ankerite; greenish-grey and reddish, soapy, papery shales. Red argillite predominates. Occasionally a greenish quartzite, tinged with red, has rippled surfaces and pyritous lenticular layers, and

West Branch of East River Pictou.

* An. Rep. Geol. Surv., vol. II., 1886, Part P, p. 56.

† Trans. N.S. Inst. Sc., vol. II., p. 67; vol. III., p. 171; vol. V., p. 206; Progress Report Geol. Surv., 1866-69, p. 408.

the grey and greenish flags resemble those of Big Brook. Up stream they are succeeded by the grey slates of the Middle Devonian.

Big Brook.

The rocks of Lorne, south of the gypsum, are shown both on the Big Brook road and on that to Trafalgar. From Kenneth McKenzie's to the Glengarry railway station, by way of John McDonald's, all the debris points to the country being underlain by Carboniferous and by the red Deyonian rocks. From the bridge over Big Brook on the Trafalgar road, to the road on the left to Elgin, the dark, coherent argillites are, no doubt, equivalent to those on the road near Kenneth McKenzie's. South of the plaster land are outcrops of red and green slate, like that of the west branch above Elgin. Above the fork of Cross Brook, Big Brook exposes greenish-grey, fine, pyritous, flinty sandstone and argillaceous shale, succeeded up stream by light greenish, soft argillite, blackish argillite or soft slate, with nodules and lenticular bands of black calcveined limestone, very much broken and associated with diorite, followed by reddish, fine, rubbly, argillaceous sandstone, and near the mill by the Middle Devonian slates.

Cross Brook

The rocks of Cross Brook, like those described above, are perhaps equivalent to the coaly strata of west branch and Kemptown. Above the road they consist of light grey, rusty-weathering, fine, micaceous, flinty sandstone, or quartzite and argillite, sometimes slaty, of blackish and light grey argillaceous shale, with bands of micaceous sandstone, well-bedded, but jointed and sometimes slaty. Some of the graphitic shales have been mined. Immediately succeeding these rocks are dark slates and quartzites.

Black shales.

Middle River of Pictou.

From Lorne to West River the railway seems to follow closely a band of Upper Devonian. In the fields south of Glengarry railway station, reddish, purple and greenish, flinty argillites and quartzites are in place to the back road, and on this road westward along the railway are associated with traps. To the north, reddish-grey argillite and sandstone, in thick beds veined with quartz, appear in the Middle River, and similar rocks, resembling also those of Big Brook, abound on the roads towards Whitehill and Marshdale. On the road from Lorne to Glengarry the rocks are no doubt also of this age, the huge blocks of veined diorite indicating the igneous rock so often seen in the same position, cutting no higher rocks than Upper Devonian; and the black slate mined at Jesse Grant's is perhaps the same as that of Cross Brook, of the Big Brook and other places. The rough land east of Glengarry is covered with blocks of white-weathering, flinty sandstone. About one hundred yards west of the station, a cutting shows purplish slaty argillite, and on the road to the northward are grey and purplish coherent

Igneous rocks.

rocks. Near the railway tank are grey, coarse sandstones and bluish-grey shales, not unlike Carboniferous. Other cuttings show greenish and grey, coarse, flinty grit, dirty greenish-grey, bluish-grey, red and green crumbly shales; and black shales, which would seem to be about the horizon of the coal of West River, have been dug for coal in a shaft and several pits in this neighbourhood. Some of the associated sandstones are very siliceous and resemble the Guysboro' quartzites and rocks of the Salmon River west of Riversdale, which underlie the red and green rock of Calvary Stream. Search for coal.

On the road from Glengarry to the fork of the Middle River, the green slates are Devonian, as well as rocks associated with the trap below the bridge. Some distance above the bridge, a flinty quartzite is in contact with greenish coarse diorite, among which is a breccia containing pebbles of the cream-coloured siliceous rocks and argillites.

Apparently most of the rocks of the magnificent outcrops above the fork of Middle River in the west branch, as far as the railway crossing at Lansdowne, belong to the horizon between the Middle and Upper Devonian. Those first seen comprise greenish-grey, fine, flinty, argillaceous sandstone, in shales and flags, with layers of polished graphitic slate and of flinty quartzite. They are traversed by veins of ankerite, and by minute veins of quartz, one of which yielded specks of copper pyrites. Up stream are red, slaty argillites, with bands of green, and a greenish grit, perhaps Carboniferous; succeeded by cliffs of purplish, flinty, splintery, massive, jointed, micaceous, argillaceous sandstone or quartzite, cut by threads of quartz and spotted with rusty grains and bright green blotches, sometimes calcareous, and in one place passing into impure limestone; and still higher, fine outcrops of purplish, coherent argillite and sandstone, with bands and reticulations of green, veined or blotched with quartz, and ripple-marked, followed by greenish and cream-coloured argillites, purplish rocks with plates of spathic iron and large cream-coloured blotches, greenish and light grey, flinty, argillaceous and siliceous rocks, with light grey, very pyritous, rusty-weathering bands, most thick-bedded, also a greenish and grey, massive, rubbly, rusty-weathering siliceous rock, with ferruginous veins. Specular iron accompanies a band similar to that of the iron-bearing rock at the Roman Valley, Caledonia Mills, South River and elsewhere. Reddish, greenish and grey rocks extend to Matheson's Mills. Copper ore.

Good exposures of the red and green rocks occur in the brook from the mill-pond immediately north-east of Lansdowne station and on many of the roads of the neighbourhood. The first rocks seen Iron ores.

below the pond are greenish, rusty-weathering, somewhat massive, rubbly, ferruginous, siliceous and argillaceous, containing a quantity of specular iron and ankerite. Lower down the greenish are associated with purplish beds, also containing veins of specular iron ore, one of which, one inch thick, cuts across the bedding, and of ankerite, sometimes more than a foot wide, in part converted into specular ore.

Gordon's
Summit.

On the railway near the 29th mile-post are blackish graphitic slates, and light grey, crumbly, granular, quartz-felspathic grit, dug from iron. At Gordon's Summit, rusty-weathering, siliceous rocks are followed by flaggy, and by a greenish-grey and grey argillite and quartzite to Matheson's Mills, sometimes associated with volcanic material. At the head of a branch of Middle River, near Gordon's Summit, purplish, bluish-grey and grey argillite and compact sandstone, the latter containing many veins of specular iron, are associated with greenish and grey slates. At the fork of Dan Matheson's Brook the river exposes red sandstone and argillite, together with grey rocks like those of Roman Valley.

West River,
Pictou.

The rocks near Campbell's siding, include a great thickness of red, crumbly argillite; but a large portion are of rubbly, flinty, slaty argillite at a little brook further east. The dirty greenish rocks further east have among them layers of flinty sandstone or quartzite, and also of black *Cordaites* shale and crumbly, greenish and reddish argillites, of which there is a great thickness near Landsburg's. The cuttings near the county line, and those near Jonah Langille's show red and green flinty flags. On the road from Langille's to the main road at Landsburg's, the debris seems to indicate greenish and purple slates, and along the main road eastward the grey rocks of Riversdale, numerous blocks of which are seen near the West River road. To left, down the river, the land on the right and left is very rocky as far as a little cemetery, the grey, flinty, quartz-veined quartzites show as far as the river bank. Then the land is better as far as the ford and foot-bridge, below which, grey, rusty-weathering, flinty rocks are again apparently in place as far as a small brook near a house on the left, where the hill turns to westward and the overlying conglomerate begins.

Contact of
Carboniferous

On the east bank of West River the debris hereabout is of blue-purple rock, not of the colour of the rocks of Union. If as seems probable the rocks of the left bank are beneath those of the right, this would imply either a great bend of the strike from east to south, or a great fault carrying the purple and green rocks of the east side far south past the grey underlying series. The road

on the east side shows the grey rocks only at the end near the station.

The Riversdale rocks almost certainly underlie those of Union, and a great tract of the intermediate series seems to occupy the country north of the railway, being spread over a great area by frequent folds and faults, some of which can be indicated with considerable accuracy; a great area of black slates seems then to succeed that of the Riversdale rocks and to be repeated in the same manner at the head of Stewiacke River and south of the East River of Pictou.

Riversdale
and Stewiacke

On the track north from Campbell's Siding, about a quarter of a mile south of John McKay's, Devonian rocks are found which connect those of the south with the rocks of Mount Thom and the east end of the Cobequid Hills. They comprise green, light grey and purple pearly slates, with whitish quartzites, intersected by dykes of diorite. On the road to the west end of Mount Thom, are reddish and cream-coloured argillite and rusty-weathering quartzite, veined with ankerite; and similar slates are everywhere in the vicinity.

Devonian of
Mount Thom.

Dykes.

The rocks of this track south of the crossing of a branch of Black River, consist of grey and reddish fine sandstone and grit, very shaly, associated with coarser rocks and probably belonging to the Carboniferous series to the northward. Near the railway they are rusty-weathering, finer and argillaceous. From where the track strikes the railway, the first cuttings to the eastward show dirty greenish-grey and grey, rusty-weathering, crumbly, argillaceous sandstone and shale; underlaid by reddish marly rocks resembling those below the fork of Middle River, and succeeded, further east on the railway, by dirty, greenish and grey rocks and black carbonaceous *Cordaite* shales, containing layers of slaty bituminous coal which have been dug and which appear in two of the cuttings to the eastward.

Carboniferous
rocks north of
the railway.

Coal.

Nearly all the rocks of Calvary Stream below the driving-dam, three miles above the railway, lie between the grey rocks of Riversdale and the red rocks of Union. Near the dam they are massive, full of iron pyrites, and veined with quartz and ankerite; certain bands of light grey, often flaggy, sandstone show bright red blotches. The greenish and grey, wrinkled, shaly rocks of the cliffs at the dam, at the iron mine, are much more flinty than the rocks above it, perhaps because of the proximity of volcanic rock. Below the dam is a white-weathering, green slate and a wrinkled, scaly, graphitic, polished slate, full of quartz veins, succeeded downstream by cream-coloured slate, ribbanded flags and a small outcrop of trap. Below, are grey, rusty-weathering, crumbly shales, underlaid by light grey Guysboro' quartzite, again underlaid by flags, breaking into bricks.

Calvary
Stream.

Iron mine.

Dyke.

Limestone.

These lie at the mouth of Johnny's Brook (which flows from Island Lake) up which are the red rocks of Union. A band of five feet of impure limestone is found in Calvary Brook, not far above the railway, * among light-coloured flinty sandstone and shale, veined with milky quartz. Then come, up stream, red rocks with green blotches, with minute veins of ankerite and calcite, and a patch of greenish conglomerate. Black slates with lenticular patches of grey sandstone are interstratified, near the mouth of Brown's Brook, with whitish, very flinty, coarse quartzite or grit, veined with quartz, of great thickness, with greenish, grey and reddish, ripple-marked, flinty flags, veined with quartz and ankerite, and with blackish shales with a few nodules of ironstone. Outcrops are nearly continuous to the driving-dam and are also found in the tributaries. The dip is very high and the strike along the brook perhaps indicates a large fault which may be an extension of that which follows the East River of Pictou.

In Johnny's Brook, near the river, are dark bluish-grey graphitic slates, overlaid by whitish, quartz-veined quartzite. Up stream are cliffs of light grey, fine, somewhat soft, micaceous sandstone and greenish compact quartzite, overlaid by a reddish, massive, quartz-veined quartzite; and, at a track from the driving-dam, by reddish and greenish, somewhat crumbly, argillite. Above the track the dip is up stream at angles varying from 50° to 80°, and the rocks are those of Union—reddish and whitish spotted sandstone or quartzite and argillite, veined with quartz. Greenish and grey slaty argillite and quartzite occur with the red rocks near Island Lake, and on the hauling road to the Pembroke road, on which, towards Riversdale, red rocks show occasional green layers. In Brown's Brook are light grey and greenish quartz-veined quartzite, in thick beds with red and light grey, glistening, coarse, flinty, quartz-veined, quartzose sandstone, resembling that of the main brook.

Stewiacke River.

Beneath an unconformable covering of gypsum which occurs on both sides of Stewiacke River near Crockett's at Eastville, lie red and purplish strata like those of Union, veined with quartz, containing bands of greenish sandstone, and probably overlying the grey rocks seen higher up stream, as they do at Salmon River, although the steep dip renders this difficult of determination. At Cox Brook is another outcrop of red rocks, probably of this age, underlying a conglomerate which seems to be identical with that

Carboniferous conglomerate.

*Sir J. W. Dawson states that he has collected at Riversdale [Lower Carboniferous Plants, pp. 29-34] *Calamites Cistii*, *C. cannaeformis*, *Odonopteris antiqua*, *Cardiopteris*?, *Hymenophyllites furcatus*.

which overlies grey quartzites and slates of the gold-bearing series at the Newton Mills iron mine. The exposure of these upper rocks in the river is narrow, but on some of the lower tributaries larger areas of them come from beneath the Carboniferous limestone, as at Glenbervie, where the latter is succeeded by the red rocks of Union, and on the parallel road from the Smithfield lead mine, where red argillites alternate with grey, rusty-weathering rock, often coarse and pebbly, and with whitish, massive quartzite. On the road near Harmony and also at Manganese Mines, precisely similar rocks underlie the Triassic, and will again be referred to.

In the Little River of Stewiacke, at and near a fork above the head of the settlement, red Devonian rocks are exposed, and, about two hundred and ten paces below the fork, are in contact with grey and dark flaggy Carboniferous limestone, dipping $277^{\circ} < 43^{\circ}$. Lower down near a bridge, are great outcrops of gypsum, north of which lie grey flaggy sandstones, like those of the Goldmine Brook, succeeded almost immediately by the red rocks of Union, including a grey rusty-weathering sandstone and coherent flags, with many markings of plants, which extend northward to a branch, and down this branch to the river at the two bridges near Leander Nelson's. On the road up the river from these bridges, flaggy sandstone and whitish quartzose grit, like those of the Goldmine Brook, perhaps indicate that these latter belong to the limestone and gypsum series. Along the most southerly of the two roads at Brookfield iron mine a strongly marked valley runs 254° towards Little River. In and immediately north of this hollow lies the iron ore, the rocks of both hills being those of Union, including, next the ore, a grey spotted, flaggy sandstone. Down Little River, Devonian rocks extend for thirty-five paces below the road to the iron mine, and are then succeeded by grey bituminous Carboniferous limestone, dipping $174^{\circ} < 60^{\circ}$, and overlaid by grey, soft, rusty-weathering sandstone and gypsum. The boundary closely follows the river for a great distance down stream.

The almost unbroken section in Salmon River is clearly a descending one from the rocks of Union to the mouth of Black River, the red of the strata being interrupted by only a few little bands of dirty green. About 200 paces above the mouth of Black River they are succeeded by massive, rusty-weathering sandstone, underlain by whitish, fine and coarse quartzite, veined with limonite, including thick beds of very flinty conglomerate with pebbles, as large as a hen's egg, of quartz, syenite and green slate, which

Carboniferous
limestone and
gypsum.

Brookfield
iron mine.

Salmon River

Iron ore

Fault.

may possibly indicate unconformity between these and the lower rocks ; the dip, however, is nearly vertical and the bedding-planes are finely polished or slickensided. The rocks of this vicinity strikingly resemble those of Grand River and Guysboro', and the country underlaid by both is precisely the same. Higher up, alternating with red beds, vertical or overturned, are whitish red-spotted quartzites, like those of Johnny's Brook ; bright green and purplish, fine quartz-veined argillite and greenish rusty-weathering or cream-coloured flinty quartzite, precisely like those of Londonderry mines, with darker grey and greenish bands, very much

Specular iron ore at a dyke.

altered, containing specular iron and ankerite, and succeeded immediately by a small dyke of diorite. Up stream from the diorite are cliffs of dirty greenish, grey and dark bluish-grey argillite and flags, with bands of grey rusty-weathering sandstone, perhaps equivalent to the rocks of Riversdale, but succeeded immediately below the Telegraph road by the red rocks. There is no doubt that these rocks are frequently repeated by faults. Strata of the

Carboniferous and Devonian of Steel's Run.

intermediate series are abundant in Steele's Run, but those first seen above the mouth are argillite and flinty sandstone of the Union series, overlaid by a conglomerate in detached masses, and evidently newer than Devonian. Beyond the conglomerate, are red or purple argillite and quartzite, succeeded by light cream-coloured,

Iron mine.

rusty-weathering strata, mined here some years ago, containing scales of specular iron and minute veins of ankerite, quartz and calcspar. They are finely striped or banded, but often too massive to show the dip, include bands of greenish pyritous slate and of pearly slate and grey and bottle-green and whitish, compact, rusty-weathering quartzite. The cliffs immediately below the saw mill contain a considerable quantity of red hematite in blotches and threads. The specular iron seems to indicate the proximity of igneous masses such as come to the surface in the adjoining country. Above the saw-mill the brook comes through marshes and intervale, but on the road are outcrops of purplish rock

Mount Thom. which extend to Mount Thom*.

Earltown.

On the Salmon River road near Earltown, succeeding the syenite of Upper Kemptown, are red and green flinty rocks perhaps of this age; but they require further examination to separate them from the Silurian of the vicinity.

Iron ores.

Above Jacob Fenton's, the Salmon River shows good outcrops of greenish-grey, flinty, rusty-weathering, ferruginous rocks, with patches of botryoidal limonite, alternating with other red and grey

* Acad. Geol., p. 502.

rocks as far as the foot-bridge at John and David Ross's. Similar rocks, also containing a considerable quantity of limonite, have been worked in Upper Kemptown at several places. Between Kemptown and Upper Kemptown are indications of the red rocks of Union, and some of the large blocks of rusty-weathering Devonian rock which are abundant on the Telegraph road east of the road to Mount Thom contain traces of botryoidal limonite. On the road to the left from the mill, debris of purple and green Devonian slates and of grey flaggy sandstone and shale is seen as far as the clearing of John and David Ross.

Whether or not newer rocks occur on the road between Kemptown and Upper Kemptown is somewhat obscure; the red rocks are perhaps all of the Union series. But there is no doubt of the Devonian age of the rocks of Matheson Brook, the first stream to eastward north of the post office, which flows over red and green slates not far below the road, and, about half a mile below it, dashes down fine little falls composed of grey, compact, flinty, rusty-weathering slates, succeeded down stream by all the rocks of the river below the Telegraph road, including light grey, bluish-grey and greenish-grey quartzites, of considerable variety of texture, more altered than usual. Salmon River, above the mouth of Matheson Brook, exposes rocks like those of the Red Bridge, sometimes massive and crumbly, with several red beds. These extend to the mouth of Ross Brook, where many blocks perhaps indicate the beginning of the syenitic rocks of the mountain, which are in place higher up. In Ross's clearing and on the road to the eastward, as described above, and in the fields as far as Pat McAulay's clearing, Devonian slate abounds. Red and grey Devonian rocks apparently follow the Telegraph road from McAulay's westward to the Riversdale road, and extend southward along the latter nearly to the top of the hill where the dark slaty strata of Riversdale and the vicinity begin.

The strata of Salmon River about a quarter of a mile below the mouth of Black River are perhaps near the base of the red rocks of Union. They comprise indian-red and purple, coherent, flaggy rocks, striped with lighter colours and interstratified with beds of softer, crumbly argillite, resembling the rocks of Rocklin, underlying which is a thick bed of rusty-weathering, glistening quartz-veined sandstone or quartzite.

Up Lamby's Brook, two miles west of Riversdale, red quartzite and argillite are interbedded with whitish quartzite. At Allan's logging road in this neighbourhood are blocks of light-coloured sandstone or quartzite, spotted with hematite, and of flinty con-

Upper Kemptown.

Syenite of Salmon River.

Brooks between Riversdale and Union.

glomerate, like that of Salmon River near the fork of Black River. Narrow Mouth Brook, below the logging tramway, shows good outcrops of light grey, massive sandstone, of somewhat coarse texture and very coherent, among a great mass of red rocks. Reddish and greenish flinty flags and shales and whitish quartzite are also found up along the tramway; and on the track past Moose Lake are light grey and whitish quartz-veined sandstone and quartzite, apparently belonging to the intermediate series, although no iron ores appear yet to be discovered in this vicinity.

About half a mile above the Greenfield Brook a little brook enters Salmon River from the north, showing, for some distance up stream, reddish and rusty, quartz-veined flags and argillites, white-weathering, forming rocky barrens like those of Loch Lomond and Grand River*.

Greenfield
Brook.

Greenfield Brook shows fine outcrops of these rocks in as great volume apparently as is exposed on the railway. Immediately above the railway are cliffs of bright red, crumbly, micaceous argillite, with flinty layers and bright green spots covered with broken carbonized plants. They resemble the red rocks of Rocklin and Concord. Higher up they are more sandy, jointed and flinty, include a band of bottle-green, ribbanded, flinty, fine sandstone, and exhibit lines of jointing at right angles with the bedding. A short distance up, at a turn of the brook, is a very compact, reddish and greenish, glistening, micaceous, red-spotted quartzite, like that of Salmon River and the Pembroke road, breaking into blocks which encumber the almost barren surface of the land adjoining the brook. Higher up are greenish rocks veined with quartz, and above the Greenfield settlement similar rocks extend towards Smithfield, and are exposed in all the little brooks of the neighbourhood.

Diorite east
of Valley.

East of the cross-roads near Valley, the Telegraph road passes over red flinty rocks in contact with coarse diorite. With the former are interstratified greenish quartz-veined rocks containing minute veins of limonite.

Henry Chris-
tie's Mill-
brook.

In Henry Christie's Millbrook, Triassic rocks are overlaid by light grey flinty quartzite, with minute veins of white quartz, succeeded up stream by indian-red quartzite and argillite, well exposed in rough falls and exhibiting numerous veins of white crystalline quartz, some of which are nine inches thick, contain traces of crystalline pyrolusite and have been worked. For some distance above the mill are good exposures of red argillite, and the occasional outcrops higher up are of red flinty sandstone and argillite.

Manganese
ore.

* Geol. Surv. Rep. for 1877-78, p. 20 F.

In Murray's Brook, below the Triassic, are quartz-veined red quartzite and argillite and whitish compact quartzite. Similar rocks, sometimes full of fossil plants, extend south to Harmony and across to Henry Christie's Millbrook, the land being very rocky.

The rocks of the lower part of Victoria Park Brook, of Truro, Truro, are reddish or purple crumbly shales which might represent the upper beds of Tracadie and Rocky Bay*. Higher up at a fall, they are succeeded by fine grit, sandstone or quartzite, whitish and like that of Grand River, part of the surrounding country being also like the Grand River barrens. The bands of sandstone interstratified with the shales are very coherent and contain markings of plants. The brook is rocky and steep and presents views of extreme beauty. Fossil plants.

Passing to the tributaries of the north side of Salmon River, the first rocks from beneath the Triassic in Clifford's Brook are red crumbly argillites, followed by reddish-grey, fine, striped sandstones and coarse grit, with streaks of green, containing a little pyrolusite in the joints which has led to the cutting of many pits and trenches in search of that mineral. Above the road, at one of these openings, pieces of Carboniferous limestone are found in the drift, and not far up stream this rock forms a cliff. In McKenzie Brook, above Philip Archibald's, the red argillites first seen are succeeded by dark grey argillites and rusty-weathering sandstones or quartzites probably of the Riversdale series. A little lower down, red argillites are found in contact with green marls, which may be associated with the gypsum of the quarry. Down stream from the fork to Salmon River are outcrops of grey and reddish, sometimes bright red, mottled, greenish, cream-coloured and reddish sandstones and shales, with a two-foot band of concretionary limestone conglomerate. Plates and veins of manganese ore occur in the planes of bedding and jointing. On the railway between the mouth of this brook and Valley, the quartzites are curiously channelled in the direction of the joints which are at right angles to the dip; they belong, of course, to the higher series of Union. Clifford's Brook. Manganese ore. Carboniferous outliers.

In the west branch of Halfmoon Hill Brook, which follows the Telegraph road for some distance, are reddish, purplish, greenish and grey, striped and banded flags and shales, with layers of flinty, micaceous sandstone, containing veins and large blotches of pyrolusite, just as the hematite and specular iron ores occur in the Guysboro' quartzites. Many pits have been opened on these deposits which are unconformably covered down stream by Triassic rocks. Manganese mines.

* Geol. Surv. Reports for 1879-80, p. 39 F; and An. Rep. Geol. Surv., vol. II., 1886, p. 65 F.

Triassic and
Carboniferous
rocks.

The purple and red argillites, with greenish and grey spots, of the upper part of Farnham's Millbrook will be described with the Carboniferous limestone at their unconformable contacts.

On the Jollytown road for 472 paces north of the Telegraph road, obscure traces of greenish perhaps Carboniferous sandstone are met with. In the brook a short distance further, pieces of grey, flinty, flaggy sandstone are succeeded down stream by red argillite and quartzite, overlaid at one point by Carboniferous limestone. Further out, the road crosses grey and reddish soft sandstone and shales, comparatively unaltered, very like Carboniferous, but also like certain Devonian rocks of the North and Salmon Rivers, not well exposed, and associated with flinty sandstone and with dark bluish-grey or blackish shales, resembling rocks of the Three Mile Lake near Lochaber and of the bridge on Salmon River near Riversdale.

Rocks between East
and West
Rivers of
Pictou.

These exposures connect the rocks of Salmon River with those of the south branch of North River. But before describing the latter, we may again turn eastward to the great block of Devonian rocks lying north of the railway between the East River of Pictou and the head of the West River, which consists chiefly of the red rocks of Union and of the ferriferous intermediate series. They are affected even more than the other series by faults and flexures, the minute structure being in many cases still obscure.

Devonian of
the Pictou
coalfield.

The extension of these rocks from the Middle River nearly to the East River of Pictou on the north side of Blackwood's Brook, as shown on the map of the Pictou coalfield by Logan and Hartley, seems to be a mistake, no outcrops being found and the drift pointing rather to the presence of sandstone, like that of Fraser Ogg's quarry and of the New Glasgow conglomerate.

Dyke near
Fishpools.

On the other hand, the red, flinty, veined slates of Fishpools and the rocks immediately south of the south fault in the East River are apparently Devonian rather than Millstone grit; and, as was pointed out by Mr. Poole, superintendent of the Acadia Coal Company, they are cut on the left bank by a small dyke of diorite, five yards wide, containing spots of quartz. The adjacent strata, which resemble those of Rocklin on the Middle River, also contain veins of quartz, calcspar and ankerite. The red rocks on the right bank of the river, a short distance above the mouth of the McKay Brook, are, beyond question, Devonian. In the most northerly of the three branches of this brook, the rocks are of the flinty series, with a possible exception of the highest outcrop of flaggy red sandstone which seems to belong to the Millstone grit. The fields indicate Millstone grit between this and the middle branch

Veins.

and also the outcrops near its head where it turns into the woods. Thence to the head of the third or southerly branch, the debris is of flaggy Millstone grit, down to an outcrop about 150 yards from the road, which seems to belong to the lower series. Good outcrops of rocks, often vertical, extend down stream from the road to the river. In a very small brook on the left bank of the river is an outcrop of greenish and reddish flinty sandstone like that seen at the south fault. It has, however, a vein of quartz one-quarter of an inch in thickness. In the river bank immediately above the mouth of the brook are bright red slaty rocks, like those of Fishpools, passing apparently insensibly into the red rocks of Rocklin and the south fault. Fifty-five yards above the brook is the dyke mentioned above, which may account for the greater alteration of the rocks hereabout. At a short distance higher they are greatly faulted and twisted, but are soon succeeded by the limestone of the Riverton quarry, in the neighbourhood of which a little brook crossing the railway shows red, flinty sandstone and argillite so cleaved as to make it difficult to obtain the dip.

The outcrops in the brook near D. J. McDonald's at the west end of McGregor's Mountain are probably of the same series; while below the road they are undoubtedly of Millstone grit. On the hill are knobs of trap, north of which is a conglomerate and on the south-west escarpment is a large quantity of red and green slate, veined, and like that of the East River.

Another tributary of the East River, Cameron (Meadows) Brook, exposes rocks, some of which perhaps belong to the lower group. They comprise red, greenish and bluish-grey argillite, dark bluish-grey shales, sometimes siliceous and quartzose, sometimes brecciated, containing crystals of pyrite, druses of calcspar and markings of graphitized plants, with bands of massive quartzose grit and greenish and yellowish siliceous slate, resembling certain rocks of Alma and Glengarry, and altered by the igneous rocks of the neighbourhood. The red sandstones on the railway, a short distance above the crossing of the main branch of this brook, are probably Millstone grit, the vertical dip of which may indicate a great fault. A short distance further west, in the brook immediately below the meadows, they are succeeded by red rocks apparently of the Union series, with two bands of shaly, calcareous argillite, six feet in thickness, and with layers of grey sandstone or quartzite, like that of Grand River. The shales are coherent and slaty, the sandstones flinty, ringing and rubbly; they are associated with bluish-grey and greenish-grey slates, similar to those found north-east of Glengarry. On the road which crosses the railway west of the marsh, there is

McGregor's
Mountain.Cameron
Brook.Fault near
Hopewell.

Marshdale.

no question of the Devonian age of the purple slates; to the north of this road are many blocks of Devonian rock, with others of syenite; and rocks similar to those of Watervale extend to the Marshdale cross-roads. On the road to the left from the cross-roads, slaty, Devonian sandstones and argillites, greenish and grey, purple and reddish, extending to the road along the Middle River, are well exposed in a large brook not far above Concord Mills. On the road up the river to Glengarry the debris is very like that seen on the railway and on other roads north of it.

Lorne.

Blocks of purplish argillite and striped diorite on the railway east of Lorne probably indicate the rocks of Glengarry and Big Brook; and a rusty-weathering limestone, resembling that associated with a black shale of Big Brook, is found with whitish sandstone, perhaps that dug with the black shale at Jesse Grant's.

Limestone
quarry at
Glengarry.

The green shales below McDonald's road near Lorne are probably the equivalent of those of Middle River; the black graphitic rock below is perhaps the black shale, with lenticular limestone masses, of Middle River and Balfour Brook. The flinty, rusty-weathering sandstone and grey and greenish flags, below the limestone and dark shale, belong probably also to the Devonian. The limestones of this formation when not well exposed are apt to be confounded with the Carboniferous. Gordon's quarry is on one of them. Near the road to the quarry are greenish and grey, rusty-weathering, flinty, siliceous, slaty argillites, like certain strata found in the neighbourhood of Marshdale cemetery associated with red argillites and sandstone.

Contact with
Carboniferous
at Lorne and
Elgin.

From Lorne siding on the road towards Lorne the debris indicates Devonian slates and igneous rocks; but on approaching the post office these give place to the plaster pits of the Carboniferous. On the road to Elgin, reddish and bluish slates occur; and the red rocks in the little brook a quarter of a mile north of the Elgin post office are perhaps Devonian; but the reddish and grey micaceous flags of the larger brook, half a mile further along the road, are undoubtedly Carboniferous, and in the river, below the mouth of this brook, are fine cliffs of red and grey Carboniferous sandstone and shale which continue to Hopewell.

Middle River.

No finer exposures are anywhere to be found than those of the various branches of the Middle River, and, judging by the variable dip, there must be many displacements of these strata. In the west branch, above the fork below Glengarry, the bluish-grey sandstone and slate first seen are not more altered than most of the rocks of Riversdale, and the greenish-grey sandstone greatly resembles the rubbly sandstone of the barrens. Immediately below the fork, dirty

greenish-grey, rubbly sandstone and argillite, lying nearly horizontal and, lower down stream, dipping southerly, resemble the rocks of Riversdale; the soil on the banks being rusty like that of West River and Riversdale. The cliffs on the left bank, lower down, are of dirty greenish-grey, crumbly argillite and of soft, flaggy, micaceous, quartz-veined sandstone, very like the rocks of Campbell's siding, the argillite containing small nodules of ironstone. Underlying these, still dipping down stream, are reddish, slaty argillites like those of Campbell's siding, and also remarkably like rocks seen in Salmon River. On the right bank, at Murray's mill-pond at Concord mills, are red rocks like those of Union, with greenish-grey bands, dipping north-westerly at a high angle, extending for some distance below the dam and being succeeded, in nearly vertical bedding, by alternations of light steel-grey, dark greenish and bluish-grey, flinty, micaceous, compact argillite and sandstone, cut by small veins of quartz, with a calcareous band, one foot thick, associated with the prevailing reddish argillite which is slaty or prismatic, breaking into large scaly pieces or into knife-and-needle-shaped fragments. The sandstones are spotted with minute cubes of pyrite and interstratified with darker papery shales, with lenticular masses of pyritous, rusty-weathering limestone. Some of the more arenaceous bands are full of reticulations and blotches of whitish quartz. Similar rocks extend in almost unbroken cliffs and reefs, the whole section being very much like that between Union and Riversdale, and some of the quartzites strikingly like those of the fork of the Black and Salmon Rivers.

Ironstone.

Concord mills.

Quartz veins.

Limestone.

The slates at the head of Rocklin mill-pond are greatly altered, as well as those off the brook coming into the pond, among which a pit has been dug in search of copper. The dip is southerly as far as the mouth of Balfour Brook; and up stream in this brook is a descending sequence of the red rocks of Union, jointed into blocks, the argillites greatly predominating, with a low angle of dip. The blackish shales higher up are, perhaps, those of the fork of the river; they are papery and include lenticular masses of greenish-grey limestone, slaty, polished and graphitic. Above the bridge on the river road are light sea-green nacreous slates, cut by veins ofankerite and quartz, sometimes one inch thick, interstratified with whitish-weathering quartzite with rusty patches; overlying are purplish, rubbly, flinty sandstone or quartzite, and up stream is a mass of greenish-grey, fine, pyritous limestone, succeeded by rusty-weathering, pebbly grit, containing specular iron ore, and by compact quartzites like those of Guysboro'. Higher up the rocks form a gorge. The dip is generally obscure.

Rocklin.

Black shales.

Iron ore

Whitehill.

On the road from Hopewell to Whitehill school, the reddish and grey, flaggy, wavy sandstones are probably Millstone grit; but, on the steep road north-westward from the school, flinty, friable Devonian argillites are immediately in place. On the road south from the school, blocks of flaggy Carboniferous sandstone are in one place seen, but for the most part, for two miles, as far as the road on the left, the debris seems to indicate Devonian. On the road to the left are quartzites and trap, succeeded by Carboniferous rocks, which extend to Hopewell. Up stream in the brook, not far west of Whitehill school, are outcrops of grey and red, rubbly, coherent rocks, with veins of ankerite and films of specular iron in the joints. Below the road in this brook, similar coherent rocks, often rusty or cream-coloured, full of ferruginous matter, and very like strata of the Londonderry iron ore series, are fairly well exposed down to the house in a clearing, where a high hill is on the right and low land on the left. At the foot of the clearing, not far from the house, the brook exposes rocks of a totally different character—red, soft sandstones, dipping at a low but variable angle, perhaps Carboniferous. A short distance lower, however, reddish and dark grey, rubbly, veined, ferruginous strata are again in place and are well seen at the bridge below on the river road.

New Larig.

On the road north-east from New Larig post office, purple Devonian slates are interstratified with greenish and grey varieties*.

Millbrook.

Upper Devonian rocks are well exposed at and below the picturesque thirty-feet fall at Thomas Fraser's mill at Millbrook. They consist of grey, rusty-weathering, greenish, sometimes silvery, and reddish, flinty, splintery sandstone and slate, which are also found in the roads and brooks of the neighbourhood, spotted with specular iron, pyrite and ankerite, like the rocks containing specular iron at Guysboro' and West River. Certain beds contain fossil plants. Succeeding the quartzites and slates of the falls down stream, are reddish argillites with greenish bands and blotches, and hard layers of micaceous, fine sandstone, the argillites crumbling into pieces of a regular shape as large as marbles. Lower down these are associated with graphitic slate, containing papery layers and lenticular patches of wrinkled graphitic limestones, like that of Balfour Brook. Below the bridge, at Kerr's old factory, are ribbanded shales with a high and variable dip, they include grey soft beds of argillaceous shale and sandstone, with many carbonized plants, and some of the associated rocks are veined with ankerite and contain much yellow iron oxide in the joints. The road from this point up the Middle

* Canadian Naturalist, vol. IX., 1880.

River is probably all underlaid by Devonian flinty rocks. From the end of the Millbrook road and down along the river road, the land is flat and cultivated, and shows no rock to the road across Middle River at Union Centre. Argillaceous debris is still found, but perhaps only as drift. In front of Mr. Duncan McDonald's house are several blocks of grey Carboniferous sandstone and in the road beyond, near the next house, are many pieces of red Carboniferous sandstone. On the road from the bridge to the Pleasant Valley cemetery no rocks are seen, but on the back road the debris is Devonian.

In the little brook which enters Middle River opposite the Millbrook, greenish and grey sandstones lie at a variable angle. Below the bridge they contain traces of copper ore. Higher up are red rocks like those just described. Perhaps at or near this brook is the passage of a great north-and-south fault. Copper ore.

The first rocks seen in Hugh's Brook above the Middle River roads, are, perhaps, Carboniferous. Those found a little higher resemble the red rocks of Union, which are also indicated by the blocks in this neighbourhood and towards Pleasant Valley. The rocks of Hugh's Brook, from the school at Pleasant Valley down stream, are singularly rubbly, notwithstanding their great lithological resemblance to Carboniferous. The Devonian metamorphic aspect is, perhaps, best seen at a little brook from the left, below a bridge on a farm road, where the dark argillaceous shales with calcareous bands strongly resemble a rock on the railway between Hopewell and Lorne, and also that of Balfour Brook and Millbrook. Hugh's Brook.

In Middle River, below Balfour Brook, is a descending sequence of red flags and argillites, underlaid by light grey and greenish-grey, flaggy sandstone, all of which contain broken plants. The sandstone is about twenty feet thick and is underlaid by five feet of greenish shale, succeeded by red rocks, one fine, flinty bed of which contains spathic iron in the joints. The grey sandstone is on both sides of the river and seems to form an anticlinal to it. It is very flinty and, like the rocks of West River, contains pipes of coal. Lower down are reddish, coherent rocks, almost certainly the same as those above Rocklin and including a band of red quartzite. Then come the nearly vertical, reddish-grey and greenish, rusty, broken, flinty sandstone and argillite beneath the church, veined with ankerite and glistening with quartz. The red beds greatly predominate. The grey and greenish beds include pipes of coal. These rocks are exposed to a little below the bridge, the grey sandstone being perhaps the same all along, the strike Balfour Brook.

carrying it down the river. They are still seen at a brook from the right opposite Millbrook, where a sparkling, fine sandstone, breaking into pieces of irregular size and shape, shows none of the smooth-bedded, flaggy character of Carboniferous sandstone. Below this brook rocks are concealed for some distance, and red, greenish-grey and grey sandstone and argillite are next seen, while immediately below are grey sandstones of flaggy, coarse variety, full of broken plants, less altered than those above described and perhaps Millstone grit, the Carboniferous limestone being apparently all cut out on the river by a great fault.

Brown's
Brook.

At the mill on Brown's Brook, not far east of Pleasant Valley road, are outcrops of greyish, dark-grey, greenish-grey and reddish shales and sandstones, coherent, rubbly, nearly vertical and like the rocks north of Glengarry. Eastward from the mill to the main road the grey soil perhaps indicates Devonian, although at the bridge and in the brook up to the mill the New Glasgow conglomerate is in place. Devonian debris is very abundant on the road to the south from the bridge. On the main road, north as far as the carpenter's shop, the soil is also grey, but outcrops of the Permian conglomerate are in the brook on the right. To the westward, however, on the Truro road, 744 yards before coming to the watering brook east of Salem church, greenish Devonian rock, precisely like that of McCulloch's Brook and the railway, is in place in the road cuttings. Thence the boundary seems to follow the road to the fork of the road to Limerock, the conglomerate of Greenhill lying to the north. Up stream the watering brook for half a mile from the road shows only blocks of grey and greenish-grey Devonian rock with films of specular iron. From this point north-westward to the road above the church, similar debris is found in the fields, and pits have been sunk in search of iron ore.

Greenhill.

McCulloch's
Brook.

The Devonian rocks of McCulloch's (Bear) Brook, Alma and Waters' Hill have been described by Sir J. W. Dawson*, Dr. Honeyman†, and Mr. Hartley, but the latter has included in his description small areas of the New Glasgow conglomerate, which lie unconformably upon them§. In McCulloch's Brook they underlie the Permian and Carboniferous, and comprise greenish-grey and red, mottled, rubbly slate and micaceous sandstone, with patches of conglomerate which contain large pebbles of a quartzite, like that of Guysboro'. With these are associated

Newer rocks.

* Acadian Geol., p. 502, and Supplement, pp. 48-70.

† Trans. N.S. Inst. Sc., vol. III., p. 141.

§ Geological Survey Report for 1866-69, p. 58, l. 4.

greenish soft rocks and light grey micaceous quartzites, full of quartz-veins. The series resembles certain rocks of Silvey Brook and of Elgin. In the lower part of the brook the outcrops are interrupted by overlaps of the New Glasgow conglomerate. From these rocks in 1866 Dawson obtained "stipes of ferns, apparently of two species; a *Pinnularia* and branching stems much resembling those of *Psilophyton*, a characteristic Devonian genus; also fragments of carbonized and pyritized wood, but not sufficiently perfect to show structure." The broken conglomerate and bluish-grey slaty rocks of the railway cuttings west of this brook, and the rocks which underlie the New Glasgow conglomerate above the bridge at Alma are also of this age. They consist of greenish-grey fine breccia or conglomerate and light grey, micaceous, compact, flinty sandstone, resembling in their brecciated and rubbly character Cambro-Silurian rocks; but the argillaceous layers are soft and earthy.

Fossil plants.

The crystalline, non-fossiliferous limestone of Waters' Hill is a shaly and thick-bedded, greenish, compact, splintery and ringing variety, full of veins of calspar. It is underlaid by greenish, rubbly, splintery slate, cut by blotches of ankerite; and obscure deposits of iron ore have been found in the immediate vicinity.

Limestone of Waters' Hill.

Iron ore.

Exposures of Devonian rock, perhaps equally interesting, are exposed in the West River of Pictou, between the railway and Saltsprings. The debris seen on the road down the west side of the river indicates, as already stated, rocks similar to those of the railway west of the station. The first outcrops in the river, a short distance above Watervale, are grey and greenish-grey rubbly argillites and siliceous sandstones, blotched with quartz and with joints full of films of specular iron, somewhat pearly but not graphitic, with veins of rusty-weathering ankerite and specks of pyrite. These are associated with layers of green and reddish more evenly bedded rocks, with graphitic streaks, all very flinty and compact, and including patches of conglomerate; also with ripple-marked flags, sometimes dark and graphitic, resembling the rocks of Guysboro'. Immediately above the Watervale bridge, are cliffs of bluish and greenish-grey, massive, siliceous and argillaceous slates, dark grey graphitic flags containing a few veins of quartz, and joints glistening with specular iron. Among them are patches of conglomerate or breccia and several purplish layers; the green slates are finely ribbanded; the quartz veins contain also spathic materials. Succeeding these rocks some distance down stream are greenish, soft, pearly slates, like those of Silvey Brook, with specular iron in the joints and reticulating veins. Some of the

West River.

Iron ore.

Watervale.

Fossil plants. layers show *Cordaites*, *Calamites* and other land plants. Lower down the proportion of red beds is larger, and a fine gorge shows nearly unbroken outcrops of banded and mottled red, green and grey rocks, often veined with quartz, sometimes calcareous, and with limestone nodules. Many impressions of trees occur in the sandstones, and of broken plants in the dark shales. At the high picturesque bridge above Saltsprings, rocks are still exposed, being here bright green, bottle-green and grey, with red layers, and a rusty-weathering, wrinkled, slaty, impure, crystalline limestone, ten feet thick. At a fault a short distance down stream, soft Permian rocks succeed these strata, but they reappear in cliffs on the right bank, where they contain patches of conglomerate and of bluish-grey flinty breccia. Still lower down are cliffs of greenish-grey, thick-bedded or massive Devonian quartzite.

Watervale Brook.

Carboniferous and Devonian.

In Watervale Brook, for a great distance above the red, purple and greenish slates and quartzites of the mill-dam at the river road, the ground is covered with blocks of bright red and grey conglomerate, grit and soft sandstone, probably Carboniferous strata resembling those of the West River of St. Mary's, and of Galant River, Margaree. On the north side of the brook, however, is a hill upon which are exposures of purple, grey and greenish Devonian slates, and high up the brook are good outcrops of Devonian rock. On the road from the Telegraph road to Watervale all the rocks are Devonian as far as the crossing of the first branch of Watervale Brook, where the conglomerates begin. On the road from the head of this brook, at McKay's, back to the railway, Devonian rocks again appear, but the greater part of the track is occupied, as already stated, by Carboniferous sandstone, grit and conglomerate. At the head of Watervale Brook, on the road to McKay's, and elsewhere in the neighbourhood, are good outcrops of light grey, greenish and whitish slates and quartzites.

In the brook from the west below Watervale exposures of broken rocks above the road, perhaps indicate a fault. The rocks on the north-east side of the vertical dip are grey sandstones and dark shale or slate, like those near Riversdale. Higher up, the steep dipping rocks do not again appear, but to the northward is a glen supposed to indicate newer unconformable rocks.

Saltsprings.

In the little brook which enters the West River from the eastward at the forge at the end of the suspension foot-bridge opposite Saltsprings, there are exposed greenish-grey, rusty-weathering, flinty Devonian rocks, with whitish calcareous bands, layers of rusty-weathering sandstone, full of blotches of specular iron and ankerite, associated with lilac and red rocks. In the

large brook to the eastward, the outcrops show a large preponderance of red. They are associated with wrinkled, brecciated, very pyritous limestone, veined and blotched with calcspar, underlaid by a considerable thickness of whitish sandstone like that of the suspension bridge. The limestone passes into, or is intimately associated with, black shale, veined with calcspar and quartz, and full of pyrite. These rocks are overlaid by the soft sandstone and conglomerate of the river. The limestones here and in the river are no doubt those referred to by Sir J. W. Dawson*, as "altered Carboniferous rocks." But they differ from and are unconformably beneath the unaltered Carboniferous limestone of Limerock further down the river. Limestones.

The large blocks of purplish, flinty conglomerate on the road between Lovat and Millbrook are perhaps Devonian. Between Millbrook and Limerock, purple Devonian slates are cut by igneous rocks; they include a greenish breccia, like that of McCulloch's Brook, and are overlaid with soft sandstone, probably Permian. Other brooks of this region present good outcrops, but need not be referred to as they are indicated on the map. Dykes.

South-west of Millville, among the felsites and breccias of Mount Dalhousie are red and green argillite, probably of Devonian age. Mount Dalhousie.

In this connection the doubtful red rocks of Waugh River and the vicinity may be described as probably of this age. Near the head of Nabiscump Brook they are found, near the margin of the Silurian areas, altered by dykes of felsite and diorite, and comprise flinty red argillite, quartzite, grit and conglomerate. South of this brook are reddish and purplish flinty, micaceous, rubbly sandstones, spotted with white and green, in part calcareous, and massive, with traces of hematite, very like the red rocks of Union, and associated with bluish-grey massive argillite, blotched with quartz. Waugh River.
Dykes.

On the road down along Waugh River, below Earltown, are great blocks of very flinty conglomerate, like that of Arichat or Barney's River, in which are found traces of hematite. Where the river crosses the road, outcrops both of sedimentary and dioritic rocks are present, while in several brooks of the neighbourhood there are red flinty rocks, which resemble the Devonian lithologically. In a little brook from the north, which crosses the road below Earltown Falls, reddish, very rubbly argillites, with polished joints, full of calcspar and hematite, are found above the road, associated with layers of reddish, micaceous, nearly compact, somewhat flinty sandstone, showing a few *Psilophyton*-like markings of Fossil plants

* Acadian Geology, p. 315.

plants. They most closely resemble the red rocks of Union, and probably include a very flinty conglomerate of the neighbourhood. In other brooks this is calcareous, blotched with green and veined with quartz and calcspar.

Limestone
nodules.

Not far above the bridge, on a road to Baillie's, is an outcrop of dark greenish-grey, soft trappean and dioritic rock, followed by reddish, fine and somewhat flinty argillaceous sandstone, interstratified with red, soft, crumbly argillite, and with pebbly patches. The shales hold many greenish and grey nodules of limestone, smaller than a hen's egg, also one greenish nodule of argillaceous rock, nine inches thick. Then in cascades are seen alternations of reddish-grey, flinty Arichat conglomerate, composed of pebbles of felsites and quartzites. Similar outcrops occur in other streams of the neighbourhood about Ferguson's Brook.

Whetstones.

In a branch of McDonald Brook, a tributary of Waugh River, blocks of diorite or trap are found not far above the mouth, succeeded up stream by outcrops of light grey, flinty, fine sandstone, reddish sandstone, and grey, soft, argillaceous flags, used locally for whetstones. But the greater part of this district is underlaid by dark grey, massive, fine diorite.

Cobequid Bay
North River.

Devonian rocks are well exposed in all the streams flowing into Cobequid Bay from the north. Of these the first is North River, in all the branches of which they are met with. In the south branch of North River both the upper and lower rocks are present and have in most places been indicated on the map. The contact of the iron ore belt of these rocks with the overlying conglomerate of Carboniferous age is well seen in the little brooks which flow into the North River from McKenzie settlement; the junctions appear nearly all to be faults. On the road from this settlement to the Earltown road, the debris indicates Devonian rocks, and the Carboniferous seem to be cut off in this direction. On the track through the woods eastward to the south branch of North River, the blocks, as far as the crossing of this river in a hay-marsh or meadow, are of reddish-grey, somewhat flinty sandstone, often coarse and flaggy, possibly Carboniferous, but more probably similar to the coarse rocks found greatly altered by the syenite in the branch above John Munro's. On the east side of the meadow a great quantity of rubbly quartzite debris, chiefly red, and containing traces of specular iron, points to the extension of these rocks in this direction; and at the edge of the clearing, near the site of an old portable mill, limonite has been dug in considerable quantity from red and cream-coloured slates. Down stream from this mill are outcrops of grey, rusty-weathering and red or

Iron mine.

purple, coherent, slaty argillite, full of threads of limonite, and with films of red hematite in the joints, interstratified with bands of fine, micaceous, flinty sandstone or quartzite. Rocks less altered succeed down stream; then none are seen down to the branch from a meadow and large lake, and for nearly half a mile below this fork; then grey and reddish-grey, fine, flinty sandstone is found, the river passing through a barren waste, like that near Landsburg's, on the West River. Few rocks are, however, seen to Mingo's intervalle where they appear to be chiefly of the lower group.

Reddish crumbly shales with bands of flinty sandstone come from beneath the Triassic on the right bank of North River, seventy-seven yards below the iron bridge, the Triassic lying at a very low angle; and in the brook immediately to westward are outcrops of grey slaty argillite and of reddish and grey, somewhat flinty, flaggy sandstone and rusty-weathering shale. On the opposite side of the river the contact is again seen in Smith Brook, the boundary between the Triassic and the reddish, flinty, sandy shales following the edge of the intervalle for some distance.

Contact of
Triassic.

On the south side of, and underlying the conglomerate and grit in the North River near Cranberry Brook, is a great thickness of red rocks of this series in descending order, the dip at the top being about 61° , but generally much lower. If there is no fault here, the rocks exposed must represent a thickness of 4,745 feet, as computed from the dips. They consist of reddish-grey and grey, flinty, micaceous flags and quartzites, the grey beds being full of broken plants, and including a layer of flinty nut-conglomerate, of mottled red and green crumbly argillite. The sandstone is fine, sparkling with grains of quartz; it includes patches of grey and greenish limestone conglomerate, streaks of black carbonaceous shale, and lenticular layers of greenish argillaceous shale, and of light grey, rubbly, wavy sandstone, with *Calamites*. The dip to this point has been up stream. Now it is reversed to $172^{\circ} < 67^{\circ}$ perhaps at a fault, and there is a fine exposure of grey wrinkled shale and thick-bedded limestone, probably fifty feet thick, full of calcspar veins. On the north side this stands nearly vertically against red argillite, succeeded by grey flinty sandstone or quartzite. On the south side the rocks are concealed for some distance. It is like the limestone found altered among the syenite and diorite above McCallum settlement. Below the bridge, on the post-road, the rocks are dark bluish-grey with reddish bands; evenly-bedded shales with limestone layers and nodules, perhaps belonging chiefly to the lower group; and on the road to the westward, perhaps underlying the red

Coaly shale
and limestone.

shales, is a coal seam which has been worked in a shaft*. At the limestone the rocks dip down stream at a very high angle, but a short distance from it they again dip up stream, and the grey rocks would thus underlie the red, as at Riversdale and Salmon River. In Canoe Brook, the red rocks are also well exposed, as shown on the map.

Upper North
River.

Contact with
igneous rocks.

Earltown.

New Annan.

In the river, where it follows the Earltown road, between Upper North River and Nuttby, the flinty rocks succeed the conglomerate and Carboniferous grit about 240 yards above the bridge on the road to the McKenzie settlement. Here they are light grey, flinty, sparkling sandstone or quartzite, with reddish bands, greatly altered, followed by greenish, more argillaceous rocks, flinty and porcellaneous, full of reticulations of quartz. Then, at a little cascade, greenish sandstone is seen within four feet of a granular chloritic diorite of many shades of dark green, traversed by veins of epidote, and mixed with bright red syenite. The slaty rocks are half a mile wide; then comes half a mile of coarse syenite and diorite, then sedimentary rocks mixed with igneous, the former consisting of greenish-grey, flinty, nut-and-egg conglomerate, with fine, grey, rusty-weathering sandstone, succeeded by black shales with layers of bluish-grey calcareous rock, sometimes a fair limestone, and in one place eighteen inches thick. The slates show graphitized markings of plants, and perhaps belong to the lower group. Higher up are flinty bands of grey grit and of greenish and dark porcellanite, the prevailing rocks being dark shales and flags of lighter colour, often greatly contorted and in contact with greenish fine diorite, full of grains and threads of quartz. Similar rocks occupy a great breadth on the road towards Earltown. In a brook near the top of the hill they are flaggy and quartz-veined, but in the first brook flowing the other way, trap and diorite prevail, although among them are still found red flinty rocks. On the old Earltown road red syenite is the country rock for a great part of the distance from McKenzie settlement to the junction of the new road at the top of the hill, altered red argillite being, however, found three-quarters of a mile from that road; and from the junction to Nuttby post office apparently including masses of diorite. On the road towards New Annan at Kavanagh's mills, about 200 yards beyond the house, half a mile from the fork of the roads, is a mass of pinkish porphyritic felsite, but almost immediately again come in dark slates, Silurian or Devonian. Slates extend for some distance on this road, as far as the last house at the head of the brook, beyond

* Geol. Surv., Ann. Rep., Vol. I, 1885, Part E, p. 47.

which rusty-weathering porphyritic felsite, dark diorite and black and grey trap extend to Kavanagh's mills.

In the west branch of North River, above the bridge at the Presbyterian church on the Tatamagouche road, blackish shales are succeeded by reddish and greenish sandstone and shale, with a few bands of ironstone, again succeeded by greenish and grey and reddish argillaceous shale, with layers of compact, flinty sandstone or quartzite. At one point a light grey sandstone includes a patch of pea-and-nut conglomerate and of limestone conglomerate, while higher up a dark grey underclay is interstratified with the greenish shales and with coarse grey sandstone, full of small pebbles of white quartz. Among these rocks are many carbonized plants. Then come rusty, coarse sandstones, with a coaly band, fifteen feet thick, consisting for the most part of carbonaceous shale, with thin layers of shaly coal and many irregular layers and nodules of ironstone. An upright tree one foot in diameter is found in connection with the coal seam. Then come coarse and fine sandstones, with pebbly patches, dark shale and greenish-grey shale. Some of these coarse beds may belong to the higher conglomerate series, brought in by faults or unconformity. Above a band of newer conglomerate come grey flinty sandstones and shales like those of Riversdale. Then for some distance below the mill at McCallum Settlement is a coarse reddish conglomerate containing pebbles of the Devonian and igneous rocks. But above the road at this settlement these higher rocks are succeeded by the diorites and reddish-grey, rubbly, flinty quartzite and altered slates, which here include a limestone, the contact of which with the igneous rocks is described elsewhere. The quartzites in thick beds dip $123^{\circ} < 85^{\circ}$ near the contact. After more than a mile of diorite and syenite in the river comes another patch of altered sedimentary rocks, more than half a mile wide, immediately above a saw-mill. These consist of light pea-green, bottle-green and dark bluish-grey nut-and-egg conglomerate, with bands of fine grit and sandstone, patches of shale like that of Baxter Brook, and compact quartzofelspathic sandstone. The pebbles are of porphyritic felsite, quartz and other rocks, but none of the syenite and diorite with which they are in contact. Then follow dark grey, flinty quartzite and conglomerate, in colour and texture very like that of Cape George, but also reddish, with pebbles of red syenite, but for the most part of altered quartzite. These rocks have blotches of rusty-weathering limestone and one bed four feet thick of whitish-grey crystalline limestone or dolomite, succeeded immediately by red slate and conglomerate with many veins of crystalline quartz, which cut both

Fossil plants
near igneous
rocks.

pebbles and matrix. Then a greenish, slaty, fine sandstone shows black graphitized markings of plants; and dark grey slaty shales higher up, associated with flinty grit and sandstone, are full of markings of minute plants and of broad *Cordaites*. Some of the shales are fit for whetstones. The grit resembles that seen lower down near the coal, but is of course much more altered. Dark slates and rusty calcareous flags are again cut off by light greenish trappean rocks, granular quartz-felsite, fragmental and porphyritic, mixed with greenish diorite and small blotches of red syenite; but higher up, immediately below the bridge where this stream crosses the Tatamagouche road, dark bluish-grey slates are again present.

The rocks, which begin almost immediately below the little branch from the lake on the west side below McCallum settlement, are probably those of Union. The grey sandstones and grits underlying are probably equivalent to those of the middle branch. Below them is a band of rusty conglomerate, loose in texture, like that of McCallum's mill, composed of felsitic and quartzose rocks; this is Carboniferous and is underlaid at a little brook from the right, by dark shales containing coaly matter, and by more rusty grit and conglomerate, the river falling over rocky cascades. Then follow grits to a brook from the right, below which alternations of grit and black shale dip up stream. Then light grey, flinty, syenitic grit, with layers of black shale, occur on a roll. The outcrops are far apart. Lower down is an extraordinary thickness of grey, fine, flinty sandstone and slaty flags.

Coalmine
Brook.

Dykes.

In Coalmine Brook, reddish, very flinty, micaceous sandstone and rusty-grey, rubbly, compact rocks, greatly metamorphosed, come against the coal-bearing rocks by a fault. The red rocks predominate and have green spots, with specular iron in the joints, like the rocks of the manganese mines near Valley. Higher up, are dark slates in contact with light grey and greenish, granular, syenitic rock; and wedges of light greenish-grey trap penetrate the argillite. Above a mass of syenite and diorite, reddish, micaceous, flinty argillite is again in place at the head of the brook near the old Tatamagouche road. On this old road among the igneous rocks are many outcrops of altered sedimentary strata shown on the map.

Belmont.

In Beaver Brook above Belmont, are only a few obscure outcrops of grey shale, flaggy, flinty sandstone and other rocks perhaps of this group. In the west branch of Baird Brook are reddish, greenish and grey, mottled, somewhat crumbly shales, with greatly contorted dip.

A large proportion of the rocks of Chiganois and Folly Rivers and of the streams of East Folly Mountain belong to this group, but they are so intermixed with the others by frequent foldings that it has been found more convenient to describe them with these latter. And the same rule will be followed with regard to such rocks of the lower group as occupy small areas among the red rocks in the country west of Folly River.

About 330 yards north of the road-crossing below the foot of Folly Lake. Folly Lake, a large brook from the westward crosses the Inter-colonial railway, and up it a logging sluice has been laid for about one mile and a half to a mill. At this mill are reddish and greenish, flinty, banded, altered rocks, followed down stream by light green and dark bluish-grey, flinty, compact slates in contact with a massive dark magnetic diorite. In falls and rapids further down there are flinty slates, almost gneissic, with included irregular masses of diorite in the bedding, the gneissic rocks carrying veins and blotches of quartz and epidote; and light-coloured and rusty quartzites or greatly altered fine sandstones and schistose argillites, intermixed with epidotic diorite and compact quartz-felsite, extend to the cascade, about thirty-five feet high, immediately above the bridge on the railway, at which diorite, veined with syenite, is well exposed.

In the gorge of the east branch of Great Village River below the mouth of the tributary mentioned on page 40, are cliffs of massive reddish syenite, quartz-felsite and diorite, among which lie greenish more or less schistose rocks, chloritic, dioritic and quartzose, dipping $167^{\circ} < 80^{\circ}$, with small veins, layers and blotches of quartz; succeeded a few yards down stream by well-layered, flinty quartzites and splintery slates with the same dip, coherent and strongly bound together, interrupted again by greenish calcareous, chloritic diorite, followed among the falls of a wild gorge by reddish and grey, compact, syenitic rock. Below the foot of this gorge, about 750 yards above the dam for the Londonderry company's sluice, the igneous rocks no longer predominate, but are replaced by those of the iron ore series, presenting purplish altered slate or quartzite, of considerable thickness, among greenish and grey and cream-coloured rusty-weathering quartzite. About forty yards below the lowest of a succession of fine falls are dark bluish-grey slaty layers which ought to yield fossil plants.

Between the falls and the overlap of the Carboniferous at the pond at the rolling mills, are occasional outcrops of cream-coloured, greenish and red, mottled, micaceous, very fine rocks. The conglomerate is reddish, contains pebbles of all these rocks, and its

Great Village
River.

Contact with
Carboniferous

contact is well seen in the brook which here enters the river from the eastward, nearly parallel with the Base-line road.

Above the tributary, the river shows only small detached outcrops of greenish, flinty, layered quartzite or gneiss and slate, which occur for only a short distance up, red syenite and epidotic chloritic dark diorite, often with thick and thin banding or jointing, and with masses of whitish nearly pure quartz, extending to the head of the river, sometimes one sometimes the other predominating, the diorite being blotched and veined with syenite in very many instances. In one of the branches is an interesting "pudding-stone" consisting of a paste of reddish and whitish syenite, in which are pebbles? three inches and downward, of dark greenish fine diorite; and in the immediate vicinity is a jointed diorite veined with syenite.

West Branch
of Great Vil-
lage River.

Up stream from the nearly vertical exposures of Carboniferous sandstone, shale and conglomerate of the neighbourhood of the Base-line road, the west branch of Great Village River* exposes grey slate and quartzite, bluish and grey fissile, ferruginous, unctuous slates, with small veins of quartz and ankerite.

Londonderry
iron mines.

At the wooden bridge at the falls, the rocks are more or less massive, rubbly, full of ankerite in spots, blotches and minute veins. They dip up stream, are sometimes blue or lilac, but generally cream-coloured, grey or greenish. Where the gorge begins, there is a band of blackish, slaty, veined argillite. Opposite the old charcoal-furnace, excavations have been made and considerable quantity of white ore or carbonate extracted from the hill on the west. At the first dam above are greenish argillites, followed up stream by purple siliceous argillite and grey sandstone to the iron bridge on the Cumberland road, where diorites occur among the bedded rocks. Then for a considerable distance follow alternations of quartz-veined bedded quartzites, micaceous schist and hornblende-schist and diorite, followed by syenite with gneissic foliation and by mixtures of the two rocks which extend towards the head of this branch of the river.

Cook's Brook.

In Cook's Brook, west of Great Village River† immediately above the Base-line road are dark graphitic slates, full of veins of ankerite, specular iron and limonite and too twisted to show fossils; succeeded up stream by grey and greenish and cream-coloured, rusty-weathering rocks, sometimes soft and argillaceous, sometimes flinty and quartzose. Among the grey rocks are blotches of plum-coloured sandstone and shale. About 300

* Acadian Geol., p. 582.

† Geol. Survey Rep. for 1872-73, p. 23.

yards above the Base-line road is a band of blackish, mica- Fossil plants.
 ceous, sandy slate, marked with narrow impressions of stems
 of plants. Up stream, greenish and grey softshales are succeeded by
 greenish-grey, massive, compact, flinty argillite and sandstone or
 quartzite, spotted and veined with specular iron, at one time largely Iron mines.
 mined by two long tunnels driven into the steep banks on opposite
 sides. In a pit sunk in 1890 in the bed of the brook by Ned Lan-
 gille and others, specular iron and ankerite were found in a vein,
 said to be from two to five feet thick, running up stream between the
 tunnels and perhaps on the line of the old workings higher up,
 above which a grey and greenish-grey, massive, quartz-veined, flinty
 sandstone or quartzite occupies the brook, the pasture land at its
 head and the hillside as far as the river.

At the head of Martin's Brook, dark fine diorite is in contact with Martin's
 grey and light-coloured, altered, massive quartzite and purplish Brook.
 argillite. A short distance down stream, purple argillites are inter-
 stratified with greatly altered, cream-coloured, grey, purple and
 olive argillite and quartzite, resembling the rocks of Baxter Brook ;
 and near the road is one of the deepest shafts on the iron ore veins
 of the West Mines.

In Cumberland (or Spencer) Brook the iron ore rocks again Cumberland
 succeed the Carboniferous above the Base-line road, the first seen Brook.
 being black graphitic slates or shales, succeeded at a fall fifteen feet
 high, by reddish porcellanous argillite in contact with dark bottle-
 green, flinty, massive, more or less porcellanous rock, in part
 resembling volcanic breccia, stained with hematite and chlorite,
 like a rock seen in Martin's Brook, and with compact flinty por-
 phyrritic quartz-felsite. Higher up stream are the light grey
 quartzites, associated with grey, greenish, yellow and purple
 quartzite, which have been largely mined ; and, at a fork of three
 branches, with greenish-grey and dark shales and flags which show
 blackened markings almost certainly of fossil plants. In the east
 branch are light greenish and grey rusty-weathering shale and Igneous rocks.
 flinty sandstone, succeeded by dark greenish dioritic rocks, causing
 cascades, and by mixtures of altered flaggy sandstone and purplish
 porcellanous argillite, with dark hornblende-rock and schistose,
 chloritic diorite, blotched with red syenite, which continue to the
 head of the brook. Similar mixtures of sedimentary and igneous
 rocks are found in the middle branch, which follows the Cumber-
 land road. In the west branch a level has been driven in fine,
 rusty-weathering quartzose rocks, veined with ankerite, from
 which a considerable quantity of ore seems to have been taken.

The rocks of Matheson Brook require no special mention, they resemble those found in other streams of the neighbourhood.

Portapique
River.

One of the finest exposures of Devonian rocks is found in the gorge of the Portapique River after passing, on the lower part of the river, red Triassic sandstone and conglomerate and nearly vertical outcrops of grey and red Carboniferous sandstone and shale. The dark shales, flinty sandstones and quartzites appear in cliffs, and among certain coarse grey sandstones, in black and grey, lenticular, mottled beds on the left bank, a large quantity of carbonized vegetable debris was found. These lenticular beds resemble underclays, but are greatly altered. The associated dark shales yielded only obscure fragments of plants, but closer examination might lead to other discoveries. The fossil-bearing beds have veins of ankerite and limonite, and are strikingly like the dark sandstone of the west branch of North River, above the Earltown road. At the mouth of Otter Lake Brook, diorite is in contact with gneiss or greatly altered micaceous sandstone, almost certainly that seen below, and similar alternations extend for a considerable distance up stream. Between Sutherland Lake and the river stratified rocks in abundance are met with.

Plantremains.

Big Bass
river.

For some distance above the bridge over Big Bass River on the back road the interval is low and no rocks are exposed. Then follows an outcrop of light grey, soft, Triassic trap, in part amygdaloidal, with black spots, weathering or separating into more or less globular masses. The next rocks up stream are grey and reddish broken sandstones and shales, in all probability Carboniferous, greatly tilted and broken, among which a bed of grey thick-bedded, unusually fine sandstone has been quarried for building; it shows numerous markings of plants, streaks of mineral charcoal and coal, contains patches of conglomerate and grit and bands of light grey concretionary limestone-conglomerate. These are succeeded in cliffs in a gorge by quartzites of the iron ore series, associated with syenite and diorite. At the junction is a loop of the river round a little island of Devonian rock. Higher up occur alternations which are shown on the map.

Devonian and
Carboniferous

Birch Hill
boss.

Near the shore east of this river, the prevailing Triassic of the neighbourhood is interrupted by a knob called Birch Hill, in which are good outcrops of the red quartzites of Union, containing quartz veins and traces of specular iron ore in small veins and blotches. These veins have been prospected in little pits, one of which is twenty or twenty-five feet deep, but no promising quantity of the ore seems to have been obtained.

Little Bass River at and below the run which goes to Bass River, shows outcrops of grey and reddish, coarse and fine, rubbly, probably Carboniferous sandstone, with bands of reddish and dark grey crumbly argillite, with very small veins of calcspar and limonite, interstratified with bands of limestone-conglomerate passing into a pure limestone, among the pebbles of which are many of red syenite. The dip is upstream nearly to the contact with the older rocks, the last beds consisting of coarse conglomerate, with layers of reddish and grey, fine, flaggy grit and sandstone, in falls; the pebbles being of syenite, diorite, quartzite, and other rocks of the mountain. There is a concealed gap of only seven yards between this and a dark argillite with lenticular masses of dirty limestone—the first of the Devonian—beyond which is a band of dark grey, coarse, Carboniferous conglomerate which occupies fifteen yards in the brook, above which, however, there is no break in the continuity of the iron ore series, as developed at the Londonderry mines, their identity with which is indisputable. Some of the grey and greenish olivaceous shales contain obscure impressions of plants, and certain grey sandstones look like underclay, while higher are the grey and rusty quartzites of Cook's and Martin's Brooks, full of grains of specular iron. Greenish and grey and purple sedimentary rocks extend thence to the great fall, at which flinty syenite, diorite and other igneous rocks show a sort of rough bedding, like that of Economy Falls and seem to have greatly altered the sedimentary rocks. West of the falls, on the hill in McLellan's clearing, are outcrops of dark diorite, in part gneissoid, followed nearer the house by a narrow belt of dark grey Devonian slate, and that by reddish coarse and fine Carboniferous rocks in which is the small coal seam worked at Robert Young's.

Little Bass
River.

Contact of
Carboniferous

Carboniferous
with coal.

On the back road in the next brook, which crosses west of the school, Triassic conglomerate extends nearly up to the saw-mill, about 60 paces below which, however, in a run from the westward, and again about 200 paces below it, is a mass of light grey vesicular trap, mixed with the conglomerate which seems to contain pebbles or boulders of it. At the mill, grey and greenish rusty sandstone and shale, with red bands, dip nearly vertically down stream; while half way up the mill-pond the dip is very steepy up stream. These rocks resemble the coal-bearing strata at Young's, and are probably Carboniferous.

In the next brook to the westward, grey and reddish Carboniferous flags and sandstones show a nearly vertical dip up stream, are associated with coarse grit and conglomerate, containing pebbles of the iron ore series, and are succeeded, near the head of the brook,

by grey Devonian quartzites. Below the road, Triassic conglomerate and sandstone are exposed to the fork of the brook from the school; but on the road, a short distance to the southward, these are succeeded by grey, flaggy sandstone and argillaceous shales, like those of Economy River, which extend nearly to the shore and are again succeeded by Triassic.

In the second brook to the eastward of this road, at a bend from the eastward, not far from the shore, Triassic sandstone grit and conglomerate, with impure argillaceous limestone, dip eastward 38° , in high sloping cliffs, immediately behind which lie unconformably blackish shales, holding *Naiadites*, *Cythere* and other fossils, strongly resembling the dark shales of Port Hastings, and other points on the Strait of Canso, interstratified with red shales and very coherent, micaceous sandstone or quartzite.

Fossil shells.

The outcrops of blackish shales, holding *Naiadites*, *Cythere* and other fossils, associated with red shales, which include bands of very coherent micaceous sandstone or quartzite, seen below the Triassic in the little brooks on the shore towards Economy River, are probably Devonian.

Fossil plants.

The rocks of the lower part of Economy River have been described by Dr. Ellis*, and a careful survey of the relations of the fossiliferous, quartz-veined slates to the syenites and diorites of the gorge above the falls was made in 1877 by Mr. Scott Barlow, who discovered in the former indistinct vegetable fragments and obscure *Orthis*-like forms of the gold mine at the mouth of Peleg Brook. Immediately above Economy Falls are great cliffs of greenish argillite, passing into gneissic rock with coarse diorite, syenite and compact quartz-felsite, which prevail thence for two miles to the fork of the river, interrupted only by patches of greenish-grey slate. At the fork are cliffs of grey, massive, compact or obscurely granular quartz-felsite. Above it is the following succession measured along the windings of the west branch, which will give some idea of the mode of occurrence, the exposures being nearly continuous:—

Section of
West Branch
Economy
River.

Paces above the
Fork.

200	Dark dioritic rocks among the prevailing felsite and quartz-felsite.
700	Felsite and quartz-felsite, including a patch of bluish sedimentary rock or slate.
1000	Reddish, compact, flinty quartz-felsite, at a little brook from the west.
1300	Red, jointed, compact felsite and quartz-felsite, with grains of hornblende; sometimes fine-grained.
1387	A large outcrop of slates begins. Greenish and bluish-grey, highly altered, jointed, broken slates.

* Geol. Surv. Rep. for 1885, p. 49 E.

Paces above the
Fork.

- 1396 The slates are associated with flinty, porcellanous sandstone or quartzite, containing grains of pyrite.
- 1482 Slates with bands of quartzite; small veins of quartz. Certain dark bluish-grey rusty beds, very like the darker portion of the Londonderry iron ore series; rubbly, with the bedding obscured by cleavage. In the planes both of jointing and bedding are films of specular iron ore. Certain bands have a peculiar appearance, as of altered underclay, so often noticed in the iron ore series. One small patch of red syenite, like a vein in the slates. Syenite dyke.
- 1494 Light grey, cream-coloured and rusty slates, containing veins of specular iron $\frac{1}{4}$ of an inch thick. Specular iron ore.
- 1620 Rusty slates continuous to this point. Then an exposure of dark bluish-grey slate.
- 1700 Greenish grey, schistose quartzo-felspathic rock which may be of igneous origin.
- 1790 Reddish and grey, massive, compact, flinty felsite.
- 1797 Greenish-grey, flinty, porcellanous, slaty argillite.
- 1865 Chiefly slates, to a small logging-dam, 6-feet fall.
- 1921 Greenish slates, to another dam and fall.
- 2080 Reddish and grey, compact, flinty, porphyritic felsite, with blotches of quartz, exposed in a cliff. Then a rough stretch of the river, showing alternations of igneous rocks with slates and greenish quartzites.
- 2380 Greenish slaty porcellanites, at a little brook from the eastward.
- 2457 Greenish slates at a dam.
- 2620 Greenish slates cut by a greenish-black fine hornblende-rock.
- 2650 A cliff on the left bank shows a few obscure markings of plants in greenish-grey, evenly bedded, flinty shales and quartzites.
- 2745 to 2760 Blackish, graphitic, slaty shales, in a cliff on the right bank, yield plants among which Dr. Ami has detected *Cyclopteris* (*Aneimites*) *obtusa** and obscure impressions of *Orthis*? in abundance. Fossil plants
- 2855 & 2916 Blackish quartz-veined slates, well exposed.
- 2970 Greenish, flinty, greatly altered slate.
- 3026 Light grey and rusty slate and quartzite with quartz veins.
- 3210 Greenish coherent slate, dipping steeply down stream at a little brook from the eastward.
- 3220 Darker, somewhat papery slates or shales.
- 3446 Light and dark shaly and slaty argillites, with very few hard bands, at the mouth of Peleg Brook.
- 3490 Very black shales.
- 3510 Slates lighter in colour.
- 3533 & 3590 Greenish, rusty slate, with bands of quartz, at two little dams.
- 3730 Greenish, more flinty and quartzose rocks. Outcrops now become fewer.
- 3850 Greenish, flinty quartzite in thick beds. A little brook from the eastward.

* Dawson's Fossil Plants of the Devonian and Upper Silurian, p. 45.

Faces above the
Fork.

- | | |
|-------------|---|
| 4360 | Greenish, flinty slate and sandstone at a little brook from the westward. |
| 4435 | Greenish, fine, epidotic trap or diorite begins. |
| 4483 | Greenish, reddish and purplish amygdaloid, then amygdaloid and diorite. |
| 4551 | A patch of reddish, greatly altered argillite and nut-and-egg conglomerate, containing pebbles of reddish quartzite, mixed with purplish amygdaloid. |
| 4555 | Dark green, fine, epidotic, flinty diorite. |
| 4570 & 4600 | Outcrops of grey amygdaloid and purple trap. |
| 4670 | Bridge on the road to River Philip, at a large driving-dam above the road. Outcrops of grey amygdaloid and diorite, with a small exposure of greenish, soft, slaty rock between the dam and the road. |

Similar alternations are found on the road from this dam to the settlement of Ebbtown, while to the north past Simpson Lake the blocks and cliffs seem to indicate principally red syenite.

Economy
Falls.

At the foot of Economy Falls* the rock seems to be igneous, but has an appearance of being in steeply inclined thick beds. Down stream, however, reddish or indian-red Carboniferous conglomerate, with layers of grit and sandstone, occupies a considerable breadth in the river, dipping first southerly, then vertical and very highly inclined, below which is a great breadth of dark grey and rusty sandstone and argillaceous shale containing ironstone nodules, with bands of pebbly grit, resembling coal measures or the rocks of Debert, the high variable dip indicating faults. At the turn of the river to westward these rocks are succeeded by cliffs of brick-red, coarse, pebbly grit, probably Triassic, dipping downstream at a low angle, but afterwards steeper and variable, which occupies the river to the bridge on the road to Beaver Meadow, where the Triassic gives place to rubbly rocks, resembling those of Union, which contain a few greenish and bluish-grey bands, dipping at a high variable angle. Lower down the road follows the river which exposes dark and light grey rocks, which may represent the grey and black slates of Peleg Brook, and extend nearly to the iron bridge on the shore road, where Triassic rocks are again in place and the land is low and good.

Rocks probably equivalent to the Devonian of Union are also seen on the road from the post office to Ebbtown as far as the top of the hill, beyond which the debris indicates Carboniferous Triassic.

Slates similar to those just described in the west branch occur in the Chain Lakes Brook and other tributaries of the east branch

* Acadian Geol., p. 557.

of Economy River. In Murphy Brook is a great breadth of dark slates, some beds of which are "full of leaf stalks of ferns, but only remnants of fronds. The stalks are like those of *Aneimites Acadica* of the Lower Carboniferous."* Fossil plants.

Kerr Brook and all the rivers of Five Islands to the westward show fine alternations of Devonian sediments and igneous rocks. The altered shales and quartzites of the North River, containing traces of *Cordaites* and other plants, are described by Dr. Ells as Devonian, as including the Londonderry Mines series†, and as identical with the quartzite series south of Truro. No line of separation between them and the iron ore series seems here possible; on the contrary the greatly altered rocks of the latter are sometimes succeeded by less altered beds yielding fossils, and in most cases the greatly altered rocks are immediately in contact with diorite and syenite, which appear to have been the cause of their alteration. North River of Five Islands.

The various shales and quartzites of the west branch of Economy River are repeated in Harrington River,‡ and also on the road to the pretty little settlement of Lynn. Among the shales of the lower part of the river were found "fragments apparently of crustaceans—one may be an *Estheria*—and a small Cyclopterid leaf, resembling a *Cardiopteris* of the millstone grit, but very imperfect."§ Harrington River.
Fossils.

On Harrington River between the mouth of Boyd Brook and the shore road, light grey sandstone or quartzite is interstratified with blackish argillaceous shales, with greenish shales and underclays, the shales containing *Cordaites* and other fossil plants, layers and nodules of ironstone, and dipping steeply down stream. Above Boyd Brook for about 1,000 paces to an old dam, the black shales, besides the usual abundance of *Cordaites* and *Calamites*, show delicate branching ferns and the crustaceans mentioned above, and include a coal layer. About 75 paces above this dam they are more altered and in contact with greenish granular, coarse and schistose, syenitic or dioritic rock, containing many grains of specular iron. For 250 paces higher the rocks are chiefly cream-coloured quartzites and shales, traversed by thin veins of claystone, with small porphyritic crystals, succeeded by a small dyke of massive crystalline diorite, on both sides of which are reddish compact quartz-felsite and syenite. Alternations of sedimentary and igneous rocks, found higher, contain veins or blotches of quartz and calcspar which have been Coal.
Dykes.

* Determined by Sir J. W. Dawson, from a few little pieces sent to him, but large slabs covered with these impressions are in the Museum.

† Geol. Surv., Ann. Rep., vol. I., 1885, pp. 50 and 53 E.

‡ Ibid., p. 50 E; Acadian Geology, p. 264.

§ Determined by Sir J. W. Dawson.

prospected, some of the red and green slates resembling those at the base of the Union series. Near the fork are reddish flinty quartz-felsite and felsite with apparently a north-easterly dip.

Shore of
Minas Basin.

From the post office at Lower Five Islands, the road towards Parrsboro' runs across a plain and shows only debris of grey and bluish-grey flinty rocks as far as the bridge over Harrington River. Immediately below this bridge, on the right bank of the river, are outcrops of grey, flinty, jointed sandstone or quartzite, forming a prominent hill, interstratified with grey argillite with impressions of fossil plants. The dip seems to be $62^\circ < 17^\circ$, which is also the direction of certain striæ, which may be glacial, on a smooth face of the rock on the river bank. About 150 paces below an old dam, darkshales and grey, flinty flags dip $60^\circ < 67^\circ$ and a few paces lower are more nearly vertical; they resemble the rocks of Riversdale and are well exposed to within 150 paces from the mouth of the river, where they are succeeded by indian-red, soft, marly, Triassic sandstone and conglomerate, with many concretionary, nodular patches, associated, a few feet further along the shore, with brick-red sandstone which occupies the shore for some distance; the Devonian rocks coming very nearly upon the shore in several of the small brooks. The dip of the Devonian a short distance from the contact is $27^\circ < 67^\circ$; that of the Trias is westerly at a low obscure angle.

Contact of
Triassic.

Blue Sack.

The contact of the Triassic sandstone and Devonian is also seen on the road from Harrington River to Blue Sack, which comes to the shore at the mouth of a little brook, a short distance west of which the high cliffs expose reddish and grey soft sandstone, somewhat altered, mixed with globular masses of trap. Immediately to the westward at the mouth of another little brook, a breccia of grey flinty rock with a paste of red gypsum perhaps indicates a Carboniferous outlier. Here the Devonian rocks also come to tide-water, although at ten paces further, Triassic sandstone is on the shore, mixed, at 125 paces, with trap-conglomerate overlaid by concretionary calcareous marl. The high cliffs of red Triassic rock with bands of greenish-grey coarse sandstone which then fringe the shore for a great distance, produce a fine scenic contrast with the thick layer of dark boulder-clay—composed of debris of the dark shales or slates of the Devonian—which in most places caps the cliffs or falls in great masses to the beach. Then come cliffs of the Riversdale rocks, cut by small veins of quartz and ankerite, contorted and jointed, full of fossil plants, black shales predominating as far as the mouth of Moose Creek, and beyond it interstratified with flinty flags. Past Moose River, which has a narrow rocky mouth, grey, rusty-weathering quartzites, in thick layers and wavy bands, with

Moose Creek
and River.

a large quantity of comminuted carbonaceous matter, include only small beds of dark shale. Not only is iron ore present in the joints and in veins, but the dark shales have also many layers and nodules of clay ironstones. The bright green massive rocks immediately west of Moose River are like those of the shore west of Clarke Head, of Port Greville and also like those which overlies the dark strata of Riversdale; and above them seem to come the red rocks of Wasson Brook and Swan Creek, above which lie unconformably the gypsum and limestone series of Clarke Head. At 310 paces from the river, dark bottle-green and red trap—which has been seen below high water for some distance back—mixed with red Triassic sandstone, succeeds Devonian rocks, which are again, however, on the beach at 83 paces further; and similar alternations are found beyond as far as Wasson's Bluff. The traps are here in part blackish hornblende rocks, in part roughly columnar. In some places the Triassic sediments dip into the basin at a very low angle; but the number of points at which the ends of the beds strike against the black shales or appear to dip under them where they are all but in contact seems to indicate great faults which affect even the Triassic and are not apparently dependent on the intrusion of the trap.

Iron ore.
Carboniferous
of Clarke
Head.

Near Moose Creek the Devonian rocks come to the shore of Minas Basin and to the westward are exposed on the coast, as well as up the rivers and brooks, in contact with Triassic sandstones and traps and with Carboniferous limestone, so that several fine examples of the unconformable superposition of the limestone upon the Devonian can be distinctly seen.

From Moose River mouth westward along the shore-road are outcrops of light grey flinty sandstone or quartzite and dark shales also exposed in two small brooks nearly to the shore. Opposite the Two Islands (the Brothers) dark Triassic trap is in the road, while in a little brook north of it there are ledges of quartzite, and westward along the shore and in the brooks they alternate with red Triassic sandstone, as shown on the map. Up the brooks east of Wasson's, the red rock of Union are exposed. On the post-road, from the bridge on Parrsboro' River for some distance towards Five Islands only drift is seen; then, near the top of the hill, dark and light grey flinty rocks, like those of Moose River, and probably Devonian.

At the mouth of Phinney's Brook are outcrops of slate like that of the East River of Pictou at Sunnybrae, netted with small veins of quartz, calcspar, ankerite, &c., with beds of compact quartzite. Immediately above these lies a great mass of limestone, rusty, bluish-grey and whitish, the upper part white, brecciated, apparently

Phinney's
Brook.

Crystalline
limestone.

intimately associated with the slates, which at one point it seems to vein; it is crystalline and full of spots of pyrite, shows a little arch and cave, and is interstratified with greenish brecciated sandstone containing specular iron. In contact with these rocks to the eastward are dark, pearly slates with bands of quartzite; then an interval of drift, succeeded by greenish and cream-coloured rocks, like those of the pinnacle west of Clarke's Head—the olivaceous rocks of Londonderry—soft and hard, rubbly, with brecciated, rusty-weathering veins. At a little brook are black twisted slates; then another mass of brecciated limestone, often crystalline, possibly a vein, but more like a mass irregularly bedded among the black slates. Pearly, soft, graphitic slates then stretch along the shore, weathering so as to look like the outcrop of a great seam of coal, crumpled, wrinkled, polished, cleaved and full of veins; they do not seem to promise fossils.

Natural arches
and dykes.

Henning's
Brook.

Brookville.

About 300 paces before reaching a little island of rock and natural arch is a small outcrop of greenish, fine diorite, succeeded, 80 paces nearer the arch, by dark, flinty, altered slate or porcellanite. The arch itself is of similar porcellanite with an immense number of quartz veins. Past it is a little brook and beyond this—all the shore being of black slate—another, called Henning's Brook, on the left bank of which the black slate contains lenticular masses of breccia, also a mixed rock containing black slate, quartzite, limestone and lenticular masses of schistose rock. Then follow greenish rocks, slaty but otherwise like the foregoing, in a great thickness of dark slate. Dark diorite and fragmental rock, on the beach below high water, stretch past the first of the Brookville brooks to rise into a cliff at the Big Rock; but in the bank the dark slates, with light grey and greenish-grey layers of soapy rock, extend to the next natural arch. Immediately past De Wolf Brook are fine cliffs of greenish, brecciated, rather massive rocks, apparently largely dioritic, behind a mass of which, in a small cove, are reddish and greenish, mottled, rubbly slates; succeeded by reddish, greenish, cream-coloured and black slates, greatly mixed and like rocks near the pinnacle. The Big Rock projects nearly to low-water mark and consists of red, compact felsite and quartz-felsite, in contact with which are the black slates which stretch along the shore past four little brooks, and contain crystals and aggregations of pyrite. Soft, soapy, graphitic matter is found in a hole at the Big Rock.

Port Greville.

The rocks of De Wolf Brook, below the coal, are described elsewhere. Along the shore from Ward Brook to the mouth of Greville River and up the left bank to the road black slates prevail; but

from this point to the mouth of Fox River only banks of gravel are found; at the mouth of Fox River is a deposit of fine sandstone, whereas, immediately beyond, the Carboniferous rocks are exposed. Carboniferous

In Swan Brook, above the road, are light grey and whitish Devonian sandstone or quartzite and argillite, succeeded up stream by light grey, somewhat soft, flaggy sandstone, forming a rocky country, nearly barren; and by dark and light grey, sandy and argillaceous shales and flinty sandstone, with small veins of quartz, dipping $207^{\circ} < 70^{\circ}$, and resembling the rocks of the North and Harrington Rivers. Below the road the brook comes to tide-water over a cliff of dark Triassic trap, in part crumbly. Swan Brook.

The Devonian rocks of the Parrsboro' River are described with the Carboniferous. Those near the pier are red and green and grey, rippled, crumpled flags, with a large proportion of argillite, underlaid by dark shales and flags, like those of Horton Bluff, containing layers of limestone and of fine calcareous grit, as well as blackish bands full of broken plants. Parrsboro River.

G.—CARBONIFEROUS.

Unlike the Devonian, the continuity of which is scarcely broken, the Carboniferous rocks occur in detached areas, as sketched on page 4. These will be described under the following groups, the general characters of which have been given fully in previous reports:

G. 1m.—Carboniferous conglomerate.

G. 1.—Carboniferous limestone.

G. 2.—Millstone grit.

G. 3.—Coal measures.

G. 1.—Carboniferous conglomerate.

G. 1m.—Carboniferous conglomerate.

Following Dr. Ells and including in this formation the coarse sandstones and shales, with small seams of coal, which lie immediately south of the Cobequid Hills, (from which, however, he seems disposed to exclude certain grey rocks of Folly River)* the principal areas may be enumerated as follows:—1. Small doubtful patches on the east side of the East River of Pictou. Areas.
2. The detached areas north of the railway west of West River station. 3. A small narrow belt along the Truro road west of Saltsprings. 4. The patches of the Stewiacke Valley, including the conglomerate in which search has been made for gold

* Geol. Surv., Ann. Rep. for 1885, vol. I., p. 47 E.

at Brookfield. 5. The long strip of irregular width on the south side of the Cobequid Hills, which occupies the railway between the Triassic of Folly River bridge and the Devonian of the foot of Folly Lake.

Pictou coal-field.

1. *Basal Carboniferous rocks east of the East River of Pictou.*—Among the greatly faulted rocks which surround the Pictou coal-field the conglomerate east of Sutherland's River, in McLaurin's Brook, down stream from the iron mines, is perhaps of this age. The pebbles are principally of Devonian quartzite, sometimes three inches in diameter; and among it are a few grey beds. It is seen on a line of fault near the contact with the Silurian. In the vicinity is a greenish and reddish, impure, concretionary limestone, like that found at Park's Mills. Similar conglomerate occupies a considerable breadth in Sutherland's River between the north fault and Park's Mills, and extends up along McLean's Brook, where it is associated with or overlaid by gypsum and by the limestone of McDonald's.* This conglomerate is seen in the cuttings on the new road between the Vale colliery and McPherson's Mills. It is reddish, greenish and grey, and contains beds of red and grey sandstone, as that of Sutherland's River, marked with plants. The reddish, flinty, micaceous sandstone of the mill-dam may possibly be lower. The limestone has been somewhat largely quarried.

McGregor's Mountain.

On McGregor's Mountain a conglomerate, seen in contact with trap and Devonian sedimentary rock south of the south fault, is perhaps also of this age; and large outcrops of conglomerate are also found near Churchville.

2. and 3. *Basal Carboniferous Rocks of West River of Pictou and of the Truro Road.*—Above the railway near the 30th mile-post and on it east of West River station are large blocks of conglomerate, perhaps indicating a patch among the Devonian of the neighbourhood. Possibly a basin of Carboniferous may at one time have extended up the river to this point.

Watervale.

The reddish, grey and whitish soft sandstone, grit and conglomerate, west of Watervale, are well seen on the road up the large brook, as far as the crossing of this brook, and on those about Botany Bay Brook. They are like the rocks of Londonderry station, and like those of the Telegraph road between Mount Thom and Salt-springs, from which they are separated by a ridge of Devonian which extends nearly to the valley of the Telegraph road at Reid's. On this road to the westward is a cliff of grey conglomerate, loose in texture, which seems to lie in patches in the valley, and to be

* Geol. Surv., Rep. of Progress, 1866-69, p. 39.

composed of fragments of the greenish Devonian slates of the vicinity, and of reddish-grey coarse syenite. From the second house west of Reid's, and immediately past the road to Bezanson's, a wood-road running north shows blocks of reddish conglomerate and grit, as far as the crossing of the first branch of the Juniper Meadow Brook; and the outcrops here are no doubt continuous with those of the road south of Bezanson's. North from Pat McAulay's, on the track to Lippincott's old clearing, and also at other points in the vicinity, conglomerate seems to be in place beyond the red syenite.

On John McKay's track, as already stated, the barren shows blocks of reddish-grey grit and conglomerate, with pebbles as large as a hen's egg. Light grey, fine, flaggy sandstone is associated with the coarse rocks as far as the Watervale road; while on the west branch of the track the coarse rocks extend to within a quarter of a mile of McKay's, where they are succeeded by Devonian slates. In the large brook which crosses this track a few outcrops seen below the track seem to be of this age, comprising reddish-grey, fine and coarse, flaggy sandstone, indian-red soft sandstone and marl, lying at a low angle; reddish conglomerate and grit, and near the Black River, indistinct outcrops of reddish and grey fine sandstone and coarse grit. On the barrens are blocks of grey and reddish-grey, fine, flaggy, somewhat soft sandstone. But on the railway are cuttings of the flinty rocks, perhaps along one of the many faults of the district or unconformably beneath the conglomerate.

Fault or
unconformity.

Possibly some of the outcrops along the Truro road are continuous with those of Steele's (Irving's) Run, but the latter seem rather to be detached. About half a mile above Salmon River, a bank of reddish conglomerate and sandstone seems to follow the brook. The conglomerate contains pebbles of whitish quartzite and of red sandstone; it is overlaid by layers of indian-red, soft, crumbly, fine sandstone and marl. Grey, greenish and drab, fine sandstone, glistening with quartz and covered with impressions of fossil plants, occurs higher up the brook, and about one mile and a half from the river these give place to the iron ore rocks, beyond which, in a little brook from the north above the marshes, Carboniferous rocks again appear with a vertical or very steep dip, being here dirty greenish-grey, soft, rusty-weathering shales, with reddish-grey, flaggy, fine and coarse grit.

Steele's River.

On the road along Salmon River, below Jacob Fenton's, are blocks of reddish and grey, flaggy, fine and coarse sandstone.

Unless these are drift, like the numerous blocks of grey syenite and granite, they may indicate a Carboniferous outlier. Red, fine sandstones appear near the Telegraph road. On the road to Earl-town, reddish flags prevail, which may belong, however, to the red rocks of Union, as do most of the rocks of the vicinity.

Brookfield.

4. *Basal Carboniferous Rocks of the Stewiacke Valley.*—Associated with the limestone and plaster, which so largely prevail in the valley of Stewiacke River, are small areas on both sides of the basin, generally of little extent or importance, which will be described with the associated rocks. The road from Brookfield to the iron mine passes over coarse grit and grey flags. Up to the first brook on the north side of the river, above the road across the river to Johnston's, the rocks first seen are brownish or reddish, flaggy and thick-bedded sandstone and shale, interstratified with grey fine beds and with grey coarse conglomerate, made up chiefly of quartz, but having also pebbles of grey quartzite and fragments of dark slate, perhaps derived from the Riversdale rocks, and of red sandstone or quartzite, perhaps from the rocks of Union. To the head of this brook are many outcrops of grey grit and conglomerate, probably Carboniferous and not unlike rocks seen north of the Gore.

To the eastward above the mill in Bill Putnam's Brook are dark grey shales which perhaps underlie the Carboniferous limestone. At and below the dam are alternations of very flinty, coarse, quartzose grits, sandstones and shales. Down stream is a patch of coarse conglomerate which seems to contain pebbles of these flinty rocks and is perhaps Carboniferous; it extends to the boundary of the limestone and gypsum.

Goldmine Brook.

About 170 paces above the road in the Goldmine Brook, good outcrops dip $217^{\circ} < 35^{\circ}$; they show reddish conglomerate with pebbles, larger than a hen's egg, of red and white quartzite and soft argillite; sandy and argillaceous flags, apparently like the rocks described above. About 50 paces above an old mill-dam, are other outcrops of reddish flags underlaid by grey, rusty-weathering, plant-marked sandstone and grit, very micaceous and usually somewhat flaggy; associated with reddish flags. About 180 paces higher, grey, coarse quartzose grit of similar texture appears to show a south-easterly dip; and 120 higher, indian-red, micaceous, soft, argillaceous rocks dip $228^{\circ} < 65^{\circ}$. Then comes a long interval or marsh, at the end of which, about 450 above the last outcrops, the barren on the left shows blocks of grey, rusty-weathering, friable, quartzose sandstone. Then at a brook from the left near the gold mine, the dip is $227^{\circ} < 36^{\circ}$, as shown in the cliffs of light and dark grey, rusty-weathering, micaceous, sandy flags,

including bands of coarse grit and conglomerate full of pebbles of white quartz as large as a hen's egg, upon which the so-called gold mine is situated*. The pebbles of the conglomerate when not of quartz are with difficulty determinable; they may be of the whin and slate of the gold-bearing series or of the Devonian. The flags are of loose texture and do not resemble rocks older than the Carboniferous; although they may underlie the limestone and gypsum, which may be also the position of the grits and sandstones south of the Stewiacke River. Some distance above the mine, grey flags, a quarter of an inch thick and over, dip $219^{\circ} < 49^{\circ}$, well exposed in cliffs and underlaid as before by grey, pebbly, quartzose grit and conglomerate. At a little brook from the left, a band of bluish-grey argillaceous shale or flag is included among the coarse grits, and at the next cliff on the right, dark micaceous sandy flags again show layers of dark argillaceous shale, though the coarse grits greatly predominate. Cliffs of grey flags and grits alternate to the uppermost of two dams across the brook, representing a great thickness of rocks of only these two varieties. Above the dams, a long boggy meadow obscures the rock for some distance, above which are outcrops of bluish-grey, fine, jointed, striped, argillaceous sandstone, interstratified with a considerable thickness of bluish-grey argillaceous shale. Only a small exposure is seen here; but higher up stream are grey and blackish flags and grits, precisely like those of the gold mine dipping $224^{\circ} < 43^{\circ}$, extending as far as the brook shows exposures and northward to the red Devonian rocks of Little River.

5. *Basal Carboniferous Rocks of the Southern Slope of the Cobequid Hills.*—As already stated, there is nothing to fix the precise age of these rocks except their strong resemblance to the Lower Carboniferous of other localities, and as an immense thickness of them is sometimes exposed among the faults of the mountains it is not improbable, that assuming most of them to lie beneath the Carboniferous limestone and gypsum, higher beds may be brought in. And as at Parrsboro' but a small belt of conglomerate intervenes between limestone holding typical shells of the G.1. formation, it is not improbable that the latter as well as Millstone grit may be included. But the limestone is distinct at Valley, on Minas Basin, in the basins of the Stewiacke and Shubenacadie Rivers and also throughout a large portion of Hants county, so that in the absence of other evidence that of lithology will be followed. Fossil plants abound, but such evidence seems too vague and uncertain to settle the question.

* Summary Geol. Surv. Rep., 1890, p. 41.

Upper North
River.

These rocks are seen furthest east, in the various branches of Cranberry Brook, in contact with Devonian ferriferous slates. For a short distance above the bridge at Upper North River, and for more than half a mile below it, they are again in contact with the flinty rocks, from which they are separated on the north side by a fault, the course of which seems to be about east and west magnetic. They consist of reddish, somewhat crumbly egg-and-nut conglomerate, containing fragments of the rocks cut by the syenites and diorites, of reddish-grey coarse grit, and reddish, soft, crumbly argillaceous shale, not unlike the Permian rocks of the west branch of River John. They are also met with in all the little brooks of the immediate neighbourhood. In the middle branch, conglomerate is present, as already stated, for a short distance above the road, but on the hill between this settlement and McCallum's, there is apparently evidence of the want of conformity of this with the slate series, the latter appearing generally on the hill, while the conglomerate is present in both valleys. The conglomerate of the west branch of North River, near McCallum's mill, includes pebbles six inches in diameter, and is interstratified with patches of light greenish-grey, soft, coarse and fine sandstone. The cliffs above the mill-pond, however, show grey and reddish massive sandstone or quartzite, as hard and brecciated as those of Guysboro' and St. Mary's, belonging to the Devonian. The conglomerate first seen here lies at a low angle; and on the road it is exposed for at least 150 yards north of the mill.

Coalmine
Brook.

Coal.

Coalmine Brook, a tributary of this west branch, shows near its mouth, grey, greenish, rusty and reddish contorted shales and flags, the shales containing *Stigmara* and nodules of ironstone. Up stream, a grey, coarse grit contains fragments of blackish, shiny, argillaceous shale, and masses of coaly rock, lenticular, and sometimes nine inches thick, from which layers of good bituminous coal, one inch thick, may be broken; coaly matter is again found in a flinty, grey grit and pea-conglomerate, in which *Stigmara* is very abundant; and a lenticular layer of an inch and a half of bright clean coal, in grey shales full of large nodules of ironstone and interstratified with greenish and reddish, mottled, crumbly shales. The dip is variable, generally very steep. Greenish shales are found at the road to Delaney settlement. Above it, these rocks occupy a breadth of more than half a mile, with a dip increasing from an angle of 30° at the road to vertical where they come against the Devonian slates, the direction being southerly—they are grey sandstone, greenish shale and pea-and-nut conglomerate. About ten chains from the road are openings made on eighteen inches of stony coal; and about a quarter of a mile higher, flaggy, argillaceous shales include three feet at least of carbon-

Coal mine.

aceous shale, from which in places a foot of shaly coal may be obtained. Small bands of coal occur higher up in lenticular layers in the shales and in streaks in the bedding of the grey and greenish conglomerates and grits which come against the Devonian rocks 140 yards above the fork of a little branch from a lake, the two formations for a short distance keeping on opposite sides of the brook.

Some of the bands of nut-and-egg conglomerate interstratified with the grit and finer rocks of this Coalmine Brook not far above its confluence with the North River, give the key to the difficulty connected with the conglomerate and dark sandstones above Upper North River bridge in the middle branch, showing clearly that these latter belong to an older series, although at first sight it would be hard to distinguish them, the pebbles not being always distinctly identifiable, and those of the dark grey sandstone being readily confounded with those of a bottle-green, chloritic, weathered diorite so largely found everywhere with the syenite. The conglomerate of Coalmine Brook is largely made up of pebbles of dark grit and blackish coarse sandstone. If we assume therefore, that the shales and flags of this brook are G. 1m, as supposed by Dr. Ellis, no further proof of the Pre-Carboniferous age of the pebbles would be necessary, and the underlying series must be Devonian. If however, the upper series be millstone grit, as supposed by Mr. Barlow, the rubbly rocks might be G. 1m, for they are equally unconformable to the Carboniferous limestone. Between the Devonian and G. 1m, there are still perhaps doubtful areas.

The outcrop in North River below the Coalmine Brook yields large pebbles of greenish sandstone and conglomerate, with others of red sandstone; it weathers red and has indian-red streaks and patches. Perhaps all the grey and greenish flags and shales in the river below, as far as the next conglomerate, which contain a three feet layer of dark carbonaceous shale with a quarter of an inch of good coal at top, may belong to this group. The conglomerate extends thence for fifty yards below a little brook from a lake on the west side of the river; and the rocks immediately down stream are more like those of Union.

The conglomerate of Chiganois River, in the cliffs above Higgins' mill, contains pebbles of red, flinty sandstone and of the rusty rocks of the iron ore series, as well as of the syenite, diorite and felsite of the falls. It appears to be more altered than that lower down the river; but this appearance may be due to the smooth wearing by the river or to faulting; for a few paces higher are the rocks of which it seems to be composed and the boundary in this river and in the three brooks to the westward seems to be a straight fault.

Carboniferous
and Devonian
conglomerates

North River.

Coal.

Chiganois
River.

Fault.

Coal.

In Higgins' Brook immediately to the eastward, the conglomerate is well exposed and holds traces of coal; and on the old Tatamagouche road it is seen nearly to the fork of the Coalmine Brook, On the Higgins' road west of the mill, grey, rusty-weathering sandstones are seen, and also in the brooks to the boundary of the Devonian a short distance above the road. In the first of these, a branch of Old Sam's Brook, the first rocks seen are igneous and altered; but in that which crosses the road a mile to the westward are grey and greenish-grey, fine and coarse sandstone, grit and nut-and-egg conglomerate, with pebbles of the iron ore series, the rocks resembling those west of Debert River and at Londonderry. Down stream in Old Sam's Brook, are outcrops of reddish-grey, broken, flaggy, somewhat coherent sandstone, in part calcareous, with rusty, grey, fine sandstone, often flaggy, but with few argillaceous beds; some of the flags are covered with impressions of fucoids and rain-marks. Grey, brown and reddish-grey, earthy, flaggy sandstone, with carbonized plants, extends to a little stream from the left near Chiganois River, where conglomerate and more argillaceous rocks succeed. At the river here, coarse grit and conglomerate are found, whereas lower down are red argillaceous shale and sandstone, spotted with green; and similar rocks extend up the river to Higgins' mill.

Succeeding the Triassic in Staples Brook, are dark grey sandstones, with reddish-grey belts, which extend to Higgins' road, but are not well exposed and may be in part Devonian.

Debert River

Coal.

The rocks of Debert River, at the mouth of Totten's Brook, have been already described. Higher up are bluish-grey and greenish shales containing a layer of clean coal of indefinite thickness and crowded with nodules of ironstone; they are associated with coarse, grey sandstone. Above the bridge at Cottam settlement is a repetition of the seam probably, which is eighteen inches thick. Immediately above this coal are outcrops of red conglomerate and coarse grit, as in North River (containing pebbles, sometimes one foot in length, of red syenite, green diorite, reddish and greenish, soft, slaty argillite, compact quartzite and quartzose grit), which seem to come against the graphitic slates above by a fault.

Fault.

Totten's
Brook.

Coal.

The red sandstone and conglomerate seen near the river in Totten's Brook, are associated up stream with reddish and grey and rusty flags and shales, marked with *Cordaites*, *Calamites* and other plants, ripple-marks and rain drops; among them are layers of matted carbonized plants, passing into seams of coal sometimes an inch thick. Above the road to East Mines are frequent outcrops of grey, rusty-weathering, fine and coarse sandstone, with layers

of whitish pea-and-nut conglomerate, and a patch of reddish coarse conglomerate, containing pebbles of syenite and of Devonian rocks, associated with dark grey, soft shales and flags, covered with impressions of ferns, *Calamites* and other plants, including a seam of coal more than two inches in thickness, and succeeded at a fall by the Devonian.

In the Coalmine Brook, another tributary of Debert River, the red rocks nearest the river are succeeded up stream by dark grey or bottle-green, somewhat massive, coherent, pebbly grit, overlaid by reddish-grey fine grit and conglomerate. Small seams of coal have been mined on this brook in several pits, but their dimensions could not be ascertained. The associated greenish, rusty-weathering, soft shales are crowded with ironstone nodules, precisely like those of the Coalmine Brook of North River. Above the road are outcrops of light grey or whitish, fine, soft sandstone, and of greenish-grey, rusty-weathering conglomerate, which extend to a house on a hill at the head of the brook, beyond which dark Devonian slates appear.

Pine Brook flows in a marsh or intervale from the Base-line road to a little brook from the west, at which reddish-grey Carboniferous sandstone and shale dip about $133^{\circ} < 50^{\circ}$ and are thence well exposed without great variety, forming an ascending section to a brook from the left, immediately below which red sandstone and marl lie at a much lower angle; again become higher and undulating, and at a fall dip $351^{\circ} < 45^{\circ}$. Immediately down stream the angle is lower, then nearly vertical for a great breadth to a high cliff at a turn, where a greenish concretionary layer, embedded in the red sandstone and shale, shows a large quantity of broken carbonized plants. The dip is up stream, and one of the last rocks of the series is a grey and reddish pebbly sandstone. Not far down stream is a cliff of more altered, rubbly rock, fine, micaceous, generally red, but with siliceous flinty layers full of broken plants; it might easily be mistaken for a rock of the Union series, but is perhaps Carboniferous, its rubbly condition, the presence of limonite in the joints, and other appearances of alteration being probably due to faulting or to the proximity of the Triassic sandstone, which, 200 yards down stream, lies apparently horizontal. A similar appearance of alteration near a contact was seen in Salt-spring Brook, near its confluence with Great Village River, and another where the north fault of the Pictou coalfield crosses McCulloch's Brook. In a small branch of Pine Brook from the eastward, more than half a mile above the road in the Totten settle-

ment, is a small outcrop of conglomerate among and apparently unconformably upon the altered rocks of this brook.

At the East Mines conglomerate is nearly everywhere seen south of the openings on the iron ore.

Folly River

Where the Carboniferous conglomerate comes in contact with the Devonian rocks at a fall in Folly River, it holds pebbles of all the latter, those of dark diorite and syenite being very numerous and up to one foot in diameter. Below this point outcrops are continuous for a great distance, and the conglomerate is seen first to inclose bands and patches of reddish and grey and greenish-grey soft sandstone and grit, with large carbonized markings of plants, and afterwards to be succeeded by these rocks, which show prostrate trunks of trees and minute veins of coaly matter, overlaid by greenish and dark grey argillaceous shales, which contain *Stigmaria* and streaks of coal, one of which is an inch thick, in the bedding. Grey and brownish sandstones then extend to the bridge on the Base-line road, at which outcrops of conglomerate are again found, interstratified down stream with reddish sandstone and shale. A large proportion of the rock, for some distance below the bridge, is of conglomerate; but in one place a quarry of red sandstone shows included layers of concretionary limestone-conglomerate, grey, greenish or rusty in colour, with carbonized plants. Below the quarry are cliffs and ledges of indian-red and grey sandstone and shale, with strong, calcareous, concretionary bands. At their contact with the Triassic these rocks strike 243° , with a dip both ways at angles varying from 73° to 87° ; and the Triassic rocks also, although not seen on the river section, seem to be faulted; but at the railway bridge they dip at a low angle.

Coal.

McElman
Brook.

In McElman Brook, about half a mile above the fork, the doubtful flinty rocks are succeeded by grey and bottle-green sandstone and shale containing rootlets, *Calamites* and broken plants, interstratified with grey, coarse, pebbly grit, red soft marl and reddish and greenish sandstone, often calcareous and including a band of one foot of pure concretionary limestone-conglomerate, precisely like some of the Permian strata of Pictou and Tatamagouche. The sandstones are crowded with plants, one trunk, three inches in diameter, being converted into black spathic iron ore. The coarse rocks contain pebbles of black argillite. At and near the railway, the brook exposes cliffs of grey and greenish sandstone and conglomerate, darker beds, crowded with plants, and reddish shale, succeeded above by greenish egg and coarser conglomerate, with a low dip down stream, seen only a few yards above the railway, and followed by the iron ore rocks.

In the west branch of McElman Brook, the rocks which succeed the Triassic resemble those just described, and above the railway, outcrops of conglomerate are succeeded by flinty Devonian slates. On the railway, at the entrance of the snowshed near the 82nd mile-post, Devonian rocks are succeeded by nut-and-egg conglomerate holding large boulders of the former, interstratified with finer beds which, nearer Londonderry station, predominate to the junction with the Triassic conglomerate, the grey and greenish layers inclosing stumps, prostrate trees and *Cordaites*.

Below the mines-railway at Londonderry, Saltspring Brook cuts reddish, soft, flaggy sandstone and shale, dipping about $42^\circ < 41^\circ$ and containing grey beds fit for quarrying, small patches of conglomerate and greenish concretinary sandstone, as far as the Telephone line road. Below the road, similar rocks, jointed or rubbly, somewhat coherent, dip first $34^\circ < 18^\circ$, and 120 yards below an old dam, $36^\circ < 51^\circ$. Still lower, rocks precisely like those of the railway bridge dip about $16^\circ < 72^\circ$ and continue to Great Village River, about 150 yards above which is a light grey, greenish and rusty sandstone, in places a compact ganister, with *Stigmara*, and three bands of blackish shale, one of which is coaly, interstratified with red rocks and nearly vertical. The hard bands are very flinty and rubbly. Saltspring Brook.
Coal.

Above the mines-railway on Saltspring Brook similar beds dip about $52^\circ < 33^\circ$, and a grey, flaggy layer has been quarried for rough building stone. About a quarter of a mile up stream, a black, coaly shale, overlying grey sandstone, has been worked in a shaft and several pits, and a quantity of coal from a layer at least one inch thick, and perhaps much thicker, lies on the bank. Grey sandstone has been quarried near the shaft and prevails for some distance up stream, becoming mixed with greenish coarse conglomerate and grit; and at the bridge on the Base-line road the coarse rocks predominate, striking about east and west with a vertical dip. From Great Village River to this point the section is, according to the dip, continually ascending, and many of the upper flags resemble Millstone grit and Coal measures in texture.

A similar sequence is well exposed in Great Village River. At the dam, about 267 yards above the Base-line road on the east branch, is a coarse, Carboniferous conglomerate, which contains patches of grit and fine sandstone, and is succeeded down stream by light green, pebbly sandstone, with patches of conglomerate, and by grey sandstone, with layers of greenish shale and streaks of coal an eighth of an inch in thickness. At the dam the dip is doubtfully horizontal, while seventy yards below it red shales dip confusedly Great Village River.

- 147° < 80° and are succeeded by blackish shales, including layers of whitish flinty sandstone. In the black shales are siliceous concretions and concretionary, rusty-weathering layers. They are again followed by red sandstone and shale, with one carbonaceous layer. At 325 yards below the bridge red shales and sandstone dip 12° < 15°, while at the bridge close by, on the road down the river, near the fork of the rivers, grey and greenish, rusty-weathering, coarse and fine sandstones dip 157° < 47°. At forty-five yards below the fork, red, soft rocks are nearly horizontal, showing a dislocation between them and the sandstone of the fork. But immediately below is a pebbly band which may be the conglomerate of the fork, dipping 17° < 18°, while a few yards down stream are dips of 87° < 25° and 57° < 27°. Thence to the fork of Cumberland Brook the dip is about 43° < 37°, on red rocks, including ledges of grey sandstone and coarse grit. Immediately below this brook is a quarry of rough, grey sandstone. Down stream are reddish sandstone and shale; grey sandstone, fine and coarse, some beds rippled, rusty-weathering, holding carbonized plants, with bark converted into coal, dipping 5° < 42° to a point nearly a mile below Cumberland Brook, where the dip is 12° < 80° and the rocks differ from those seen above in being finer in texture, flaggy or evenly-bedded, rubbly and perhaps more coherent. They are all reddish, rusty and greenish in colour, full of broken, carbonized plants, and include a layer of blackish, papery shale, with lenticular bands of ironstone, precisely like the adjoining rocks of Saltspring Brook, about 250 yards below which they are overlaid by coarse conglomerate, with patches of nearly horizontal Triassic sandstone.
- Up Cumberland Brook to the mouth of Cook's Brook, reddish sandstone and shale, with patches of grey and red conglomerate, full of broken, carbonized plants, dip about 12° < 41°. They are exposed up the latter with a somewhat lower dip for some distance, after which they dip 55° < 21° to the Base-line road, above which the dip is 172° < 67° and higher, to the contact of the slates. Between Cook's and Martin's Brooks, reddish, brownish and grey sandstones and shales are exposed in cliffs, dipping about 345° < 31°, but disturbed near the mouth of a little brook from the south, as shown by two dips of 355° < 80° and 247° < 19°. Not far below the Base-line road the dip is 352° < 27°, above which no rocks are seen to the Devonian slates.
- Immediately below the main road in Cook's Brook, the reddish conglomerate and grit contain bands of black graphitic shale with

hard nodules. Good outcrops are seen everywhere in the neighbourhood of the iron mines.

These rocks as they occur in Portapique River and other streams to the westward have been described with the Devonian.

In Crowe Brook, above the Base-line road, greenish-grey breccia and olivaceous shale of the iron ore series are in contact with coarse, flaggy, Carboniferous sandstone and conglomerate, dipping about $157^{\circ} < 80^{\circ}$. Below the road and near a mill-pond, reddish-grey sandstone and marl and greenish and grey flags and sandstone dip about $6^{\circ} < 43^{\circ}$ - 90° , and are succeeded above the settlement of Montrose by Triassic conglomerate and sandstone.

Triassic.

G. 1.—Carboniferous Limestone.

This formation is characterized by the occurrence of gypsum, limestone, sandstones, marls and other soft and friable rocks, apparently everywhere unconformable upon all the underlying formations.* It appears at the following localities, from most of which fossils have been described by Sir J. W. Dawson†, Sir Chas. Lyell‡, and others: 1. In a basin along the East River of Pictou, and in isolated areas at the south-eastern corner of the Pictou coal field. 2. In small areas on the Middle and West Rivers of Pictou. 3. In broken areas of small extent north-east of Valley and Truro stations, in Farnham's Millbrook and on Penny's Mountain. 4. A large and important basin along the Stewiacke and Shubenacadie Rivers. 5. In outliers on the north side of Minas Basin.

1. *Basin of the East River of Pictou.*—Reference has been made already to the narrow basin of these rocks which the East River follows from above Sunnybrae to Bridgeville, and which then expands between the Pre-Carboniferous rocks of McLellan's Mountain and those of Middle River.§ The small patch shown on the map as of this formation at Fall Brook displays limestone blocks only, and the valley, although very like a Carboniferous glen, may, perhaps, indicate only the contact of the Silurian and Cambro-Silurian.

In McLellan's Brook, where the limestone overlies the Cambro-Silurian, it strikes vertically 20° , and is streaked with marl and patches of grey conglomerate; it has been quarried and is over-

* Geol. Surv. An. Rep., Vol. II., 1886, Part P, p. 69; Proceedings of the Geol. Soc. of London, vol. III., p. 712; Lyell's Travels in North America, vol. II., pp. 148, 177-183; Summary Report of Geol. Survey for 1891, p. 35.

† Acadian Geol., pp. 285-316.

‡ Geol. Soc. of London, vol. IV., p. 185.

§ Geol. Surv. An. Rep., Vol. II., 1886, Part P, pp. 86 and 109; Trans. Roy. Soc. Can., vol. IV., pp. 159-163; Acadian Geology, Supplement, 1878, p. 76; Trans. N.S. Inst. Sc., vol. III., p. 63; vol. IV., pp. 143, 144, 161, 163, 465; vol. V., pp. 31, 65, 66, 213.

laid by reddish shales with green blotches. Where quarried, near the Mountain road, it is coherent, veined with calcspar and associated with grey and reddish sandstone.

On McGregor's Mountain, limestone of this age is in place as shown on the map. It is grey and blackish, oolitic, full of shells, and overlies conglomerate, while not far off is a hill of diorite and flinty conglomerate, and on the opposite side of the road a knoll of Silurian. That at Finlay McDonald's, near the Vale, is a grey variety which makes good lime: it has been already referred to.

St. Mary's
road.

In McLean's Brook, below the St. Mary's road, near the Vale colliery, gypsum is found in a small exposure near the conglomerate, and again on the hill slope west of the brook. It is associated with a grey compact limestone containing shells. The limestone of Park's mills, on Sutherland's River, is grey, veined with calcite and full of characteristic fossils. It is in place, 100 yards north of Park's house, and is undoubtedly identical with that of McLean's Brook, and, perhaps, also of McLaurin's Brook, near the iron mine, as a conglomerate below the falls is the equivalent of the conglomerate of McLean's Brook. This conglomerate indicates an unconformity rather than a fault, the south fault crossing, apparently, further down the river.

East River.

The best known crops of gypsum and limestone of the East River of Pictou are defined on the map. Perhaps in places they are mixed in the river with rocks of the lower group. Above the bridge at St. Paul's, reddish and grey and rusty, micaceous, soft shale and calcareous, argillaceous sandstone show large impressions of plants. Up stream are grey, ferruginous, flinty, massive, jointed sandstones, succeeded by light bluish-grey limestone, massive or in thick beds, associated with limestone-breccia and shale, veined and blotched with calcite and baryte and succeeded by grey grit and conglomerate. Immediately above the confluence of John McDonald's (Ogg) Brook, are outcrops of whitish and grey marly grit and calc-veined Carboniferous limestone. Below the mouth of this brook, grey limestone with white blotches and veins follows on the strike down the river. A short distance down stream is a greenish and grey crystalline limestone or marble, full of rusty blotches, which may be Carboniferous, altered by some of the adjoining traps, or Devonian. In the bed of the river, near the mouth of the brook from William Grant's Lake, a crumbly, argillaceous limestone, containing shells, is associated with grey, greenish-grey and reddish, coherent, fine, flaggy, calcareous, argillaceous sandstone, often finely ripple-marked, and

Crystalline
limestone.

with dark nodular and flaggy limestone, passing into a limestone, full of shells, some of which has been quarried. At the old mill is a band of twenty feet of limestone in horizontal bedding. Nearer the Springville bridge, there are cliffs of red marl, greenish-grey shales and bluish-grey shales and flags, blotched with ferruginous veins and with gash veins of calcspar. Below the mouth of the brook, nearly continuous cliffs of Carboniferous rocks extend to and below the fork of the west branch at Ferrona, the dip being very changeable and the reddish soft sandstones and shales, with greenish and grey bands, resembling those of the lower part of French and Sutherland's Rivers. With them is a band of eight feet of limestone, full of fossils, blackish or grey, somewhat shaly, in part nodular, overlaid by grey calcareous shale and sandstone; and other bands four in number, found lower down, range from one to three feet.

Cliffs and mounds of gypsum are found south of Bridgeville. Near the post office is a quarry from which a good mortar limestone has been taken, and other outcrops occur on the lands to the southward. The reddish-grey sandstone and shale on the road to Hopewell, in Centredale, and on the left bank of the East River, between Springville and Bridgeville are perhaps also of this age; but the rocks of Archibald's Brook may belong in part to the conglomerate. Above the road to Archibald's mill, beyond a considerable exposure of red flinty rocks, greenish slate and trap, probably Devonian, is a calcareous conglomerate, with patches of light grey, good Carboniferous limestone, the conglomerate holding pebbles of the flinty rocks; and still higher are immense blocks of grey limestone, which perhaps indicate an outlier among the slates.

The limestone of Springville is apparently in several detached patches in the neighbourhood of the Sluice; about Lime Brook, it has been largely quarried and in Campbell Brook is seen to overlie the Silurian above the road. In the little brook from Calder Lake it is associated with bluish-grey sandstone and flags, dipping 224° and containing small impressions of a lamellibranch. In Holmes Brook, the Silurian rocks are in contact with conglomerate and limestone, presenting the following section:—

	Feet.	
1. Grey limestone, beneath which the water of the brook disappears. Of unknown thickness. [Trans. N.S. Inst. Sc., vol. IV., p. 465, vol. V., p. 202.]		
2. Rusty-weathering, somewhat crystalline, ferruginous, whitish limestone, with specks of copper pyrites	15	Copper ore.
3. Grey limestone, composed of a mass of shells	2	
4. Soft soapy conglomerate	12	
5. Silurian rocks.		

Contact of
Silurian.

Near Lime Brook*, outcrops of gypsum and limestone abound. Lists of the fossils of the limestone are given by Sir J. W. Dawson† and Dr. Honeyman‡. It is interstratified with reddish crumbly sandstone, shale and marl, with green blotches; and similar rocks are found in the river above and below the iron bridge; while a short distance down stream, greenish massive sandstone is associated with a conglomerate or breccia composed of Silurian pebbles; down stream from which is a grey, flaggy, massive limestone, with spots of baryte and ferruginous veins, described above.

At the foot of David's Lake are great blocks of Carboniferous conglomerate which probably indicate an outlier in this direction. The contact of the Carboniferous and Silurian follows closely the road from Springville to Churchville, and the various outcrops towards Forbes Lake§ require no special mention. At Churchville the limestone appears to be closely associated with reddish coarse conglomerate. In Robinson Brook, limestone appears near the contact, associated with red sandstone, shale and marl and greenish grey flags, underlaid by the Cambro-Silurian. Below the outlet to Forbes Lake, this brook exposes reddish sandstone; and on the road from the brook to the East River, a limestone, probably fifteen feet thick, usually in thick beds, veined with calcspar and stained with copper ore, is interstratified with reddish sandstone, and has been quarried to some extent.

Copper ore.

West Branch
East River.

Above the fork, the west branch of East River shows a few exposures of red sandstone as far as Eureka mills. Here on the shore of the mill-pond a thick band of limestone has been quarried. Above the pond are cliffs of red sandstones and shales, with variable dip, including some grey beds. Above the bridge at Hope-well, for more than two miles the river cuts few rocks, but the banks seem to indicate chiefly red micaceous sandstones and flags, of this age, or Millstone grit, which are exposed as far as Elgin, and also on Fox Brook. Similar rocks are found at Elgin as far as the outcrop of Carboniferous limestone in the west branch. This latter is dark bluish-grey, shaly and thick-bedded, veined with calcspar and at least ten feet thick. Overlying it are reddish and grey soft sandstone and shale. The limestone has also been largely quarried up the Big Brook, where it seems to lie

* Quarterly Journal Geol. Soc., vol. IV., p. 276; Gilpin's Mines of Nova Scotia, pp. 105, 107.

† Acadian Geol., p. 315.

‡ Trans. N.S. Inst. Sc., vol. V., p. 213.

§ Acadian Geol., p. 317; Trans. N.S. Inst. Sc., vol. III., p. 67.

unconformably upon grey sandstones and ferruginous shales, the dip to the south being apparently caused by a fault which seems Fault. to separate it from the older rocks. Near the brook, on the road from Lorne to the railway platform, is a shaly and thick-bedded limestone of the usual character; and near the school-house the land is broken by gypsum, as already stated, interstratified with grey and greenish, soft, crumbly shales.

The limestone of Lorne seems to form a tongue in the valley of Lorne. Big Brook, runs thence across to William Dunbar's quarry, and appears again on the farms of Murray, Halliday and Grant. In the other direction it has been traced to the west branch, to William Ross's, to Macdonald's on the Crockett road, to the Bridgeville post office, thence up the East River. Whitish-grey, rusty-weathering, rough, somewhat soft, brecciated and oolitic limestone is found on the brook which crosses the railway north of Lorne siding. A short distance further west, flinty, whitish, siliceous grit, probably Upper Devonian, is in place.

The rocks of Cameron (Meadows) Brook, for some distance above the river, perhaps belong to this formation, whilst the reddish-grey, fine, coherent sandstone and argillite and impure limestone of the neighbourhood, altered by diorite, and having the joints full of grains of specular iron, are probably Devonian.

On the East River, at Stellarton, the outcrops begin near a tunnel Stellarton. from which a blackish underclay, probably of Millstone grit age, was extracted for brick-making. This underclay and an accompanying dark band are succeeded up stream by grey false-bedded sandstones with a dip of about 30° ; these by reddish-grey, crumbly, argillaceous shale and sandstone, which prevail for some distance, and are succeeded by bluish-grey or blackish shales with bands of rusty, nodular ironstone, associated with greenish and grey sandy shales, apparently both overlaid and underlaid by red rocks, including bands of greenish and grey sandstone, on one of which quarries are situated on opposite sides of the river; and, towards the base, with thick layers of nut-and-egg conglomerate. At the bottom of this conglomerate, on the west side of the river, Logan puts the south fault. But a line drawn from this point to the base South fault. of a similar conglomerate on the east bank, instead of giving the direction of Logan's fault, runs 137° . These and other questions connected with the Pictou coalfield are now being studied by Mr. Poole. Immediately up stream are rocks which resemble those of Rocklin—reddish, flinty, slaty or prismatic sandstones and argillites, with bright green patches and veins of quartz and ankerite, three inches thick and downward, cut by a dyke of diorite, already Devonian rocks.

described as Devonian, and succeeded up stream, probably unconformably, by bluish-grey Carboniferous limestone, upon which a quarry has been opened in the bank north of Riverton station.

Waters Brook.

Immediately south of Power's clearing and north of Waters Brook, is an apparently nearly vertical dip of reddish sandstone. Down the brook, reddish, grey and greenish-grey sandstone, pebbly grit and fine conglomerate dip $310^\circ < 40^\circ$, and forty paces lower, $342^\circ < 32^\circ$. They are succeeded immediately by light grey and rusty, fine, flinty sandstone or quartzite, greenish and reddish amygdaloid, probably Devonian; but lower down, grey, fine, quartzose sandstone, and greenish-grey and reddish, spotted, coarse, pebbly grit, containing carbonized plants, are interstratified in thick beds with reddish fine sandstone, dipping $85^\circ < 30^\circ$ at Power's quarry. At the Drummond railway these rocks are again seen nearly in contact with the Devonian, from which they are separated by a fault. In a well ten yards north-west of James McDonald's house, a bed of green and grey soft marl, full of fibrous gypsum, was cut; and gypsum is said also to be found on Robert Waters's land in the vicinity. Perhaps the rocks seen north of the north fault on the Drummond railway and at the mouth of Waters's Brook are Lower Carboniferous. North-west of McDonald's is an exposure of spathose rock, apparently ankerite, mixed with a rock probably Devonian.

Fault.

2. *Lime-rock Outlier on the West River of Pictou.*—The limestone quarried at this locality Sir J. W. Dawson compares with the lower limestone of Hants and Colchester*, "containing *Crinoids*, *Terebratulæ*, *Fenestella*, *Corals* and other fossils," particularly in the upper, yellowish, shaly part, which is spotted with crystals of pyrite. It is light and dark bluish-grey, strongly bituminous, veined with calcespar, in both shaly and massive beds. It is evidently an outlier in contact with Devonian and Permian rocks and would seem to indicate not immense incredible changes of conditions of deposition, but rather the faulting which has given rise to the assemblage of so many distinct geological formations in this small district.

A similar outlier of gypsum, marl and limestone is found in the first brook South of Millbrook, about three-quarters of a mile above the Middle River road.

Carboniferous
and Devonian.

3. *Outliers in Farnham's Brook, Penny's Mountain and the vicinity.*—Red Devonian argillite is found both up and down stream from an outcrop of greenish marly rock, probably Carboniferous, in the bed of McKenzie Brook, near Philip Archibald's. On the bank, also near

* Acadian Geol., p. 315.

the flinty rocks, gypsum has been quarried. The funnel-holes at the quarry do not seem to reach below the level of the brook*.

Carboniferous limestone has been quarried on the left bank of Clifford Brook the next stream to the westward, below Mr. Hoar's house and not far from a cliff in which the unconformity between this formation and the Devonian is not less well-marked than that between the Devonian and the Triassic. At the point of contact on the right bank, a runlet from the westward has cut its way through the cliff about fifteen feet high into the main stream. Beneath the limestone, which is more or less massive and concretionary, is an irregular bed of egg-conglomerate, composed of pebbles of the red rocks of Union, upon which it immediately rests. On the left bank also is a knoll of red spotted limestone and conglomerate, and immediately east of it, outcrops of grey and reddish, whitish-weathering quartzites, which occupy a considerable breadth of the brook higher up. The dip of the limestone is $107^{\circ} < 10^{\circ}$, that of the quartzites obscure but probably $172^{\circ} < 55^{\circ}$, and of those up stream nearly vertical. Cavities in the limestone contain crystalline or botryoidal concretions of calcite and limonite, and in places both it and the underlying slates are stained with hematite. A little higher, doubtful indications of Carboniferous marls are met with, while at the fork of the branch from James Clifford's house, marl and limestone are in the brook, apparently continuous with the gypsum and shelly limestone at the house. Up the west branch, blackish shaly limestone and greenish-white marl are succeeded, immediately above the fork, by slates like those of the iron ore series, cut by veins of ankerite which contain fine specimens of specular iron ore. Higher up, greenish, Carboniferous shale is again present; and near the Telegraph road, dark grey massive limestone with white veins of calcspar, has been largely quarried; but it is not known to cross the road or to crop on Johnston's farm adjoining.

Unconformity

Iron ore.

Limestone quarry.

Succeeding greenish and reddish quartz-veined Devonian slates on the east branch of Farnham's Millbrook, is a cliff of grey brecciated Carboniferous limestone, stained chocolate-brown and indian-red with hematite; and at the contact a large quantity of crystalline pyrolusite has been taken from a shaft. Devonian rocks are seen lower down, succeeded again by red, grey and greenish micaceous shales and gypsum in cliffs; while still lower, dark bluish-grey, flaggy limestone is well exposed in the bed of the brook, separated from the Triassic by a belt of greenish and reddish, shaly argillites, apparently Devonian. In the adjoining branch, a few yards above the fork, light grey, fine, soft

Farnham's Brook.

Manganese ore.

* Gesner's Geol. of Nova Scotia, p. 132.

sandstone is interstratified with dark bluish-grey limestone, or calcareous flags, containing shells; and good exposures of blackish limestone are found nearly to the back road, the outcrops being, perhaps, continuous with those which extend from Penny's Mountain along the road.

Penny's
Mountain.

On the top of Penny's Mountain, south of the turn in the road, a large outcrop of Carboniferous limestone forms a hill. It is of various light colours, somewhat dirty, weathers on the surface rusty and indian-red, and is probably the equivalent of that seen in Farnham's Brook. In a branch of this brook, from about the middle of the mountain, are reddish and light greenish-grey shales and marly sandstones. At the eastern end of the mountain a brook on the north side shows black, calcareous, shaly limestone, earthy, and full of brachiopods; but not far distant are the flinty Devonian rocks. From the top of the mountain the limestone does not seem to extend far in any direction, most of the neighbouring brooks exposing the older rocks, upon which both Carboniferous limestone and Triassic are spread in very irregular unconformity.

Iron ore of
Newton Mills.

4. *Basin of Stewiacke and Shubenacadie Rivers.*—Carboniferous limestone occupies the Stewiacke River from its mouth to the top of the settlement at Eastville, where a narrow basin lies between Devonian on the north side and light grey, fine, micaceous, schistose, quartz-veined slates of the gold bearing series of Berry Hill Brook and other brooks of the neighbourhood, a large quantity of drift sand, gravel and boulders often obscuring the contact. The red hematite of Newton Mills is in a contact conglomerate, containing pebbles of whin and other rocks. Cox Brook, in the main branch above the road, shows the gold-bearing rocks in contact with Carboniferous limestone. In the branch which follows the road where it climbs the hill is a conglomerate full of hematite, containing pebbles of the red rocks of Union. At Upper Stewiacke are caves, springs and natural bridges among the great deposits of gypsum and limestone which occur on the north side of the river and towards Pembroke. At Pembroke and Smithfield the limestone contains galena, which has been prospected to some extent at the junction with the older rocks. At Smithfield the limestone is interstratified with reddish, soft marl, including bands of greenish and grey, flaggy, calcareous sandstone, grit and conglomerate.

Caves.

Lead mines.

Unconformity

The boundary between the rocks of Union and this series in Smithfield Brook shows patches of the latter after the first exposures of Devonian, as if to mark a great unconformity. On Otter Brook for a great distance from the river the country is

low and occupied by sandstones, shales, gypsum and other rocks of this formation. After crossing the road to Pembroke, one branch displays red Devonian argillites, with associated whitish quartzites, which extend thence to the Pembroke River near the bridge at Sam Deyarmond's, immediately below which a little brook from the westward exposes Carboniferous limestone, apparently at the contact. East of this river, the boundary seems to follow the brook along the road, past the lead mine, to Eastville, and is well shown in several of the little brooks, the conglomerate of the Carboniferous being easily distinguishable from the quartzose grit or conglomerate of the underlying formation. In the little brook which comes into Sam Deyarmond's clearing from the north-east, red and grey, flinty Devonian rocks contain layers of quartzose, pea-and-nut conglomerate, about 300 yards from the house. North of the house for a short distance is a flat piece of land, perhaps indicating Carboniferous rock; and in the brook from the westward, immediately below the bridge on the Riversdale road, are, as already stated, good outcrops of limestone, rubbly pieces of the red rocks being on the left bank, as if the brook here followed the contact. Red Devonian rocks are met with thence along the road as far as Glenbervie mill-dam, where they are well-exposed, dipping nearly vertically down stream. Not far from the pond is an outcrop of flinty conglomerate, which has been mined for gold. It is included between layers of the red rocks of Union, which are succeeded by the grey, greenish-grey and bluish-grey sandstone and shale, rusty-weathering, coherent and rubbly, so well exposed in the large brooks near the school to the northward, and which occupy most of the road to the top of the settlement, some of the dark strata being like those of the road south of Lansdowne. After passing the track to Island Lake, there is a quantity of red argillite and sandstone, belonging probably to the lower part of the Union series.

Supposed
auriferous
conglomerate.

In the immediate neighbourhood of Stewiacke River, rock exposures are so scarce that it is doubtful whether the grey sandstone and shale of the East Brook are of this age. Immediately south of the road, a seam of coal, said to be eighteen inches of mixed coal and coaly shale, is overlaid by eight feet of dark shale, dipping about $277^{\circ} < 14^{\circ}$ at the openings and also at the outcrops some distance up the brook; while higher still the dip changes to $202^{\circ} < 19^{\circ}$, the rocks being for the most part red; and, not far up stream, to $127^{\circ} < 17^{\circ}$. A bed of fine ironstone or impure limestone, a few inches in thickness, then lies nearly horizontal among grey and rusty shales, succeeded further south by alternations of grey and red sandstones

Coal of East
Brook.

and shales. A quarter of a mile below the road, grey sandstones dip $281^{\circ} < 14^{\circ}$; and at the rocky falls in the river, $167^{\circ} < 15^{\circ}$; but both these outcrops are small and somewhat obscure. In Johnston Brook to the eastward, as I am informed by Mr. James Pitblado, a shaft was sunk forty feet and a borehole continued forty feet below the bottom of the shaft. No coal was found but only traces of dirty gypsum. Similar rocks are found between the main river and the south branch, although most of the brooks are sluggish and dirty.

Brookfield
quarries.

A large quantity of fossiliferous limestone from the Brookfield quarries is used at Londonderry in the reduction of the iron ores, and from a fine specimen presented to the Provincial Museum in 1887 Dr. Honeyman has described the large species *Nautilus Brookfieldi*.*

Short Lake.

Out the road from Brookfield station towards Pleasant Valley, about a mile from the railway-crossing and a short distance past a cutting in red shale, the plain and marsh give place to higher land, broken on the left by pits which probably denote Carboniferous limestone. Past the road on the left to Short Lake, the limestone which has kept parallel with the road, crosses to the right and shows outcrops of shaly and of rough massive limestone, which has been quarried and burnt. On the road to the left towards Green Oak, across the outlet of Short Lake, and again on the road to the left beyond, are exposures of red marl. At Francis Short's farm, immediately past the school-house at Upper Pleasant Valley, gypsum has been quarried and is perhaps continuous with that at Kennedy's a mile and a half nearer Irwin Lake. Grey, reddish, greenish and rusty soft marls and sandstones are interstratified with limestone and gypsum at various points which require no special mention. The principal outcrops are indicated on the map as well as the contact with the Devonian wherever it has been ascertained. Much of the land north of Pleasant Valley is wooded and boggy, and the Cunard Swamp affords a good example of the broken land produced by the outcrops of gypsum which abound at the head of and for some distance down Soley Brook, where they are succeeded by the rocks of Union, which extend to the contact of the Triassic near Cobequid Bay.

Broken
gypsum-land.

Irwin Lake.

On the road to Irwin Lake from the fork of Pleasant Valley road, gypsum is indicated by pits, and quarries and limekilns indicate the presence of limestone as far as the house near the head of the lake, where outcrops of dark grey rusty-weathering slates begin, and nearer the head of the lake have been cut by trenches

* Trans. N.S. Inst. Sc., vol. VIII., p. 13.

and small shafts in search of gold. To the northward the debris Search for gold.
indicates the red rocks of Union. A brook comes into the head of Irwin Lake from a small lake about a mile out, on the side of which gypsum has been quarried. From the house at the head of the lake a track runs through woods to Beaver Brook settlement at the fork of a road north of Yuill's house, but shows no rocks. In the brook, however, below the bridge immediately past Yuill's house, greenish-grey, flinty, micaceous sandstone or quartzite, with dark grey, slaty argillite, containing threads of quartz a quarter of an inch thick, is associated with whitish, massive, coarse, quartzose grit or fine conglomerate, dipping about $160^{\circ} < 80^{\circ}$, resembling the rocks which underlie the red rocks of Union, and overlaid by red, soft, hematitic, marly, Carboniferous limestone.

Northward from the fork of this road, along the main road through Beaver Brook settlement, the land is flat; and at 595 yards a small brook exposes five feet of bluish-grey bituminous limestone, dipping $237^{\circ} < 17^{\circ}$ in a quarry, a few yards above which the Devonian and Triassic rocks.
Devonian and Triassic rocks.
begin. Further north, other points of contact are found; and the boundary has been traced round to the brooks of Clifton, in which the red rocks of Union are well exposed beneath the Triassic. At the saw-mill in Irwin Brook, they dip $299^{\circ} < 40^{\circ}$, their contact with the Triassic being immediately opposite a fork of the road lower down.

About 500 yards below the fork of Beaver Brook road, and the post road, on the left bank of a little brook from 270° , are two shafts, twenty-three yards apart, which have cut the red Devonian rocks and from which a considerable quantity of limonite has been Clifton iron mine.
taken. It occurs in small veins or concretions. One of the shafts is said to be seventy feet deep and to have cut a white sandstone in the bottom.

Along the post road, west of the Beaver Brook road, a red hematite has been dug for paint, and beyond it are outcrops of the rocks of Union. It is doubtful whether the limestone and gypsum formation appears again between this point and Blackrock, where large exposures of dark, shaly Carboniferous limestone, containing spots of pyrolusite and hematite and white veins of calcspar, dip south-westerly into the Shubenacadie River, and are succeeded up the river by cliffs of red marl and sandstone, gypsum, limestone and other strata of this formation, described by Mr. Gilpin*, and Sir J. W. Dawson.† At Anthony's Nose, a limestone about forty feet
Blackrock.
Shubenacadie River.

* Trans. Roy. Soc. Can., p. 159.

† Acadian Geol., p. 266.

thick, which is a mass of corals and shells, "stands quite on edge, projecting like a huge wall into the river. Soft marls rest against each side and include a bed of gypsum, and, at a little distance, a thick bed of this mineral appears with an arched stratification. On the opposite side of the river there are other limestones and gypsums, also very much disturbed; and, immediately adjoining them on the south, there is a cliff of nearly horizontal reddish sandstone, like that of Eagle's Nest."* The banks of the river are rocky by turns, and rocks of this formation are seen on most of the roads of the vicinity as well as on those towards Pleasant Valley and Brookfield. At Green Creek, red and green and grey soft marl, with limestone and gypsum, are found lying at a low angle.

South shore of
Minas Basin.

Down the west side of the river, between Shubenacadie railway station and Maitland, none of the land is high, although occasionally hilly, and some of it is wet and barren. Outcrops of gypsum and limestone are met with along the streams, but are still better exposed in the banks of the river. West of Maitland, Triassic rocks skirt the shore for some distance; but on the western edge of a large piece of dyke land past Selmah Creek, and not far below the shore-road, irregular, and nearly vertical beds of reddish, greenish and grey, coarse, flinty grit, probably Devonian, have been quarried for rough building stone. Above the road, in Sterling Creek, however, is a large quantity of grey and red marl, probably associated with the gypsum exported at one time from this locality.

Outliers
among De-
vonian and
Trias.

From Sterling Creek the coast is low, with a few headlands of Triassic rock, to Mungo Creek, where, between the bridge and the shore, the Triassic includes several beds of very coarse conglomerate. It follows in high cliffs to the westward and up King Creek to a mill. No Carboniferous limestone rocks appear on the shore to the westward, except in small patches, as at Walton, Cheverie, and Summerville, either the Triassic or Devonian strata occupying the coast; but a short distance inland and over a great part of the country between the shore and Kennetcook River, the gypsum, limestone and associated strata occur; and at their contact with the older rocks are found ores of manganese and iron.

Noel to
Kennetcook.

The road from Noel to Kennetcook runs south up the east side of a large brook which shows, at a fall and shingle mill, about half a mile from the corner, fine outcrops of grey, micaceous, flinty flags and sandstones, with rusty spots, and plants probably Devonian

* Op. cit., p. 268.

These dip up stream at a low angle and are associated with wavy, micaceous, somewhat massive sandstone and light grey flinty grit, many of the strata resembling those of the Tenecape manganese mine. But a short distance north of the outlet of a long lake, the soil is rusty and sandy, perhaps denoting Carboniferous limestone and gypsum, which occur on the east side of the lake. Immediately south of the fork of the roads at this point, about fifty yards south of the house of Mr. John Hennigar, and 100 yards west of the road, a pit dug in search of manganese ore cut a reddish and grey rock, full of calcespar veins with threads and specks of pyrolusite, and a red soft sandstone, probably Carboniferous; and in the immediate vicinity are outcrops of limestone and gypsum. South from Hennigar's, blocks of grey, soft, flaggy sandstone and of dark marly rocks indicate this formation as far as Captain Scott's, about four miles from Kennetcook River, where limestone is exposed; and probably also as far as the river. Out the road to the Gore the land is bouldery with blocks of grey granite or syenite, covered with spruce, tamarack and birch second-growth or small clearings, for some distance. Then coarse, rusty sand and pieces of soft, flaggy, coarse and fine sandstone and pebbly grit, composed almost wholly of quartz, no doubt indicate the country-rocks, which are seen on the hill, succeeded by black, papery, micaceous, rusty-weathering, coaly shales and argillaceous shales with rootlets; succeeded in turn by the greenish and light grey, chloritic and micaceous, pearly and soapy, striped slates of the gold-bearing series, upon which also is situated the Gore antimony mine.

Manganese ore.

Gore.

Contact of Cambrian.

Several miles higher up Kennetcook River, in a large brook from the southward immediately below Mrs. O'Brien's, grey fine sandstone near the bridge dips $337^{\circ} < 30^{\circ}$, and a little higher $< 10^{\circ}$; while not far below an old saw-mill, above which gypsum has been quarried, grey soft sandstone, shale and limestone dip $0^{\circ} < 30^{\circ}$; and in this vicinity search was made for coal.* Near the mouth of this brook, an opening was made from the road in black carbonaceous shale, containing small traces of coal, and on the opposite side of the road are several pits in one of which streaks of bright clean coal, one inch thick and downward, are exposed, and also, it is said, a seam one foot thick. Gypsum and limestone underlie it at no great distance. On the north side of Kennetcook River, immediately below the shop and house of Mr. Nelson Weir, the best of these small coal seams was opened in several shallow pits on opposite sides of the

Coal seams.

*Acadian Geol., pp. 268 and 276.

river; but it appears to have been only a few inches in thickness and an extension of the coal seen both up and down the river. The strike is easterly, the dip doubtful. In a brook from the northward, not far above Mrs. O'Brien's, grey, fine, soft, shaly, flaggy and thick bedded sandstones dip $192^{\circ} < 18^{\circ}$, so that the width of this basin is apparently not great; but whether limestone and gypsum overlies as well as underlies, was not determined.

Elmsdale.

On the road west from Shubenacadie station to Indian road and Bar settlement, rocks of this formation are everywhere in place nearly to the Gore; and on the road down Nine-Mile River to Elmsdale, their contact with the auriferous series is frequently seen.

Debert River.

5. *Outliers of the north side of Minas Basin.*—The limestone and gypsum, red soft sandstones and shales which come from beneath the Triassic of Debert River, not far from its mouth, are described by Dr. Ellis* and Sir J. W. Dawson.† For a great distance to the westward, no rocks clearly of this age appear between the shore and the Devonian of the mountain, but at Clarke's Head‡ “beds of common gypsum and a beautiful purple variety of anhydrite” occur faulted with strata of the underlying formation; and similar patches are found between this point and Port Greville, the unconformable superposition of the basal beds upon the underlying slates being well marked at several places.

Shore east of
Spencer's
Island.

Between the mouth of the brook east of Spencer's Island post office and Mahoney Brook only drift is seen on the shore. Then red marl and sandstone, shattered, rubbly and slickensided in part, are interstratified with bands of greenish-grey conglomerate, grit and sandstone, dipping inland at a high angle and extending to Fowler Brook, where they have an easterly dip, at first very high but decreasing to the eastward and covered again by drift. In the landwash at the brook next west of Phinney Brook is a patch of very soft bright red sandstone, greenish conglomerate and greenish soft marl, perhaps Triassic, with a low variable dip seaward and westward, and a band of grey limestone at the base, which breaks into large nodular blocks. At Phinney Brook, Devonian rocks begin and the outcrops of Carboniferous are interrupted as far as Fox River, from which, however, they extend east in cliffs and reefs nearly to Parrsboro' pier. Near the mouth of Fox River they consist of red shales or marls, with green spots and layers, interstratified with grey, fine-grained flaggy sandstone, wavy and false-bedded, containing

Trias and
Devonian.

*An. Rep. Geol. Surv., 1885, vol. I., Part E, p. 42.

†Acadian Geol., p. 100.

‡Acadian Geol., pp. 105 and 265.

rusty patches full of broken carbonized plants. They greatly resemble millstone grit and the dip would appear to place them, if there is no dislocation, above the rocks of Bull's Bluff and the dark shales and red and whitish, more flinty and broken strata east of Cape Sharp. Between Ramshead and Diligence Rivers, grey sandstones and red marls are finely exposed and probably occupy also the flat land between the shore and the foot of the mountain above the post-road, which extends also towards Parrsboro' with a ridge on the south side.

Up the left or east bank of Diligence River for some distance, rusty and coarse sandstones and rough flags, one of which has a surface often feet by six feet and is a foot thick, are interstratified with red and grey shales, like those of Cape Sharp; then tidal marshes prevail. South of the river, the shore exposes a great thickness of reddish and grey, fine, flaggy, wavy, somewhat coherent sandstones and shales, the former very full of carbonized plants. Near Bull's Bluff are two bands of black bituminous shale, one six inches, the other two feet thick, and a coal seam an inch thick. From Bull's Bluff, these rocks, dipping inland, strike along the shore as far as the Triassic trap and sandstone of Cape Sharp, immediately beyond which, however, they are again well exposed to within half a mile of the Triassic of Partridge Island. A close and accurate survey of these shores was made by Mr. Barlow. Immediately east of Cape Sharp a few blocks of limestone were found on the beach. The marls here dip easterly at a very high angle, are chiefly red but include bands of hard grey sandstone, with two inches of coaly matter and a band of coaly bituminous shale, two feet thick, full of *Naiadites* and other fossils. Then for some distance, sandstones and marls chiefly dark-greenish or grey but also red, containing a few small veins of calcite and ankerite, dip inland and undulate, showing good examples of contorted and faulted strata, some of which have been broken without displacing the beds above and below. About fifty chains north-west of the north end of the gravel beach at Partridge Island, these rocks are underlaid by grey and red conglomerate, associated with grey sandstone and with limestone; and, about a quarter of a mile from the beach, resting directly upon Devonian slates which dip $153^{\circ} < 76^{\circ}$, whereas the dip of the conglomerate and associated red sandstone is $284^{\circ} < 18^{\circ}$. The conglomerate is exposed for only twenty-five paces west of the contact; then comes an interval in which a road goes up from the beach, then a little brook shows red crumbly marl, which continues along the coast to an outcrop of black bituminous limestone, full of shells, succeeded by massive limestone; that by red conglomerate overlaid by grey conglomerate and sandstone,

Diligence River.

Coal and black shale.

Cape Sharp.

Contorted strata.

Unconformity near Partridge Island with Devonian.

Fossiliferous limestone.

flaggy and full of broken plants; overlaid by red conglomerate and marl and by grey, thick-bedded, jointed sandstone, with rusty streaks, large carbonized plants and patches of dark shale. From the first band of grey sandstone to the second is about 200 paces. About 130 further, at a little brook, the dip is easterly; about 250 further at a larger brook, red conglomerate is again exposed, with a westerly dip and overlaid by the rocks described above.

Unconformity
at Parrsboro'
River.

At a point on the east side of Parrsboro' River, lying 121° from the lighthouse, another contact of these two series is to be seen in the cliffs, the conglomerate dipping $282^\circ < 22^\circ$, the Devonian, a few feet from the contact, $165^\circ < 83^\circ$. The conglomerate is red; its pebbles plainly derived from the underlying flinty rocks, every variety of which is represented, range in size from that of a nut to more than a foot in diameter; it contains lenticular layers of greenish-grey flaggy sandstone, full of comminuted carbonized plants, and is overlaid by reddish shale and flaggy sandstone, with green blotches and spots, which are exposed northward to the mouth of a large tidal brook. On the road at this brook, reddish, soft, marly shales, with greenish bands, dip $18^\circ < 51^\circ$. Three-quarters of a mile to the eastward are indications of indian-red Carboniferous marl, and about a quarter of a mile further, of greenish gypseous marl, in the road at a house; whereas immediately above the road, and also below it to the eastward in a brook, the flinty rocks of the iron ore series are exposed and on the shore road eastward to Swan Creek, dark shales and flags. In Swan Creek, a conglomerate outlier, similar to the above, lies among the Devonian near the road. It is indian-red and contains many large pebbles of the whitish quartzite, with which it is undoubtedly unconformable. On the shore between Parrsboro' River and Swan Creek are several outcrops of Carboniferous rocks upon the Devonian.

Swan Creek
outlier.

Wasson's
Bluff.

Triassic trap.

Clarke's Head

With the exception of one small patch of Triassic conglomerate, of which an area of only ten feet square is exposed, the little brook east of Wasson's is occupied, from the road to the shore, by the red rocks of Union. Immediately to the westward, however, cliffs of trap-conglomerate or globular trap begin, and, in alternations with red Triassic sandstone, occupy all the shore round Swan Cove to the gypsum and limestone of Clarke's (Fraser's) Head, large blocks of the trap being apparently completely surrounded by Triassic sandstone. In contact with the trap on the south side, seven paces north of a fish-house, are soft green and red and blackish gypseous marls, with veins and masses of rose-coloured and white gypsum, succeeded by flaggy layers of calcareous rock or limestone, dipping $9^\circ < 70^\circ$, succeeded by a light greenish and rusty

sandstone and dark and light soft marl, dipping $352^{\circ} < 80^{\circ}$, faulted, and succeeded by gypseous marl, containing masses of gypsum, and by limestone veined with calcespar. At 133 paces from the first outcrop the strike is 170° . At fifty further a mass of gypsum carries specks and aggregations of pyrite; it strikes 173° for 241 paces further, then turns at right angles to the westward, a high cliff of purple and greenish slates towering above it along a fault. Devonian slates and flinty sandstones, with veins of ankerite sometimes two inches thick, here dip $22^{\circ} < 42^{\circ}$; but thirty paces further, $119^{\circ} < 50^{\circ}$. The shore turning due west from the Head shows little patches of soft marl and gypsum at 130, 430 and 540 paces, the unconformity of the last being plain; at 900, the granular felsite or diorite of a pinnacle rock has close to it gypseous marls and sandstone, quite unaltered; while through them stick little bosses of the purple and rusty and dark slates, marked with plants, greenish flinty sandstone or quartzite, veined with ankerite, precisely like the country-rock at Londonderry mines, and dipping $200^{\circ} < 45^{\circ}$. One of the veins of ankerite is six inches thick. At 1380, soft marl lies upon the slates; and at 1,750 rusty Carboniferous sandstone and conglomerate, containing much calcespar are succeeded by whitish and dark limestone and gypseous marl; followed at 1,830 by Triassic trap and sandstone, which extend to the brooks in the cove mentioned above as showing the Devonian near the contact of the Carboniferous. Between this brook and the conglomerate are outcrops of dark gypseous marl, with layers of brecciated black crystalline limestone, of purple, red and green Devonian rocks, with a large proportion of dark beds.

Dyke.

Iron ore.

On the west side of the harbour between Parrsboro' and the coal-loading ground at Whitehall Creek are flinty sandstones or quartzites of somewhat doubtful age. Across this creek and that south of it dark shales are well exposed. Then the lighthouse point and a large salt marsh intervene. On Crane Point red and green, flinty, Devonian slates, jointed into rectangular and triangular blocks, and veined with ankerite, underlie a considerable thickness of dark grey and green and grey sandstone and shale. Then towards the pier the red rocks come on the coast, as shown on Mr. Barlow's map, as well as the red and grey rippled flags, underlaid by dark shales and flags, like those of Horton Bluff, containing layers of limestone, of fine calcareous grit and of blackish rock, full of broken plants, upon which rests the conglomerate west of the pier.

Parrsboro'.

Up the large brook quarter of a mile south-west of Parrsboro' railway station, immediately above the road, are dark shales which

have been dug, and grey sandstone in thick and flaggy beds, probably Carboniferous, dipping $341^{\circ} < 70^{\circ}$. Above these outcrops none occur as far as the large alder-marsh, but on the south side of the brook is a ridge or terrace of low hummocky land, its top showing gravel, its base blocks of grey compact sandstone. Above the marsh, light grey fine sandstone and dirty greenish-grey, crumbly, argillaceous shale, dip $300^{\circ} < 40^{\circ}$; and higher up $335^{\circ} < 30^{\circ}$, in barren land not far north of the Blackrock road.

Northumber-
and Strait.

The outcrops of this formation on the shore of Northumberland Strait, between Wallace Harbour and Saddle Island, are apparently the lowest beds of a sharp anticlinal or a great fault which passes between Saddle Island and the mainland. They appear first immediately west of the marshy sand-flats at a lobster factory west of Treen Bluff, and consist of blackish-grey somewhat brecciated limestone, whitish gypsum and dark marl, striking 234° with a nearly vertical dip; interstratified with grey and greenish rusty-weathering sandstone, full of carbonized plants mineralized with black crystalline spar, and containing small veins and blotches of albertite, black spathic iron and calcite. Apparently overlying these unconformably* at a small brook, are reddish pebbly grit and conglomerate, probably Permian, like the cliffs of Cape Malagash and the shores of Tatamagouche Bay. Fine exposures of plaster occur on the inner shore of Wallace Harbour, as stated by Dr. Ellis.

G. 2.—Millstone Grit.

Rocks of this formation, as they occur at Merigomish, have been already described†; and it has also been stated that certain areas included among the lower formations may belong to this, the great faults and unconformities of the district, and the uncertain value of the evidence of fossil plants having left obscure the relation of the various groups, even in the immediate neighbourhood of the coal measures. At the base, at Merigomish, Sutherland's River, the Vale colliery and McLeod's Brook, is a conglomerate not unlike that described as occurring to the eastward and perhaps its equivalent.

Merigomish.

In the little brooks near the railway station of West Merigomish, reddish and grey soft sandstone, with conglomeratic and concretionary patches, is interstratified with marls like those on the banks of Sutherland's River. The grey flaggy beds are blackened by carbonized plants, and certain layers have been quarried. The age of the outcrops of conglomerate and greatly broken, red, micaceous

*An. Rep. Geol. Surv., 1885, vol. I., Part E, p. 41.

†An. Rep. Geol. Surv., 1886, vol. I., Part P, p. 86.

sandstone along the fault near the iron mine at McLaurin's is, as already stated, doubtful.

Some of the grey sandstones, containing impressions of ferns, *Calamites* and other plants, traces of impure coal and black shale, found in thick beds and in flags along the contact of the Pre-Carboniferous rocks on the St. Mary's road and other roads in the vicinity, such as McLellan's Mountain road, are perhaps of this age or higher. The red sandstones and shales of the railway west of French River contain large nodules of grey fossiliferous sandstone and are similar to reddish sandstones, with bands of grey, found in the neighbourhood of Glenfalloch.

The rocks of the East River at Stellarton have already been described. In the rocky land between the head of the McKay Brook and McNaughton's mill on McCulloch's Brook, thence out the old road to the Westville road, are blocks and a few outcrops of a reddish sandstone similar to that of Stellarton and probably of the same age, a large area of rock north of the south fault being referrible to this rather than to the coal measures. The reddish somewhat coherent and greenish-grey and grey beds on the road north towards the Drummond colliery, and also south to the Foxbrook school, exposed in several brooks of the neighbourhood, are perhaps Lower Carboniferous.

Near the Foxbrook school, at Finlay's, a band of calcareous concretionary or conglomeratic rock was supposed to be a limestone and an attempt was made to burn it. Some of the reddish and grey, flaggy, fine sandstones in the immediate neighbourhood of the school are flinty and rubbly as if influenced by a fault. They extend through to the Middle River road and on the road turning to the left about a mile past the school. At the Whitehill road here, a brook shows reddish micaceous sandstone, but a short distance down stream, where it turns away from the road, reddish, very rubbly rocks, include bands of sparkling, quartzose sandstone or quartzite, resembling the Devonian of Rocklin. Lower down are others, lying at a moderate angle yet as rubbly as any of the rocks of Riversdale or Loch Lomond, generally red, but including layers of grey flinty sandstone; these extend to the head of the mill-pond. At the bridge are small veins of pyritous calcspar. But almost immediately below the mouth of this brook the Middle River shows grey sandstones, which have been quarried near the bridge at Union Centre, and include layers of concretionary limestone-conglomerate, a few feet above and below the bridge and supposed by Mr. H. S. Poole to be Lower Carboniferous. And from this point, red soft rocks, with bands of greenish limestone-conglomerate

East River
Pictou.

Foxbrook.

Doubtful
Devonian
rocks.

and of red and grey, mottled, argillaceous sandstone, like that seen on the road from the Black Diamond colliery to McLeod's Brook, are well seen in the river and on the roads of the neighbourhood, including, about 350 yards above the mouth of McLeod's Brook, a small seam of dirty coal. The rocks seen where the railway leaves the road west of Hopewell, are red, soft, flaggy Carboniferous strata, probably millstone grit. Those in Cameron (Meadows) Brook where it approaches the railway, are similar, as well as those seen in the main branch above the railway and in a cutting west of it. But about 250 yards from the brook is a large block of the dioritic rock so characteristic of this region, which, if in place, indicates the Devonian, a supposition which is strengthened by the next outcrops. And the steep dip of the red rocks seems to indicate a great fault.

Hopewell.

Middle River.

At the west end of the Foxbrook road the rocks resemble those of the Black Teeth of East River, being chiefly argillaceous, with hard bands and a layer of green concretionary limestone-conglomerate. Near the river road the dip is $80^\circ < 80^\circ$. On the Crockett road near the limestone are reddish-grey Carboniferous sandstones like those of Hopewell and Foxbrook, associated with bands of concretionary, calcareous conglomerate. No limestone is seen between the outcrop at Crockett's and the quarry at John McDonald's. The rocky ridge of reddish sandstone perhaps cuts off this limestone by a fault or overlaps it both here and between Finlay's and Grant's. The adjoining rocks are almost certainly Devonian. The green shale is very characteristic, and the black shale of Jessie Grant's is perhaps that of the Cross Brook and Archibald's Brook, of West River and of Riversdale.

McLeod's Brook.

Returning to the Middle River, the rocks of McLeod's Brook* are like those of the East River above the west branch, and seem to dip uniformly down stream. They are reddish shales and sandstones, associated up stream with bands of greenish and grey, rusty-weathering sandstone, with pebbly patches. Below the dam at the road a quarry has been opened on a thick bedded, reddish-grey and grey, fine sandstone. At the dam a thick band of nut-and-egg conglomerate is seen, and similar rocks extend to and beyond Oliver's mill.

McCulloch's Brook.

In McCulloch's Brook, a patch of reddish and greenish, micaceous Carboniferous sandstone, which occurs among the Devonian and Permian strata near the Drummond railway, and includes a band of dark grey limestone, is perhaps, like the gypsum of Waters' Hill,

*Geol. Surv., Prog. Rep. for 1866-69, p. 60.

Fraser Brook and the neighbourhood, to be included rather with the underlying formation than with the millstone grit. It is not shown on Logan's map, although the Carboniferous area, a short distance higher, is indicated.

The grey sandstones in Middle River at the mouth of McCulloch's Brook, seem to be coal measures rather than millstone grit. They are for the most part of fine grain, with greenish layers and bands of red and green argillite, ripple-marked and flaggy; and continue in cliffs to the mouth of French's tunnel, from which a large quantity of coal was extracted from a seam supposed to represent one of the workable coals further east. It is underlaid by a rusty, pyritous underclay, and in the river there are reddish argillaceous rocks, with a dark bituminous layer three feet thick, underlaid by calcareous concretionary underclay, perhaps representing the coaly rocks of the tunnel. Grey strata and bands of nut-and-egg conglomerate, and of concretionary grit, occur higher up; but most of the rocks consist of red sandstone and shale, which are well exposed in cliffs. They are succeeded near Union Centre by broken faulted rocks which have been described as Devonian.

The red sandstones and marls west of Burnside and Union Centre are perhaps of this age, the high angles of the dip no doubt indicating faults. Their contact with the flinty series is still somewhat uncertain in places.

As already stated, it is possible that the strata of Debert* and Chiganois Rivers, described as Lower Carboniferous, may be in part at least of this age.

G. 3.—Coal Measures.

The true or productive coal measures are confined to the area determined by Sir William Logan and Mr. Hartley, in their report of 1869 on the Pictou coalfield. The limits as defined by them remain practically unchanged, but "recent mining operations, borings made by Mr. R. P. Fraser, of Pictou, with the diamond drill for certain mining companies, and geological explorations made by the late Mr. Jesse Hoyt and Mr. H. S. Poole for the Acadia Coal Mining Company, have added many facts necessary for understanding the complicated structure of this field," and some alterations and additions are now consequently required in their map. Some of these are indicated by Mr. Gilpin,† and all of them have been

*Trans. N. S. Inst. Sc., vol. VI., p. 93.

†Trans. N. S. Inst. Sc., vol. VI., p. 90; Trans. Roy. Soc. Canada, vol. I., Sec. IV., p. 137; vol. V., Sec. IV., pp. 25-30.

McCulloch's
Brook fault.

worked out in detail by Mr. Poole.* As already stated, a narrow belt included with the coal measures on both sides of the East River, along the southern edge of the field, and east of McCulloch's Brook fault, is now regarded as millstone grit, whereas the rocks of French's tunnel appear to be coal measures. This fault is of much more importance† than is assigned to it, and the Acadia mine so-called basin, instead of being only 800 feet deep, is more than 1,600 feet, and the fault 2,600 feet.

McLeod fault.

The evidence seems to be insufficient upon which the McLeod fault and other minor faults of the district have been drawn. Mr. Poole believes that the former is of trifling importance, and that the continued deterioration of the seams at the east end of the basin—so marked at Grant's slope on the East River and at the Pictou Company's shaft—has produced such a change of thickness and quality that the McLeod seam of less than eight feet represents the Albion main seam of nearly forty feet in thickness, as would seem to be proved by the large quantity of black shale overlying both. A bore-hole was sunk sixty feet at the bottom of the McLeod pit, but no coal found. There is no evidence of this fault on the railway, where it is shown by Hartley. In the railway cuttings, on the contrary, the northerly dip of the Albion mines measures is retained nearly to the McCulloch's Brook fault, where it changes to west, a dip also seen among the red sandstones at the great turn of the Drummond railway, and probably due to this fault. All the faults of the workings on the main seam are north and south faults with, west of English church downthrows to the west, and to the east on the east side of the church; and it seems not improbable that the McLeod fault is one of these. To the westward of the McLeod pit, red rocks are said to have been cut which perhaps indicate the millstone grit or termination of the coal measures, which is also found in a boring at the Nova Scotia or Black Diamond Company's slope. Mr. McBean found the coal south of the pit. North of the pit it seems to have been lost at a north-and-south fault. A number of little faults and consequent derangements of the dip, the paucity of exposures and their small extent, render the precise description of the structure still obscure.

Another east-and-west fault shown on the map appears to be a combination of the Stair-pit and Dalhousie faults inaccurately represented.

*Trans. Amer. Inst. of Mining Eng., vol. XIV., p. 403.

†Trans. N. S. Inst. Sc., vol. VII., p. 391.

Instead of the west fault there appear to be, according to Mr. West fault. Poole, small faults on the flank of a hill of Devonian rock at High-field farm near Westville. The main seam at the Acadia mine is eighteen feet thick, while at the Black Diamond it is eight feet, the bottom benches having turned into stone. And it is supposed by many that, by a further deterioration, the main seam becomes the dirty seam of French's tunnel.

The Mill-road fault also, from close investigations made along the supposed course by pits, appears to be of little importance. Sir William Logan states that it cannot be traced north of Black's mill-site, and at the mill-site the displacement by a number of little faults seems to be of little moment. Above the mill-site at a great turn in McLellan's Brook, is a slight fold of the sandstone which gives rise to two small basins and a slight squeeze or dislocation in a distance of 150 yards east and west, the dip going round in one place from 114° to 157° . Lower down, about twenty yards above the old mill-site, is a curious disturbance, which appears to be only local, as if a small piece in the bed of the river has been thrust on edge, whereas on the left bank the measures are undisturbed.

Changes as great as those described above take place in the character of the coal and of the strata associated with the coal at the Vale. Conglomerate in one place replaces a fireclay and in another the shale above the seam becomes a massive rock. The coal seams deteriorate in going south towards the mountain, and where dipping east or south they are said to be seldom, except in the case of the Captain seam, of such good quality as where dipping away from the east and south faults. The St. Lawrence pit is supposed to be on the eight foot seam of the Vale. The supposition on page 41 of Logan's Report that the Widow McLean seams underlie the McBean seam has since been proved to be erroneous. The eight foot or McBean seam represents the eight foot nine inches or Widow McLean seam, somewhat disturbed by faults; and the McBean and other seams have been traced by Messrs. Barton, Mitchell and McBean to the east fault. The contact of the different series near Donald McLean's south of the Vale—of the coal measures, gypsiferous series and Cambro-Silurian—is shown on the map.

From the George McKay slope a considerable quantity of coal has lately been taken by Mr. Muir from a seam about four feet three inches thick. It is said to be an excellent house coal, easy to work, and is largely sold in Truro. Recent explorations render it doubtful whether Sir William Logan was right in identifying the McKay seam as the six feet seam and in separating the latter from the Mountain seam. The four feet seam, of page 35, line 10 of his

report, is said by McBean to be only two feet, and he supposes it to represent the ten inches of coal lying above the oil shale.

Potter's
Brook fault.

From the Foord pit, levels have been extended a considerable distance east of the East River, and in the opposite direction round the end of a basin, across the supposed position of the Potter's Brook fault and to the high angle of the north rise. Instead of this fault there are here a great number of trifling north and south faults. On this north side of the basin, at Dan Tupper's on the Truro road, a coal seam has been worked, which is supposed by many to be the main seam but is perhaps rather a seam overlying that at some distance. The age of the rocks north of the Truro road at this point is a disputed question. They strongly resemble the Permian grey sandstone of the East River, north of the New Glasgow conglomerate; and their dip at Fraser's quarry is north at a very low angle.

North fault.

The north fault has been shown as crossing McCulloch's Brook a quarter of a mile north of its actual crossing, and, as already stated, the size of the Devonian area of this corner of the map is greatly exaggerated, the rocks in and south of Waters' Brook between Waters' quarry and the railway being millstone grit or Lower Carboniferous, and several large patches in McCulloch's Brook and Middle River, shown as Devonian, being New Glasgow conglomerate.

The rocks of the little branch of McLeod's Brook, between it and the Nova Scotia colliery, along which the road now follows, consist of grey, coarse, rusty-weathering sandstone, associated with one seam of dirty coal. Below the bridge are reddish-grey, fine, soft, marly sandstone and spotted concretionary, reddish-grey sandstone, probably the upper beds of the millstone grit, unless a fault intervenes, of which there seems to be no evidence.

G. 4.—PERMIAN.

Subdivisions.

Rocks of this age as displayed between Merigomish and Pictou and along the north side of the Pictou coalfield, have been already described.* They may be subdivided as follows:—

1. New Glasgow conglomerate.
2. Middle grey sandstone and shale group, with small coal seams.
3. Upper red sandstone and shale group, with thin bands of limestone.

*An. Rep. Geol. Surv., 1886, vol. II., Part P, p. 93.

These groups lie in parallel belts along the shore of Northumberland Strait between Merigomish and Wallace,* dipping seaward, generally at a low angle, but broken by faults sometimes of considerable magnitude. Between the second and third groups there is no distinct line of demarcation and the subdivision is only one of convenience. Distribution.

1.—New Glasgow Conglomerate.

Although rocks of the lowest of these subdivisions occupy a belt from five to two miles wide between Fitzpatrick Mountain and Waugh River, they are entirely absent at Bailey's Bridge, one mile and a half west of Waugh River, owing either to a fault or to unconformity, the grey and brown sandstones coming upon the Pre-Carboniferous rocks of Tatamagouche Mountain. The other groups are everywhere present, exhibiting more or less persistence in their composition and appearance until traced into connection with the large areas in Cumberland county.

The outcrops of the conglomerate between Merigomish and the Middle River of Pictou, between Alma and Granton, have been fully described. At the Middle River, they are broken apparently by a great north-and-south fault, and on the west side of Greenhill by another, beyond which they reappear in Fitzpatrick Mountain and are continuous to Waugh River. Considering that the conglomerate at New Glasgow and elsewhere contains pebbles and blocks of grey sandstone which are as likely to have been derived from the coal measures as from the millstone grit (which here contains far more red beds than grey); that the millstone grit has not been proved unconformable to the coal measures, but seems rather to pass upwards into them, the presumption is strong that the New Glasgow conglomerate is newer than the coal measures, as assumed in last report, the absence of fragments of coal from such coarse conglomerates counting for nothing,† as a larger proportion of pebbles of syenite and diorite and of Devonian and Silurian slates is present in all the conglomerates. A hole 734 feet deep, bored on the south side of Sutherland Point, below New Glasgow, in search of coal, on the assumption that the coal measures were there concealed by an unconformable overlap of the Permian, seems rather to add weight to the supposition that the conglomerate is a basal portion of the Permian, a conclusion at which, I am informed by Mr. McBean, Sir William Logan arrived Evidence of age.

New Glasgow
Borehole.

*Acadian Geol., p. 129.

†Trans. N. S. Inst. Sc., vol. VII., p. 202.

upon a re-examination of part of the coalfield subsequent to the publication of his report. The borehole seems to have cut only strata similar to those naturally exposed on Smelt Brook and on the river.

Fault.

At New Glasgow on the old Merigomish road, and south of it, about a-quarter of a mile from the bridge on the river, the conglomerate strikes 64° , vertically or with a steep dip to the south. Perhaps this is the fault mentioned by Mr. Poole.* The last outcrop is near the fork about 200 yards east of Church's livery stable. A steep dip is also seen on the left bank of East River, above the bridge. Perhaps both are due to the proximity of the north fault, which must be in that case subsequent to the deposition of the conglomerate, as are others in the neighbourhood of the Middle River.

Unconformity

Along Blackwood's millbrook, however, which, as described by Mr. Hartley, is the unconformable boundary between the conglomerate and millstone grit for some distance to the westward, the dip of the former is not so steep. The dip of the millstone grit in the first little tributary from the south, about 250 yards from the river road, is $29^\circ < 62^\circ$, while the general dip of the conglomerate is much more northerly. Nearer the old quarry road, the millstone grit dips $44^\circ < 66^\circ$, and still nearer, reddish harsh shales of the same age dip $51^\circ < 66^\circ$. On the south side of the road at the bridge on this tributary, underclay and coal indicate the measures of the south side of the great north fault. The direct superposition of these rocks is seen in this brook at the dam forty yards above the bridge on the East River and twenty yards north of the old quarry road, showing very clearly the unconformity between the two groups. Grey sandstone, with greenish and reddish tints, dipping $42^\circ < 51^\circ$, is overlaid by thick beds of very coarse conglomerate which fills depressions in the lower beds. These are not perhaps, however, necessarily higher than the Carboniferous limestone, patches of which are found on Waters's Hill, although included with the millstone grit by Mr. Hartley.

Coal and limestone

The limestone associated with the seam of coal which overlies the conglomerate at James Small's and William Fraser's (Moose) is said by Mr. Fraser to have been struck in a boring on Middle River, near Sylvester station, and to be there twenty feet thick. In Small's Brook the rocks of this horizon are well exposed, consisting of underclay, coaly shale and botryoidal limestone, but no pure coal seems to have been obtained. The dark layers are perhaps equivalent to those of the Smelt Brook described by Mr. H. Poole. According to Mr. Fraser, the coal and limestone come to the East

*Trans. N.S. Inst. Sc., vol. I., p. 37.

River a little below the cemetery. To the westward they do not seem to have been satisfactorily traced, although the dark layers of Rear Brook are no doubt those of the small brook. At Deacon's Cove, at the mouth of Rear Brook, according to Mr. Poole, a pit twenty-three feet deep struck six inches and a-half of oil coal, passing through light blue clay stone, full of fossil plants; and dark shales are found higher up this brook at the quarry.

About 100 yards above the bridge at Alma, Middle River displays Middle River. red coarse conglomerate, dipping $155^{\circ} < 50^{\circ}$, containing patches of grey soft sandstone and of red marl; some of the large pebbles are certainly derived from the millstone grit or coal measures, but most of them are Devonian. Down stream these rocks are succeeded by the Devonian, but again reappear and run up Brown's Brook, in which the conglomerate, in nearly horizontal bedding, includes red and greenish, calcareous, micaceous shale, sometimes coherent and like Lower Carboniferous. Among these beds is a six-inch layer of dark fine sandstone, full of carbonized plants of large size; overlaid by nut-and-egg conglomerate and grey, shaly sandstone, stained green with copper ore. At the mouth of McCulloch's Brook come coal measures, dipping steeply down stream, south of the north fault. Good outcrops of the conglomerate are seen along the Pictou Branch railway, immediately east of Middle River; it contains large pebbles of the reddish, greenish and grey sandstone of the millstone grit, but perhaps none of the coal measures; the dip is northward along the railway at a very low angle. North of the railway bridge, in the small brook shown by Mr. Hartley, as the northern limit of the conglomerate, no rocks are seen up to the bridge on the Nova Scotia Company's old railway, although large blocks of reddish sandstone are found, which may, however, be similar to the thick beds of red sandstone interstratified with the conglomerate in the railway cuttings at Middle River. But far to the northward on the shore are outcrops of conglomerate among layers of red soft marl and sandstone—alternations precisely similar to those on the west side of Middle River some distance back from the river, the western shore of which is skirted by red marl and sandstone, which appear to overlie the conglomerate and thus indicate a north-and-south fault, with a downthrow on the west side. North of the brickyard, conglomerate, sandstone and marl, with a low easterly dip, extend to Little Gut, on the north side of which a greenish and grey marly rock, exposed at the base of the cliffs, includes coaly streaks, overlaid by red marly shale and succeeded to the northward by a fine outcrop of reddish, nut-and-egg conglomerate, which, near the Granton wharves, dips steeply east.

North of this point the shore is low as far as Begg's Gut, where grey sandstone begins.

Devonian and
Carboniferous
rocks.

About 300 yards below the fork of McCulloch's Brook and Middle River, and half way between the river and the Truro road, in a little brook, are large blocks of fine sandstone and conglomerate. Lower down and about 450 yards above the dam, also on the right bank of the river, sandstone, marl and conglomerate are in contact with Devonian rocks, which apparently do not extend to the road. The conglomerate first seen in contact with the Devonian below the dam, and below Brown's Brook, dips steeply towards these rocks, from which it appears that the junction is a fault; in the brook it is not seen in direct contact with the Carboniferous rocks. The latter do not resemble the grey rocks of French's tunnel so much as strata somewhat lower in the series; they include, however, a band of dark grey underclay.

McCulloch's
Brook.

The road from Alma bridge westward to the cross-road appears to be all in conglomerate, and in the other direction this rock extends apparently to the bridge on McCulloch's Brook, where the grey coal measures begin. The outcrops of New Glasgow conglomerate, first seen in McCulloch's Brook above the Truro road and in the neighbourhood of the high railway bridge, are succeeded by Devonian; but two patches lie nearly horizontally, higher up the bed of the brook, separated by Devonian strata. The hills and left bank of the river near the railway bridge seem to be an extension of those of the east side and to be composed of conglomerate. There is apparently, however, a fault down along the river hereabout.

Greenhill.

The little brook 365 yards south of Alma cross-roads shows no rocks above or below the road, but only blocks of grey sandstone. On the road south-east from Brown's carpenter shop, at the Truro road, good exposures of very crumbly nut-and-egg conglomerate are seen all the way to Brown's Brook. The watering brook above the Truro road shows only Devonian debris; but the Greenhill, along the south foot of which the road follows, shows coarse conglomerate everywhere on its steep sides, along the tops of the ridges and on its western terraced slopes. The soil of this hill is wonderfully good, having maintained its fertility for many years under constant cultivation. Near the foot of the hill is a very steep dip 167° , but in most parts the dip is nearly horizontal. Some of the blocks of greenish-grey sandstone in the conglomerate are two feet in diameter.

On the road from Durham up along Roddick Brook, are many blocks of reddish, soft sandstone. Above the crossing of the brook the latter shows outcrops of similar sandstone succeeded by conglomerate, with pebbles as large as cocoanuts, chiefly Pre-Carboniferous, but also of rusty fine sandstone, concretionary limestone and other Carboniferous rocks, which continue to the top of the hill, thence south to Salem Presbyterian church. Durham.

The brooks north of Alma show good outcrops of the conglomerate, with a low dip, overlaid by reddish, softer rocks, containing scattered grains of bright red hematite. In Crockett Brook near the school, conglomerate dips at a very low angle. South of Sylvester station, in the brook between John Roy's and Elbridge Archibald's, reddish-grey, soft, flaggy sandstone, including patches of concretionary conglomeratic rock, dips northerly and easterly, probably at the apex of a basin. Further north the dip is more southerly. Sylvester.

The conglomerate of Greenhill is apparently interrupted near the West River by a fault; and higher rocks, still dipping eastward, occupy the country for some miles west of the river. It reappears, however, in Fitzpatrick Mountain, is exposed in Sawmill, Stewart and other brooks, and follows the high land to the westward. Towards Millsville, the sequence of these and the overlying formations can easily be made out in the brooks and rivers; and ledges of reddish coarse conglomerate on the roads show pebbles of reddish and green Upper Devonian flinty rocks and also of softer sandstone, probably Carboniferous. West River fault.

Elmfield Brook, above the post-road, shows red sandstone and marl, succeeded by conglomerate affected by a fault. In the upper branches of Plainfield Brook, grey, greenish-grey and reddish-grey sandstone and marl include bands of coarse, calcareous conglomerate, and the conglomerate which underlies these beds is then continuous to the head of the brook. In the left branch, below fine outcrops of conglomerate, are reddish sandstone and marl, with green layers, calcareous nodules and small veins, succeeded by a coarse conglomerate in contact with very flinty, igneous rocks. These and other fine outcrops of Mount Dalhousie require no special mention. With the conglomerate is always interstratified sandstone of great variety of texture and often marly; sometimes its pebbles are six inches in diameter; sometimes on approaching the older rocks it is too coarse and massive to show the dip. Numerous east-and-west faults affect these rocks, and their dip towards the mountain is no doubt due to one of these and perhaps also the disappearance of the conglomerate west of Waugh River; for it seems hardly probable that in so short Elmfield and Plainfield.
Igneous rock
Waugh River fault.

a distance it should have lost its conglomerate character and have been replaced by finer sediments, as at Quarry Island.*

West Branch
of River John.

The west branch of River John above the iron bridge at the village, flows between cliffs of coarse conglomerate, underlaid by red marl, succeeded up stream by dark grey fine grit, reddish, harsh, sandy shales and purplish and green mottled shales, with calspar blotches mixed with albertite. At the mill-dam the rocks are vertical. Above the pond, coarse conglomerate and reddish crumbly marl, with green blotches, are overlaid by dark reddish-grey fine grit. These rocks are apparently not changed, either in dip or texture, by the trap with which they are in contact; they are followed up stream by marls with concretionary patches, sandstone spotted with baryte and films of albertite, which is in places the cementing material of the pebbles. Similar rocks extend to Loganville; then coarse conglomerate to the old rocks. The strata below the village are affected by one or more important faults which bring higher rocks in contact with a conglomerate, probably equivalent to that just described. Their relations to the beds lower down the river will be understood from the following approximate section which begins at Cape John and is measured in the river. The limestone (No. 15) is, perhaps, equivalent to that found above the conglomerate in the neighbourhood of New Glasgow. It is said to be hard to burin, but to yield a white, excellent lime greatly prized by plasterers and masons. Overlying it a seam of coal, several inches in thickness, is said to have been found among rocks resembling those of Quarry Island and Big Island and including beds of fine and coarse conglomerate.

Trap.

Albertite.

SECTION OF PERMIAN ROCKS IN RIVER JOHN IN DESCENDING ORDER.

1. Grey and greenish-grey, crumbly, coarse sandstone, rusty-weathering, full of carbonized plants, underlaid by reddish sandstone and overlaid by grey fine sandstone, in shaly or thick beds, with spherical and cylindrical masses of fine rock sometimes 4 feet long

Ft. In.

32 0

The thickness may be greater. For the next mile and a half the shore is occupied by red sandstone and marl with grey and greenish bands apparently underlying nearly to the lobster factory at Cape John†, where a coarse, grey sandstone, perhaps the same as above stands vertically in every direction, greatly broken to the "bill" of the Cape. The faults here are hard to understand.

Faults.

*Geol. Surv. of Can., An. Rept., 1886, vol. II., p. 94 P.

†Trans. Geol. Soc., London, vol. IV., p. 507.

Ft. In.

From the "bill" eastward along the outer shore for three miles, the section is ascending to the bottom of a syncline, at a small brook which falls over the cliffs and in which occur small concretions of bog manganese. Perhaps the grey sandstone or conglomerate of the headland is the same as that already referred to, and is separated from all the rocks in the bottom of the basin by a fault. The syncline mentioned above may be only a turning of the strata towards a fault with upthrow on the north-west (magnetic) side which is followed by others near the "bill."

- | | | | |
|--|-----|---|-----------------------|
| 2. Red sandstone and marl with greenish and grey layers and a band of concretionary rock. Some layers fit for quarrying. Dip turns to $232^{\circ} < 4^{\circ}$, and the thickness is consequently uncertain..... | 217 | 0 | |
| 3. Grey somewhat impure limestone, quarried to a small extent.... | 2 | 0 | |
| 4. Reddish wavy sandstone, with green blotches, interstratified with red argillaceous shale. Dip $325^{\circ} < 5^{\circ}$ | 66 | 0 | |
| 5. Measures concealed by the low shore north and south of Murphy's Creek. On the opposite shore are exposed several bands of grey and reddish, fine and coarse sandstone and shale, in one of which are the nodules of copper glance found on the shore at River John. Dip $< 5^{\circ}$. At the base of the long sand beach rocks are again well exposed..... | 545 | 0 | Copper ore. |
| 6. Reddish soft sandstone and shale or marl, showing in places broad markings of <i>Cordaites</i> . Includes the bands upon which Hines's, Rogers's, and other quarries of the neighbourhood are situated, from which the celebrated brown stone of River John, used in the erection of the New Glasgow post office and other buildings, was obtained. Includes also the strata exposed in "The Brook," one of which contains many plants stained with copper. To the bridge at River John village. Dip $318^{\circ} < 8^{\circ}$. The exposures are by no means continuous, but wherever seen, the rocks dip at a low angle..... | 973 | 0 | Brown stone quarries. |
| 7. Red, crumbly, micaceous sandstone and marl with concretionary, nodular, calcareous layers; grey, fine, banded sandstone, with a tinge of red, quarried in large blocks. To the south end of the railway bridge..... | 416 | 0 | |
| 8. Reddish sandstone and shale, with layers of greenish, grey and reddish, nodular, concretionary, calcareous sandstone and grit, rusty in part, and holding plates of coal, perhaps albertite and carbonized plants. To the Telegraph road at Welsford... | 164 | 0 | Coal. |
| 9. Brick-red massive sandstone, seen in high cliffs at Man-of-War rock..... | 30 | 0 | Man-of-War rock. |
| 10. Red sandstone and shale; grey flaggy and thick-bedded sandstone, some of fine grain but chiefly of coarse grit, of which one band, at least 25 feet thick, has been quarried; band of grey, calcareous, concretionary rock; several bands of coarse, green and red, spotted, concretionary rock, one of which passes into an impure limestone 18 inches thick. Like certain strata of Cape John shore, and not unlike the Trias of Truro..... | 970 | 0 | |

		Ft.	In.
	11. Red sandstone and marl; fine, thick-bedded, grey, wavy sandstone with concretionary patches and layers of grey coarse grit. Exposed as far as Weir's mill. Dip $337^{\circ} < 12^{\circ}$. These enormous thicknesses may possibly be due to original deposition on a slope, or the steeper dips may indicate faults which cross in the concealed spaces.	1,053	0
Grindstones.	12. Grey, coarse, pebbly sandstone, overlaid by reddish sandstone and shale, and by grey, fine, flaggy sandstone which has been quarried and includes bands of red sandstone and shale, and of calcareous, flaggy, concretionary limestone-conglomerate. These latter often occur among the grey sandstones. Grey and greenish fine sandstone then extend for a great distance. The grey sandstone largely predominates, and many beds have been quarried for grindstones. Well exposed to the mouth of the little brook south of the McNab road. Dip $< 25^{\circ}$. This high angle of dip prevails for nearly the whole distance, and does not seem due to false bedding or faulting.		
Copper ore.	Copper ore has been found at this brook.	3,124	0
	13. Reddish conglomerate and coarse grit $< 9^{\circ}$	340	0
	14. Red and grey, mottled, concretionary, fine and coarse sandstone.	10	0
Limestone.	15. Grey botryoidal limestone quarried below William Matheson's, on the left bank of the river, and also on the right bank. It is wrinkled, compact, somewhat impure, mixed with clay and sand.	5	0
	16. Reddish sandstone and shale, reddish crumbly conglomerate and whitish fine sandstone. The conglomerate greatly predominates; it is generally pea-and-nut conglomerate, but holds pebbles 18 inches in diameter. Among others of syenite, felsite, &c., are pebbles of reddish, soft, Carboniferous sandstone and grit. Dip $0^{\circ} < 10^{\circ}$. To a fault about 1,000 feet below the fork of the east branch. From the fault the continuity of the section is perhaps unbroken to the mouth of the river.	160	0
Fault.	17. Brownish-grey, fine, sandy flags; reddish-grey sandstone with layers of reddish argillaceous rock, spotted with green; crumbly shale with whitish and greenish patches; concretionary beds full of nodules of impure limestone as large as eggs; patches of whitish-green grit. Some of the rocks show rain marks and blotches of calcspar. These rocks occupy a space of about 1 mile along the bends of the river, and are perhaps unconformably below the foregoing. They are broken by two faults, and a third occurs at their base. ....	..	..
	18. Greenish-grey, reddish and brownish argillaceous shale and somewhat soft sandstone in irregular flags, more or less calcareous and concretionary, with films of calcite and albertite in the joints. The red strata predominate, the grey sandstone is of good grindstone grit. Exposed only at intervals, dipping $341^{\circ} < 32^{\circ}$, to an east-and-west fault, at the base of 17, which crosses the west branch about 1 mile below the bridge. ....	..	..
Albertite.	19. Measures concealed. ....	..	..

Ft. In.

20. Dark grey coherent conglomerate with a few veins of calcspar, overlaid by reddish fine sandstone. Dip $292^{\circ} < 10^{\circ}$. Seen below the bridge at West Branch, but exposed for only a short distance. Perhaps the same as 16.....

.. ..

Total thickness of Permian rocks..... 8,107 0

The conglomerate of North Earltown overlies Silurian, igneous and, probably, Devonian rocks; that of the Biorachin rests upon Silurian, whereas that of Mount Dalhousie is in contact with felsitic rocks: it is composed chiefly of Devonian debris. Many blocks of grey sandstone occur on the Earltown road near the county line, but in the brooks to the southward there are outcrops of conglomerate, like that of Loganville, which extends north apparently to the fork of the Denmark road, and is abundant about McBean's Corner. Outcrops are seen almost everywhere within the limits marked on the map, which are generally well defined; and it would be useless to attempt to enumerate all the localities. In Matheson Brook, not far above its confluence with Waugh River, is a cliff of grey rusty-weathering sandstone, underlaid by grey concretionary limestone-conglomerate, with plates of baryte in the joints, near which a little coal is said to have been found. Further up stream the brook comes through a small spring, bog or barren, on which nothing grows, and from which have been taken pieces of wood impregnated with copper ore; above which reddish-grey fine sandstone, in thick beds, is underlaid by reddish conglomerate, with which the brook is floored all the way up to and beyond the mouth of Moore's Brook. Boulders of Silurian rock found in this conglomerate exceed three feet in length, and perhaps give rise to the large number of field-stones, full of Silurian fossils, which over-spread the country between Balmoral mills and the falls of Waugh River. The conglomerate of Waugh River occurs at the base of a succession of Permian rocks between Tatamagouche Harbour and the mountains, of which the following is the approximate thickness and section. French River section begins from the same point but is four miles and a half distant at the base.

SECTION OF PERMIAN ROCKS IN WAUGH RIVER FROM WHARF AT
TATAMAGOUCHE VILLAGE IN DESCENDING ORDER.

	Ft. In.
1. Red marl and sandstone, including a bed which has been quarried. To bridge on the Telegraph road. Dip $44^{\circ} < 8^{\circ}$	64 0
2. Reddish-grey, coarse, pebbly sandstone, underlaid by red marl and sandstone. To bridge on the back road.....	173 0

		Ft.	In.
Quarries.	3. Red marl and sandstone, with a band of dark shale towards the bottom.....	375	0
	4. Reddish-grey, coarse, pebbly, massive sandstone, with partings of red and green shale. Quarried.....	20	0
	5. Red marl and sandstone. Dip $1^{\circ} < 13^{\circ}$. To mouth of the Black Brook.....	282	0
	6. Red marl with bands of shaly and flaggy sandstone and including layers of greenish-grey sandstone and of coarse limestone-conglomerate. The latter passes into a grit full of calcspar veins and nodules of reddish impure limestone. The sandstone is sometimes fit for quarrying. In one of the lowest concretionary beds near the bridge copper has been mined. To the red bridge at the mills of Waugh River post office.....	682	
	7. Rocks for the most part concealed or where seen consisting of reddish and grey soft sandstone and shale. To the mouth of Yellow Brook.....	653	0
Copper ore.	8. Grey and greenish-grey coarse and fine sandstone, in rough, flaggy beds, with lenticular layers of greenish-grey concretionary limestone-conglomerate. Some beds of light-grey colour and good grindstone grit, in smooth, even layers of 2 feet and 1 foot in thickness, have been quarried. Underlaid by reddish-grey, somewhat coarse, pebbly, soft, micaceous sandstone, often striped and spotted with black, and by brown or indian-red fine sandstone, with green spots, false-bedded. In the quarry-sandstone are occasional hard spots and soft patches. Some beds are prettily striped greenish-grey and brown. Well seen in the Yellow Brook. Markings of plants. Red, soft, marly layers. To near the mouth of Four Mile Brook. Dip $346^{\circ} < 13^{\circ}$	490	0
	9. Between the mouths of Four Mile and Matheson Brooks. Rocks also well seen in Four Mile and Sutherland Streams and in Yellow Brook near Frederick Haymond's. Brownish and grey sandstone and banded and spotted, arenaceous shale, with layers of dark reddish-grey sandstone. Also greenish-grey, fine and coarse, flaggy sandstone, full of broken plants, with concretionary, coarser patches, containing traces of copper ore dug in the Yellow Brook about half a mile below John McKay's; fucoids in grey and reddish soft shales. Some beds of fine sandstone which have been quarried. Brownish, and grey and blackish, fine, micaceous flags, like rocks in the east branch of River John, not far above the fork of the west branch. The brown stone is sometimes in bands 20 feet thick and somewhat massive or in even flags, some of it fine in colour and texture. Layers of limestone-conglomerate. Blotches and bands of hematite, seen in Four Mile Brook. "Bulls" of harder sandstone; comminuted plants. A streak of albertite, a quarter of an inch thick in bedding of grey, fine sandstone. Films of baryte in the joints. A very large preponderance of sandstone usually more or less grey. Dip $346^{\circ} < 11^{\circ}$	580	
Albertite.			

	Ft.	In.
10. Sandstone similar to No. 9, to the boundary of the conglomerate. A thickness of about half of this or 195 feet brings us to the base to the felsitic rocks at East New Annan; and at Bailey's bridge this is the base there being no conglomerate. The dip at both these localities is low, so that perhaps there is an overlapping and not a fault, in which case the grey sandstone would appear to be unconformable to the conglomerate.....	390	0
11. Conglomerate, seen well in a picturesque, rocky valley above and below the falls. Reddish-grey, nut-and-egg; pebbles chiefly of fossiliferous Silurian rock and of reddish flinty sandstone, like that of Earltown supposed to be Devonian. Some boulders several feet in diameter. Reddish-grey, soft sandstone layers. Lines of bedding sometimes dip at a very high angle but obscure. Thickness consequently doubtful: it occupies a breadth of about 5940 feet, $< 13^\circ$	1,336	0
12. <i>Pre-Carboniferous</i> . Light grey and greenish-grey, fragmental, flinty agglomerate or breccia of dioritic or felsitic aspect; contains much chlorite, a few blotches of quartz and syenite. Has occasionally a minute jointing or lamination.....	.....	..
Total thickness.....	5,045	0

In the Millbrook, a tributary of French River, at 500 and again at 800 yards above the Florida road, and also in the fields east of that brook, a conglomerate is in place which resembles that of New Glasgow; it has been included by Dr. Ells with the Lower Carboniferous. About 800 yards below the road, reddish-grey and brownish, soft shale and flaggy sandstone dip $9^\circ < 35^\circ$ and extend for some distance down stream, including bands of good grindstone grit, and, about one mile and a half below the road, traces of coal. Grey sandstone occurs along the Florida road to the westward, and has been quarried in Higgins Brook; it has the tinge of pink characteristic of the rocks which overlie the conglomerate to the eastward, and is hardly distinguishable from the rocks of Wallace River, at the bridge on the road to Westchester station, coloured Permian on Dr. Ells's map. The road to Swallow settlement shows indications of sandstone, like that of French River, and of a coarse, reddish conglomerate.

The road to Westchester station from the bridge mentioned above, runs south along the west side of Wallace River for about a mile, then turns to the westward; it shows no definite exposures as far as the road which turns to the right across the west branch of Wallace River. About a quarter of a mile north on this latter road, however, are probable outcrops of reddish-grey, crumbly, fine sandstone, and at the bridge over the west branch are cliffs and reefs of fine, reddish, Permian sandstone, in thick beds. Up stream the river

Greenville

exposes reddish, brownish, grey, and greenish, thick-bedded sandstone, fine smooth flags and marly shales, dipping north-easterly at a low angle, with coarse, calcareous, concretionary layers; underlaid by reddish soft, nut-and-egg conglomerate, dipping $350^\circ < 10^\circ$, and interstratified with greenish-grey fine and coarse sandstone, coarse quartzose flags and dark reddish and grey sandstone and argillite, among which was seen an upright *Sigillaria*, two feet in diameter. The conglomerate is very like the Lower Carboniferous conglomerate of McElman Brook and the railway west of Londonderry. Up the branch from Westchester station are rough beds of reddish-grey somewhat crumbly, nut-and-egg conglomerate, with layers of dark reddish sandstone, precisely like the rocks of the west branch of River John below Loganville. The proportion of finer sandy beds is very small; some of the pebbles are more than a foot in diameter, and fine exposures occur in cliffs both above and below Greenville station and as far as the bridge on the railway, above which, at Purdy's mill near Westchester station, grey sandstone is said to have yielded threads of coal.

In the other branch of the river, west of Greenville station, outcrops of reddish, coarse conglomerate, grit and sandstone are also found above the railway, along which westward towards Thomson station, and also on the road from the station south to Williamsdale, and on River Philip above the railway, similar rocks dip northerly at a low angle. But as already remarked, the Permian resembles the Lower Carboniferous and millstone grit in lithological character and there are evidently faults along the north side of the Cobequid Hills as well as on the south; so that it would be rash to attach too much importance to these indications without a closer investigation of this district.

2.—Permian Middle Group.

Coal.

In the two sections presented above, the grey, brownish and reddish sandstones which overlie the conglomerate have been described; and many particulars concerning those which occur on the Big Island of Merigomish and on the coast between King Head and Pictou Harbour were given in last report.* The coal of the Big Island of Merigomish is said to be again found near the lighthouse on King Head, from which coal is said to have been taken a few years ago. Coal is also said by Sir J. W. Dawson to occur at Little Harbour, at Abercrombie and at the mouth of Middle River;† by Mr. Poole,

*Geol. Surv. of Can., An. Rept., 1886, vol. II., p. 95 P.

†Acadian Geol., pp. 326 and 343.

to be found between Abercrombie Point and New Glasgow, and again near the gas-works at Pictou. Several quarries have been opened on the grey sandstone north of New Glasgow, the dip being at a low angle, somewhat hard to distinguish precisely, even with large exposures. Quarries.

A section of the strata between Smelt Brook and Shipyard Point is given by Mr. Poole,* together with many particulars about the rocks of the west side of the East River. Smelt Brook.

Rear Brook above the bridge on the shore-road exposes grey and greenish-grey, nearly horizontal sandstone, full of carbonized plants, interstratified with greenish, rusty, grey and red argillaceous shales and a thin band of underclay. Below Captain Fraser's quarry, a spring deposits yellow ochre; at the quarry is a little band of coaly shale less than a foot in thickness, containing *Cordaites*, fish-scales, teeth and coprolites; above it are grey and greenish flags with a bed of black calcareo-bituminous shale showing markings of plants. On the road towards New Glasgow the point of junction of the conglomerate and grey sandstone is not seen, although many pieces of the latter are found near the first brook south of Rear Brook, and up stream to a farm road, above which are fragments of reddish sandstone, perhaps millstone grit. Rear Brook.

At Abercrombie Point, from the ferry wharf south towards the loading ground, broken, grey sandstone is in the road-cuttings; and further south coaly debris, 120 paces north of a little brook at which is a fine spring, said to come from a bore-hole. Another boring was made at the mouth of this brook, and search for coal lately renewed by Mr. Hugh Fraser and others. At 405 paces further south is a little brook upon which is a spring and bore-hole, on Matheson's farm, mentioned by Mr. Poole.† Abercrombie.

East of McKeen's quarry at Pictou a piece of very rough land shows blocks of coarse sandstone, like that of the shore west of Widow Point. At Mr. Smith's (ice dealer), north of the town-line and west of the road to the Millbrook, the dip is said to be due east at a moderate angle. At Brown's Point is an exposure of red soft shale. Thence along the railway towards Scotch Hill, the debris of similar rocks abounds, the country being low and the streams showing no outcrops. About a quarter of a mile east of Scotch Hill station are blocks of grey fine sandstone, a hill lying on the right. In Lyons Brook, immediately below the dam, are alterna- Pictou.

*Trans. N. S. Inst. Sc., vol. I., pp. 36 and 39; Acadian Geol., Supplement, 1878, p. 35.

†Trans. N. S. Inst. Sc., vol. I., p. 36.

tions of grey and reddish sandstone and shale, with a very high southerly dip down to a bridge on a farm road below which the dip is low. At the railway on a branch of Lyons Brook, the dip is $167^{\circ} < 35^{\circ}$ and immediately to the westward is a nearly vertical northerly dip which probably indicates that the fault is just at the railway track, passes through the Big Marsh and meets a fault shown by the dip in Black River. At the crossing at the main road to the westward, a steep hill is on the right, composed apparently of grey sandstone, resembling that of Battery Point and the marine slip. The high easterly dip north of the southerly dip of Haliburton Creek may point to a master fault coming from the south, which continues to the northward, but against which the Lyons Brook fault ends.

Pictou
Harbour.

From Pictou to Brown's Point the railway closely follows the shore which shows no rocks but only a loose, coarse sand formed from grey sandstone like that found near the marine slip at Pictou, near Pictou Landing and the lighthouse. On the shore towards Haliburton Creek are indefinite outcrops of brownish, crumbly sandstone, with a very low easterly dip; and beyond two little brooks where the road comes close to the shore near Gavin Island, is a small outcrop of coarse conglomerate, interstratified with grey, shaly sandstone. No rocks are then seen as far as Sawmill Brook, above the bridge over which, however, grey sandstone has been largely quarried. Further up the harbour is a small exposure of red sandstone and marl; but all the shore is low in the neighbourhood of the bridge over West River, and also down the right bank towards Loch Broom Point for a great distance. At and near the point, conglomerate and reddish concretionary sandstone are interstratified with harder, globular, concretionary masses, almost horizontal. From Loch Broom Point up the Middle River the shore is fringed with marshes infested with mosquitoes, and the cuttings on the railway are in clay and gravel as far as the bridge, above which reddish, coarse, bouldery conglomerate is met with.

Loch Broom.

North of the marine slip at Pictou, the rocks exposed are for the most part grey crumbly sandstone, lying at a low angle, the dip at the south end of the hospital grounds being $87^{\circ} < 12^{\circ}$.

Mr. Fraser's
section of
bore-holes at
Pictou.

In the town of Pictou several deep borings have been made in search of water; and from the records of these a section of the Permian strata between the most easterly at the marine slip and the conglomerate of Haliburton Creek, has been made by Mr. R. P. Fraser. The dip is assumed to be easterly < 1 in 7.5. Good sections of two of these bore-holes at Campbell's tannery and Fraser's, give the greater part of the thickness. The principal bore-holes are:—

1. Campbell's tannery, bore-hole 677 feet deep, 60 feet above tide, gives strata to Haliburton Creek, 5,000 feet.
2. McKimmie's, 300 feet deep, 80 feet above tide, 863 feet east of or to deep of No. 1 (=115 feet vertical and 20 feet higher) gives 135 feet of strata overlying No. 1.
3. Howard Primrose's, 140 feet deep, 30 feet above tide, 425 feet to deep of No. 2, all grey freestone. Only 7 feet above top of No. 2.
4. Fraser's, 380 feet deep, 130 feet above tide, 1,100 feet to deep of No. 3, gives 247 higher than 3. Cores at the Pictou Academy.
5. Clarence Primrose's house, 288 feet deep, 70 feet above tide, 1,300 feet to deep of No. 4, gives 113 feet higher than it.
6. Clarence Primrose's mills, 600 feet deep, 20 feet above tide, a little to the rise of No. 5. Cuts the same strata.
7. McConnell's, 121 feet deep, 20 feet above tide, 838 feet east of No. 5, gives 112 feet above No. 5.
8. Ross's borehole, 147 feet deep, 30 feet above tide, 635 feet east of No. 5, gives 43 feet above No. 5.

The section is as follows :—

SECTION OF PERMIAN ROCKS AT PICTOU.

	Ft.	In.
1. Red clay.....	15	0
2. Dark, mixed, hard rock.....	5	0
3. Red soft clay.....	15	0
4. Red sandstone.....	20	0
5. Dark sandstone mixed with gravel (water).....	11	0
6. Grey, soft, pebbly freestone.....	10	0
7. White hard freestone.....	3	0
8. Bluish hard freestone.....	32	0
9. Fire clay (1 to 9 in McConnell's borehole).....	10	0
10. Measures concealed.....	25	0
11. Grey and bluish freestone.....	32	0
12. Soft, bluish clay-stone.....	13	0
13. Grey freestone.....	30	0
14. Red clay-shale.....	1	6
15. Bluish freestone.....	25	0
16. Red clay (9 to 16 from bore-hole at Clarence Primrose's house) ..	18	0
17. Red shale (17 to 34 cut in Fraser's).....	8	0
18. Light shale.....	6	0
19. Light freestone.....	22	0
20. White coarse sandstone.....	29	0
21. Red shale.....	1	0
22. Grey sandstone.....	38	4
23. Red shale.....	20	0
24. Light shale.....	7	0
25. Red shale.....	23	3
26. Red sandstone.....	20	9
27. Light shale.....	1	3
28. Grey sandstone.....	22	9

	Ft.	In.
29. Sandstone, fine, grey ; 8 feet coarse and 6 feet brown.....	51	0
30. Red shale with partings of red sandstone—great run of water....	13	0
31. Grey sandstone, cut in McKimmie's boring 28 feet from surface and in Howard Primrose's, 54 from surface.....	24	0
32. Red shale.....	9	6
33. Red shale with bands of red sandstone ; calcareous.....	44	6
34. Grey freestone—cut in Campbell's tannery bore-hole and perhaps No. 31 repeated.....	58	0
35. Red clay rock.....	3	0
36. Red clay rock with light partings.....	19	0
37. Red clay rock.....	73	0
38. Red rocks of lighter colour.....	10	0
39. Grey freestone.....	18	0
40. Fine grey sandstone with coal partings.....	3	0
41. Limestone, oolitic or concretionary.....	1	0
42. Bluish fire clay.....	2	0
43. Red marl.....	27	0
44. Red marl with sandstone partings.....	29	0
45. Red marl.....	36	0
46. Grey sandstone.....	1	0
47. Light marl.....	5	0
48. Red marl.....	43	0
49. Red marl mottled.....	25	0
50. Red marl.....	30	0
51. Red sandstone.....	1	0
52. Red marl.....	21	0
53. Red marl and sandstone.....	13	0
54. Red sandstone.....	16	0
55. Sandstone-conglomerate.....	2	0
56. Red marl.....	11	0
57. Red sandstone.....	79	0
58. Sandstone-conglomerate.....	1	0
59. Red sandstone.....	21	0
60. Red sandstone with beds of marl.....	10	0
61. Red sandstone.....	17	0
62. Red sandstone with beds of marl.....	15	0
63. Red sandstone.....	23	0
64. Red marl.....	21	0
65. A millstone-conglomerate to be seen at Haliburton Creek, where the brook enters the pond above the cemetery.....	41	0
66. Grey sandstone.....	0	8
67. Red sandstone.....	0	4
68. Red marl, bottom of Campbell's tannery bore-hole.....	10	0
Total thickness.....	1,146	10

Haliburton
Creek.

On the railway between Brown's Point and Haliburton Creek, cuttings have exposed greenish shale, flaggy sandstone, and red marl and sandstone. Above the railway, on the west side of the

creek, similar rocks include a layer of nut conglomerate, and near a tributary dip $147^{\circ} < 55^{\circ}$ a reddish mottled sandstone containing impressions of fucoids. Near the head of this tributary, immediately below a bridge on the road, the dip $177^{\circ} < 65^{\circ}$ probably indicates a fault, the general dip being easterly. In the brook above the road, red rocks contain plants in greenish and grey layers and concretionary, calcareous beds. Above the cemetery bands of coarse sandstone and conglomerate are interstratified with marls, concretionary limestone and patches of rusty-weathering sandstone, spotted with coaly matter. Fault.

Along the Pictou and Oxford railway, from Brown's Point to Scotch Hill station, no other rocks are seen; but the ditch-cuttings seem to indicate red shales and sandstones overlying the grey sandstones of Sawmill Brook. Lyons Brook shows good exposures of the red strata, and at the railway is a nearly vertical dip which seems to indicate an extension of the fault referred to above. Hardwood Hill is composed chiefly of grey sandstone. Before reaching Scotsburn the hill of conglomerate is close on the left, and the rocks immediately overlying the conglomerate are probably those which contain the copper ore of Scotsburn Brook. These comprise greenish-grey fine sandstone and shale, marked with plants impregnated with coaly matter and copper ores, together with reddish and greenish shales and marls dipping $127^{\circ} < 33^{\circ}$. Large banks of gravel reach nearly up to the mine, and a plain extends to the road behind McIntosh's. Up stream no rocks are met with for some distance, but on the steep hill to the southward conglomerate is apparently in place, separated, perhaps, from the grey and reddish sandstones in the brook at the foot of the escarpment by a fault. In the little brook north of Scotsburn station, immediately above the main road, greenish-grey shaly sandstone, like that of the copper mine, dips $89^{\circ} < 24^{\circ}$ in smooth beds, associated with layers of coarser texture; and a little higher is underlaid with coarse Permian conglomerate. Scotsburn.
Copper ore.

In the West River, above Saltspings, the soft rocks which come against the Devonian are probably of this age, for they resemble more closely the Permian of Big Island than Carboniferous rocks. Those first seen on the left bank are indian-red, soft, micaceous shales and sandstones. At the wire footbridge, light greenish-grey, fine, crumbly, calcareous sandstone and conglomerate, dipping $133^{\circ} < 70^{\circ}$, are followed by concretionary red rocks and by grey fine sandstone, crowded with broken carbonized plants, passing into streaks of coal, including patches of conglomerate and balls of Saltspings.

Eight Mile
Brook.

harder sandstone. Near the confluence of the Eight Mile Brook a grey, fine, red-spotted sandstone, jointed and broken, also abounds in carbonized plants, and contains patches of reddish soft marl and of calcareous, concretionary rock, sometimes four feet thick. Below the next bridge, grey, fine, soft sandstone is underlaid by reddish, argillaceous sandstone and light grey, rusty spotted, massive sandstone, often exhibiting a very steep dip, and apparently separated from the Devonian by a fault. Lower down the rocks are nearly horizontal, and although generally too shaly they contain many beds fit for quarrying. They include at one point a ten feet layer of reddish nut-and-egg conglomerate, the larger pebbles of which seem to be principally of Carboniferous sandstone, with a few of Devonian rocks. Many of the smaller fragments are of red hematite, while the paste is a calcareous, coarser grit, with many particles of hematite. Overlying this conglomerate are reddish soft flags which produce a bright red soil. Some of the shaly, marly sandstone and conglomerate lower down are soft enough to be ground up by the fingers, resembling in this respect the Triassic. Similar rocks, with a large proportion of red, extend to tide-water at Durham, but are seen only at intervals. On the left bank, below the head of the tide, certain grey beds have been mined for copper ore.

Hematite.

Durham.

Copper ore.

Cuttings in the road along the west side of the river north of Durham expose light grey fine sandstone, containing hard spherical masses and patches of calcareous conglomerate, marked as usual by carbonized plants. In Quarry Brook there is exposed a great thickness of grey rocks, overlaid by reddish-grey sandstone and shale: they resemble the rocks of Roaring Bull and Quarry Island, and above the bridge they include thick beds of coarse grit and calcareous concretionary limestone-conglomerate, and pass downward into red rocks; while in the brook to the westward, and also towards Millville, are fine outcrops of coarse conglomerate.

Four Mile
Brook.

In the rocks which immediately overlie the conglomerate in Four Mile Brook, explorations have been made for coal; they are grey and reddish and brownish fine sandstones, marked with plants, marls and limestone-conglomerates, passing into a fair limestone. The south-easterly dip of the grey rocks of Four Mile Brook beneath the conglomerate of Greenhill, the dip of the grey rocks against the Devonian at Six Mile Brook and Saltsprings, the contact of the conglomerate of Watervale with the Devonian, and of the rocks of West River station with flinty Middle Devonian slates, seem to indicate the existence of an immense dislocation along the river, with an upthrow on the east side.

Faults.

Rocks similar to those of Four Mile Brook are found in Six Mile Brook, the bands of concretionary limestone-conglomerate being here seldom more than two feet thick and very variable; but the conglomerate does not everywhere intervene between the felsitic rocks of the mountain and the brownish and grey sandstones, which again may indicate a fault. There is a considerable belt of country in which no rocks are seen. At the head of the main branch of this brook are felsitic rocks, unconformably overlaid by coarse conglomerate, succeeded at the head of the settlement by grey, soft, glistening sandstone, upon which are situated the quarries worked by Messrs. Elliott and McPherson. On the flanks of the hills are large blocks of limestone-conglomerate; and the low land underlaid by these Permian rocks in Brookland settlement is fertile and productive.

Six Mile Brook.

Tombstone quarries.

Between Saltsprings and Ten Mile House, grey sandstone is abundant; and grey sandstone and conglomerate north of Saltsprings and towards Dalhousie Mountain; the conglomerate is sometimes very calcareous and appears in cliffs in the clearings on the mountain and towards Loganville, some of the pebbles being of reddish fine grit, apparently Carboniferous. In the brook near the manse at the Saltsprings, are good outcrops of grey, rusty-weathering, fine, jointed sandstone, full of fragments of carbonized plants and of trunks of trees converted into coal. Below the bridge and as far as the river, grey shales, full of comminuted plants and pebbly patches are associated with red rocks.

Saltsprings.

In Limerock Brook, red soft marls dip up stream at a low angle to a bridge on a farm road not far above West River. Above it, coarse conglomerate, largely composed of pebbles of soft sandstone, derived from the millstone grit or Lower Carboniferous, comes against grey and greenish-grey, shattered, rubbly sandstones, nearly vertical and probably belonging to the same series as the limestone at the quarry.

Limerock.

On the Truro road past Saltsprings, are outcrops of grey and bluish-grey sandstone and argillaceous shale, associated, further west, with reddish soft sandstone, grit and conglomerate, and perhaps Permian. They have however in the meantime been included with the Carboniferous.

Truro road.

The rocks of Caribou, Toney and other rivers of the vicinity are probably of this age, the brooks running east and west for long stretches nearly on the strike. They consist of rocks similar to those described above: they are perhaps best exposed in the Black River; but outcrops are also seen on the roads throughout the

Toney River.

district. At Sundridge, Rogers Hill and other places, are great masses of concretionary limestone. Much of the country underlain by the grey rocks is more or less barren or covered with second-growth, with large marshes and meadows along the rivers. At Hardwood Hill, a boring in search of coal was made with the diamond drill through 700 feet of grey fine sandstone.

Hardwood
Hill.

East Branch
River John.

In the Black River, or east branch of River John, for a mile and three-quarters above the fork of the west branch, grey and brownish rocks are exposed, with an inclination which seldom exceeds 30°. Then similar rocks show signs of a fault; they are grey and reddish, evenly bedded, flaggy sandstones, brownish fine sandstones, always soft, with a few layers of reddish, crumbly, argillaceous shale. Above the bridge, greenish and grey sandstone, coarse and pebbly, blackened by carbonized plants, is underlain by eight feet of conglomerate: some of the bands have been quarried. Higher up, a grey, argillaceous, impure limestone, about two inches thick, is found among dirty greenish argillaceous shales and flags, cut by a lenticular vein of calspar, one inch thick, holding a small quantity of albertite. At the second bridge above, similar coarse rocks are found, one of the bands of conglomerate being 20 feet thick and containing a few pebbles of hematite; and, half a mile higher, dip at a high angle; above which no rocks appear in the main river. The ridge of grey sandstone which follows the north side of Black River, resembles that of Hardwood Hill.

Albertite

Plainfield Brook, above its confluence with Black River, shows reddish, soft, marly sandstone, with a vein of calspar half an inch thick, interstratified with dark grey and greenish flaggy sandstone and pea-and-nut conglomerate, to the Earltown road; above which grey and reddish flaggy and thick bedded sandstone and red marl are exposed at a fault, and succeeded by alternations of marl, sandstone and coarse conglomerate. Coarse and fine rocks in confused bedding extend up to a fork, at which a band, apparently ten feet thick, crowded with plants and rootlets, is in place, blackened with coaly matter, contains nodules of copper glance, and has been worked. Up stream, grey, greenish-grey and reddish-grey sandstone and marl include layers of coarse calcareous conglomerate, which soon replaces the finer rocks.

Fault.

Copper mines.

Waugh River.

Sections of these rocks in the west branch of River John and in Waugh River have been already given, and the tributaries of course expose only the same strata. About 450 yards below Bailey's bridge, at which the last of the igneous rocks of the mountain are exposed, Sutherland Stream displays a bank of reddish and brown fine Permian sandstone, with a low northerly

dip, the thick conglomerate of Waugh River being entirely absent. Red sandstone and marl, with cream-coloured blotches one foot in diameter, and other fine rocks, showing comminuted plants, spotted sandstones and sandstones which have been quarried, extend to the Four Mile Brook.

In Biz (Sam Waugh's) Brook, the red sandstone and shale of the upper part of Waugh River section are well exposed, often on the strike. Above the mill-pond is a band of reddish-grey coarse grit which resembles that quarried on Waugh River at the Telegraph road.

In French River there is presented a good section of rocks which apparently belong chiefly to the middle group. It begins, like that of Waugh River, at Tatamagouche Harbour, and extends to Tatamagouche Mountain. In these beds Sir J. W. Dawson discovered *Endogenites*, *Calamites*, *Stigmaria*, branching fucoids, *Spirorbis*, scales of ganoid fishes, reptilian foot-marks, and other indications of terrestrial and littoral life.* The strata are as follows :—

SECTION OF PERMIAN ROCKS IN FRENCH RIVER IN DESCENDING ORDER.

	Ft.	In.	
1. Reddish and reddish-grey sandstone and marl with greenish streaks. Includes one bed of fine brown sandstone that has been quarried. The same as No. 1 of Waugh River section. Extends to the bridge on the shore road. Dip $51^{\circ} < 6^{\circ}$	68	0	Quarries.
2. Reddish-grey fine sandstone in thick beds; interstratified with reddish and brownish shale with greenish layers and streaks. Bands both at the top and bottom have been quarried	234	0	
3. Measures for the most part concealed, but consisting chiefly apparently of red rocks as above. Dip $32^{\circ} < 9^{\circ}$	733	0	
4. Red marl and sandstone to the mouth of the Millbrook, well exposed in cliffs above the iron bridge near the mouth of the Lake Stream	609	0	
5. Red sandstone and marl, the former largely preponderating; in thick beds, generally fine, but with a coarse layer towards the top. Green blotches. The sandstone has been quarried near the top	267	0	
6. Greenish, marly, concretionary rock, for the most part argillaceous and crumbly or shaly, but including harder bands of concretionary rock and of sandstone. In the soft places are many nodules of clay and calcareous sandstone and of pyrite, copper ore and albertite mixed; these are seldom as large as a hen's egg. The coal adheres to the nodule of pyrite, and is sometimes half an inch thick. Towards the top the shales become more bluish-grey. They yield no fossils except comminuted plants	12	0	Copper ore and coal.

*Acadian Geol., p. 217; Geol. Jour., London, vol. I., p. 326.

	Ft.	In.
7. Reddish and brownish, thick-bedded, fine sandstone, alternating with red marl, with patches of concretionary limestone-conglomerate. Dip. $0^{\circ} < 9^{\circ}$	310	0
8. Red sandstone and marl, with bands of concretionary limestone-conglomerate from a foot downward. Much of the sandstone is coarse and pebbly, but some thick bands are fine, of a good colour, and fit for quarrying.....	258	0
9. Red sandstone and marl, with a band of reddish concretionary limestone-conglomerate, and another of reddish-grey, pebbly grit or fine conglomerate.....	437	0
10. Grey and greenish, shaly, fine sandstone, weathering white.....	5	0
11. Greenish concretionary limestone-conglomerate, full of prostrate trees, the trunks of which are carbonized and coated with copper ore.....	2	0
12. Red sandstone with greenish layers and one band of coarse grit, alternating with red marl. To iron bridge on a good road....	134	0
13. Red sandstone and marl, with bands of reddish and grey, spotted; some argillaceous and concretionary, greenish, thin layers. A band of sandstone near the top has been quarried. The upper part is fine, but somewhat light in colour, the lower part is of coarse grit. Dip $0^{\circ} < 12^{\circ}$	970	0
14. Brownish thick-bedded sandstone mixed with grey rusty-weathering sandstone, containing patches of coarse grit, marked with trunks of trees, the bark of which has become coal, mineral charcoal, pyrite and copper ore. The streaks of coal, &c., seldom exceed one-eighth of an inch in thickness. In one nodule, however, two inches thick, the pyrite occupies nearly the whole of that thickness, and is separated from an outside layer of coal by one-twentieth of an inch of grey copper, the coal being little thicker. All the ore, perhaps, comes from one of the concretionary bands so common in these rocks, in which small nodules and grains of limestone are mixed with particles of sand and gravel, the rock being, in places, nearly a pure limestone, in others a grit or sandstone. The coal matter in certain grey sandstones appears to be in true veins. A tunnel [Gilpin's Mines of N. S.; Poole, Report of Commissioner of Mines for 1877, p. 48] has been driven thirty feet or more to cut the ore at this mine. Included in the preceding: apparently two feet of ore-bearing rock.....	...	...
15. Reddish and brownish, fine, shaly sandstone, with red marl and a patch of concretionary limestone-conglomerate. Also reddish and grey, soft, argillaceous sandstone, with whitish yellow blotches and dark stripes. Dip $356^{\circ} < 12^{\circ}$	540	0
16. Greenish and reddish, coarse, pebbly grit, with layers of nut-and-egg conglomerate, underlaid by alternations of grey, fine, flaggy sandstone, of greenish and reddish, concretionary, nodular marl and of reddish sandstone and marl. One bed of brown sandstone shows a patch spotted with copper ore in spherical spots about the size of a pea. Underlaid by light grey sandstone,		

Coal and
copper ore

	Ft.	In.
fine and marked with carbonized plants, below which are alternations of grey and reddish-grey, soft, calcareous, fine sandstone, crumbly, coarse grit and bands of reddish, greenish or grey nut-and-egg conglomerate, largely composed of the waste of the silvery slates which underlie. Like the conglomerate of River John near the confluence of the west branch	346	0
17. <i>Pre-Carboniferous</i> . Grey and greenish, compact and slaty felsitic rocks seen immediately below the bridge at New Annan .....	...	.
Total thickness of Permian rocks	4,925	0

This thickness is greater than that given by Dr. Ellis,* the observed dips being much higher than his assumed angle of 7° .

The similarity of many of the coarse beds to the Lower Carboniferous will be at once noticed; and it is not improbable that in districts in which the two come together they may be confounded. In the brooks below Wentworth station, the rocks are perhaps of this age, particularly if those of the Millbrook belong to the conglomerate. They are grey, whitish-grey, reddish and brownish sandstones, like those which overlie the conglomerate, towards Tatamagouche and Pictou, containing masses of reddish calcareous limestone-conglomerate. They show plates and radiating concretions of baryte in the joints, and many carbonized plants. Some of the beds are of considerable thickness and have been quarried. In other parts, the fine, evenly-bedded flags are not more than one-eighth of an inch thick. About ninety yards below the confluence of two little branches of Whetstone Brook the dip is $0^{\circ} < 81^{\circ}$, indicating a fault.

3.—Upper Permian Group.

The rocks of this group are well exposed on the coast at several points between Pictou and Wallace Harbours. One of the sections already given includes these beds in the neighbourhood of Cape John, where they seem to occupy a broad syncline with a westerly inclination, on both sides of which limestone appears; and a section from Cape John eastward to Toney River may be given for comparison with it as follows:—

SECTION OF PERMIAN ROCKS ON THE SEA SHORE BETWEEN CAPE JOHN AND TONEY RIVER IN DESCENDING ORDER.

1. Indian-red sandstone and marl, with thin lenticular layers of greenish, fine, calcareous, concretionary sandstone. One band of good brown sandstone, three ft. thick, and another of reddish

*Geo. Surv. of Can., An. Rep., 1885, vol. I., p. 13 E.

	Ft.	In.
pebbly sandstone, which forms a point. Dip nearly horizontal.....	50	0
2. Grey concretionary limestone. Seen again in a brook about a mile from the shore. No. 3 of River John section	1	0
3. Green marl.....	0	6
4. Red marl and sandstone, with two lenticular layers, two inches thick, of greenish, fine, calcareous sandstone. Dip $306^{\circ} < 4^{\circ}$	74	0
5. Green marl, with nodules of limestone.....	1	6
6. Red marl and sandstone.....	28	0
7. Measures concealed at a long pond	32	0
8. Red marl and sandstone. A reddish or brown sandstone—a good building stone, but spotted in places with carbonized plants. Dip $306^{\circ} < 5^{\circ}$	103	0
9. Greenish and grey fine sandstone, with large, brown blotches, showing markings of plants converted into a grey or red copper ore which, on decomposing, stains the rock bright green. Underlaid by a considerable thickness of brownish, fine, thick-bedded sandstone, with large blotches of greenish and reddish-white, concretionary, coarse sandstone, full of threads of calcspar; false-bedding. Towards the bottom, the reddish sandstone is coarse and contains light grey and greenish patches. The estimate of thickness is somewhat vague, the dip being variable. Forms a prominent cape.....	70	0
10. Reddish shaly sandstone and marl, not continuously exposed..	149	0
11. Red sandstone and marl, with greenish and grey spots and layers.....	103	0
12. Red sandstone and marl, not well seen, with one or more layers of grey, coarse sandstone. The beds are undulating, and the thickness given is perhaps too great.....	57	0
13. Measures concealed at a little pond	75	0
14. Grey, fine and coarse, pebbly sandstone, with spots coloured yellowish, blackish and green by fossil plants, near which occurs a large quantity of coaly matter and of copper ore.....	4	0
15. Red shaly sandstone and marl, including fifteen feet fit for quarrying, and occasional thin, green layers.....	212	0
16. Indian-red, chocolate brown and grey sandstone, with some beds of marl, but for the most part brown sandstone, much of it fit for quarrying, and like the brown stone of River John; in part coarse and pebbly, passing into conglomerate. The grey beds are spotted and concretionary. To the lobster factory..	190	0
17. Red marl and sandstone, the latter in flaggy or thick beds, some of which are fit for quarrying. One band of fine, brownish sandstone, fifteen feet thick. To a large brook north of Cape John post office. Not continuously exposed. Here the dip, after undulating somewhat, changes to $3^{\circ} < 6^{\circ}$	172	0

Coal and
copper ore.

		Ft.	In.	
18.	Red sandstone and marl more nearly on the strike. Some of the beds of fine grain; greenish layers; two bands of grey and reddish pebbly sandstone, the uppermost underlaid by a considerable thickness of dark bluish-grey argillaceous shale. These are on opposite sides of a large brook, one mile and a quarter south of the last and half a mile from the end of the measurement. Dip $3^{\circ} < 7^{\circ}$. On the lowest beds two openings have been made to quarry stone in three benches aggregating ten feet; some of this stone is very good.....	305	0	Quarry.
19.	Red marl with bands of fine sandstone, shaly and in thick beds; and masses of reddish and greenish limestone-conglomerate; greenish layers and blotches, often pebbly, sometimes concretionary. To a quarry on a small headland more than a mile from the last.....	160	0	
20.	Red sandstone and marl with a large proportion of sandstone. Some beds rough and occasionally greenish or grey with fossil plants. * Too coarse, spotted and concretionary for quarrying. To a little brook. Dip $0^{\circ} < 10^{\circ}$	126	0	Fossil plants.
21.	Grey and greenish-grey, fine and coarse, pebbly sandstone, with carbonized plants; yellowish-weathering; bands of concretionary limestone-conglomerate; layers of reddish coarse conglomerate and sandstone and fifteen feet of fine and coarse brown sandstone.....	69	0	
22.	Reddish and brown, fine, shaly sandstone underlaid by greenish fine sandstone with concretionary layers; rusty-weathering, passing in patches into conglomerate; underlaid again by red shales. To the mouth of Toney River.....	320	0	Toney River.
23.	Rocks seen at intervals on the coast as far as the lobster factory one mile and three-quarters from Toney River. Reddish and greenish mottled sandstone, brownish, shaly, fine sandstone; grey, greenish and brownish coarse sandstone, with many carbonized plants in the bedding; bands of reddish and greenish limestone conglomerate and, at the base, red marls. The estimate is, of course, vague.....	320	0	
24.	The rocks of Toney River, consisting largely of grey sandstones appear to underlie these directly and at a distance of about 2,000 feet, ($< 14^{\circ}$) is the coal which has been worked. Immediately beyond it there seems to be a fault.....	2,000	0	Coal.
25.	Coal of Toney River—a small seam cut in several shafts.....	..	..
Total thickness.....		4,622	0	

The importance of a carefully compiled general section of the Permian rocks for comparison with the strata cut in the many deep borings made in search of coal in the region is very great. The shore between Cape John and Pictou Harbour, probably gives the most continuous section, to which might be added data from some of the rivers.

Search for coal.

Sea shore west
of Pictou
Harbour.

The east and west anticline, complicated apparently with a fault, the axis of which seems to strike the shore of Pictou Harbour between Logan and Cole points, apparently brings the higher rocks out on the eastern end of this peninsula. On the west side of a deep cove north of Pictou, into which comes a little brook from McKeen's quarry, reddish and grey coarse flags dip $146^{\circ} < 13^{\circ}$. About 300 yards inside the tip of Loudon Beach is a bank of reddish fine shale and flaggy sandstone, with a very low dip, probably south-easterly. At the base of this beach are other obscurely dipping red rocks. At Cole Point, bluish and greenish-grey coarse and fine sandstone, in low irregular bedding, forms reefs. Then follows a wide cove with a small pond inside; at the mouth of the little brook from this pond, reddish fine sandstone dips at a very low angle; at the western side of the cove, greenish-grey, coarse and fine, rusty weathering sandstone, dips $123^{\circ} < 4^{\circ}$; and similar rocks, tinged with red, occur at intervals for some distance and are succeeded by red marl in a bank and by red, coarse and fine sandstone in reefs. On these reefs at Logan Point, at a strong spring from the bank, good exposures dip about 32° or somewhat more easterly at a very low angle. At the mouth of Graham Brook, the soil is bright red, and reefs of red shaly sandstone, with green blotches, lie horizontally. For about a mile the shore is sandy and bouldery as far as the lobster factory on the west side of Widow Point, immediately beyond the gut at Doctor Spit; then for half a mile the bank shows large blocks of reddish, crumbly, coarse grit to a deep broken marshy bay, immediately beyond which reddish, coarse sandstone on reefs seems to dip $352^{\circ} < 10^{\circ}$. At the point half a mile distant are outcrops of reddish-grey, coarse, pebbly, false-bedded grit, nearly horizontal, but with a possible dip north of east; and in a little cove beyond, thick beds of coarse grit dip $312^{\circ} < 7^{\circ}$. For the next mile and a-quarter blocks of grey usually fine sandstone abound, with one outcrop, however, nearly horizontal; then grey, coarse sandstone dips $22^{\circ} < 10^{\circ}$, but immediately past a broad point with a large marsh and pond, greenish and grey thick-bedded sandstones dip $93^{\circ} < 21^{\circ}$, changing at a few feet to $112^{\circ} < 5^{\circ}$, and succeeded, at 300 yards further, by greenish-grey, more or less impure limestone, striking 7° with apparently a low easterly dip, interstratified with red marl and sandstone. The outcrops nowhere exceed a few yards in width, the gaps being wide; and nearly a mile east of the Millbrook, even these cease and the shore is low nearly to the mouth of Caribou River, east of which a band of limestone, about nine inches thick, dips 347° at a very low angle.

Limestone.

For 400 yards up Caribou River,* reddish and greenish shales in Caribou River. broken banks dip seaward; at 950, grey, fine, flaggy sandstone, dipping $29^{\circ} < 5^{\circ}$, is succeeded by red rocks. About 150 yards above the bridge on the shore road, grey coarse and fine, rusty-weathering, crumbly sandstones dip $40^{\circ} < 18^{\circ}$; but with this exception no rocks are found on the left bank for a considerable distance. Then above a little brook at a marsh and lagoon, large blocks of a cream-coloured and whitish compact sandstone and pebbly grit are associated with blackish, coarse, crumbly rocks. It is like a volcanic ash or clay-stone, and is perhaps in part of volcanic origin. At the copper mine, on the left bank of the river, a large quantity of coarse conglomerate is found with the usual association of pyrite, lignite and grey copper ore, with trunks of trees, apparently underlying the coherent grit mentioned above. Some of the pebbles of the conglomerate are as large as cocoanuts; among them are several of red hematite, and this mineral coats the polished surfaces of many of the pebbles. The conglomerate band is interstratified with dark sandstone and coarse grit, dipping at a low angle into the bank and found at the pits sunk on the little brook above, one of which is said to be ninety feet deep and to have passed through copper ore, but no coal. Thence the conglomerate appears to run to the neighbouring house, to cross the grassy road about half a mile north of its junction with the main road, and to extend on this course for a mile further. North of it on the road the strata are principally red and clayey. Igneous rock ? Copper mines.

On the shore west of the ford to Big Caribou Island, the exposures are good. They consist of reddish, grey and mottled, crumbly sandstones and shales; the grey being often coarse and pebbly, with rusty patches, carbonized plants and streaks of pyritous coal. Among the red are green blotches and layers of conglomeratic rock, passing into impure concretionary limestone. In some of the beds of grey friable sandstone and conglomerate, west of the mouth of Toney River, are coaly streaks, sometimes an inch thick, with large crystals and crystalline aggregations of pyrite; and in one of them is a black streak composed of grains of magnetite. The limestone shows obscure fossils, perhaps small corals, cone-in-cone and other concretions. Caribou Island.

On the outermost reefs of Point Brulé, reddish, soft, crumbly shales dip $20^{\circ} < 5^{\circ}$, including a half-inch green band, and overlaid by reddish and grey sandstone in six-inch flags or in thicker beds fit for building stone, but containing "bulls-eyes" and patches of conglomerate. Further west, a greenish-grey, coherent, conglomeratic Point Brulé.

*Acadian Geol., p. 327; Supplement, 1878, p. 36.

Limestone.

Tatamagouche.

limestone is marked with fossil plants; beyond which rocks chiefly red, dip $141^{\circ} < 5^{\circ}$, and contain layers of greenish, coherent, compact sandstone marked with plants, and red and green marl with nodules of limestone, among other beds fit for building stone. About half a mile south of Peninsula Point, red sandstone and marl, with green calcareous layers and concretionary limestone-conglomerate, dip $137^{\circ} < 5^{\circ}$, and are well exposed, with occasional bands of grey sandstone, to the beach along which the road follows. On this beach and for a great distance to the westward, blocks of reddish and grey sandstone are found; then at a bluff point, reddish greenish and grey sandstone dip apparently to the south-eastward at a very low angle. Not far east of the Narrows of Barachois Harbour, red and brown sandstone, flags and shales dip $97^{\circ} < 7^{\circ}$, and nearer the Narrows, $67^{\circ} < 3^{\circ}$, red marl being the prevailing rock. On the west side, above the mouth, red marl and sandstone dip $87^{\circ} < 7^{\circ}$. From the mouth of the Barachois, a high bank of red marl follows the western shore, with two bands of greenish marl not far apart, the uppermost, six inches thick, being an impure knobby limestone, the lower, more than a foot thick, consisting of layers of shaly sandstone and red marl. Further north are blocks of grey and reddish coarse grit. At the north end of Chambers Point are blocks which may indicate the presence of the Cape John limestone. About a quarter of a mile to the westward, reddish, wavy, shaly sandstones, dipping $136^{\circ} < 5^{\circ}$, are followed by red flags which dip $157^{\circ} < 5^{\circ}$, some of which are fit for quarrying. And about half a mile further, beds of coarse crumbly sandstone, of a brick red decidedly Triassic colour, like the rocks at the mouth of Graham Brook, still dip south-easterly, and are succeeded by cliffs of reddish and greenish coarse and fine sandstone, in thick rough beds. It is about three-quarters of a mile north-east of the sand-beach and grassy point at the mouth of Tatamagouche River, near which a whitish-green calcareous sandstone, a foot thick, interstratified with red sandstone and marl, dips $140^{\circ} < 4^{\circ}$. About a mile up the river, at the end of a road to the shore, red or brown sandstone in a quarry at the cliffs dips $71^{\circ} < 5^{\circ}$.

The rocks of the neighbourhood of Tatamagouche have been described in the two sections of Waugh and French rivers. West of Blockhouse Point are outcrops of red marl with patches of concretionary limestone, light grey, fine, micaceous sandstone, with "bull's eyes," false-bedded, containing carbonized trunks of trees and traces of copper ore, and reddish-grey, coarse, pebbly sandstone.

The shore at the head of Tatamagouche Bay is low. On the Telegraph road, immediately beyond the bridge on Dewar River, indian-red, crumbly sandstone and marl dip $177^\circ < 15^\circ$, and are marked with fucoids and what resembles the foot-prints of an animal. The rocks resemble Permian strata, but are also similar to the red Carboniferous rocks of Great Village River. Fossil foot-prints.

A ridge follows the middle of the peninsula towards Malagash Point, and south of this runs a ledge of grey sandstone which has been quarried near a little brook which flows westward across the first road north of the shore road, where the dip is apparently $179^\circ < 52^\circ$. The sandstone at the quarry is a grey, fine, thick-bedded variety, marked with broken carbonized plants. A short distance further east red shales dip 167° at a high angle; and the soil has a Permian aspect as far as the road to Scott's Island, on the most southerly point of which are ledges of reddish fine sandstone, seen only at low water; and, on the south-east point, fine grey sandstone and greenish conglomerate. Malagash.

Down Dewar River and along the shore to Scott's Island, no rocks are exposed; about half a mile further east, however, red, evenly bedded flags and shales dip $160^\circ < 10^\circ$, and include a band of from one to six inches of calcareous concretionary conglomerate and irregular layers of grey, fine sandstone which contains carbonized plants and traces of green carbonate of copper, which has been worked in the bank. The rocks cannot be distinguished from the Permian of the shores of Brulé. Copper mine.

A few yards further east the angle of dip is lower, and brown sandstones, in beds one foot thick, are fit for building, but in low banks. Then come red marly rocks, like those seen on Scott's Island, near Stewart's house, with a very low northerly dip, changing immediately beyond to $112^\circ < 60^\circ$, but possibly broken in the bank, for a few yards further the dip is $142^\circ < 15^\circ$; and 180 yards further, brown soft sandstone lies at a low angle. Then a sand beach, with a minute pond inside, occupies the shore for half a mile, and is followed by a sandy cove at the head of which the road comes to the shore, and past it is an obscure outcrop of grey fine sandstone, blocks of which are found as far as the brook or lagoon opposite the Methodist church at Malagash. East of the lagoon, ledges of shale, like that south of Scott's Island, dip $162^\circ < 50^\circ$, and, at the east end of the outcrop, at a lower angle. Stretches of marsh and sand then reach nearly to within a mile of Malagash Point, where reefs of grey, bluish-grey, greenish-grey and reddish sandstones dip $157^\circ < 20^\circ$, the angle soon increasing to 44° . The bedding of the sandstones is rough, few of the layers being fit for quarry-

ing; they include patches of conglomerate, concretionary limestone and rusty spots, full of carbonized plants, sometimes of large size. Beneath them lie red marls and shaly sandstones, with a band of reddish-grey spotted sandstone and a reef of reddish pebbly grit, like rocks of Toney River, dipping $150^{\circ} < 41^{\circ}$. At the Cape, a bed of greenish-grey coarse sandstone has a concretionary patch at the bottom, which holds a little copper ore; it dips $151^{\circ} < 68^{\circ}$, among greenish and purplish papery shales, coarse, grey and reddish crumbly grit, marly beds, with nodules of limestone and layers, two or three feet thick, of bluish-grey limestone, veined with calcite, like the limestone of Caribou, Cape John and Pictou Island. Immediately to the westward, the red sandstones and shales include layers of greenish and reddish, spotted, crumbly sandstone; and on the cliffs at the lobster factory two pits cut a concretionary band streaked with copper ore; almost in contact with which is a seam of coal, at best ten inches thick, but generally interrupted by clay bands, supported by several feet of underclay, underlaid by a thick bed of coarse and fine grey sandstone, with rusty, carbonized plants, and by red sandstone and marl to the marshes of Purdy Island.

Copper mine.

Limestone.

Coal.

The following descending section of these rocks is given by Sir J. W. Dawson* :—

		Ft. In.
	1. Brownish red sandstones and shales, alternating with grey sandstones, one of them containing pebbles of white quartz, about..	600 0
	2. Dark grey limestone.....	2 0
	3. Grey and reddish sandstones.....	50 0
	4. Dark grey limestone.....	3 0
	5. Grey sandstones.....	50 0
	6. Reddish sandstones and shales ..	not well seen
Fossil plants.	7. Grey arenaceous shale: fern leaves and <i>Cordaites</i>	6 0
	8. Underclay with <i>Stigmara</i> , and an erect stump with <i>Stigmara</i> roots, penetrating the bed above.....	3 0
	9. Dark grey limestone.....	3 0
	10. Alternations of grey and reddish sandstone and shale; in the lower part a bed of coal six inches thick, with <i>Stigmara</i> underclay, about.....	300 0
	11. Grey sandstone.....	20 0
	12. Alternations of reddish sandstone and shales and grey sandstone, with thin layers of clay ironstone and a layer of coaly shale, about.....	300 0
Saddle Island.	Immediately to the north lies Saddle Island, the north side of which is all rocky; and not far from the west end, grey, thick-	

*Acadian Geol., p. 215.

bedded sandstones, with rusty spots, dip $349^{\circ} < 60^{\circ}$. They are of every variety, are interbedded with greenish argillaceous shale and underlaid by reddish sandstone and shale, with layers of greenish papery shale, which dip, at the eastern point, $347^{\circ} < 60^{\circ}$. At the western point the highest beds of grey sandstone dip $342^{\circ} < 60^{\circ}$, and seem to strike in a line for Amet Island. One band is of good grindstone grit and another of grey limestone-conglomerate.

From the west end of the island, sand flats, for the most part dry at low water, extend 217° to the mainland. At this point grey flags, with pebbly patches and concretionary limestone-conglomerate, dip $348^{\circ} < 55^{\circ}$, and are overlaid by grey sandstone and shale, the former containing many pebbles of white quartz, and a band of limestone-conglomerate which may be that of Saddle Island. Then grey sandstone occupies the coast for a great distance, associated with a reef of grey calcareous shale, with coherent limestone and five feet of reddish and greenish, pebbly, concretionary rock, which carries a little copper ore at the bottom, with traces of coal. About half a mile east of a lobster factory, the dip is $345^{\circ} < 82^{\circ}$; at and for a quarter of a mile east of the factory, vertical rocks strike 287° ; and the next rocks met with, beyond a point and long sand beach, belong to the Carboniferous limestone already described (page 102), which is, however, interrupted further west by unconformable outcrops of the Permian.

Contact with
Carboniferous

The coal of Cape Malagash and that of Caribou Island seem to be higher than that of Little Harbour, Merigomish Island and Toney River, and it does not seem probable that any of the seams are continuous. Two borings were made on Caribou Island, and the strata cut by them will be seen in the following record kept by Mr. Fraser, No. 2 lying north-west from No. 1.

Caribou
Island.

Besides the borings with the diamond drill made at this and other localities in these rocks, and already mentioned, one at Logan's tannery, of 1,000, and two at Lyons Brook, of about 500 feet each, were made by Mr. Fraser.

SECTION OF STRATA IN BORE-HOLE NO. 1, CARIBOU ISLAND.

Cut by diamond drill, March, 1875.

	Feet.	Inches.
1. Surface.....	15	0
2. Freestone.....	4	0
3. Red pencil rock	49	0
4. Freestone.....	60	0
5. Soft dark pencil rock.....	9	0

	Feet.	Inches.
6. Red soft pencil rock	23	0
7. Fire-clay and pencil rock	13	0
8. Pencil rock	6	0
9. Freestone	8	0
10. Grey hard, coarse freestone	5	0
11. Red pencil rock	5	0
12. Grey fine freestone	11	0
13. Speckled freestone and pencil rock	6	0
14. Red pencil rock	56	0
15. Freestone	31	0
16. Red and dark pencil rock	9	0
17. Red pencil rock	28	0
18. " "	36	0
19. Red pencil rock and marl	15	0
20. Red pencil rock	18	0
21. Red sandstone	10	0
22. Red pencil rock	25	0
23. " "	27	0
Total depth	469	0

SECTION OF STRATA IN BORE-HOLE No. 2, CARIBOU ISLAND.

Cut by diamond drill, April, 1875.

	Feet.	Inches.
1. Surface	20	0
2. Sandstone	7	0
3. White coarse sandstone	20	0
4. Grey fine sandstone	8	0
5. Grey mixed rock-conglomerate	4	0
Coal. 6. Coal [Acadian Geology, p. 343] .....	..	7
7. Fire clay	15	2
8. Red pencil rock	8	0
9. Red very soft pencil rock	4	0
10. Red pencil rock	1	0
11. Fire clay	7	3
12. Red pencil rock	13	0
13. Fire clay	2	0
14. Brown freestone	10	0
15. Grey freestone	15	0
16. Red pencil rock	2	0
17. Red sandstone	18	0
18. Limestone-conglomerate and red pencil rock	21	0
19. Red pencil rock and clay	27	0
20. Red pencil rock and beds of clay	9	0
21. Brown freestone	19	0
22. Grey freestone	19	0
23. Fire clay	4	0
24. Red pencil rock	209	0
Total depth	463	0

Sections comprising 500 or 600 feet of these rocks, with a Pictou Island. limestone near the middle, probably about the horizon of that of Cape John, are well exposed on the shores of Pictou Island and have been described by Principal McKay.* They dip north and south at a low angle from an anticlinal axis which runs about 84° from end to end of the island. A large proportion of the strata is of grey sandstone of the usual variety, certain beds of which have been quarried for grindstones.

H.—TRIASSIC.

Although Dr. Ells has excluded from the Triassic,† as not clearly distinguishable from the Permian, the rocks referred to this series by Sir J. W. Dawson in Prince Edward Island, he has retained the areas which “are found at intervals along the shores of Minas Basin.‡ They extend for the most part but a short distance inland and have their greatest development in the neighbourhood of Truro and for ten to fifteen miles west. East of that town they occupy the valley of the Salmon River for about six miles and extend northward to the second bridge over the North River, about four miles in a direct line from Truro. Thence they occupy the country westward along the line of the Intercolonial railway and for a short distance north, to the vicinity of the Folly River viaduct, where the contact with the underlying Carboniferous formation is seen about 500 yards above the railroad. From this point the area becomes narrower, the northern boundary gradually approaching the shore of the Basin of Minas which it reaches at Five Islands. The continuity along the coast is broken in the vicinity of Economy by areas of Lower Carboniferous sediments. Below this, towards Cape Chignecto, the Triassic formation occurs only in irregular patches upon the older rocks.”

The relations of the sedimentary rocks of this formation, with their associated traps, to the older formations have also been described in great detail by Jackson and Alger, Gesner,§ Sir J. W. Dawson,|| and others. The contact with the older rocks is always clear and unmistakable, so that there is no ambiguity with regard to the limits of the formation. Sometimes, particu-

*Trans. N. S. Inst. Sc., vol. VIII., p. 76.

†Geo. Surv. of Can. Rept. of Progress, 1882-83-84, p. 12 E.; Acadian Geol., Supplement, 1891, p. 10.

‡Geo. Surv. of Can. Ann. Rept., vol. I., p. 6 E.

§Geol. and Min. of N. S., p. 239.

||Acadian Geol., p. 99; Geol. Jour. of London, vol. IV., p. 50, with a map.

larly on the north side of the basin, this junction is a fault, sometimes coarse beds lie at a low angle upon, and fill inequalities in, the underlying rocks of which they are composed. Many of the sandstones are very calcareous. The total thickness of the formation is doubtful.

Valley.

In Clifford Brook, east of Valley station, the lowest Triassic rock is a pea-and-nut conglomerate lying horizontally on the red slates of Union. On the road to the Telegraph road east of the manganese mines, and also in the neighbourhood of the mines, many pieces of Triassic sandstone are in the soil and perhaps point to outliers among the Devonian.

Contact with
Devonian.

From the railway station at Valley across the bridge and out the road to the Telegraph road, the strata are Triassic; and to the eastward along the Telegraph road and for some distance up the river these rocks are also exposed. In Half Moon Hill Brook the contact with the Devonian is well seen, the Triassic being bright red, crumbly, coarse sandstones, scarcely more coherent than the sand of a sand pit, with layers of grit, less bright than the other beds, containing pebbles an inch in length derived from the red argillites. Lower down is a grey, crumbly, flaggy, pebbly sandstone, dipping at a low angle, with thin beds and blotches of light green.

Farnham's
Millbrook.

In the branch of Farnham's Millbrook, which flows from Penny's Mountain, are dark brick-red, soft, marly, very fine sandstone, containing patches of grey calcareous sandstone and of coarse conglomerate, with a vertical dip which appears to indicate a fault. In another little brook further west, brick-red sandstone and nut-and-egg conglomerate form ledges which dip 177° at a very high angle.

North River.

In Smith Brook, which runs into North River near the village, coarse and fine flaggy sandstone lies nearly horizontal at the contact with the Devonian; and on the opposite side of North River, below the bridge, the contact is again seen.

In Henry Christie's millbrook, red sandstones are exposed, for some distance above the road at Valley, in nearly horizontal bedding, the coarse sandstones containing patches of soft concretionary clay or mudrock, and, near the junction of the older rocks, beds of conglomerate.

Belmont.

For a little more than a mile above the bridge, on the road at Belmont, tile or brick-red Triassic sandstones occupy the Chiganois River. They are then succeeded by a breadth of a quarter of a mile of green and grey and red shale, with patches and small seams of coal; these by half a mile of Triassic, before coming

to the great outcrops of metamorphic rocks. Among the lowest beds are layers of nut-and-egg conglomerate, containing veins of calcspar, one of which is a foot thick, the pebbles being of gneissic and quartzose rock. At the mill-dam above Belmont, reddish fine sandstone, crumbly and like that of Truro, dips $191^{\circ} < 31^{\circ}$, and higher towards the saw-mill, $< 55^{\circ}$. The junction here appears Fault. to be a fault.

The dip of the frequent outcrops of Triassic sandstone seen above Staples' Brook the railway, in Staples' Brook, is $277^{\circ} < 15^{\circ}$ to 34° , and the beds are fine nearly to the bridge at the post office; where fine sandstones are succeeded by coarse sandstone and conglomerate, with a steep south-westerly dip.

In Debert River these rocks extend a mile and a half above the Debert River. railway; and at or near their junction with the older rocks dip down stream at a very high angle, and appear to be affected by a fault, the rocks at the base being finer and more flaggy than usual, but including bright red, crumbly, coarse sandstone and pea-and-nut conglomerate.

The Triassic rocks of Pine Brook are well exposed above the Pine Brook. railway, presenting as much variety as is anywhere met with. They comprise red soft sandstone, with small patches in which are pebbles as large as nuts; pea-and-nut conglomerate; brick-red nut-and-egg conglomerate, hollowed into a cave thirty feet deep; coarse Cave. sandstone and fine conglomerate, with small green blotches; red fine sandstone, massive, but with bedding planes marked by blackish streaks of magnetite, and with patches of green and grey concretionary limestone-conglomerate, seldom more than a foot thick; succeeded by the Carboniferous.

In McElman Brook, the contact of the Triassic with the older McElman Brook. rocks is at a fork about three-quarters of a mile above the railway, where brick-red, crumbly, coarse sandstone and nut-and-egg conglomerate are irregularly intermixed.

In the brooks between Truro and the mouth of the Shubenacadie Shubenacadie River. River at Blackrock, Triassic rocks rest nearly horizontally upon the edges of the red rocks of Union at no great distance from the shore. Those on the shore between Salter's Head near Maitland and King Creek (page 96) have been already referred to; and the prevailing low angle of dip is found in the cliffs, which are almost unbroken as far as Noel Bay, the rocks being precisely like those of Truro and Economy—essentially red coarse sandstone, with layers of greenish and grey concretionary sandstone and patches of coarse, pebbly grit. Across Noel Bay is a wide expanse of low Noel.

dyke-land, which presents a curious picture, with its numerous stacks of hay set on high foundations of wooden piles. At Densmore's mills, flinty Devonian slates have a nearly vertical dip, and reappear at several points on the road for the next two miles to Noel village, where the Triassic extends probably to the bridge on the post-road. High unbroken cliffs extend thence round Burntcoat Head into Moose Bay, showing islands and pierced masses of the red Triassic sandstone, hardly distinguishable from the Permian of River John, but as a rule less coherent. A large proportion of the rock at Teny Cape Creek is rusty grey nut-and-egg conglomerate.

The rocks of Walton and the shores to the westward need not here be referred to.*

SURFACE GEOLOGY.

Many points concerning the distribution of the ancient gravel ridges and beaches, the deposits of unstratified and stratified clay, sand, gravel and boulders, which cover to a variable depth the solid rocks, and indicate the action of ice and water during the Post Pliocene period, have been discussed by Sir J. W. Dawson,† Dr. Honeyman,‡ Mr. Poole,§ Dr. Ellis,|| Mr. Chalmers and others.

Hogsbacks.

Pictou.

Waugh River.

A well marked kame or hogsback, composed of coarse gravel and sand, runs from the neighbourhood of McKeen's quarry, east of Pictou, across the back road, and was traced by Principal McKay north-westward along the left bank of a little brook nearly to the seashore of Caribou, a distance of about three miles. Other banks of sand and gravel occur in this vicinity, and a remarkable number of boulders, principally of syenite, granite and diorite, are scattered over the face of the low, flat country along the strait. For a great distance below Earltown, the valley of Waugh River, which resembles a Carboniferous glen more than a valley cut out of Pre-Carboniferous rocks, contains a large quantity of drift, derived apparently from Permian rocks, everywhere along its banks; and from near Earltown to far below Mr. Gilbert Sutherland's house extends a well marked sand and gravel hogsback, broken, of course, in places, and represented in others only by

*Acadian Geol., pp. 89 and 258.

†Acadian Geol., pp. 60 to 83.

‡Trans. N. S. Inst. Sc., vol. III., p. 345; vol. IV., p. 109; vol. V., p. 325; vol. VII., p. 138, and other papers.

§Op. cit., vol. VII., p. 388.

||Geol. Surv. of Can. An. Rept., 1885, vol. I., p. 64 E.

knolls or mounds. On the south side of the river, near Donald Sutherland's house, sand and gravel are in hills and ridges. Banks of sand and gravel are also seen where the Salmon River road leaves the Earltown post-road, in the valley which follows the road from Nuttby to Waugh River, and in other valleys of the district, the drift here resembling the soft rocks which lie to the northward. Along Byers Brook and at Farmington are banks of reddish drift, composed largely of Permian debris, which is seen in other places on the northern slope of the mountain, and appears to have come from the north. The fertility of the well wooded hills and of the romantic mountain farms on this slope is in part no doubt due to its presence. Byers Brook.

On the Stewiacke River, down the right bank from Eastville, great banks of drift gravel are seen, and at Middle Stewiacke curious mounds, apparently of gravel, the abundance of blocks of granitic and felsitic rocks, both here, at Green Creek and at Shubenacadie River, being as remarkable as in the neighbourhood of Pictou. Stewiacke.

The gravel pits of Scotsburn, from which ballast was taken for the Oxford and Pictou railway, are of large extent and seem to contain only the debris of rocks of the hills lying to the southward, accumulated as it were in an old lake. The excavations show banks twenty-five feet high, containing comparatively few large boulders. Scotsburn.

On the Portapique River, two terraces on the left bank show a considerable distance opposite the post office of Montrose. Terraces.

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

Pictou, [mentioned by Lyell, *Travels in North America*, vol. II., p. 179], 53°.

Grant Lake, on the road between the lake and the first house towards Hopewell, 192°.

Foxbrook and McLellan's Mountain (observed by Mr. H. S. Poole) 197°.

West Branch of River John near Loganville, 175°.

Hardwood Hill west of Pictou, three sets of grooves, 147°, 197° and 92°, the last being the most recent and produced probably, according to Mr. Chalmers, by the passage of ice into the neighbouring valley, whereas the others may run from the Cobequid Hills.

Folly Mountain, at the clearings near Archie Slack's, not far west of the foot of Folly Lake, 172°.

Saddle Island, well-marked, on a plane which does not face the sea, 102°.

Old Westchester Mountain road near the county-line, 162°.
Lynn, 169°.

None of the numerous bare knobs of diorite and syenite on the top of the hill on the old Tatamagouche road show ice grooves, though many of them are rounded and irregularly channelled.

Direction of
the drift.

Many facts bearing upon the direction of transportation of the drift are given by the authorities mentioned above; and as the determination of this question has a practical application in prospecting or searching for mineral deposits it is of the greatest importance. Mr. Donald Fraser, of Springville, states that blocks of iron ore are most numerous north-east of the beds in Pictou county, but that the drift from the south side of the watershed of Nova Scotia went to the southward. Mr. Alex. McBean, of the Vale colliery, also maintains that the drift has gone north from the high land and that much coal debris is found north of the seams, whereas it frequently happens that the sand and gravel immediately overlying the coal seams contain absolutely no traces of coal. Late explorations made in search of coal immediately north of Logan's north fault revealed an abundance of coal-measures drift, including large blocks of coal, overlying solid red rocks of the millstone grit. And on McLellan's Brook, on the left bank immediately above the fulling mill, drift from the red rocks to the southward is so abundant that it might be supposed to indicate the rock in place were it not that the shales of the coal measures are seen at water level along the pond.

Boulders.

The numerous boulders of white-weathering syenite and granite so abundant in the neighbourhood of Pictou, Haliburton Creek, New Glasgow, Kempton and other localities have been already referred to. The gravels of Lorne appear to be derived from Devonian slates, many of them ferruginous, and from syenitic and dioritic rocks, together with blocks and pieces of softer, newer sandstone and shale from strata underlying. In Cross Brook, among the Silurian rocks is a large boulder of Carboniferous limestone, already referred to as possibly indicating a Carboniferous outlier. Boulders of syenite and diorite, like those of the mountain to the southward, are abundant on the roads about Staples Brook and the vicinity.

The blocks of gypsum said to have been washed out of the bank at Cape John* seem to be boulders brought from a distance, as no rock of this kind is known in place in the neighbourhood. One is at the lobster factory, another, twelve feet by four feet, lies on the outer shore three miles east of the cape.

On the shores of Minas Basin, large irregular deposits of sand and gravel are met with, but will not here be described.

*Acadian Geol., p. 327.

On both Speid and Maple Lakes, raised beaches were seen. On the north side of the former, at a little brook near the outlet there is said to be a stone weighing ten tons, perched, twenty feet high, on a pivot on another. Raised beaches.

IGNEOUS ROCKS.

According to their periods of formation, these rocks may be arranged in three groups, as follows:—

1. Cambro-Silurian.
2. Devonian.
3. Post-Carboniferous, principally Triassic.

These groups differ, as will be seen in the sequel, in the character and composition of their rocks, those of the last being, as a rule, much less massive, crystalline and coherent.

1. *Igneous Rocks associated with Cambro-Silurian strata.*—The igneous materials everywhere associated with Cambro-Silurian strata east of the East River of Pictou, seem to be older than the adjacent Silurian, as described in last report.*

The felspathic schists, agglomerates, porphyries, and other rocks of the neighbourhood of Moose River, require no special mention. Moose River schists. The relation of the schists to the massive volcanic rocks is obscure; in Sutherland's River they are associated with fragmental felsites and masses of soapy, serpentinous, fragmental slate. They differ from the Cambro-Silurian slates and do not seem to be an altered form of them, but rather bedded volcanic breccias. They are greenish, pearly, scaly, chloritic and micaceous, full of veins of quartz, and intimately mixed with rocks like those of Baxter's Brook. Soapy slates and mica schists, weathering-rusty, and silvery grey, are found in the French River in the neighbourhood of Blue Mountain, containing so many large veins of quartz that in places they pass into quartzite; with blocks of felsite, hornblende-rock and diorite. Quartz veins. In the first small brook below Patrick's are blocks of felsite, but no outcrops. Near Murdoch Lake, massive dioritic rocks are associated with felsitic schists and Cambro-Silurian grits. 250 yards north of the Blue Mountain church, is a pink porphyry, jointed and crossed in all directions, blotched with quartz and spotted with crystals of red felspar. Porphyry and diorite crop out at other points in the same neighbourhood;† and ridges of greenish and dark grey diorite, on Blue Mountain.

*Geol. Surv. of Can., An. Rept. 1886, vol. II., p. 99 P.

†Trans. N. S. Inst. Sc., vol. III., pp. 69, 72, 107 and 108; vol. V., pp. 67, 7 and 73.

the mountain road near the church at McLellan's Mountain. Large outcrops of greenish diorite are found on the road through the Ross settlement north of Sunnybrae, associated with Silurian rocks and with flinty Cambro-Silurian slate; and smaller outcrops on Irish Mountain and towards Churchville. In Cameron Brook is a dyke of dark grey amygdaloid, with cavities and veins of calcespar, among greenish flinty conglomerate and black rusty Silurian slate; and at Churchville, a trap precisely similar, coated with hematite, perhaps cuts the Carboniferous conglomerate.

Corrimony.

The reddish traps of Corrimony, containing specks of colourless quartz, cut Cambro-Silurian rocks and also the doubtful flinty grit, which may be Medina. Near Dan Urquhart's, massive and slaty fragmental, soapy rock is associated with dark crystalline diorite, light-coloured felsite, chloritic and nacreous rock, cut by quartz veins, and with bluish-grey pyritous trap. In Glencoe Brook, greenish compact diorite and felsite, blotched with quartz and hematite, appear in large outcrops; and at Mount Horeb, a greenish diorite cuts ribbanded slates; and purplish trap and diorite form precipices near the road. Where the boss strikes the River road, the diorite contains scales of specular iron ore; but there appears to be no alteration of the Silurian rocks.

Blanchard.

In the west branch of Blanchard Brook* there are outcrops of greenish massive diorite and reddish breccia in contact with which the Silurian appears more altered than usual; the fossiliferous iron ore at William Ross's also appears to be cut by the traps and diorites; as well as the Silurian rocks of the iron mine further north.

Iron ore.

Sam Cameron's Brook.

The igneous rocks of Sam Cameron's Brook are of great variety and interest; they underlie the black slates of the Clinton and the siliceous sandstone of the Medina, and are probably contemporaneous with the Cambro-Silurian. The lowest in the brook are greenish and purplish amygdaloids, with cream-coloured compact rocks; succeeded by claystone and syenite, by a dyke-like mass of volcanic breccia, and by quartzite and light-coloured agglomerate. Higher up, purplish and bluish-grey ash-rocks and greenish chloritic rocks are associated with soapy slates, perhaps sedimentary, and with fine crystalline diorite. Light grey, greenish and cream-coloured, felsitic, splintery slates, of silky lustre, are intimately mixed with and apparently pass into greenish, fine agglomerate slates, and are cut by dykes of dark crystalline diorite. Some of these beds are very coarse, apparently horizontal, and associated with patches of

*Trans. N. S. Inst. Sc., vol. III., p. 63.

agglomerate resembling that of Bear's Brook. Greenish, cream-coloured and reddish, felsitic, soft-aluminous shales, containing greenish, soft, steatitic patches, are cut by an irregular vein a foot thick but thinning out, composed of limonite and spathic iron. Iron ore. There are also light-coloured, compact, ribbanded rocks, the banding of which is vertically 167° , and resembles the colour lines of a slag, but which split more readily along the nearly horizontal lines above described. Scales of specular iron ore are in the joints; and chloritic diorite, breccia and massive felsite are found higher up. Greenish, massive diorite and syenite are found in McLellan's Brook and on the neighbouring hills not far above the contact of the Carboniferous.

The Weaver's or McGregor's Mountain is composed partly of McGregor's Mountain. black vesicular trap of doubtful age, with conglomerate in contact with Carboniferous rocks.

2. *Devonian Igneous Rocks.*—The igneous rocks of John Mc- East River. Donald's (Ogg) Brook (page 35), not far above the East River of Pictou, consist of reddish and greenish massive felsite, trap, syenite and diorite, granular and compact, of serpentinous diorite-breccia and coarse, rusty calcareous agglomerate, with other varieties like argillite or amygdaloid. In the fields near the little branch from Specular iron ore. John McDonald's (Weaver) are chloritic and quartzose gneiss, felsite and diorite.*

Reddish trap cuts dark grey massive argillite near the contact of the Carboniferous and Devonian rocks of Archibald's Brook; while higher up is a massive, grey, calcareous, porphyritic felsite, in part vesicular, in part yellowish-white, decomposed and trachytic, containing spots of specular iron; and at Archibald's bridge, a granular syenitic rock. Blocks of a reddish trap are also found near Alex. McDonald's, at the head of Black Brook, and of coarse diorite at Centredale; while at Sam Cameron's mill is an outcrop of grey, greenish and reddish, massive or laminated and wrinkled felsite-breccia.

In the west branch above Elgin, Upper Devonian rocks are West Branch, East River. associated with greenish and cream-coloured flinty rock, agglomerate and purple loosely coherent breccia.

About Lorne are many large blocks of greenish-grey, white-veined, gneissic diorite, the veins being of compact or granular felsite. Near Cameron's Brook, opposite Jessie Grant's, a hill shows compact and granular flinty quartz-felsite. Near the Marshdale Marshdale. school the trap and diorite, well exposed on the hill, contain traces

*Trans. N. S. Inst. Sc., vol. V., p. 206.

of specular iron ore and have been prospected in several pits. Except on the hill, however, sedimentary rocks are probably in place. The diorite near the limestone is a soft mixture of feldspar, hornblende and chlorite; it is well seen on the Crockett road, and perhaps cuts Carboniferous rocks. Large blocks of chloritic, white-veined, hornblendic rock are found south of Kenneth McKenzie's, at Lorne; also a doubtful outcrop of rusty-weathering, light greenish-grey, calcareous clay-rock, sometimes shaly, resembling a crystalline limestone and full of blotches of pink calcspar.

Glengarry.

On the Cross Brook are light grey, slaty, felsitic, epidotic, obscurely fragmental rocks with threads of ankerite and specular iron ore; and in the Big Brook, above John McDonald's road, large blocks of dark, pyritous, finely crystalline diorite with white veins. Near Glengarry, on the road to Concord Mills, calcareous flinty trap cuts reddish coherent Devonian argillite; west on the railway, are blocks of trappean and fragmental rock; and near the thirtieth mile-post, a pit south of the railway exposed decomposed, felsitic and granular, flinty hornblende-rock. On the road from Glengarry to Lorne by John McDonald's, granitoid, syenitic and felsitic debris appears near the school; and between McDonald's and the road near Cross Brook the land is bouldery with diorite derived from the hills of the vicinity. The blocks of veined diorite near the railway tank are followed on the road westward towards Lansdowne by others of purple trap. The reddish and dark trap of Robert Gordon's Hill, north of Glengarry, occurs between layers of limestone at the quarry, and also cuts a bluish-grey slaty, siliceous rock; near the main road on this hill are reddish porphyritic felsite and trap.

The sandstones in the neighbourhood of the diorite of the Marshdale Hills are slightly indurated, and the greenish and reddish argillites in some places almost porcellanous, but not more so than the strata of Millbrook. The hill between the Crockett road and Jessie Grant's is apparently in great part trappean. At the picnic ground at the north end of the hill, compact and fragmental felsite is intimately mixed with reddish quartz-veined quartzite and greenish porcellanous argillite, knobs of rock coming through the soil on the highest peaks.

West River.

In the brook near Limerock, are cliffs of light grey, calcareous, fine and coarse, rusty-weathering, trachytic and fragmental rock, full of grains of chlorite.

On the opposite side of West River, near the head of Six Mile Brook, compact, greenish, felsitic, serpentinous, dioritic rocks are

covered on both sides by Permian, at what may be termed the east end of the Cobequid Hills. The arrangement of the rocks in these hills is stated thus by Sir J. W. Dawson*: "There is a central mass of red intrusive syenite or syenitic granite, usually having a large predominance of red orthoclase, with a moderate quantity of hornblende and quartz. This sends veins into the overlying beds, and is itself penetrated by dykes of diabase. On this central mass rests a great thickness of felsites, porphyries, felsitic agglomerates and diorites, evidently of volcanic origin. Upon these are grey, black and reddish slates and quartzites, with a bed of limestone, and penetrated by metallic veins..... The rocks have been altered and elevated before the Carboniferous period†; but, on the other hand, these altered rocks themselves are in part Devonian, and there is no reason to believe any of them to be older than Upper Silurian."

Structure of
the Cobequid
Hills.

Underlying the Permian conglomerate of Mount Thom is a reddish and grey coarse syenite and greenish and grey gneissic rock; at the west end of Mount Thom, greenish diorite, greenish, reddish and grey granular and porphyritic felsite, quartz-felsite and syenite; while near the Telegraph road, dark green, soft, fine diorite is in contact with greenish-grey slates. Near Bezanson's, a pit fifteen feet deep has been sunk in search of gold, in a grey crystalline diorite, associated with rocks similar to the above; and further north, greenish felsitic rock is veined with calcspar. At Mount Dalhousie, grey and greenish, massive, felsitic rocks include greenish and purple and dark breccia, calcareous, felsitic, chloritic, somewhat pearly, often slaty, like the rocks of Coxheath. On the hill south of Loganville and in the Biorachin are outcrops of grey and black syenitic rock and of all the other varieties of Mount Thom. In some of the little tributaries of the west branch of River John, above Loganville, there is a great variety of these rocks. In one of them from the west they comprise amygdaloid, fine trap, epidotic and compact felsite and breccia, with apparently a southerly dip like the associated fine sediments. Up stream are reddish and grey syenite, greenish grey, nearly compact Coxheath felsite or diorite, with a well-defined bedding or cleavage, which dips $177^{\circ} < 40^{\circ}$.

Mount Thom

Search for
gold.

Loganville

On the road to McIntosh Lake, and in the brook near the lake, reddish and grey coarse syenite is abundant. Further down stream, greenish diorite is succeeded by greenish-grey, pearly, pyritous felsitic slates, often papery and scaly, showing flakes of different

McIntosh
Lake.

*Acadian Geol., Suppl., 1878, p. 79.

†Acadian Geol., pp. 561 and 580.

colours, spotted with quartz, serpentinous and chloritic, with calcespar in the joints, and with veins, sometimes three inches thick, of white barren quartz; and where overlaid by the Permian conglomerate, associated with grey massive felsite, quartz-felsite and diorite.

Dykes of black and light green crystalline hornblende-rock or diorite and of massive greenish-grey or grey felsite cut the Devonian strata of Salmon River, above the fork of Black River, the sedimentary strata being considerably altered near the contact, and having specular iron ore developed from the ankerite veins so abundant in the neighbourhood, as is often the case in proximity to the dykes. The bright red slates at the uppermost and largest of the dykes, resemble those near the manganese mines. No other igneous rocks appear in the river as far as the head of the settlement.

Salmon River.

Specular iron
ore. ^{Winn.}

About 100 paces south of the railway station at Riversdale, large blocks of reddish-grey syenite may indicate a boss of this rock, but are perhaps drift. The outcrop of grey, soft, vesicular, calcareous trap about a mile below the driving dam on Calvary Stream has already been referred to. North of Steele's Run, the hills show grey and greenish diorite, syenite and felsite, sometimes slaty and chloritic. On the main road through Upper Kemptown, and on some of the by-roads, are large exposures of red syenite, mixed with blackish diorite, succeeded towards Earltown by fossiliferous rock, mixed with grey amygdaloid. Some of the syenite is coarse; much of it is of a fine colour and probably fit for ornamental purposes.

Ornamental
stone.

Diorite and syenite are in contact with Devonian and newer rocks in the Juniper Meadow Brook and other streams of the vicinity, being separated from the latter by faults.

Valley.

On the Telegraph road, about a mile east of Valley cross-roads, is a hill of coarse black diorite, not extending far above or below the road; associated with flesh-red compact felsite, overlaid by Triassic rocks.

North River.

Many rocks of this group in North River have been incidentally described with the Devonian, with which they are in contact. The outcrops of syenite, diorite and trap of McKenzie settlement, of Brian Lynch's, and of the road towards Earltown, are shown on the map. On the Tatamagouche road, in the neighbourhood of the old mountain inn above McCallum settlement, red syenite is abundant in the brooks and extends to the head of Falling Brook, a stream which runs from a large barren or peat bog, winds for some distance without showing rocks, then rushes over nearly

compact syenite rock and plunges into North River, over a cliff, forty feet high, of reddish coarse syenite, succeeded in the river by Devonian sediments, cut by dykes of syenite and diorite.

On the west branch of North River about a quarter of a mile above the saw-mill at McCallum settlement, a bluish-grey calc-veined limestone is seen, dipping first at a low angle, then overturned and ending in contact with a dark greenish-grey crumbly diorite or trap, like that of New Annan, into which it penetrates in wedge-shaped masses, the bedding conforming in places with the line of contact, and small detached pieces of the limestone occurring in cracks in the diorite to a distance of twenty feet from the contact. The greenish, massive, rubbly Devonian rocks which immediately succeed are more flinty and altered than usual: they include ferruginous calcareous bands, light grey flinty sandstone and a grey rusty-weathering quartzite, showing plants converted into anthracite, resembling a Guysboro' quartzite, and succeeded immediately by greenish, fine fragmental, igneous rock. Greenish, quartzose, greatly altered sediments are again seen, including a reddish argillite, full of spots and veins of specular iron ore, cut by a dyke of red igneous rock resembling mud squeezed into them; succeeded by greenish-grey trap and diorite, mixed with small patches of red syenite, which increase until the whole brook is occupied with bright red syenite. Then for more than a mile up stream, the magnificent gorges of the river show mixtures and alternations of dark diorite and reddish or light-coloured syenite; above which near a saw-mill, is a breadth of more than half a mile of sedimentary rocks. Succeeding these, as far as the road crossing, is another belt of light greenish trap, granular, fragmental and porphyritic quartz-felsite and greenish diorite, sometimes exhibiting rough bedding and containing patches of bright red syenite. Fossil plants.

The dykes near the head of Nabiscump Brook consist for the most part of greenish fine diorite and reddish quartz-felsite. The rocks which cut the Silurian in the little brook immediately above Earltown are of considerable variety, including a purplish-grey, fragmental, scaly rock, greenish and dark diorite and syenite, overlaid by Permian conglomerate. Below Earltown falls (which are "fifty feet high, resembling the falls of Foyers in Scotland,") are cliffs of greenish-grey, blackish and dark-reddish diorite and trap, full of veins of calcespar and quartz. The rocks of the falls consist of diorite and trap; but at the base are traces of red soft argillite, probably included masses of the supposed Devonian rocks of the brook to the eastward of the road. Earltown.

On some of the roads about the head of Matheson Brook, are outcrops of slaty or schistose felsite, full of quartz, and of dark trap. Nearer North Earltown, reddish, fine, granular quartz-felsite is mixed with argillite, and with greenish and light grey, striped, compact porphyry, containing grains of quartz. In one of the branches is a cliff of dark reddish and greenish, flinty and soft, calcareous, compact and fine trap, with felsitic, chloritic and dioritic slate, containing veins of quartz upon which a shaft has been sunk in search of gold. Underlying the Permian conglomerate of Moore's Brook, are greenish, slaty, felsitic, soft and rubbly, calcareous rocks, which extend west into Waugh River.

Search for
gold.

On the road from Nuttby to Waugh River, the coarse syenite and porphyry of the south side of the mountain are succeeded by the traps of the north side. Where these come from beneath the conglomerate above the falls in Waugh River they consist of light grey and greenish-grey agglomerate and of bottle-green felsitic or dioritic breccia, like that of James River, containing much chlorite and a few blotches of quartz and syenite, and showing in places a minute jointing or lamination. Higher up, similar rocks, containing more quartz, show a kind of scaly foliation which dips $118^{\circ} < 30^{\circ}$, and include flinty diorite and imperfectly crystalline syenite. In one of the tributaries from the west, reddish, fine, coherent sandstone is associated with grey soft trap and greenish flinty diorite.

Falls of
Waugh River.

Foliation.

Dark-greenish and blackish trap and diorite, fine and crystalline, with blotches of calcespar, occupy most of McDonald's Brook, and in the clearing near McDonald's house are in contact with red sandstone at a little fall, whence they appear at several points on the road towards the Earltown road. Ferguson Brook, one of the wildest streams of this part of the country, shows cliffs of dark grey and greenish, compact and crystalline trap and diorite cleft in one place into a small cave. In the adjoining tributary of Waugh River from the south, reddish, fine, massive sandstone or quartzite is cut by dark grey, fine, crystalline trap or diorite; and higher up the brook, red argillite is associated with red flinty quartz-felsite and amygdaloid. Other outcrops in this neighbourhood show igneous rocks cutting red sediments which consist of conglomerate, quartzite and argillite.

Cave.

Among the Silurian rocks of Spiedel Hill are grey, greenish and rusty-weathering, compact, porphyritic felsite, with crystals of amber-red feldspar and small spots of colourless vitreous quartz, passing into granular felsite and quartz-felsite. In the little brooks above Gilbert Sutherland's, schistose rocks are exposed, Murray's Brook showing felsites from the road to the river.

Immediately west of Waugh River on McLeod's farm is a dark rotten trap; but for some distance before reaching Mr. Paul McDonald's house, the debris indicates flinty porphyritic felsites, like those of Coxheath, which extend to Little River (Sutherland Stream) at the mill-dam and are well exposed down stream to Bailey's bridge and up stream to Kavanagh's mills. The first rock seen below the mills is light grey fine trap and blackish and red amygdaloid with a tendency to globular structure; succeeded by reddish and greenish, massive, flinty felsite, obscurely porphyritic, sometimes in layers dipping $51^{\circ} < 40^{\circ}$; greenish-grey and red chloritic and calcareous, fine, softer diorite; compact felsite and porphyritic diorite, with veins of colourless oily quartz, four inches thick, which have been mined; flinty fragmental felsites; and bright flesh-red compact quartz-felsite. About a mile above Bailey's bridge, a greenish, striped, jointed rock, very like a quartzofelspathic sandstone, probably sedimentary, is immediately followed by the felsites. At Drysdale falls, greenish chloritic and dioritic rocks, soft, slaty and crumbly, are cut into a pillar separated from the mass in the bank. Below the bridge, as already mentioned, these rocks are succeeded by reddish, flaggy, Permian sandstone. Above Kavanagh's mills the brook shows, as far as the little lake at its head, a few outcrops of greenish-grey and blackish trap, with small white amygdaloidal spots, associated, on the Corktown road, with masses of dark green nearly compact diorite. In the east branch of Little River, not far above the fork below Kavanagh's mills, blackish, greenish and reddish, compact and crystalline, soft, calcareous trap, easily broken up to make the fertile soil of this part of the mountains, is well exposed. A short distance higher, bluish-grey and greenish-grey argillites, in flaggy layers, dip $257^{\circ} < 45^{\circ}$. They yielded no fossils, but lithologically are like Silurian. They are underlaid by cream-coloured claystone of igneous aspect, succeeded by massive trap in cliffs. At the head of this branch, grey and blackish amygdaloid and diorite are succeeded by reddish nearly compact quartz-felsite or syenite and light grey rusty-weathering compact felsite, with a few porphyritic crystals.

Bailey's Bridge.

Quartz veins.

Silurian strata.

A brook crosses the road west from Bailey's bridge, 495 paces east of the cross-roads, and shows up stream outcrops of light and dark bluish-grey rubbly rock, probably an altered felspathic sandstone, dipping apparently $207^{\circ} < 25^{\circ}$; succeeded for a short distance by cliffs of greenish diorite; these in turn, by quartzites and porcellaneous argillites.

Dark trap and diorite are seen also to the westward as far as the Tatamagouche road. On the Four Mile brook, the first rocks south

Four Mile Brook

of the Permian are grey, reddish and greenish, flinty, splintery and rubbly felsites, some of which are fragmental, full of quartz veins; greenish compact porphyry; greenish and purple, mottled, soapy, soft, aluminous slates, like those of Louisburg and Coxheath,* scaly and serpentinous containing spots of hematite and a large quantity of calcite. Greenish felsite-slates are found on the roads between this point and the French River.

New Annan. In French River† immediately above New Annan bridge, grey and greenish, rubbly, porphyritic slates and flinty, pearly, papery or scaly
Schists. slates dip $77^{\circ} < 49^{\circ}$ with regular bedding or foliation. A little higher, greenish, much less regular, felsitic slates, containing a vein of white crystalline calcspar, three-quarters of an inch thick, are associated with greenish, light grey and black chloritic schists, in which the veins and blotches of calcspar are sometimes three inches thick: they are greatly corrugated, banded and striped, scaly, pearly and silvery, sometimes nearly horizontal, and hold large masses of quartz. High up the river at a dam, the schists are replaced by black, rusty and crumbly diorite and trap, among which occurs a greenish-grey
Limestone. fine limestone which has been burnt, the relations of which to the igneous rocks, however, require further examination.

Near the head of Byers Brook are outcrops of red flinty quartz-felsite, with grains of quartz, and of dark grey felsites and diorites, magnetic and containing small porphyritic crystals of feldspar and pyrite; and further down, vesicular and amygdaloidal trap. In the fields near William Warwick's, among other varieties of fragmental and Coxheath felsite and quartz-felsite, is a light-coloured slaty variety that might make a good fireclay, but does not seem to be abundant. At a school on the road to the Florida road, dark friable trap and diorite abound.

Fireclay.
Old Tatamagouche road. For some distance south of its junction with the present road near the head of the west branch of North River, the old Tatamagouche road shows rusty-weathering compact felsite; succeeded, at 880 yards from the fork, by dark green diorite, veined with epidote, and bright green and red, mottled, compact and fragmental felsite; and at 1,475 yards, by cliffs of massive porcellanite or altered argillite; while in a brook at 2,850 yards, dark and light grey Devonian shale and quartzite extend nearly to the North River, where the slates are mixed with great masses of dark diorite and small patches of red

*Geol. Surv. of Can., Rept. of Progr., 1875-76, p. 379; 1876-77, pp. 419 and 425; and 1877-78, p. 8 F.

†Geol. Surv. of Can., An. Rept., 1885, vol. I., p. 60 E.

syenite, above a narrow mill-pond at the head of a gorge. Further south on the old road are other outcrops of diorite.

On Chiganois River, the first igneous rock seen above Higgins' mill is a dark reddish somewhat compact trap, succeeded up stream by a small outcrop of sedimentary rock; then by reddish coarse syenite which surrounds a patch of red argillite. Grey and reddish syenite and greenish epidotic diorite then form falls, probably thirty feet high, in a rocky, inaccessible gorge; from the head of which the syenite, though including patches of almost pure quartzite, alternates with diorite in unbroken cliffs for a great distance. In places the syenite is bright red; the diorite is greenish, shows gneissic lines; and up stream, grey gneissic rocks underlie massive syenite. At the fork of the river, whitish-grey layered rocks dip $345^{\circ} < 80^{\circ}$, the bands being of fine gneiss, of quartz and of felsite. The bands of contorted gneiss which occur among the massive rocks resemble those of St. Ann's, Boisdale and Margaree, the dip is regular but contorted and the lamination very fine. Then come dark hornblendic rocks, also gneissic, with massive grey diorite; followed by alternations of coarse syenite and diorite immediately in contact with slates of the iron ore series, which occupy a breadth of more than a mile below Patterson's old mill, above which, syenitic rocks are again seen. At the mill and on the road from it, reddish porphyritic felsite and quartz-felsite abound, whereas on the Tatamagouche road at the end of this road, grey trap is in place. The few rocks seen about Clear Lake are syenitic; but on the road from that lake to Peter McIntosh's at the head of New Annan settlement, flinty felsitic or dioritic rock gives place to dark bluish-grey trap and diorite, found also on the track across the hills to Nelson's Corner and towards Kavanagh's mills. The little brooks immediately west of Chiganois River above the Higgins road also show outcrops of igneous rock among the Devonian. In that nearest the river, these consist of dark grey calcareous and chlorite volcanic ash or mud rocks, and of light grey and purple mottled amygdaloid; and in the second, of blackish diorite, whitish granular diorite and flinty breccia. In the upper part of the main branch of Old Sam's Brook, reddish coarse syenite and dark grey diorite contain calcite, epidote and chlorite, the syenite passing into granular quartzfelsite. The associated sedimentary rocks are reddish slaty flinty sandstone or quartzite and porcellanized red argillite.

In Higgins Brook nearly all the outcrops above the conglomerate consist of syenite, diorite and trap.

The igneous and sedimentary rocks mixed in the Debert River, three-quarters of a mile above the bridge at Cottam settlement, have

Chiganois River.

Gneiss.

Devonian slates.

Debert River.

been already described: the first seen are traps and diorites, succeeded by whitish coarse diorite containing much quartz, coarse grey syenite with obscure gneissic patches, whitish massive quartz which may be sedimentary, and is usually in contact with or near dark slates altered into schists. Similar alternations extend nearly to McMullin's mill* from which a long logging-sluiice runs down the river to Debert station. Near the mill, red syenite is associated with greenish breccia, in contact with greenish, flinty, slaty or porcellanous rocks which show black marks resembling plants, and mixed with silky slates and reddish porcellanite, including a thin band of crystalline limestone. At the mill, greenish epidotic, flinty, felsitic rocks, reddish or purple dioritic slates, often epidotic and chloritic, and reddish and greenish pearly slates have an easterly strike. Above the mill-pond, greenish chloritic schists include a band of what appears to be altered sedimentary rock, bedded conformably with them, and extend to the mouth of Shatter Brook. At the bridge on this brook are greenish, scaly, chloritic, soft rocks; below it, they are succeeded by red syenite cut by a dyke of black diorite, two feet wide, below which pyritous diorite and syenite are mixed to the river. Above the mouth of Shatter Brook, grey and greenish chloritic slates give place to banded and contorted syenitic rock, succeeded by massive syenite and diorite. The banks are then low and the outcrops less imposing, but ledges of red syenite with patches or dykes of dark diorite extend to Debert Lake, the syenite being in places coarse and containing very little hornblende.

Limestone.

Totten's
Brook.

On the south side of the marsh at the iron mine on Totten's Brook are small outcrops of mottled, massive, fragmental, granular syenitic and felsitic rocks, stained with films of red hematite and carbonate of copper, and light greenish diorite, blotched with specular iron ore, in contact with very flinty flags or porcellanites. Near the head of the brook is a greenish, soft, granular diorite. In the east branch of this brook, north of the sedimentary rocks, a dark green diorite, sometimes soft and containing traces of specular iron ore, is followed by coarse syenite with patches of green soft diorite.

Pine Brook.

In Pine Brook* not far above the Totten settlement, greenish compact and granular diorite, containing films of red hematite and blotches of white calcespar, in which are dendritic markings of specular iron ore, are associated in the cliffs with mottled greenish and reddish, fine, fragmental breccia; above which appear other rocks of the iron ore series in contact with greenish soft pea-breccia, containing globular

*Geol. Surv. of Can., An. Rept., 1885, vol. I., p. 56 E.

masses of dioritic rock; alternating with dioritic schist, flinty gneissic quartz-felsite, breccias with patches of sedimentary rocks, hornblende schist, striped quartzite, granular quartz-felsite and other gneissic rocks with a steep southerly dip. Near the head of the brook are coarse and fine syenite and diorite and whitish compact quartz-felsite.

The dykes of diabase and syenite,* which cut the Silurian rocks west of Wentworth station, have been already referred to. Between Wentworth and Folly, reddish, flinty, obscurely granular quartz-felsite and syenite are associated with diorite and porphyritic felsite, as described by Dr. Ellis.† Below the outlet of Folly Lake, diorite and syenite are seen in several cuttings along the railway and in the river, succeeded by sedimentary rocks at the first snowshed near the siding, the latter being cut across and in the bedding by dark flinty diorite and reddish compact quartz-felsite, and intermixed with massive igneous rock and with chloritic and mica-schist veins of quartz, sometimes of large size being found in connection with some of the patches and prospected in the hope of obtaining gold. These rocks are well seen near the fork of the river, and are very interesting.

Intercolonial railway.

Search for gold.

Above the railway, the iron ore rocks of McElman Brook are cut by greenish, fine diorite, succeeded by light-coloured compact and granular quartz-felsites, flaggy and like gneiss in part, and by greenish-grey massive diorite or hornblende-rock. Blackish very fine diorite cuts the sedimentary rocks in several places up to the head of the brook. On the track from the east branch of this brook past Archie Slack's house to Folly Lake, masses of slaty diorite, chloritic and hornblende schists, greenish and whitish coarse and fine diorite are found with altered sediments.

The syenite, diorite, felsite and allied rocks of the various branches of Great Village River have been already referred to. On the west branch, immediately above the bridge on the Cumberland road, black and grey diorite and felsite are in contact with light greenish and grey flinty slates, probably cut and altered by the former, while down stream the reddish and green slate and massive greenish and grey argillite and quartzite include the great vein of ankerite.

Londonderry mines.

The rocks of this group in Portapique, Bass and Economy Rivers have been described in connection with the Devonian.

Economy River.

*Acadian Geol., Suppl., 1878, p. 75.

†Geol. Surv. of Can., An. Rept., 1885, vol. I, p. 57 E.

In Murphy Brook, as already stated, after crossing a great breadth of igneous rocks, purple and greenish altered slates, with quartz-veins, blotches of specular iron ore and hard small concretions, are the finest exposures of the black Devonian shales or slates with associated Guysboro' quartzite, full of matted plants. In a branch of this brook from the westward, one of the veins of quartz in a quartzite, conglomerate and slate, is more than a foot wide, but barren.

On the shores of British Lake are outcrops of greenish, massive, nearly compact diorite; and cliffs of greenish and reddish mottled, compact trap or diorite are found on a tributary of the Bass River to the northward. Lower down this river and in the neighbourhood of the Gundalow road, greenish felsite, syenite, diorite and trap are mixed with flinty slates.

For a short distance above the bridge on the shore road, the North River of Five Islands displays fine outcrops of nearly horizontal Triassic shales. These are underlaid at a saw-mill by reddish, grey and greenish, coherent, fine sandstone and shale; and above them, with a high north-easterly dip, appear light grey, fine, flinty sandstones, with layers of dark shale full of *Naiadites*, and of carbonaceous matter, very like rocks of the North River of Onslow and precisely like the altered rocks of Portapique River. Higher up, the dip changes to $165^{\circ} < 37^{\circ}$, then to $332^{\circ} < 33^{\circ}$, and again to $155^{\circ} < 22^{\circ}$, and dark crumbly argillites, breaking into long knife-shaped pieces, are full of fossil plants, show an inch band of coaly shale and are overlaid by greenish compact sandstone or quartzite, containing ferruginous matter and associated with a greenish shale, like that of the mill-dam, full of *Cordaite*s, ferns and other fossil plants and penetrated by minute veins of limonite. Near the seventy-two feet fall occur greenish-grey massive, flinty sandstone or quartzite, nearly vertical, resembling certain iron ore rocks of Great Village River; cream-coloured massive quartzites, with veins of siderite and ankerite; cream-coloured and olivaceous soft shales, with a coaly band, three feet thick, and a large vein of iron ore on top; dark and light grey flinty quartzites and slates in contact with a massive diorite, containing calcespar and hematite. At the top of the fall are greenish and dark slates and quartzites, probably the altered equivalents of the rocks near the mill pond, with greenish diorite-schist, whitish, compact crystalline limestone or marble, spotted with grey, greenish and yellowish, white-weathering, fibrous serpentine, perhaps in a vein, and grey massive diorite. Above the outcrop of marble are others of dark and light-coloured shales or slates, sandstones or quartzites, up to a little brook from

the westward, above which wrinkled slates are intersected by small dykes of diorite and syenite; while still higher these rocks totally replace the slates.

Up the little brook mentioned above, red syenite prevails. From its head, blocks of syenite, diorite and altered slate are found to the back road at Lynn.

In the first large branch of Harrington River from the westward above the Parrsboro' road, coarse syenite and diorite are associated with grey flinty quartzites and red or purple porcellanite, dipping, $288^\circ < 50^\circ$. Higher up are blackish diorite or breccia, full of grains of specular iron ore, and cream-coloured, soft, pyritous, brecciated vein-rock, among greenish slates and chlorite-green, wrinkled diorite-schist, with small veins of mixed quartz and calcite, which extend for some distance and are then succeeded by more massive red syenite, reddish and brown granular quartz-felsite and felsite, often porphyritic and epidotic. In a small branch of this brook from the north-east, bright indian-red altered argillite is associated with reddish and greenish trappean rock. Above the fork, reddish epidotic felsite and amygdaloid extend to the wet, mossy lands at the head. In an adjoining brook to the westward, at the Parrsboro' road, grey, flinty, Devonian flags, and black slates, dip $34^\circ < 50^\circ$; and above the road contain plants. Where the brook comes over a fall thirty feet high, grey, coarse syenite is exposed; above the fall, greenish-grey schists dip about $177^\circ < 45^\circ$, near a mass of red syenite; then light greenish-grey and grey quartzite-flags and dark slates, precisely like the sandstones and shales down stream, but more altered, are cut by ferruginous veins an inch thick, and succeeded by purple porcellanized argillite, light grey soft argillite, greenish, cream-coloured and grey calcareous breccia, replaced in turn by syenite and diorite with small patches of grey slate.

Harrington River.

Mixed sedimentary and igneous rocks.

At the head of a branch of Moose Creek, immediately to the westward, red syenite, porphyritic felsite and quartz-felsite are well exposed to the bottom of the hill, where light grey, flaggy, flinty sandstone and dark shale, not much altered and containing *Naiadites*, dip $202^\circ < 46^\circ$, being, perhaps, separated from the syenite by a fault. Immediately below the contact, a little brook from the left shows grey, coherent flags, dipping $74^\circ < 17^\circ$, while at the post-road dark shales and flags dip $134^\circ < 5^\circ$, but, a short distance to the eastward, strike in vertical beds 127° . In the branch from the left, a considerable thickness of grey, rubbly sandstone or quartzite and shale dip $155^\circ < 17^\circ$. In a little tributary from the north, they show markings of *Calamites*, seem to pass

Moose Creek.

Fossils.

Contact with
sedimentary
strata.

into flinty, quartz-veined porcellanite and quartzite, and are spotted with specular iron ore; and on the hill these latter give place to red syenite. At the head of the very steep and rocky little branch of Moose Creek, west of those mentioned above, red syenite is well exposed. Down stream it includes a mass, five feet wide, of dark green, fine diorite, immediately succeeded by or mixed with, greenish, compact, soft and hard argillite or rubbly porcellanite; light grey and greenish argillite and quartzite, veined and twisted, dipping $167^{\circ} < 80^{\circ}$, the veins being mostly of reddish compact and fine grained syenite and felsite; nine feet of massive syenite with a patch of veined, bedded rock; dark red and greenish, nearly compact, fragmental felsite; followed by dark grey Devonian argillite, breaking into cubical blocks, interstratified with greenish-grey sandstone or quartzite, like that of Loch Lomond, with yellow ochre in the joints, dark grey argillite and light grey sandstone, with obscure fragments of plants. About twenty-five yards lower, a band of blackish shale, only partially exposed, has an altered aspect, breaking out in rectangular blocks or in pieces with a woody-fibre cleavage, difficult to split in the bedding, but showing on some layers *Naiadites* and a long, grass-like plant; it dips $157^{\circ} < 32^{\circ}$, and is succeeded down stream by sandy micaceous flags and dark shales, with *Naiadites*.

West Branch
of Harrington
River.

The falls of the west branch of Harrington River at the fork show red felsite and quartz-felsite, massive, compact or finely crystalline. Above a fifty-foot fall, about a mile from the fork, felsite and syenite are in contact with greenish and light grey slate and quartzite, probably greatly altered sediments, succeeded by greenish and dark grey massive argillite, dipping $142^{\circ} < 36^{\circ}$, and containing minute veins of quartz; these rocks, after occupying the brook for more than half a mile, become mixed with dark and light green and grey diorite and felsite and red syenite, at the upper end of which, coarse, grey, soft, calcareous, dioritic rock, in contact with light grey, altered, flinty argillite, is succeeded by light greenish schistose rock, perhaps, also, altered argillite, and by greenish slates, porcellanites and schists, the whole occupying a breadth of 340 yards, beyond which the brook comes through alders and mossy land in a spruce thicket, in which no rocks are seen for a distance of 1,430 paces to a small rapid about three miles from the fork, at which a compact rock, perhaps an altered argillite, is associated with greenish epidotic diorite. In the level, wet land between the head of this brook and a portable mill near the head of a tributary of Harrington River no rocks were seen; between this mill and the north end of the settlement of Lynn at

Lynn.

Peter A. Lewis's house, are several outcrops of red coarse syenite and greenish diorite; but, immediately north of the house, and also in the fields south-west of George McLennan's, are grey and greenish altered slates. Below Lynn, Harrington River shows in its gorge similar intermixtures of greenish massive and schistose diorite, red syenite and greenish flinty slates, the diorite-schists having, for a great distance, in common with the other laminated rocks, a low dip to the eastward, containing chlorite, epidote, minute veins of quartz, in some places asbestiform fibres, several inches in length. Similar alternations are seen on the road to Five Islands. Asbestos.

The junction of the two series is also well exposed in several of the branches of Boyd Brook. Between the river and the lower bridge on the Lynn road, dark shales and flags and grey sandstone or quartzite dip very regularly $154^{\circ} < 45^{\circ}$; while at the old mill-dam above the road, purple and greenish, mottled, flinty, rubbly rocks, like those of Brian Daly's Brook, have a nearly vertical southerly dip and are underlaid by the light grey and greenish-grey, rusty-weathering, compact, massive and rubbly quartzites of the iron ore series. Higher up the brook, dark slates and flags display obscure carbonized plants; one portion looks like an underclay and has a lenticular patch of coarse grey grit. The lenticular, pyritous and siliceous plates or veins of the rusty rocks may represent the ironstone of the less altered strata; the dip is greatly contorted and scales of specular iron ore are abundant. At two points the rusty-weathering rocks, greatly veined with ankerite and spathic iron, are mixed with what seems to be a fine agglomerate, breccia or claystone, soapy and soft; the second outcrop being thirty yards below a little brook from the eastward. For about 180 paces above this fork, rusty quartzite and purplish-grey argillite are exposed. Immediately north of it, on the Lynn road, grey and reddish quartzites are succeeded by felsitic, dioritic and syenitic rocks like those described above. At forty paces up the little brook from the eastward, red syenite is also exposed for fifty-six paces; then whitish, soft, soapy claystone or breccia, for seventy paces, with lumps of quartzite succeeded by light quartzo-felspathic rock, perhaps sedimentary, with a shale or slate, rich in graphite, which has been prospected by a tunnel. Then for 283 paces are alternations of blackish diorite, greatly altered, purplish, dark and light grey flinty flags, whitish or cream-coloured calcareous flags, dark, flinty, rubbly sandstone and grey soft sandstone or breccia; then 165 paces of red syenite succeeded by masses of light greenish diorite, broken up in a search for asbestos, which occurs irregularly intermixed with Devonian strata.
Contact.
Graphite mined.
Asbestos.

quartz veins. At 155 paces beyond, the hill exposes purple rubbly sandstone or quartzite, interstratified with greenish and dark slates; and other intimate associations of these different rocks have been traced in the fields and brooks of the neighbourhood, as shown on the map.

Moose River. Igneous rocks are in contact with the Devonian of Moose River about a mile above the Parrsboro' road. About 250 paces above this road, dark shales, striking 314° with a vertical dip, are interstratified with flinty flags; while 375 paces higher, the dip is $151^{\circ} < 25^{\circ}$, and continues at this moderate angle for some distance. The sandstones contain small veins of quartz; the shales, nodules of ironstone, rootlets, stems and leaves of *Cordaites*; while both are intersected by veins and blotches of ankerite. About ninety paces below the first appearance of the igneous rocks, greenish-grey, flaggy sandstone or quartzite and dark argillaceous shale, containing small threads of limonite, dip $162^{\circ} < 58^{\circ}$, and some of the finer beds show good specimens of *Cordaites*. Then after a concealed interval, come greenish-grey, massive, white-weathering, felspathic and dioritic rock, passing in places into red syenite; succeeded immediately by grey, flinty, porcellanous slates, cut by veins and blotches of red syenite, a foot thick and downward, and resembling what one would imagine the fossiliferous rocks down stream might alter into. These rocks occur at a brook from the north-east and are succeeded by cliffs of red syenite as far as a large brook from the north-west, immediately above which, greenish compact sandstone dips $162^{\circ} \vee 68^{\circ}$, interstratified with green slaty or schistose rock, in part apparently dioritic, with flinty flags or compact quartzite, dark grey porcellanized argillite and light grey sandstone or quartzite, full of quartz veins which contain chlorite. About 585 paces above the last little brook, the river comes over a fall into a deep pool, above which is an inaccessible gorge. Slates extend to within 130 paces of the face of the fall and are in contact with greenish diorite and red felsite; and from the fall up to the large driving-dam, indian-red, spotted, soft trap or volcanic-breccia, passing into compact flinty felsite containing aggregations of quartz and red porphyritic crystals, is associated with greenish massive diorite on the hill, the gorge being occupied by three falls, one of which is said by Mr. Jones to be 108 feet high and the aggregate of the three more than 200 feet. Above the driving-dam, red and purple porphyry and greenish and reddish amygdaloidal trap extend to the fork.

Falls.

Most of the tributary from the north-east below the falls, is occupied by red syenite, passing into red, compact, porphyritic quartz-felsite, and dark fine diorite, which in one place has a flat

bedding or lamination, and is succeeded by a patch of greenish and dark grey altered slate, with quartz veins. The brook from the north-west shows syenite and diorite at its mouth, then a considerable breadth of dark and greenish slates, dipping $207^{\circ} < 40^{\circ}$, in part schistose, mixed with diorite as far as a very pretty twenty-five feet fall, above which bright-red, compact and granular, porphyritic quartz-felsite and felsite occupy the stream to its source.

A short distance above the Parrsboro' road, on the west branch of Moose River, great cliffs of red syenite form the mouth of a gorge. Below them, on the left bank, are dirty green and dark diorite, and reddish felsite and quartz-felsite; and not more than seventy paces down stream from the last outcrop of this igneous rock begins a fine exposure of grey glistening quartzite or sandstone, like that of Loch Lomond, veined only with small threads of ankerite, and not more altered than is usual with these rocks at a distance from the syenite; rather massive, with beds of coarse grit, full of fine specimens of the coarser parts of *Lepidodendra*, *Calamites*, *Cordaite*s and other plants, with twisted, carbonized and graphitized surfaces; breaking into blocks of irregular shape, and quarried in one place for rough building stone. The dip is not distinct. At the head of a little tributary, which enters from the westward immediately below these outcrops, are knobs of red syenite, upon which in one place rests a dark crystalline diorite, which shows slaty cleavage; and less than two hundred paces lower, rubbly felsitic and dioritic rocks are in contact with dark grey slaty quartzite and porcellanite, full of threads of quartz and calcspar, succeeded by very ferruginous, dark and light grey shale and sandstone or quartzite, the former full of *Naiadites*, *Cythere* and *Cordaite*s, the latter showing only broken carbonized plants, resembling the country rock of the iron mines, containing numerous threads of limonite and ankerite, and dipping nearly vertically to the southward. They resemble also the porcellanites up stream, but are less altered; and where soft rocks come in contact with hard surfaces, certain planes are slickensided.

Along the Parrsboro' road to the westward, dark shales and flags dip $124^{\circ} < 73^{\circ}$, and a little further $102^{\circ} < 70^{\circ}$. They are followed by grey, rusty-weathering, compact, rubbly quartzites, like those of Loch Lomond, including a band of greenish-grey, wavy, flaggy sandstone, which in the next little brook dip $177^{\circ} < 45^{\circ}$, while higher up the brook the dip is very variable. Up the brook which comes into the head of the pass on the road immediately to the westward, grey sandstone and shale prevail as far as a fall, where red felsite is in place; but above it, at another little fall, is

West Branch
of Moose
River.

Fossil plants.

Iron ore.

Road from
Moose River
to Parrsboro'.

Crystalline
limestone.

a very light grey fine sandstone, like an altered form of that seen at the road, but too rubbly to show fossils; beyond which, blackish slaty argillite is found nearly in contact with red and grey friable syenite, penetrated by veins of white crystalline limestone or marble.

Cranberry
Lake.

Head of
Diligence
River.

West Branch,
River John.

Westward from the head of the pass, the road runs down a brook with a high hill of syenitic and dioritic rock on the north side, while on the south are dark graphitic slates, with rusty veins and nodules of crystalline limestone, interstratified with flinty quartzite, like that of the iron ore series, shown in several of the mountain brooks at and near the contact. Where the road to Parrsboro' leaves that to Prospect, the hill is still close on the right, indicating the boundary of a mass of igneous rock which is at the bridge 107 paces east from the fork of the roads, while up stream the brook shows porphyritic felsites and diorite to its head; and these rocks occupy a great part of the country back to an old mill about a mile west of the foot of Cranberry Lake, where grey and greenish-grey, greatly altered argillite and fine sandstone, dipping $277^{\circ} < 15^{\circ}$, lie not far from cliffs of red and grey, compact, epidotic quartz-felsite and felsite. Along the south side of the escarpment the felsitic rocks can be followed to Parrsboro' River. West of the river, however, the low land which extends along Diligence River indicates the presence of light grey and greenish-grey, flaggy, rubbly quartzite and micaceous slate, full of quartz veins and dipping obscurely south; and dark and light grey flags and slates extend up to a saw-mill, above which they are intermixed with greenish, massive, epidotic diorite, fragmental felsite and syenite.

3. *Post-Carboniferous Igneous Rocks*.—On the west branch of River John above the village are masses of dark grey amygdaloid, passing into dark green diorite, the former prevailing, being veined with calcespar and containing amygdules of calcespar, chlorite and various white zeolites. These rocks seem scarcely to affect the red marl and other Permian sediments with which they are in contact. In Plainfield Brook, near McKay's, are small exposures of very flinty, light grey and brick red, spotted felsite and quartz-felsite, underlaid by light greenish-grey, soft, trachytic rocks; while on the roads in the vicinity diorite and trap also cut the Permian.

North side of
Minas Basin.

But the finest development of the trappean rocks of this age is found overlying, cutting through or contemporaneous with the Triassic, forming Gerrish Mountain, Indian Point, Five Islands, Two Islands, Partridge Island, Cape Sharp, Spencer's Island and other headlands and islands of the north side of Minas Basin

described by Gesner,* Jackson and Alger,† Lyell,‡ Dawson,§ Ells,|| and other writers, so fully that they need not here be referred to. A detailed description of the shore between Five Islands and Cape Sharp and a section of the junction of the sedimentary rocks at Two Islands is given by Sir J. W. Dawson.**

SCENERY, CLIMATE, TIMBER, PRODUCTIONS, ETC.

The natural history of the district need not be "particularly described, as its flora and fauna are the same with the other portions of the province. The beaver has become extinct, though the effects of his labours may yet be seen in various places," several of the shallow lakes owing their origin to his dams. "Its meteorology exhibits little of interest as distinct from other portions of the province. Like the rest of the north coast it presents a remarkable contrast to the southern, in its almost entire freedom from fog. The mean and extreme temperatures are, however, higher there than here, owing specially to the influence of the Gulf Stream. The ice which comes down from the north in spring lingers long off our coast, cooling the air, so as to retard vegetation and impart a rawness to the east winds at that season, which is trying to the health, particularly to persons under any pulmonary weakness. The autumn, however, is much finer than on the south coast, there being much less wet weather, and the southern gales of that season being felt less severely." ††

References to the geography have purposely been omitted where it was possible by the map to indicate the structure in such a way as to assist others in finding the localities examined, minuteness of detail being reserved for the description of the outcrops. For fuller information concerning these and other particulars, the authorities cited above, those given in last report,‡‡ Lyell's Travels in North America, the more recent histories of the province, and the various Transactions of the Nova Scotia Institute of Science may be referred to.

*Geol. and Min. of N. S., pp. 229-262.

†Mem. of Amer. Acad. of Arts and Sc., vol. I., 1833, pp. 262-279.

‡Travels in North America, vol. II.

§Acadian Geol., pp. 99-108.

||Geol. Surv. of Can. An. Rept., 1885, vol. I., p. 61, E.

**Jour. Geol. Soc. of London; vol. IV., p. 50.

††Patterson's History of Pictou, p. 21; Cf. also Trans. N. S. Inst. Sc., vol. IV., pp. 429-438, and other papers.

‡‡Geol. Surv. of Can. An. Rept., 1886, vol. II., p. 107 P.

Barrens.

Excepting the areas of barren ground shown on the map, most of the land is fit for cultivation. The most extensive barrens lie at the head of the east and west branches of the East River of Pictou, on the West River of St. Mary's, south of the Pictou branch of the Intercolonial railway. In the neighbourhood of Maple Lake, the barren is covered with ledges of Devonian quartzite and slate, upon which blueberry and other small bushes, clumps of second-growth spruce and birch and many bog and marsh plants are noticeable. On Calvary Brook are patches of wet, mossy spruce land, bogs and small, wet barrens. Part of the country underlain by Triassic sandstone near Debert is a blueberry barren, the soil being sandy, although near the shore it is easily reclaimed by the addition of marsh mud.

Timber.

Large quantities of deal, of ship and ton timber and of hemlock bark for tanning are still obtained from the forests, as might be inferred from the large number of driving-dams seen on the streams and rivers, the logging-roads and sluices. But the pines have nearly all disappeared, and spruce is the prevailing soft wood cut.

Scenery.

In the mountains and along all the Pre-Carboniferous formations the brooks and rivers cut deeply into the rocks, and are clean and rapid, the land being broken, uneven and hard to work, the hills and valleys picturesque and beautiful. Falls of considerable beauty are found on the Moose River, on Economy River,* North, Waugh, Sutherland and other rivers. Near the contact of the felsites and Permian rocks in Four Mile Brook is a fall twenty-five feet high, at the top of which the water comes through a gorge six feet wide; but instead of falling vertically it is dashed against the rocks and spread for twenty-five yards at the base all broken into white spray. Above this fall are others in a rocky gorge through which the brook runs in barren land. In the adjoining brook, called Little River, are the Drysdale Falls, thirty-five feet high, above which rise cliffs thirty-five feet high, and a pool at the foot of which is said to be thirty feet deep. In Fall Brook is a pretty little fall eighteen feet high, from which the brook derives its name. On many of the sluggish streams of the low land there are large hay marshes or meadows, overflowed by freshets. The dykes by which large tracts of land along the Bay of Fundy are preserved from its turbulent tides have often been described. Many of the old French dykes have been replaced by more modern ones, which cross the brooks at their mouths instead of turning up along them. The tidal sand-flats of Shubenacadie River are shifting, like other masses of loose material along the Basin. The

Meadows.

Dykeland.

Sand flats.

*Gesner's Geol. and Min. of N. S., p. 134; Acadian Geol., p. 557.

channel is narrow at low water, and the banks of the river high and rocky by turns.

On a rough branch of the Millbrook, off the Florida road, is a cave Caves. said to be "capable of seating a congregation." In the limestone of Cross Brook is another cave; and at the contact with the Silurian East River. the water of Holmes Brook runs beneath the limestone, to emerge as a strong spring at the Sluice, the original valley of the brook following a different direction. Several other beautiful little streams occur in the vicinity. Calder Lake is a famous resort for ducks and geese, which come to dig up and eat roots, and trout are also caught in it. The roads on both sides of the East River are beautiful; near Bridgeville and St. Paul's they follow a fine intervalle, being cut through gravel banks, bordered with wild roses and overhung by large trees.

From a crack in the Permian conglomerate of one of the branches Waugh River of Matheson Brook issues a large spring. The valleys of this brook are very beautiful. The soil of the conglomerate is as rich and fertile as that of Greenhill, Rogers' Hill, Fraser's Mountain and Mount Dalhousie, although the rock is in place so near the surface as to be scratched by the plough and has rendered the land barren in patches after long cultivation. The fertility of the conglomerate land is in striking contrast with the less productive character of the soil of the belt of grey sandstone overlying it, as shown by the farms.

On the road from Patterson's mills on the Chiganois River, the Chiganois River. land is not hilly, but syenitic rocks are frequent in its bed and in other parts of it corduroy has been built across the swamps. The land is poor, fit only to grow spruce and hemlock, an immense quantity of which has been taken from this district; and the same remarks will apply to most parts of this mountain range upon which no farms have been cleared.

Fruit and wheat do not ripen as well, it is said, on the shores of Crops. Minas Basin as on the Gulf shore at Merigomish, River John and Brulé; and at Pictou Island "crops appear to be more luxuriant than on the mainland,"* the soil being generally a sandy loam, which yields hay, grain and vegetables; but there is no fruit raised upon it, the exposure to sea air being unfavourable to its culture.

A list of plants found in the neighbourhood of Truro, including Botany. some found at Stewiacke, Brookfield, Valley, Onslow, Debert, New

*Trans. N. S. Inst. Sc., Second series, vol. I., p. 78; and Patterson's History of Pictou, p. 281.

Annan and Tatamagouche, is given by Dr. Campbell;^a a Synopsis of the Flora of Nova Scotia, by Professor Sommers,^b the plants of Pictou county being for the most part given on the authority of A. H. McKay, Superintendent of Education for Nova Scotia; and Notes for a Flora of Nova Scotia, by Professor Lawson.^c The native trees, fishes, &c., are described by Gesner.^d

White lilies and violet flags were in bloom in the hay marshes near Centredale on 13th July, 1887, and in Cranberry Lake on 1st September; and the fragrant pretty little pink floating spikes of the water persicaria (*Polygonum amphibium*—var. *aquaticum*) in Forbes Lake on the 5th of August of the same year.

ECONOMIC MINERALS.

In the foregoing pages reference has been frequently made to the occurrence of various useful minerals and metallic ores among the rocks described. These will now be more fully discussed.

Coal.—Statistics of the condition and production of the various collieries of the Pictou coalfield to 1869 are given in the elaborate report of Logan and Hartley.^e Since that time this field has been described by Mr. John Rutherford,^f Patterson,^g Gilpin,^h Dawson,ⁱ Poole,^j in the annual reports of the Department of Mines for Nova Scotia and in those of the Division of Mineral Statistics and Mines of the Geological Survey^k and in the Canadian Mining Manual, pp. 91, 133 and 157.

Lorne, Big
Brook, Kemp-
town and
West River.

Mention has already been made in the course of this report of attempts to work coal in other localities, as at the Big Brook and Lorne, in graphitic shales or slates. At Kempton on the north side of the Telegraph road, several shafts and a boring, said to be 137 feet deep, have been sunk on a small seam of mixed coal and shale, which is from two to four feet in thickness. Fragments of good coal were seen among the debris at the pit mouth. This is perhaps the seam opened among the nearly vertical flinty rocks above the

^a Trans. N. S. Inst. Sc., vol. VI., pp. 209 and 283.

^b Trans. N. S. Inst. Sc., vol. IV., p. 181.

^c Trans. N. S. Inst. Sc., Second Series, vol. I., p. 84.

^d Industrial Resources of Nova Scotia, pp. 77-151.

^e Geol. Surv. Rept. of Progr., 1866-69; Cf. also Acadian Geol., p. 329.

^f Trans. North of England Inst. of Min. and Mechan. Eng., May, 1870; Canadian Min. Manual, Ottawa, 1892, p. 1.

^g History of Pictou, 1877, p. 398.

^h Mines and Mineral Lands of Nova Scotia, 1880, p. 15; Trans. N. S. Inst. Sc., vol. III., p. 281; vol. IV., p. 89; vol. VI., p. 42; Trans. Roy. Soc. Can.

ⁱ Acadian Geol., Suppl., 1878, p. 40.

^j Trans. Amer. Inst. Mining Eng., vol. XIV., p. 403.

^k Geol. Surv. of Can., An. Rept., 1886, vol. II., p. 18, S; 1887, p. 16; 1888, p. 17; 1889, p. 18.

railway between West River station and Riversdale and again in the south branch of the North River below Mingo's.

About ten chains above the road to Delaney settlement on Coal-mine Brook, openings have been made on a coal seam, containing eighteen inches of stony coal, with two or more partings, overlaid by a great thickness of fine sandstone and underlaid by greenish shale or underclay, which also shows a few thin coaly bands. This locality is described by Gesner as worked during the winters of 1834 and 1835.* The present workings at the mine are on the top of a bank a short distance from the brook. The coal is bright and good, with cubical cleavage; but the stone partings exceed in places an inch in thickness. Higher up the stream, dark shales include streaks of bright coal; and about a quarter of a mile above the first seam is another, of at least three feet of carbonaceous shale, from which in places a foot of shaly coal can be obtained: this also has been worked to a small extent; and other coaly streaks occur in a band of rocks perhaps a mile in width. The slope, on the first seam, was 100 feet deep, and laid with wooden rails worked by a horse-gin and pulleys. A small frame house was erected for the miners, a forge and other necessary buildings, \$1,500 being spent in development in 1889.†

North River coal.

The coal in the grey sandstone or conglomerate, near Higgins' mill on the Chiganois River, is in pockets, six inches wide, but dwindling within three feet to mere threads. That dug some miles down the river was nearly all coaly shale.‡

Chiganois River.

At Debert River in Cottam settlement, bore holes have been put down and several shafts sunk on a coal seam or seams, concerning the thickness of which great differences of opinion have been expressed: for while Dr. Ellis states that in the slope it was only twelve to fourteen inches of dirty coal, by Mr. Gilpin it is supposed to be of considerable value.§ The basin is evidently very limited and broken by faults. Immediately above the bridge a coal seam of a thickness of eighteen inches is exposed. Other deposits of no economic value further west have been already referred to, including that of Malagash Malagash.

Debert River

The coal of Caribou Island has also been referred to. Mr. McBean states that in one place it appeared to be four feet thick, but that this thickness was due to a little fault.

Caribou.

*Geol. and Min. of N. S., p. 130; Acadian Geol., p. 275.

†Canadian Mining Manual, 1892, p. 119.

‡Geol. Survey of Can. An. Rept., 1885, vol. I., p. 46, E.

§Trans. N. S. Inst. Sc., vol. VI., p. 93.

On the road north of Poplar Hill several deep shafts have been sunk in search of coal; at one of which pieces of coal two inches thick are found among debris of greenish argillaceous shale. The land in the neighbourhood is barren, abounding in blocks of grey and reddish sandstone and shale.

Kennetcook. Coal has at various times been reported to occur at Kennetcook (page 97) and the vicinity. In the second little brook on the right bank of the river, below the bridge on the road to the Gore, a little coal was dug, consisting apparently of streaks and pipes in a grey sandstone full of carbonized plants and *Stigmara*, limestone being in the river immediately down stream and also at several points above. In this brook and in another below, a quantity of grey soft sandstone dips $107^{\circ} < 10^{\circ}$ – 20° . About two miles to the southward, the whitish quartzose sandstone or pebbly grit used for the foundation of the new Presbyterian church is obtained, and beyond it come the auriferous slates of the Gore.

Selma. The coal reported to occur at Selma, is said by Mr. James Fraser, to consist only of thin bands of dark grey shale, with markings of plants, among thick layers of the grey flinty sandstone which forms the barrens of the neighbourhood.

Stewiacke. The search made for coal at the East Brook of Stewiacke, has been described on page 93. Explorations have also been made on the bank of Little River among the Carboniferous limestone.

Little Bass River. In a branch west of Little Bass River, near Robert Young's, a level has been driven on opposite sides of the brook, into a small coal seam, said to be a foot thick, although in this thickness seems to be included a large proportion of dark grey shale, containing masses of pyrite and ironstone. Up stream are other little seams, one of which is two inches thick, and resembles a vein rather than a bed, the inclosing rocks being reddish and grey fine sandstone and shales, greatly broken and underlying unconformably a coarse, reddish conglomerate which is probably Triassic.

Kirkhill. At the Kirkhill limestone quarry, about two miles and a half north-west of Parrsboro', coal has been found beneath nearly vertical, dark, flaggy limestone, associated with grey sandstone and shale, full of large plants. Mr. Tipping, of Parrsboro', states that at the bottom of a shaft seventy-five feet deep, the coal, which was only a few inches thick at the surface, had increased to two feet, and become more regular. In other bands of the limestone, traces of good coal are found, sometimes twisted and more like veins or lenticular masses, than beds of coal. Beneath the coal is a layer of light, soft, argillaceous shale or clay, containing nodules of ironstone, below which is broken sandstone. The coal is good; ignites very readily,

burns with a bright flame, leaving a light porous coke which contains a quantity of white calcareous ash and of reddish ferruginous ash. The quarry lies on the north side of a little hill. The low flat land to the northward shows no rock, and between it and Parrsboro', Parrsboro. there is said to be a great thickness of sand and gravel, one well having been sunk sixty feet without reaching bed-rock. On the west bank of Parrsboro' River below the town, other little seams of coal are reported by Mr. Scott Barlow.

Below Parrsboro', in two branches of a tributary of De Wolf Brook, Brookville. a seam of coal which has attracted considerable attention, occurs in a conglomerate largely composed of pebbles of red Devonian sandstone and argillite, perhaps an outlier from the main body to the northward. Some of this conglomerate is red, but the greater part, greenish or dark grey; at the mine it is interstratified with layers of rusty-grey, coarse sandstone and soft argillaceous shale, holding carbonized plants, said to make good whetstones. The dip is not well defined, the rock being like a great irregular mass of drift, but is about $2^{\circ} < 70^{\circ}$. According to Mr. Barlow, who examined it in August, 1878, the section is as follows in descending order:—

	Feet. Inches.	
1. Conglomerate,.....		
2. Shaly coal, top seam.....	1	6
3. Grey argillaceous shale.....	6	0
4. Coaly shale.....	0	6

It has been opened at several points along the brook. Above the last opening is a red conglomerate with bands of soft red marl and sandstone. Below the conglomerate lie sandstone and red and purple argillites which appear in the pebbles; and up the main brook to its source, are light green soft breccias, soapy slates with small and large masses of quartz, and dark grey sandy slates, showing obscure shiny fragments, perhaps of plants, but not well exposed.

In this connection may be introduced an account given by Mr. Alex. McBean, of explorations made by him in 1888, in search of coal at Hallowell Grant.* Here a thickness of 150 feet of black shale, containing twenty feet of curly cannel, mentioned by Campbell, and a little coal, is underlaid by a great thickness of greenish shale, underlaid in turn by coarse sandstone and soft conglomerate. Mr. McBean supposes that there are several bands of this shale arranged in the form of a basin which underlies the limestone of Big Marsh post office, and is perhaps broken on the north side by a fault. The west end of this basin seems to be at the fork of the old Gulf road, and the east

*Geol. Surv. of Can., An. Rept., 1886, vol. II., p. 113, P.

end at the fork of a large brook two miles east of the post office. It does not seem to pass more than half a mile north-west of Big Marsh road or half a mile south-east of McGillivray's road, until it is underlaid by the coarse sandstone and conglomerate. Dunlop's pits are north-east of the post office. A long tunnel is in the brook, half a mile east of the post office; it was driven 150 feet in black shale, cutting at the end a seam from which coal is said to have been taken. At a very small brook west of the long tunnel, the limestone overlies grey and reddish conglomerate. Up the west branch of this brook is the best coal seam in the district, said to be five feet thick and to dip to the westward, but to be broken off both east and west of the brook. A considerable quantity of coal was extracted from it. The dark shales are nearly all curly and polished; the masses of coal are lenticular or crushed. In most cases it is a hard bituminous variety, somewhat shaly, streaked with pyrite; but in places it resembles cancell.

West River.

At the Twelve Mile House on the West River of Pictou, a boring was made 280 feet, in search of coal, supposed to be associated with the grey Permian sandstone and other rocks of this neighbourhood.

Blue Mountain.

The dark Silurian slates of Blue Mountain have been dug for coal, and in the same neighbourhood the irregular veins of quartz associated with steel-grey, silvery and rusty slates or schists have been tested for gold. Near a mill on Archibald's Brook, at Bridgeville, black graphitic* Devonian slates were supposed to contain coal; while half a mile west of the mill, pits were sunk in search of iron ore. Near Hopewell, in somewhat similar rocks, on the farm of Jessie Grant, a shaft was sunk twenty-one feet in 1886, and from it was taken a quantity of black, shiny, graphitic clay-slate, supposed to indicate coal, and mixed with much calcareous and ferruginous vein-matter, and also with hard siliceous layers. Another pit lies about twenty-five yards from the first. About \$500 are said to have been spent in exploring here.

Pictou Harbour.

On the right bank of Corbett Brook, not far above the railway at Sylvester, a bore-hole in search of coal is said to have struck Permian limestone at a depth of 400 feet. The small coal seams of Pictou, Rear Brook, Abercrombie Point and the vicinity are described by Mr. Poole.†

Albertite.—This mineral is found in small veins and blotches on the west branch of River John, above the village, in somewhat coherent conglomerate and sandstone in the bed of the river and on

*Trans. N. S. Inst. Sc., vol. II., Part IV, p. 70.

†Trans. N. S. Inst. Sc., vol. I., pp. 36-40.

the left bank, the veins ranging from half an inch downward, and being mixed with calcespar and baryte. In places the films are very numerous, and there are blotches among the pebbles of the conglomerate. It is found at other localities in this vicinity but nowhere in large quantities, according to Mr. Donald Fraser, who prospected here for some days.

Magnetite.—The amygdaloid of Gerrish Mountain, Cape d'Or, Cape Sharp, and other points on Minas Basin contains masses and veins of magnetic iron ore, one foot wide and under, "exceedingly irregular in their course and often terminating abruptly, so that little dependence can be placed upon them for mining, although the ore is very rich."

Bog Iron Ore.—Traces of bog iron are found in several places already alluded to. The fields behind the post office at Bridgeville, in the neighbourhood of a limestone quarry, are rusty with this mineral. A very rusty clay or impure bog iron is seen on the west bank of Debert River, above Shatter Brook; but is of no value. Deposits occur, according to Mr. Barlow, at Clarke's Head, Fullerton Lake and other places.

Clay Iron-stone, Siderite, Ankerite, etc.—The almost universal occurrence of veins containing carbonate of iron among the Devonian rocks, has been so often referred to in the course of this report as to require little further notice. They all seem to pass into, or to be mixed with specular iron ore and limonite. The spathic ore of McLaurin's (p. 74) has been described by Mr. Hartley. It is associated with greenish-grey grit, reddish flinty grit and sandstone, more like Cambro-Silurian than Carboniferous, but, perhaps, altered along a fault. It contains pebbles of syenite and felsite and others of reddish flinty grit. A reddish, impure limestone has been quarried and burnt for lime, and the iron ore may be a Carboniferous contact deposit.

Limonite.—Mining operations have been vigorously begun by two companies on a vein of limonite* which lies at the contact between the Carboniferous and Pre-Carboniferous rocks on the north bank of the East River of Pictou, above Springville. By one of these, the New Glasgow Iron, Coal and Railway Company, a railway thirteen miles in length has been constructed from Eureka (Ferrona), to Sunnybrae; and blast furnaces and coke ovens

East River
Pictou.

*Gesner's Geol., p. 63; Geol. Surv. of Can., An. Rept. 1886, vol. II., p. 115, P; Gilpin's Mines of Nova Scotia, p. 63; Reports of Commissioners of Mines for 1872, p. 37; for 1874, p. 51; for 1875, pp. 61, 69; Trans. N. S. Inst. Sc., vol. II., pp. 71, 72; vol. IV., pp. 138, 142; vol. V., p. 204.

are being built at the former place.* By the second, the Pictou Charcoal Iron Company, the excellent ore on the Grant farm at Bridgeville is being prospected, 230 feet above the river; and a considerable quantity of it has been used for fettling at Londonderry. It is found here in large masses in the soil and also in place, mixed with traces of baryte, calcite, hematite, and other minerals. A face of twenty-five feet of ore showed at the end of the opening, and more was said to lie beneath the floor. It is hard and very pure, has cavities filled with botryoidal and laminated radiating ore, black or iridescent on the surface. On the west wall are shaly Silurian rocks, whilst on the north is a flinty compact rock. No Carboniferous is found in the cutting, but on the slope of the hill are pits denoting limestone or gypsum. West of this mine, openings have been made on the right bank of Grant Brook. The lowest tunnels run west forty-five feet. Another, thirty-five feet north-east, driven by the Londonderry company, is cut fifty feet east and west, partly in red shale; and a shaft is on the top of the bank seventy feet from the mouth of the first tunnel. Here the ore was found to be soft, spongy and impure, about twelve feet thick, mixed with calcite and manganese ore, chiefly psilomelane. North-west of the ore is a rock which seems to be a soft trap.

Manganese.

Springville.

At McGillivray's, near Springville, a large quantity of iron ore debris is found near the buildings and also on the road near the contact of the Carboniferous; but the parent vein does not seem to have been yet discovered.

Fraser's.

Where opened on the land of John S. Cameron in a pit, the vein was found to be twenty-one feet six inches wide. In the drift ten stones of manganese ore to one of iron ore were found, but none *in situ*. At Donald McDonald's, the ore is twenty-five feet thick with much manganese ore on top. At Fraser's (saddler), red slate, like that at Grant's Brook, has been cut in a shaft sixty feet deep, the ore being nearly vertical and from twelve to fifteen feet thick. At Duncan Cameron's, a pit twenty feet deep cut five feet of ore. Higher up the East River, about 125 yards above the fork of John McDonald's (Ogg) Brook, the ore is found to be two feet thick, having on one side Carboniferous limestone, on the other trap. At the Blackrock workings, above McDonald's Brook, and 200 yards above the river road, a large quantity of limonite has been exposed, apparently less pure than that of Grant's, laminated and with the layers separated by seams of clay. These layers are divided cross-wise into blocks, and these blocks have *vugs* containing botryoidal

Blackrock.

*Report of the Department of Mines, 1891, p. 47; Can. Min. Manual, 1890-91, p. 93; 1892, p. 186.

concretions of limonite. Carboniferous limestone is in great masses along the lower part of the brook, while the "black rock" or massive trap rises a short distance above the workings. A little hematite and specular iron ore is found in the clay on the east side of a drift at the lower workings.*

At the bottom of the old dam on Drug Brook, limonite is dug in Devonian slates, but not in such abundance as the boulders found in the drift of the vicinity would seem to warrant. Here and at Cullen's, pits, some of which were twenty-five feet deep, were sunk in 1882, and long tunnels extended from them. The ore is compact, brown, somewhat siliceous, botryoidal and radiated. Drug Brook.

A vein of limonite was found at Brookfield, by Mr. R. E. Chambers, and in 1888 about 1,000 tons were extracted for shipment to Londonderry. The ore is found among red, flinty Devonian slates, but in the neighbouring valleys, Carboniferous limestone and gypsum are largely developed. A large vein of baryte has been worked not far from the mine. Brookfield. Baryte.

As already stated, a considerable quantity of limonite has been found among the Devonian rocks of Upper Kemptown, associated with specular iron ore. At Dan Munro's, it has been prospected in several shallow pits. The ore is black, radiated and botryoidal and occurs in greenish, grey, rusty-weathering and purple rocks, in veins six inches and more in thickness. Upper Kemptown.

The veins of Londonderry mines are described by Louis.† The ore, which occurred as limonite on the surface at the first openings, changed, on working deeper, into ankerite and siderite with sometimes a large proportion of carbonate of lime. This fact may explain why little or no black or brown ores are found in the bottom of the ravines cut by the rivers. Wherever they go deep, that is due, Mr. Leckie says, to fractures in the rocks. The same change, it is said, takes place in the deep workings on the East River of Pictou. At the East mines, several large, open cuts were made during the summer of 1891, in veins containing a mixture of spathic iron ore and other carbonates with specular iron ore, the latter being in cracks or joints, veins and spots. Part of the vein is brecciated, containing fragments of the green slate of the iron ore Londonderry. Limonite changes in depth.

*Trans. N. S. Inst. Sc., vol. III., page 171; vol. V., p. 31; and Geol. Surv. of Can. An. Rept., 1886, vol. II., p. 115 P.

†Trans. N. S. Inst. Sc., vol. V., p. 47. Cf. also op. cit., vol. II., p. 112; How's Mineralogy, pp. 84 and 105; Geol. Surv. of Can. Reports of Progr., 1872-3, p. 19 1873-74, p. 229; Gilpin's Mines of Nova Scotia, p. 59.

series, and also apparently of the siderite, so that perhaps the veins which carry the specular ore are of subsequent origin and, as elsewhere, filled by sublimation in proximity to igneous rocks. The "white ore" may be in the same vein siderite, ankerite, dolomite or calcite, and has to be carefully selected. Two of the pits at present worked are those in Gory and Slack Brooks. At one of these a low tunnel was driven, several years ago, in the hope of striking the brown ore; but it cut only white ore. Professor Hind, in his report on part of the Cumberland coalfield, gives many facts concerning the iron mines.

Totten's
Brook.

The iron ore of Totten's Brook, as stated above,* lies on the side of a hill north of a little marsh, on the south side of which are outcrops of igneous rock. A long open trench has been made on the iron ore from which has been taken a large quantity of brown and whitish ankerite, containing films and blotches of specular iron ore and vuggs in which are plates of baryte. The vein runs 292° , dipping to the south-west, for 120 feet; then turns to 257° for 210 feet to the end of the trench. It is of variable thickness. For some distance the excavation is four feet and a half wide, but further west much wider. On the footwall are the light green, somewhat soapy argillites, showing films of specular iron ore at the west end; on the hanging wall, a reddish flinty argillite. On both walls and in the vein is a large quantity of yellow "paint." It has been opened again in a little brook to the westward.

Birch Hill
and Clifton.

The small veins of limonite at Birch Hill, near Bass River, and the more important deposit at Clifton,† have been described with the Devonian. Tables of analyses of many of the iron ores of Nova Scotia are given by Mr. H. S. Poole in the Reports of the Department of Mines for 1874, pp. 80 and 81; for 1876, pp. 58-60.

*P. 30; Gilpin's Mines of Nova Scotia, p. 60; How's Mineralogy; Geol. Survey of Can., Rept. of Prog., 1872-73, p. 35.

†Report of the Department of Mines for 1880, p. 15.

EXTRACTS from the Laboratory Book of the Londonderry Iron Company, Limited, Londonderry, N. S., General Manager,
R. G. Leckie; Analysts: Henry Louis, J. S. Richmond, William Small.

Sample No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Peroxide of iron.....	99.39	48.72	71.81	54.18	65.64	90.79	..	50.35	..	74.63	86.74	84.29	68.94	49.48	77.91	..	..
Protoxide of iron.....	0.32	..	..	*1.36	1.55	..	..	..	..	..	..	..	..	..	..	..	..
Protoxide of manganese..	..	0.15	0.28	..	..	..	..	..	..	..	..	..	..	..	..	..	3.02
Alumina.....	..	5.90	3.59	..	3.90	..	..	..	..	..	..	..	..	..	..	..	5.00
Lime.....	..	10.44	2.30	12.76	5.05	0.92	..	..	..	..	..	..	..	..	..	..	..
Magnesia.....	..	0.78	1.00	2.10	0.80	..	..	..	..	..	..	..	..	..	..	0.427	..
Phosphoric acid.....	..	..	..	..	..	1.38	1.26	..	0.03	3.80	0.399	..	..	..	..	..	..
Sulphuric acid.....	..	..	..	..	..	..	5.20	..	..	..	..	..	..	..	..	..	0.57
Volatile matter.....	Trace.	8.52	..	18.04	10.24	..	..	..	..	..	..	12.87	5.00	15.00	9.00	..	26.50
Insoluble matter.....	0.58	23.96	18.13	5.48	11.97	5.10	3.50	35.80	12.90	11.00	10.28	..	..	..	..	..	..
Metallic iron.....	69.81	34.11	50.27	39.08	46.73	63.55	59.10	35.25	60.69	52.44	60.72	59.00	45.45	34.34	54.54	61.38	47.50
Phosphorus.....	..	..	..	..	..	..	..	..	0.01	1.66	0.17	..	..	..	..	0.18	..
Sulphur.....	..	..	..	..	..	0.55	0.54	..	..	..	..	..	..	..	..	..	0.23

*Mn. ₃ O ₄

EXTRACTS from the Laboratory Book of the Londonderry Iron Company—Continued.

Sample No.	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34
Peroxide of iron.....						58.74	58.01	51.44	66.22	63.79							
Protoxide of iron.....										23.88							
Protoxide of manganese... Heavy trace.								0.871		0.08	1.81	1.51	12.74				
Alumina.....								6.70			3.71	6.00					
Lime.....								0.18		0.11	22.90	16.10					
Magnesia.....								0.125		3.27	2.88	8.25					
Phosphoric acid.....	0.414					2.674		1.05		Trace.	Trace.	0.075					
Sulphuric acid.....	0.196							0.123		Trace.							
Titanic acid.....	None.																
Water.....							34.30							6.73	5.63		
Volatile matter.....					15.35	6.07		10.11									
Insoluble matter.....	10.12					18.19		25.00		8.83	3.00	2.10	33.50	24.29	16.54	25.66	
Metallic iron.....	55.74	56.45	41.85	56.00	44.24	41.12	40.61	46.01	46.36	63.23	20.45	25.25		44.18	49.22	36.19	24.55
Phosphorus.....	0.18					1.17		0.46				0.03					
Sulphur.....	0.08							0.05									

1. Specular ores: 2. Red hematite from Pictou River. 3. Red hematite, massive, from Nictaux. 4 and 5. Specular and ankerite, Totten's lot, East Mines; average. 6. Pyrites, calcined. 7. Specular ore, 14 samples from West Mines. 8. Specular ore from Parrsboro', Dr. Townshend's samples. 9. Magnetite from Lower Economy. 10. Red hematite from Torbrook. 11 and 12. Red hematite from Torbrook, the latter, the average of seven cars. 13. Red hematite from North River, lump. 14. Red hematite from North River, fine. 15. Red hematite from Cambridge, Hants county, Mr. W. F. Jennison's sample. 16. Best lumps of Torbrook ore. 17. Torbrook hematite; fine ore and rock matter. 18. Torbrook ore (J. T. D., Analyst). 19. Torbrook; average of seven cars. 20. Red hematite from Annapolis. 21. Average of Torbrook ore. 22. Average of 22 samples of limonite, chiefly from West Mines. 23. Brown hematite (mixed with red), from Horton. 24. West Mines. 25. Average of pile from West Mines. 26. Bog ore from Torbrook. 27. Magnetite from Five Islands. 28. Average sample of Totten Hill ore, East Mines. 29. Average sample of Slack's Hill. 30. Manganese ore from vein 4 ft. thick, Nictaux. 31. Average of 41 samples of brown hematite from Brookfield, taken from a very large quantity of the ore used in the furnace. 32. Brown hematite, average of 24 large samples from East River of Pictou. 33. Average of eight analyses of Canfield iron ore. 34. Average of 18 assays of white ores and ankerite. Silica less than one per cent, with traces of lime, magnesia and carbonate of manganese (0.68 to 2.63). When roasted the white ore has 30 to 58 per cent metallic iron.

Hematite.—Most of the samples of this mineral obtained from the various outcrops in the district contain more than twenty per cent of silica and have not been much used for iron making.

Exposures found among Silurian strata in contact with small patches of diorite have been developed a little between the heads of French and Sutherland Rivers. On the road between the church at McLellan's Mountain and the Brookville post office, red hematite was prospected, by Messrs. Holmes and Watson in 1884, by three pits, eighteen feet deep, sunk in grey earthy Silurian sandstone. Iron ore has also been found on the track from Squire Fraser's to the end of the road from the school at McPherson's mills. French River.

At Webster's or South McLellan's Mountain, on the west side of the road, is a large opening on a bed of hematite, eight feet thick, mixed with siliceous rock and traceable for three-quarters of a mile to where it is only two inches thick and does not contain more than thirty per cent of iron. The ore and the adjacent white quartzose grit follow the high land, the Clinton slate being usually denuded. To the eastward between this point and the road it was opened beneath four feet of surface and is twelve feet thick. East of the road are what appeared to be two parallel beds, but Mr. Fraser supposes them to be the same. In the first large cutting east of the road there is a twenty-inch parting of slate in the ore and also at the next pits to the eastward, where the ore is richer, but still contains a large percentage of quartz in grains. Webster's.

At Archibald Fraser's, on the Wentworth grant, on the left bank of Sutherland River, is a bluff outcrop of hematite,* forty feet wide in a north and south direction, apparently separating Silurian from Pre-Silurian slates. On his land east of a little lake, the ore is thirty-three feet wide from north to south and associated with fragmental slates. On the opposite side of the river, near Angus Fraser's house, the ore is in white quartzite, associated with pearly and felspathic slates. Wentworth Grant.

Near the west branch of Blanchard Brook, the bed of red hematite, opened at Fred McDonald's, is in bluish-grey, somewhat massive, quartz-veined, Silurian rock, a trench in which, eighteen feet by twelve feet, exposes three feet or more of ore. Further north at William Ross's an ore bed of considerable but irregular thickness, full of fossils, is associated with dark trap. Still further north at McDonald's,† occurs the large bed. The ore here is lenticu- Blanchard.

*Trans. N. S. Inst. Sc., vol. IV., p. 140.

†Trans. N. S. Inst. Sc., vol. II., part IV., pp. 68-72; vol. IV., p. 140; vol. V., pp. 201 and 205; Canadian Naturalist, vol. VII., p. 129; vol. IX., p. 332; Reports of Department of Mines for 1872, p. 37; for 1874, p. 81.

larly interbedded with Silurian, is full of shells, oolitic, blotched with calcspar and sometimes very pure, although passing in other places, as elsewhere stated, into rock which is merely stained with hematite. From this bed was quarried in 1828 the ore used by the General Mining Association in their blast furnace at Albion Mines.* At Evan McDougall's, hematite has also been found in Silurian rocks.

Newton Mills. Several hundred tons of hematite have been mined at Newton Mills† on Stewiacke River by the New Glasgow Company [p. 92]. The ore is of excellent quality, finely brecciated, and forms another of the contact deposits at the base of the Lower Carboniferous. With the iron ore or passing into it, is a reddish and grey impure limestone, containing shells; and overlying it at many points is a red calcareous conglomerate, containing pebbles of whin and of other rocks. The hematite has in places penetrated into the joints of the underlying slates and reddened them for some distance. An analysis, made for Mr. Graham Fraser by Tallock & Readman, of a sample of this ore showed it to contain:

	In Sample as Drawn.	In Dried Sample.
Peroxide of iron	68·97	69·14
Protoxide of iron	·24	·24
Bisulphide of iron	·29	·30
Oxide of manganese	Trace.	Trace.
Lime	·49	·50
Magnesia.....	·28	·28
Alumina	5·81	5·82
Silica	22·70	22·75
Phosphoric acid	·02	·02
Titanic acid	None.	None.
Carbonic acid	None.	None.
Combined water	·94	·95
Mixture	·26	....
	<hr/> 100	<hr/> 100
Iron	48·50	48·63
Sulphur.....	·15	·16
Phosphorus	·01	·01

Tatamagouche.

At Bailey's bridge, on the Little River of Tatamagouche, small veins in the schists show a mixture of calcspar and hematite which has been locally used as red paint.

Specular Iron Ore.—Explorations, made by Mr. H. W. Leslie for the Nova Scotia Midland Company, east of John McDonald's (Ogg)

*Patterson's History of Pictou, p. 425; How's Mineralogy, p. 97; Gilpin's Mines of Nova Scotia, pp. 63 and 67.

†Report of the Department of Mines for 1874, p. 51.

Brook, have developed a considerable quantity of this ore in veins and small pockets in a grey flinty Devonian rock. South of a little brook on the west side, Mr. Leslie has again found the ore and traced it nearly to the old pits on John McDonald's (weaver) land,* although nowhere so abundant as at the latter, where the ore is near the surface, either associated with or immediately north of large outcrops of black slate and quartzite. In the pits nearest the weaver's house, the specular ore contains numerous crystals of pyrite and veins of ankerite. The veins run approximately in the bedding of the rocks about 87° , and have been opened in a long trench and in a number of shallow pits. Search has also been made in the neighbourhood of Archibald's Brook.

The pits near the school at Marshdale are in trap, showing large blotches of specular iron. The Devonian slates of West River, about Watervale, contain ankerite and specular iron, widely distributed, but apparently only in small films and reticulating veins.

On the right bank of Calvary Stream, at the driving dam, several small quartzose or siliceous veins have been developed containing specular iron ore in greenish-grey, wrinkled, more or less pearly, soapy, schistose slates, associated with ribbanded, flinty flags. As on the East River, black slates, lower down the stream, show a large quantity of graphitic matter. The veins of specular iron ore opened to the northward on Steele's Run are described on page 42. In the West Branch of Middle River, below Neil Matheson's mill,† this ore occurs in veins and blotches, sometimes six inches thick, in crystalline aggregations, and also in quartz veins in siliceous, rubbly, Devonian rocks.

Bog Manganese.—Small deposits of this ore, generally more or less mixed with bog iron, are of frequent occurrence but little value. On the hill south of Bridgeville it occurs in nodules and black earth. Concretions of bog manganese have also been found in the neighbourhood of Cameron (Meadows) Brook, not far from the pits mentioned above as cutting the Devonian altered rocks, spotted with crystals of pyrite. Above Glengarry, on a branch of Middle River, on Murdoch McKay's land, several shallow pits have been sunk on a deposit said to vary from six inches to a foot in thickness.

*Gilpin's Mines of Nova Scotia, p. 68; Trans. N. S. Inst. Sc., vol. II., Part IV., p. 71; vol. IV., p. 142; vol. V., p. 206; vol. VIII., p. 509; Report of the American Association, 1879.

†Reports of N. S. Department of Mines for 1881, p. 15; for 1883, p. 23.

Pyrolusite.—The mode of occurrence, uses and localities of this ore of manganese are given by Professor How,* Sir J. W. Dawson,† and Mr. Gilpin.‡

Farnham's
Brook.

From the appearance of the rocks at Farnham's millbrook, in which it occurs in pockets in grey and rusty, concretionary, massive Carboniferous limestone, lying unconformably on the Devonian, this ore seems to be a contact deposit. The limestone also contains much disseminated red hematite, which, on weathering, imparts to it mottled shades of colour.

Manganese
Mines.

At the manganese mines of East Onslow, a regular shaft has been sunk to a depth of fifty-five feet; but the principal workings consist of an equally deep irregular open cutting in red Devonian sandstones or quartzites, which dip very steeply to the southward, and in which the ore occurs in the joints and bedding, like the specular iron in other places, following one band of the flinty rocks. Between the shaft and the quarry is an argillite or clay-rock which effectually keeps the water of the shaft from passing into the present workings. The ore-joints which are richest, have a steep westerly dip, in some places a foot of pure crystalline pyrolusite being obtained. A large quantity of ore found in the soil and broken debris of the surface was passed through a jig, worked by a twelve-horse-power engine which also pumps the mine. That from the mine is picked and sorted on the surface, separated from the rock and put into parcels, the high grade ore containing little or no impurity, the low grade containing more or less rock. A small quantity of whitish clay-rock is mixed with the ore, which contains also in places particles and wedges of stone which form with it a kind of breccia. The mine has been worked intermittently for twelve or fourteen years, as many as twenty-two men having been employed at one time. Mr. McLennan, the manager, estimates that it has yielded 150 tons of ore.

Tenycapc.

The manganese mine of Tenycapc lies about a mile south of the main shore road, three-quarters of a mile west of Tenycapc Brook. On the road to the mine are outcrops first of dark slates, then of coarse and fine greenish grit, and near the mine, of reddish and grey flinty slate, immediately beyond which is Carboniferous limestone. The deposit seems to be similar to the limonite of London-derry; it is in veins in the hard rocks, associated with calcspar,

*Trans. N. S. Inst. Sc., vol. I. (3), p. 128; Mineralogy of N. S., pp. 110-126.

†Acadian Geol., p. 273.

‡Mines of N. S., p. 90; Report of the Department of Mines for 1885, p. 72: Trans. Roy. Soc. Can. vol. II., sec. IV., pp. 7-13.

baryte and other minerals; large masses have been found weighing hundreds of tons. The mode of working followed by Mr. Joseph Stephens, the owner, resembles that described above. The ore follows the bedding in a vein of variable breadth, a hard belt being above and soft rock below; and a cutting has been extended several hundred yards along it. Some of the ore is pure enough to use without dressing; but much of it is crushed, washed and jigged.

Copper Ores.—The presence of unimportant traces of copper ore has been indicated in the foregoing descriptions of the rocks of various localities.

Small pockets and crystals of copper pyrites are found at several places in the neighbourhood of McLellan Mountain, in or near the Cambro-Silurian igneous rocks. Above the mills at Rocklin, traces of ore are found in dark Devonian slates, also in minute quartz veins on the west branch of Middle River, in a brook near Pembroke, and in other places, and perhaps the pits in the polished, shiny, graphitic shales of the Cross Brook of Lorne, which contain veins and layers of dark and light-coloured limestone and calcspar, with numerous specks of pyrite, were sunk in search of copper ore. In metamorphic rocks.

Recent explorations have developed a considerable quantity of copper ore among the felsites near Pinkietown, at the head of the Ohio River, of Antigonish.* Near the head of Six Mile Brook, copper pyrites is found associated with the felsites and diorites of Mount Dalhousie.

Another class of deposits includes those found in concretionary rocks, chiefly Permian, in association with trunks of trees and other carbonized matter. On the West River below Durham, patches of greenish and grey conglomeratic rock in red sandstone have been mined for copper ore, which, like that of Pomquet and other places, consists of stems of plants, in part carbonized in part turned into copper ore and containing besides much concretionary calcareous matter; in Middle River on a little brook below and nearly opposite the Millbrook; and on the East River near Hopewell,† a similar ore is found. Opposite Angus Bailey's house on River John, grey copper ore was prospected in a grey sandstone. In the same neighbourhood on "The Brook," a spotted sandstone, marked with carbonized plants, has been dug for copper; and on the shore opposite the Presbyterian church at River John, and also in Plainfield Brook near the fork, many nodules of copper glance have been found. In Scotsburn In unaltered strata.

*Geol. Surv. of Can. An. Rept., 1886, vol. II., p. 122 P.

†How's Mineralogy, pp. 71, 72 and 208.

Tatamagouche.

Brook, a pit twenty feet deep is said to have exposed a band of cupriferous sandstone five feet thick: and several hundred dollars were spent in mining here, while as many thousands were probably spent on the French River.* The copper ore of Plainfield, Caribou, Toney River, French River and Malagash is described on pp. 130, 135 and 138. The mode of occurrence of that of Waugh River, about three miles from Tatamagouche, is thus described by Professor M. E. Wadsworth:† "The country rock is a sandstone composed of granitic detritus, and contains clay, fragments of lignite and other carbonaceous materials. Associated with this sandstone are intercalated beds of red shale, some of which is of so fine a quality that it has been used as a mineral paint. All these rocks dip N. 20° E. < 26°. The ore is in nodules and lenticular masses composed of chalcocite or its hydrous carbonate [malachite] scattered through the beds of sandstone and shale. It is so associated with the carbonaceous materials in the rocks that it is believed that the copper was collected by the percolating waters, precipitated and reduced by the organic matter, and thus collected into the masses found at present, many of which are now in part lignite and in part chalcocite. The change to the carbonate is, of course, a still further change, wrought through the medium of the percolating waters."‡

Native copper.

The native copper associated with the zeolites and other minerals of the trap of Minas Basin is described by Professor Wadsworth as occurring in the basaltic rocks (melaphyrs and diabases) disseminated in part through them and in part occurring in veins in relations similar to those observed on Lake Superior and produced by the action of percolating waters (whether thermal or not) in collecting the copper disseminated through the old basaltic lavas and concentrating it in whatever suitable receptacles existed in the lavas and their associated conglomerates, and in the fissures traversing them.

Stewiacke.

Galena.—This ore of lead has been worked to a small extent at Smithfield and Pembroke on the north side of Stewiacke River in Carboniferous limestone, in which it occurs in small veins and disseminated crystals. At Smithfield, galena, pyrite, blende and calcespar are intermixed in what appears to be a brecciated vein at

*How's Mineralogy of Nova Scotia, p. 69.

†Proceedings of the Boston Society of Natural History, vol. XXIII., p. 204.

‡Gesner's Geol. and Miner. of Nova Scotia, pp. 139, 140; Indus. Res., p. 289; Am. Journ. Sci., 1828 (1), XV., 151-153; Trans. Am. Acad., 1831 (2), I., 289-292; Dawson's Acadian Geol., pp. 327, 345, 346; Report of the Department of Mines of N. S., 1876, p. 63; 1877, pp. 48, 49; 1879, p. 13; 1880, pp. 75-77; Gilpin's Mines of N. S., p. 76; Journ. Geol. Soc., London, vol. IV., p. 511.

the contact of the limestone with quartz-veined Devonian rocks. Here an engine and smelter were erected to work and reduce the ore. At Pembroke a considerable sum of money was spent in searching for galena in a fossiliferous limestone, also near the contact with red and grey Devonian slates.*

Silver.—The erratic search made for silver on the Little River of Stewiacke, on John McDonald's (Ogg) Brook and in other places seems in most cases to have been instigated by the presence of scales of specular iron ore among the rocks.

Gold.—The occurrence of gold on the Atlantic coast in quartz-veins has led to the search for it wherever such veins traverse the newer rocks. Thus those of the Silurian rocks of the East and Sutherland's Rivers and of McLellan's Brook,† and of the Devonian of West River, Riversdale, Folly Mountain, Tatamagouche Mountain and Irwin Lake, have at various times been prospected. On Bailey's Brook, south of West River station, a shaft was sunk thirty feet in blackish Devonian argillite, cut by a vein or band, three feet thick, of whitish, greenish and rusty calcareous clay-rock, resembling a decomposed felsite, containing graphite and calcspar in the numerous planes, and minute crystals of pyrite; and other pits have been sunk in the vicinity.

A company was formed, twenty-five or thirty years ago, to search for gold at the point marked "Gold mine," near the Cumberland line on Church's map of Colchester county; but after a little work the search was abandoned. About forty-five years ago, when the land was cleared of a second growth of trees, some of which were ten inches through, hundreds of pounds of ox bones were, it is said, found beneath the soil. These were supposed to have been left at an old camp ground by the Acadians before their expulsion, the road between their settlements at Masstown and Tatamagouche having, it is said, followed the pass between the Millbrook and Debert River in preference to that taken by the Intercolonial railway. Led by some traditions, this camp was assumed to have been used by the French when mining for gold, grains of which have, it is said, been obtained from boulders and from washing the sand. In the mountain, however, only black crumbly trap and diorite, were seen, with quartz veins like those, also reported to carry gold, on the railway near Folly River.

Reference has been already made to the abortive attempts made to work the conglomerates of Brookfield, Glenbervie and other places for gold. ‡

*Report of the Department of Mines for 1887, p. 47.

†Trans. N. S. Inst. Sc., vol. III., pp. 39 and 73.

‡Summary Report of the Geol. Surv. of Can. for 1890, p. 41.

Limestone.—Nearly all the principal localities in which limestone has been quarried, for lime making, for manure or as a flux, have been already referred to in the course of this report and are shown on the map. With very few exceptions it is obtained from the Lower Carboniferous. Among the more important quarries are those of McLellan's Mountain and Brook, and of Bridgeville, Springville, Churchville and Lorne on the East River of Pictou. Near Hopewell, limestone has been worked on Halliday's, Grant's, McDonald's and other farms, but the largest quarry is probably that at Dunbar's, where a light grey and blackish, massive, bituminous and vesicular, compact limestone contains spots of hematite and blotches or veins of calcite and ankerite and yields many corals and shells.*

The quarries of Brookfield are referred to on p. 94; those of Penny's Mountain, on p. 92; of Beaver Brook, on p. 95; and of Kirkhill, on p. 172; they require no further mention.

The Devonian limestones of the West River and Waters' Hill have been described with the Devonian. That of Gordon's quarry, near Glengarry, is mixed with trap and is not like the Carboniferous limestone of the vicinity, but rather crystalline, like that of the East River near Glencoe. It is said to be hard to burn because it melts; it requires a quick fierce heat, but when burnt, makes a good white lime, requiring two bushels of sand for mortar. The crystalline Devonian limestone of Phinney's Brook† is described on p. 71.

A small quantity of the Permian limestone of Cape John has, it is said, been exported to Prince Edward Island.

Dolomite.—An analysis made for Mr. Leckie by Mr. William Smail, the analyst at Londonderry mines, of a sample of magnesian limestone from the quarry opened by Mr. Jamme west of the old Cumberland road, yielded:—

Protoxide of iron.....	1·482
Alumina.....	3·942
Lime.....	28·750
Magnesia.....	14·017
Volatile matter.....	48·913
Silica.....	2·050
	<hr/>
	99·154
	<hr/>

*Trans. Roy. Soc. Can., vol. IV., sec. IV., pp. 159-166.

†Gesner's Geol., p. 113.

As already remarked, others of the Devonian limestones are dolomitic. The Carboniferous limestones of East Onslow, Kennetcook and Shubenacadie are described by Professor How.*

Gypsum.—The great workable deposits of gypsum in the Lower Carboniferous have been described above. At a mill erected for the purpose at McQuarrie's plaster quarry near Lorne, 300 or 400 barrels were ground previous to 1885, and either used for the land or boiled for the finish in plastering houses. Another mill on Irwin Brook at Clifton, has also been allowed to fall into ruin. Fine outcrops, said to cover thirty or forty acres, of white and dark gypsum were quarried, about twenty years ago, on the east side of and near the mouth of Wallace Harbour. Statistics of the production of the quarries at present in operation are to be found in the annual reports of the Commissioner of mines and of the Division of mineral statistics and mines. Plaster mills.

Salt.—At Bridgeville a salt spring issues from beneath a cliff of gypsum; and similar springs are found in various parts of the Carboniferous areas.† On the West River of Pictou, about 1813,‡ an attempt was made to manufacture salt at Saltsprings, and a shaft, 200 feet deep, sunk to find the bed of salt; but the company failed and sold the plant for old iron. About ten years later, salt was manufactured from the brine of the spring; but the work was soon abandoned.

Mineral Water.—"A water with a strong acid reaction is reported to exist near Gairloch, Pictou county. Springs, locally famous, are found at Earltown and Shubenacadie."§

Clays.—Among the various deposits of clay, one on the Middle River of Pictou has been utilized by Mr. Cameron of Stellarton, and a large plant established for the manufacture of bricks. It is a thick bed of dark-red clay situated immediately south of Sylvester station on the left bank of the river.

Fireclay.—Various analyses of fireclays from the neighbourhood of the coal seams in the Pictou coalfield are given by Professor How and Mr. Gilpin.|| Mr. Henry S. Poole in one of his reports

*Min. of N. S., p. 155.

†Gesner's Industrial Resources of N. S., p. 264.

‡Patterson's History of Pictou, p. 273; How's Mineralogy of N. S., p. 143; Gilpin's Mines of N. S., pp. 100 and 102.

§How's Mineralogy p. 199.

||Geol. Surv. of Can. An. Rept., 1886, vol. II., p. 125 P; Mines of N. S., p. 113; Trans. N. S. Inst. Sc., vol. IV., p. 144.

as Inspector of Mines,* gives analyses of fireclays from the Deep seam and from Lingan and Springhill, comparing them with ten Scotch and English varieties. "The Nova Scotian clays contain a much larger percentage of alkalies, which are especially detrimental to the quality of a fireclay. The presence of any quantity of iron and lime is generally injurious; though there are noticeable exceptions, Stourbridge of the one, and Pease's West Ganister of the other The Dominion imported in 1873-74, fire-brick, for refractory linings for stoves, ovens and furnaces, to the value of \$78,040, and fireclay to the value of \$10,873..... The Steel Company of Canada alone imported in 1875 about 2,000,000 fire-bricks for their establishment at Londonderry." Mr. R. E. Chambers states that the quantity used in 1892 by the New Glasgow Iron, Coal & Railway Company in the construction of their furnaces was 850,000; by the Pictou Charcoal Iron Company, 100,000. A dark fire-clay has been extracted from a tunnel on the west bank of the East River of Pictou near Stellarton. The tunnel is thirty yards long and the dip of the rock at the end is $327^{\circ} < 70^{\circ}$, indicating a small fault, which is also shown in the bank.

The occurrence of a fireclay, resembling that of Coxheath,† among the felsitic rocks of New Annan has been mentioned on p. 156.

Building Stone.—"There is no country, probably," says Professor How, "better furnished with the varieties of stone suited to the purposes of the civil engineer, the builder and the architect."‡ The principal quarries of building stone, which are, for the most part, among Permian strata, have been mentioned in the course of this report. The grey beds of the quarries at Pictou, the Four, Six and Eight Mile Brooks of the West River produce a valuable building and monumental stone. Of the latter the two best are probably those of the Elliott and McPherson quarries on the Six and Eight Mile Brooks respectively. The stone is sold at the Elliott quarry for \$17 per cubic yard or 63 cents a cubic foot. McKeen's, about a mile east of Pictou, shows a face of forty feet of good grey freestone. On Rear Brook and at various points on the East River are quarries of grey sandstone and flags.

The sandstone quarried on Toney River, three-quarters of a mile above the shore road, is a striped or banded, dark grey variety, with bedding stripes of lighter colour, the whole having a reddish-

*Department of Mines, Nova Scotia, 1875, pp. 66-68.

†Geol. Surv. of Can. Repts. of Progr., 1879-80, p. 125 F; 1875-6, pp. 423 and 373; and 1873-4, p. 173.

‡How's Min., p. 169; Gesner's Geol. of N. S., p. 141.

grey tinge. It breaks into long blocks two feet thick and downward. Some of the brown stone quarried by Mr. R. E. Chambers from the shore near Toney River was shipped by rail to Almonte, Ont., where it was used in one of the public buildings. The celebrated red freestone quarries of River John, Cape John and Tatamagouche have already been referred to. From that of Mr. Rogers, above the village, a specimen was sent to the Paris Exhibition.

Grindstones.—Many of the grey sandstones referred to above have been largely quarried for grindstones, but require no special mention. The aggregate value of the building and grindstone exported from Pictou in the seven years, 1860–66, is given by Professor How as \$25,094; in 1874 188 tons, valued at \$1,448, were exported, and in the four years from 1882 to 1885, 929 tons valued at \$5,584.

Whetstones, Scythestones, &c.—The excellent scythestone of Birch Hill is a fine, grey sandstone, apparently Lower Carboniferous, with sharp grains of silica, found in the neighbourhood of the East Brook of Stewiacke. Among the Silurian rocks of the hills north-east of Earltown, are bands locally used for whetstones. They are usually dark grey and good, if kept wet or oily. Good whetstones are also found among the same strata at John McKay's (Ross.)

Marble.—The marble of the East River, near the mouth of John McDonald's (Ogg) Brook, has been already described.* Where exposed in the river it is full of rusty blotches. That found in the metamorphic rocks of Five Islands (p. 160) is described by Professor How† as of two kinds—a pure white variety, of excellent grain and great beauty when polished, and a green and white variety. A block shipped to England in 1852 was, on arriving there, pronounced to be unserviceable from being shattered.

Syenite, Porphyry, &c.—Some of the varieties of these rocks met with in the mountains are probably fit for building and ornamental purposes, but none have been utilized. Among them is a syenite of Upper Kempton, a bright-red, fine grained variety, associated with dioritic rock.

Baryte.—Reference has been made to the frequent association of this mineral with the ores of iron and manganese. It is found also in small veins and crystalline aggregations, mixed with calcspar in Permian rocks, in many of the branches of River John, above John McKay's, near Mrs. Morrison's, on Nabiscump Brook, near Peter River John.

*Geol. Surv. of Can. An. Rept., 1886, vol. II., p. 126 P; Trans. N. S. Inst. Sc., vol. III., pp. 64, 65; vol. IV., p. 466; vol. V., p. 208; How's Min., p. 158.

†Min. of N. S., p. 157.

Gratto's mill, near McBean's house, and at Welsford between the mills and the shop. In one conglomerate the pebbles are held together by a white crystalline calcspar mixed with baryte. It was quarried to some extent in the grey sandstone of Hodson near River John, some years ago, the quantity exported in 1879 amounting to 480 tons, valued at \$2,400;* but at present none of the veins are worked.

Brookfield.

About six miles east of Brookfield station, or a mile west of Bill Putnam's Brook, and half a mile north of the Stewiacke River, is a deposit described by Professor How,† from which 1,200 tons are said to have been taken prior to 1868 from a shaft or cutting forty feet deep. The ore was in three veins, having an average thickness of eighteen inches, white throughout or with a greenish tinge in part, perfectly free from pyrite and other metallic minerals, but containing traces of graphite. The veins seem to traverse irregularly a grey somewhat argillaceous limestone. Small veins of bright red calcspar also cut the limestone, which is associated with greenish-grey, fine, calcareous sandstone and flags, marked with carbonized plants, and with blackish coarse grit, in which a small streak of coal is reported to have been found. In the neighbourhood of the iron mine at Upper Brookfield, a vein of reddish and white baryte, said by Professor How to be fifteen feet in thickness, is exposed on the side of the hill, mixed with iron ore. These deposits are still intermittently worked.

Five Islands.

White and reddish baryte has been quarried‡ in considerable quantity from numerous irregular veins, sometimes three feet wide, or beautiful crystalline masses in the slates on the steep banks of the East and Bass Rivers of Five Islands, perhaps in continuation of the iron ore belt of the Londonderry mines. It is associated with specular iron, and carries a little copper pyrites and fine crystals of dog-tooth spar and calcspar. About five hundred tons had been exported to the United States before 1866.

Graphite.—Graphitic shale occurs in many places, as already stated, but none of the known deposits seem to have been worked with profit. Professor How mentions having examined specimens from a vein at Partridge Island and from Salmon River.

Infusorial Earth.—Many of the lakes in which this material has

*Gilpin's Mines of Nova Scotia, p. 99; Report of Department of Mines, 1879, p. 55.

†Min. of Nova Scotia, p. 160.

‡How's Min., p. 160; Acadian Geol., p. 592.

§Geol. Surv. of Can. An. Rept. for 1886, vol. II., p. 127 P.

been found are mentioned in last report. § It has also been taken from a little lake east of the Tatamagouche road at Corktown and from a creek or stillwater flowing from it; from a spring or pond in front of Mr. Crowe's house in the same vicinity; and also from a stillwater near the head of the west branch of Economy River.

Sand.—Promising beds of moulding sand are found at Onslow and near the mouth of McLellan's Brook.*

Slate.—In Drug (Truagh) Brook, above the post road, is a bluish-grey slate, like that of Guysboro' Intervale; † in the Middle River above Lansdowne, flaggy Devonian slates have been quarried for buildings; and from the West and Stewiacke Rivers good specimens have been obtained.

Precious Stones.—Many beautiful minerals of the quartz family—amethyst, chalcedony, agate, jasper, opal, &c.—are described by Jackson and Alger, Dr. Gesner, ‡ Professor How, § Marsh, || Gilpin, ** Dawson, †† Hoffmann ‡‡ and others, who have also devoted much time to the collection and determination of the various beautiful cabinet minerals so abundant in the trap areas of the Bay of Fundy.

*How's Mineralogy of Nova Scotia, p. 162; Trans. N. S. Inst Sc., vol. IV., p. 145.

†Geol. Surv. of Can. An. Rept., 1886, vol. II., p. 128 P.

‡Geol. of Nova Scotia.

§Min. of Nova Scotia, pp. 180 and 202.

||Silliman's Journal, 2nd series, XXV., p. 210.

**Mines of Nova Scotia, p. 117.

††Acadian Geol., p. 114.

‡‡Annotated List of the Minerals occurring in Canada; Trans. Roy. Soc. Can. vol. VII., Sec. III., 1889; Geol. Surv. of Can. An. Rept., 1888-89, vol. IV., T.

