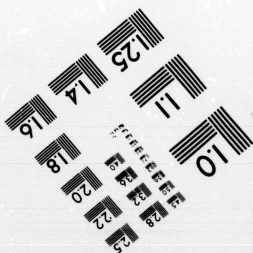
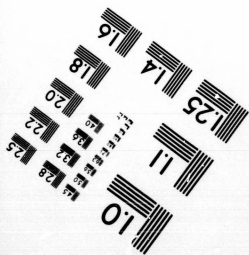
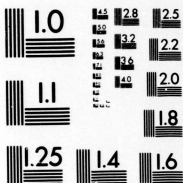


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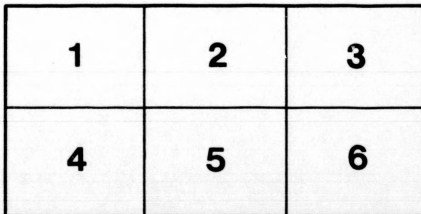
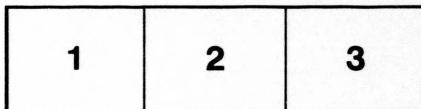
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**GEOLOGICAL SURVEY OF CANADA.**

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

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1710-11-12-13

REPORT

ON THE

PRE-SILURIAN (HURONIAN) AND CAMBRIAN, OR  
PRIMORDIAL SILURIAN ROCKS

OF SOUTHERN

**NEW BRUNSWICK**

**1877-1878**

BY

L. W. BAILEY, M.A., Ph. D.,

PROFESSOR OF NATURAL HISTORY IN THE UNIVERSITY OF NEW BRUNSWICK.



PUBLISHED BY AUTHORITY OF PARLIAMENT.

Montreal:

DAWSON BROTHERS.

1879

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ALFRED R. C. SELWYN, Esq., F.R.S., F.G.S.,

*Director of the Geological Survey of Canada.*

SIR,—I beg to submit herewith my report of geological explorations during the two past summers in southern New Brunswick.

In carrying out the instructions which I received from yourself in the spring of 1877, to endeavor to determine more exactly the limits of the belts of Primordial rocks, described in previous reports as extending to the eastward from the city of St. John, it was found necessary to make a careful re-examination of the associated strata. On this account the field of exploration has been unavoidably extended to all the older rock-formations of the area in question. Though involving an additional expenditure of time, this course was deemed desirable because strata bearing much resemblance to some of those which in St. John County underlie the Primordial, have in other parts of the Province been found to occur under circumstances which leave some doubt as to their true position and equivalency. The results thus obtained are such as to substantiate, with but slight modifications, the views advanced in the preliminary report of 1871.

The district to which this report relates lies wholly to the eastward of the St. John River, embracing a considerable portion of the parishes of Simonds and St. Martin's, in the county of St. John, and portions of Upham and Hammond, in the county of King's. To the eastward it is continuous, with a similar area extending into the county of Albert, in which direction simultaneous but independent observations have been made by Mr. R. W. Ells. This gentleman has, at my request, also visited portions of the field explored by me, making an odometric survey of the more important roads, and I am indebted to him for the reduction of the topographical results embodied in the accompanying map. With this exception, the greater part of the topographical work, both in the field and subsequently, was performed by Mr. Wallace Broad, my assistant during the season of 1877.

I am, Sir,

Your obedient servant,

L. W. BAILEY.

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In attempting to determine more definitely the relations of the several sets of strata in the region examined, more than the usual difficulties have been experienced, as apart from the fact that it is but sparsely settled and over large areas covered with forest, the rocks themselves are of such a nature as greatly to enhance the labor of their examination. Largely made up of volcanic and semi-volcanic materials and of coarse fragmental deposits, they are exceedingly variable in distribution and bulk as well as in color, while through large masses it is often difficult or impossible to detect even a trace of bedding. To this it may be added that the dips, even when recognizable, are frequently, even within short distances, of a most discordant character, apparently indicating, as do the sediments themselves, that they were formed during a period of general disturbance and in the presence of wide-spread and frequent volcanic activity. The region is also throughout highly disturbed, with numerous faults and plications, and includes several large areas of intrusive rocks. Under these circumstances, no attempt has been made to determine definitely the thickness of the several groups, but only to fix their order of succession and distribution. It having further appeared probable, as the result of recent investigations, that some at least of these groups, as distinguished in former publications, actually form a continuous series, while their names have come to be applied to a variety of rocks not originally included under

them, it has been thought best in the present report to drop such designations altogether, substituting for sub-divisions of systems a numerical and lithological nomenclature.

In accordance with these views, the entire series of rocks in the region examined may be tabulated as follows; in ascending order:—

*Pre-Silurian*,—

Division 1.—Syenitic, felspathic and gneissic rocks.

Division 2.—Limestones and dolomites (with serpentine) mica schist, quartzite and dark grey graphitic slates.

[The above divisions are those which in earlier reports have been described as probably Laurentian.]

Division 3.—Felsite-petrosilex group.

(a) Red and grey felsites; blue, grey, reddish and black petrosilex and breccia-conglomerate.

(b) Dioritic and amygdaloidal ash-rocks and ash-conglomerates.

(c) Grey felspathic sandstones and conglomerates, often ferruginous.

[The rocks in this division are those described in earlier reports under the name of Coldbrook group. They are regarded as a lower member of the Huronian system.]

Division 4.—Schistose, chloritic and micaceous group.

(a) Chloritic schists, green, grey and purple ash-rocks and amygdaloids, with purple conglomerate.

(b) Pale grey, pyritous and rusty-weathering felsites and felspathic quartzite.

(c) Hydro-mica schists, chloritic schists and felsites; grey clay-slates and purple conglomerates, with beds of hematite.

[The rocks of this division are those described in earlier reports under the name of Coasta group. They are regarded as the upper member of the Huronian system.]

*Cambrian or Primordial Silurian*—

(a) Purple conglomerates, sandstones and shales.

(b) Red and greenish-grey argillites, spangled with mica.

(c) White and grey sandstones; grey and dark grey shales and sandstones, with fossils; grey slate and flags.

*Devonian*.

*Lower Carboniferous*.

*Millstone-grit*.

*Trias, or New Red Sandstone*.

Besides the lithological differences indicated above in the pre-Silurian rocks, evidence of more or less pronounced unconformability may be traced between the several divisions, marking a corresponding number of physical breaks.\*

\* Some of the apparent want of conformity may be due to subsequent faulting.—A. R. C. S.

In the present report the only groups particularly considered are the pre-Silurian, Divisions 3 and 4, together with the Cambrian or Primordial Silurian.

### 1.—PRE-SILURIAN.

#### *Division 3—Felsite and Petrosilex Group.*

Under the designation of the Coldbrook group a general description of the rocks of this division was given in the Report of Progress for 1870. The distribution of these pre-Silurian rocks, as more particularly determined during the past season, is indicated in the accompanying map. It should, however, be stated that over portions of the area therein assigned to Division 3, masses of coarse conglomerate or of schistose strata are occasionally met with, which, from their attitude or composition, would appear to be of more recent origin. Coarsely crystalline syenites are also met with at a number of points and sometimes cover considerable areas, but as their limits are usually ill-defined and they appear to graduate insensibly into the surrounding rocks, no attempt has been made to effect their separate delineation.

The rocks which appear to be the lowest in position, as well as the most highly crystalline within the region under discussion, consist of fine-grained felsites of pale flesh-red and grey colors, of a more or less distinctly stratified character. At various points they may be seen to merge into dark grey petrosilex and felsite-breccias, and at others into compact and unstratified felspar-rock, which by the addition of grains of quartz and of a greenish mineral resembling hornblende, becomes an imperfect syenite. It is chiefly among the felsite rocks that the masses of true syenite referred to in the preceding paragraph are met with, as well as others of coarsely crystalline diorite. Some of these syenitic and dioritic rocks appear to be intrusive, but in the occurrence of rounded grains of quartz, as well as in the appearances they present on weathered surfaces, other portions suggest the idea that they are altered sediments. More particular reference will, however, hereafter be made to some of the larger and better defined areas of syenite rock in the region examined. The relations of these different groups of beds is most intricate and variable, and in general their separation is quite impossible.

In either of the two bands of Huronian sediments to which reference has been made, the most abundant as it is the most conspicuous rock is that which I have designated petrosilex. Though largely composed of felspar, as shown by the character of the weathering, it differs from ordinary felsites in being much harder, ringing under the hammer, breaking with an irregular or conchoidal fracture, and being much less

readily affected by eroding and atmospheric agencies. In color it is usually dark bluish-grey, weathering pale-grey or white, but exhibits also various other shades, as pale flesh-red, lilac and green, to black. It is also usually porphyritic, with minute felspathic crystals of a paler color. But perhaps its most noticeable feature is its extreme fineness of texture, bearing in this respect much resemblance to ordinary flint. Notwithstanding this apparent fineness, a larger proportion, if not the whole, of the rock is in reality a conglomerate or breccia, composed of numerous small and angular pieces, thickly imbedded in a matrix of apparently identical character. In many portions this feature is quite conspicuous, but in others would not be suspected were it not for the effects of weathering, revealing at the surface the occurrence of fragments even when the interior is apparently homogeneous. From the prevalence of these features and the intimate relations between the brecciated and non-brecciated strata, I am led to believe that, even though apparently made up of re-composed sediments, they all appertain to a single geological horizon, their peculiar character being due to the nature of the circumstances and to the disturbances in progress during the time of their accumulation.\*

In general, as has been observed, the stratification of the petrosiliceous rocks is exceedingly obscure, masses hundreds of feet in thickness and extending for long distances often failing entirely to reveal any reliable evidences of structural arrangement. This is particularly the case on ordinary weathered surfaces, but in the beds of streams, where exposed to a process of constant wear, the stratification is more evident, and at times even conspicuous. It should be added that with the more compact petrosilex beds there are others which are more slaty, as well as some slate-conglomerates, felsites and felspathic sandstones.

Northern Belt. In the northern belt of Huronian sediments the rocks to which the above description is intended to apply are first seen, to the eastward of St. John, in the range of rather prominent hills running along the northern side of the Loch Lomond lakes, and extending thence to and beyond Barnesville. They are apparently wanting at St. John, as also at Coldbrook, where the only beds seen between the syenite of Division 1 (Laurentian) and the grey sandstones of the Primordial are heavy beds of schistose, red and purple, more or less chloritic conglomerates, pertaining to Division 4; but a little to the eastward of this point they may be seen to rise from beneath the Primordial Silurian beds in the partially cleared track lying just west of the first Loch Lomond lake, and between the Westmorland and Loch Lomond roads. When first

\*These felsites are undoubtedly of contemporaneous volcanic origin. They do not materially differ from the great felspathic trap series of North Wales and Cumberland, but appear to have been erupted at a somewhat earlier period. A.R.C.S.

seen the petrosilex band is only a few yards wide, but in approaching the lake becomes much more prominent, forming the greater portion of the eminence known as Ben Lomond, together with several other hills of less elevation. The dip of the beds near the western end of the lake (where they are unconformably covered by white and purple sandstones of the Primordial series,) is southerly (about S. 20° E. < 60°), and the same dip apparently holds good throughout the line of bluffs which skirt the lake on its northern side. It is probable, however, that this is but a series of overturned folds, as similar belts are met with along one or more lines to the northward, in the settlement of Golden Grove, separated by depressions mostly occupied by dioritic and ash rocks. The relations of these two sets of beds, which are elsewhere intimately connected, will appear from the following section:—

*Section from North to South in Golden Grove.*

		TRAVERSE MEASURE.
<i>Pre-Silurian,—</i>		
Division 1.—Red syenite, more or less chloritic, on south side of Westmorland Road. . . . .		
Measures concealed in deep valley, traversed by a branch of Langstroth's mill-stream, and filled with Laurentian debris . . . . . 620 feet.		
Measures concealed—steep ascent of hill nearly 400 feet high. 1,187 "		
Division 3.—		
b.	Dark greenish-grey epidotic and amygdaloidal ash rocks. . . . .	730 "
	Greenish-grey ash-conglomerate, with large pebbles of amygdaloid in an earthy dioritic base, filled with spots and vesicles of epidote. Dip southerly at a high angle, but obscure. . . . .	500 "
c.	Measures concealed—to road running north of Mark's Lake. . . . .	500 "
	Coarse conglomerates, holding pebbles of pink-and-grey quartzites, red felsite, dark purple ash-rocks, &c. in a sandy paste, and holding finer sandy layers. Dip distinct S. 20° E. < 70°. These conglomerates extend through the whole length of Golden Grove, and at the eastern end of Mark's Lake (where they overlie some thin beds of micaceous sandy slate and bright purple felspathic sandstone), exhibit alternations of coarse pebbly beds containing numerous white quartz pebbles with finer sandy and gritty beds, the whole dipping quite regularly S. 20° E. < 60°-70°, with a surface breadth of. . . . .	1,250 "
	Dark-grey fine dioritic rock, similar to that in the hills north of Mark's Lake, but more crystalline—extending to south side of lake. . . . .	250 "
a. & b.	Grey slaty ash-rocks and dark-grey porphyritic petrosilex, extending to Golden Grove road. . . . .	825 "
	Grey and purple ash-rocks . . . . .	533 "

		TRAV. MEAS.	
b.	{	Purplish-grey ash-conglomerates and breccias, increasing in coarseness to the south, and holding angular blocks from 2 to 14 inches in diameter, in a sandy vesicular paste. Dip S. 20° E. < 60°.....	550 feet.
		a. Dark-grey porphyritic petrosilex. Dip ?.....	175 "
c.		Measures concealed, but including ledges of purplish cobbly and slaty conglomerate. Dip S. E. < 60°.....	100 "
b.	{	Greenish-grey and purplish ash-rocks, with pale-weathering fragments, and coarse ash-conglomerates holding large round masses, two inches to two feet in diameter, of grey amygdaloid in a purplish-grey sandy and dioritic paste. Dip distinct S. 40° E. < 40°. These rocks extend to the main road on the north side of McFarlen's Lake, with a breadth of.....	400 "
		[From this point the section is shifted about a quarter of a mile to the east, extending from near McFarlen's along the course of a road leading south to a mill on Loch Lomond shore.]	
		Grey dioritic and felspathic sandstones, somewhat vesicular and having ferruginous spots.....	400 "
		Measures concealed.....	475 "
		Grey felspathic sandstone and greenish-grey ash-rock.....	350 "
		Measures concealed.....	1,485 "
		Grey felspathic sandstone at intervals.....	800 "
		Pale-grey rusty-weathering felspathic and somewhat schistose beds dipping S. 50° E. < 80°-90°.....	500 "
		Greenish-grey sandstone and fine conglomerate. Dip S. 20° E. < 80°.....	400 "
		Measures concealed, to shore of Loch Lomond.....	950 "

Of the rocks included in the above section those of group *b*, embracing epidotic and amygdaloidal ash-rocks, are in Golden Grove by far the most conspicuous, and similar beds, though less coarse, are met with at various points both to the west and east of that settlement—in the latter direction to and beyond the Third (Loch Lomond) Lake. The conglomerates of group *c* are also both more voluminous and more varied here than elsewhere, while the underlying petrosilex (*a*) is mostly hidden from view. A little to the eastward of the line of section in its more easterly portion (near McFarlen's Lake) there are, in addition to the beds above enumerated, a peculiar pale-grey but deep rusty-weathering and highly calcareous sandstone, thin beds of hard grey, crystalline hornblende rock, fine greenish-grey conglomerate, in which the paste and pebbles are barely distinguishable, and (near the thoroughfare between the First and Second Lakes) dark purplish-grey petrosilicious conglomerate, containing numerous small concretionary nodules. Where the dip can be made out it is always to the south, usually about S. 30° E. < 70°, but sometimes as low as 30°. All or

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nearly all of these beds are again met with to the eastward, about the Third Lake and in the vicinity of Barnesville. In approaching this settlement the depression previously occupied by the Loch Lomond waters shows a tendency to bifurcate; one branch (holding the main belt of Primordial sediments) sweeping off to the south, while the other, traversed by the South Stream, an affluent of Hammond River, by keeping more to the north, intersects the Huronian series transversely, and thus affords a view of its character and structure. As stated in a previous report, the general arrangement in this vicinity appears to be synclinal, though from the obscurity of the stratification and the occurrence of numerous subordinate folds, the exact succession is not readily made out. Among the rather prominent hills (Lawson's and others) which bound the valley on its northern side, the rocks are almost entirely sandstones, conglomerates and breccias, similar to those of the hills north of Loch Lomond, and like them appearing to have a general southerly dip at a high angle (S. 20° E. < 80°). Good exposures of the felsite-breccias may be seen in the lower part of the South Stream valley, at and below the falls, half a mile above its mouth, as well as on the main stream of Hammond River, above South Stream bridge (the dip varying from N. 30° W. < 80° at the former, to S. E. < 30° at the latter). A little higher up the valley are true felsites, of a pale red color and somewhat coarse texture, which exhibit a distinct stratification and extend along the stream for a distance of one or two furlongs in a series of undulations, mostly low, but in places nearly or quite vertical. The relations of the felsites to the associated rocks is not very clear, but from what is seen at other points it is supposed that they are directly connected with the petrosilex and breccia rocks, of which they represent either a local variation, or, possibly, an inferior portion. In their more westerly exposures, where they exhibit some sharp corrugations, they are directly covered by a series of grey and purplish-grey sandstones, with beds of conglomerate composed of felsite fragments, and these in turn by purplish and grey shales. Both the felsites and sandstones are undoubtedly portions of the Huronian series, but the shales, which are much softer and apparently unconformable to the sandstones, may be a portion of a higher formation (Primordial Silurian.)

To the south of the South Stream valley, on the elevated plateau lying between this and the valley of Germain Brook, another tributary of Hammond River, the synclinal structure to which reference has been made is most clearly seen. On the hill-side at Barnesville Corner the rocks consist for the most part of a very compact dark-grey to black or purplish-black petrosilex-breccia, usually nearly homogeneous, but in which occasional fragments of red felsite are imbedded. They

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- have an evident dip to the southward (S.  $10^{\circ}$  E.  $< 40-50^{\circ}$ ), and together with some thinner beds of paler grey, felspathic sandstones and conglomerates, have a surface breadth of about 600 yards. Following them to the south are greenish-grey, ferruginous, felspathic sandstones or ash-rocks, having kaolinized crystals of felspar and holding some felspar pebbles, and to these succeed in turn ledges of coarse conglomerate, filled with well-rounded pebbles of green, red and grey felsite, stratified felspar-porphry, diorite and epidote, some of which are six to seven inches in diameter, imbedded in a light-weathering sandy and felspathic base. These beds also dip southerly (S. E.  $< 50^{\circ}$ ), extending, with a surface breadth of about 300 yards, nearly to where the road crosses the headwaters of South Stream, which here flows westerly. After crossing the latter, however, the first out-crops on the hills to the south are massive dark-grey petrosilicious rocks (breccias and conglomerates) much like those of Barnesville, upon which rest beds of grey felspathic sandstone filled with ochreous spots, and coarse conglomerates holding felsite and diorite pebbles, the dip of both sets of beds being now to the north (N.  $10^{\circ}$  W.  $< 60^{\circ}$ ). There is thus an evident reversion of the higher beds (conglomerates and sandstones), and probably of the lower as well, the petrosilex beds which extend thence to the valley of Germain Brook not only resembling those of Barnesville in general aspect, but having, like them, what appear to be intercalated beds of reddish, more or less crystalline, felsites.
- Further evidences of this synclinal structure are to be seen in the more easterly portions of the plateau, where it is cut off by the valleys of Hammond River and Germain Brook. On the first-named river, near South Stream bridge, may be seen the same felsite-breccias as those already described on the latter tributary, and similar beds again occur two and a-half miles to the eastward of Titus's (upper) mills, being here nearly vertical, while between these points the rocks are in part dark-grey porphyritic petrosilex, and in part Lower Carboniferous sediments, the latter forming the entire northern side of the stream. With the dark grey petrosilex are irregular beds of pale-red and red felsite, which in approaching Titus's mill become at the same time more frequent and more crystalline. In some portions, as in the case of those at Barnesville, a distinct but usually highly contorted stratification is discernible, but other portions are quite homogeneous, and by admixture of a dark green mineral resembling hornblende, become imperfect syenites. Still further east these syenite rocks become yet more conspicuous, replacing all others and forming a nearly continuous line of high bluffs extending past the village of Upham to the mouth of Germain Brook, and along the north side of this brook nearly to Hardingville. It is supposed that these syenitic hills form
- Conglomerate.
- Synclinal.
- Hammond River.
- Titus's mill.
- Upham.



the rim or margin of the great synclinal trough already described, and that they are simply the petrosilex and breccia-rocks in a more altered form. That they are in great part of fragmentary origin is very evident, and even where apparently most crystalline a rounding of the grains of quartz and the occurrence of irregular cavities or vesicles, suggest that all have been produced by like agencies.

In these high bluffs, around the base of which sweeps the St. Martin's and Upham railway, the more northerly of the two great Huronian belts abruptly terminates, being, as elsewhere, separated from the more southerly belt by a band of Primordial rocks which crosses their strike transversely.

In passing to the more southerly belt of Division 3 the same general features are met with as in that already described, but exhibited over larger areas and with greater complexity of detail. Southern Belt.

Including a bifurcation at its western end (one branch of which is traceable to and beyond St. John Harbor), the belt in question has a total length of over fifty miles, or nearly to the boundary of Albert County, and a maximum breadth of about nine miles. The latter, however, is subject to considerable variation, being rendered irregular, particularly on the northern side, by overlying sediments (Primordial-Silurian, Devonian and Lower Carboniferous), as well as by considerable areas of intrusive rock. It is everywhere bold and rugged, embracing many of the most prominent hills in this section of the Province, and, except where covered with Lower Carboniferous drift, affords but little encouragement to the cultivator. Distribution.

The general character of the southern belt, as well as its relations to higher divisions of the series, may be gathered from the following observations to the south of Loch Lomond and in the vicinity of Black River and Bloomsbury Mountain. It is just south of the western extremity of the First Lake that the bifurcation of the Huronian belt to which reference has been made occurs, one arm (the more northerly) extending thence in the direction of St. John Harbor, while the other and more considerable, including Bloomsbury Mountain, stretches off south-westerly towards the mouth of the Mispick, the intervening area being occupied by the basin of Devonian sediments described in earlier reports. The first-named belt is both narrow and interrupted, being traceable only in a series of more or less isolated ridges along the southern edge of the Primordial area, of which the most considerable occurs about the northern and eastern side of Lattimore Lake. They here consist chiefly of massive fine-grained and more or less epidotic rocks, without evident stratification, with which, however, are some thinner beds of grey flinty petrosilex, dipping at a low angle (S. E. < 20°). Their relation to the Primordial and Devonian, as seen on the Character.  
Lattimore Lake.

Black River  
road.

eastern side of Courtnay Bay, have been described in the Report of Progress for 1871. In the opposite direction similar beds may be seen to protrude at various points through the barrens about Black River road and Strayhorn Brook, extending thence in the direction of Negro and Otter Lakes, beyond which they are replaced by intrusive syenite. At Garnett Settlement, on the Black River road, the Devonian basin terminates in a series of low bluffs, but in the valley to the eastward, occupied by Black River and its branches, the petrosilex and ash-rocks are still concealed by overlying sediments, these being schistose rocks of Division 4, together with a narrow belt of black slates and sandstones pertaining to the Primordial group. South of these beds, however, the Huronian strata again come prominently into view and are well exposed along both the "Mountain" and Quaco roads. On the first of these two thoroughfares the following section has been measured along the road extending from the Black River bridge, in Garnett Settlement, to the south side of Bloomsbury Mountain:—

Section of  
Bloomsbury  
Mountain.

	FEET.
From Black River bridge to cross-road in Garnett's Settlement . . . . .	135
Measures concealed . . . . .	3475
[A little to the eastward of this point the valley occupied by Black River is partly filled with black slates of the St. John group, dipping southerly towards the diorites and petrosilex of Bloomsbury Mountain.]	
Div. 3.—(a) Grey white-weathering fine felspathic rocks, obscurely stratified. Dip S. $< 40^\circ$ . . . . .	175
Dark fine and epidotic petrosilex rocks, occurring at frequent intervals. Dip S. $< 30^\circ$ . . . . .	1500
Measures concealed . . . . .	735
Grey to dark grey, more or less slaty petrosilex, varying from fine to granular, and porphyritic . . . . .	1325
Measures concealed. Brook at end, with grey petrosilex.	1275
Space, with ledge at end, of dark green diorite . . . . .	250
Measures concealed . . . . .	925
Grey white-weathering felsite. Dip distinct S. $10^\circ < 70^\circ$	425
Measures partly concealed, but showing in front half ledges of greenish-grey massive dioritic sandstone.	575
Measures concealed . . . . .	2000
Greenish-grey diorite . . . . .	100
Grey fine-grained petrosilex. Dip S. $30^\circ$ E. $< 70^\circ$ . . . . .	100
(b) Dark purplish-grey ash-rocks, enclosing angular fragments of petrosilex . . . . .	200
Coarse dioritic breccia, made of angular fragments of purplish-grey banded petrosilex in an epidotic and dioritic paste . . . . .	260
Green fine-grained epidotic diorite like the last, but without enclosed fragments . . . . .	125
Measures concealed . . . . .	150

	FEET.
Grey, green and purple amygdaloid, conspicuously porphyritic, with paler spots and silicious amygdules. . .	650
Dioritic rocks, in part porphyritic, in part schistose. . . .	825

[To these dioritic rocks succeed grey slaty felsites, and pale, yellowish-green felspathic schists belonging to Division 4, dipping S. 15 E. < 40°, extending from this point to the bridge over the east branch of Black River.]

Of the rocks exposed in the above section, the petrosilicious beds which form its lower portion are the evident equivalents of those which on the other side of the Primordial belt constitute the range of hills just north of the Loch Lomond lakes, from which they differ chiefly in being less markedly recomposed. The ash-rocks and amygdaloids which succeed are in like manner the equivalents of those of Golden Grove, the breccias at their base marking a breaking up of the inferior beds coincident with the accumulation of the earlier igneous deposits. The felspathic and schistose beds which follow upon the amygdaloids are portions of the Coastal group of former reports, and both by the interposition of these igneous rocks and by the sudden reduction in their dip, indicate a want of conformity to the inferior group. Correlations.

To the westward of the above line of section the particular distribution of the several groups, owing to their being covered with extensive sand-barrens, is not fully known. Dioritic and ash-rocks, which are more or less amygdaloidal, may, however, be seen for a distance of a mile or more along the road south of the upper bridge across the Mispick River, being followed in the same direction, as at Bloomsbury Mountain, by schistose, felspathic and talcoid rocks of Division 4. To the eastward of the same line of section the beds are better exposed, and may be well seen along either of the roads leading south from Loch Lomond to Quaco. Mispick.

Along what is known as the Lower Quaco road, traversing the settlement of Willow Grove, the most noticeable feature is the great development of the volcanic or semi-volcanic members of the series and the comparative paucity of true petrosilex. In the northern part of the settlement named and along the road leading to Negro Lake, the rocks resemble those of Division 4, being pale greenish-grey felspathic schists and schistose conglomerates, upon which rest much coarser felspathic and white weathering conglomerates holding pebbles of dark grey petrosilex, red felsite, felspathic schist, syenite, &c. These may be the equivalents of the similar beds previously noticed in Golden Grove, or possibly belong to some higher series, either Primordial or Devonian. To the south of the schistose beds, which have mostly a low dip or are nearly flat, the rocks in the central portion of the settlement are fine-grained diorites and earthy dioritic sandstones, of grey, Willow Grove.

greenish and purplish colors, often very coarsely vesicular, and containing much chlorite and epidote. The first rocks met with of a different character are found a little south of the bridge over the south branch of Black River, being flesh-colored felsites with obscure stratification (N.  $10^{\circ}$  E.  $< 80^{\circ}$ ), followed after an interval of 500 yards by grey flinty petrosilex, distinctly stratified and dipping S.  $20^{\circ}$  E.  $< 85^{\circ}$ . With the latter high dip they are almost immediately succeeded by alternating beds of green and purple sandy shales, of which the dip is S.  $30^{\circ}$  E.  $< 50^{\circ}$ - $60^{\circ}$ . These latter are a portion of Division 4, the rocks of which (chiefly pale yellowish-green and purple talco-felspathic schists with purple slates and conglomerates,) occupy the remainder of the road to where they pass beneath the Lower Carboniferous sediments of Gardner's Creek.

In the hilly and thickly-wooded region lying between the Lower and Upper Quaco roads but few observations could be made. The petrosilex rocks again increase in force in this direction, and on the second of the two roads named, form the greater portion of the Huronian belt. Just south of the Primordial belt on Ratcliffe's mill-stream, the rocks are mostly grey and pink syenites, forming part of a ridge extending westwardly to Otter Lake; but after passing there and to the south of the Hibernian road, grey rusty-weathering felsites come into view, and are succeeded by petrosilex-breccias of grey, dark-grey and black colors, which, with some thinner beds of grey felspathic sandstone, extend to within a short distance of where the road crosses Stony Brook, one of the tributaries of Gardner's Creek

Stony Brook.

South of this brook are ledges of diorite containing large masses of white quartz, and similar rocks interstratified with purple conglomerates dipping S.  $30^{\circ}$  E.  $< 80^{\circ}$ . These, however, form a portion of Division 4, and with other beds succeeding them will be again alluded to in another connection.

Henry's Lake.

To the eastward of the Upper Quaco road the width of the petrosilex belt again becomes greatly reduced through concealment by overlying deposits, until at Henry's Lake, on the line of the St. Martins & Upham railway, it does not greatly exceed half a mile. The exposures at this point, which have been largely increased by the construction of the railway, are particularly interesting as affording (with Handford Brook, on the northern side of the belt,) the most complete and satisfactory section of the Huronian rocks in any portion of the district examined. As these belong, however, for the most part to Division 4, their further consideration is deferred for the present.

To the eastward of the St. Martins railway a most noticeable fact is the rapid and enormous expansion of the area occupied by the petrosilex rocks, an area now nearly equalling the combined breadth of the

two belts to the westward, together with that of the Primordial belt included between them. The cause of this increase is undoubtedly to be found in the fact that the beds in the first-named direction are thrown into more numerous but, at the same time, usually more open folds, the dips being very irregular and generally at comparatively low angles. It may also in part be due to the occurrence of more or less considerable areas of diorite and syenite. As in the Barnesville area, these occur chiefly along the northern and southern sides of the petrosilex belt, are exceedingly irregular in their distribution, and often shade into the associated rock as though they were merely a more altered portion of the latter.

From the almost entire absence of settlements and the paucity of roads or clearings, the observations in this region are necessarily partial and disconnected, being for the most part confined to the exposures exhibited by the streams which traverse it. Enough, however, is known to indicate the general character and range of the rocks which it includes. From Henry's Lake the northern limit of the band extends north-easterly to the Hammond River, of which it forms the southern side as far as the road leading south to Saddleback Settlement. Between the river and this settlement fine exposures may be seen along the course of Sherwood's mill-stream, where the beds consist chiefly of very fine-grained felspathic sandstones—somewhat micaceous, and in part conspicuously ribbanded with shades of grey, dark-grey and purple—overlying dark-grey pyritiferous petrosilex, with some crystalline diorite. The section is nearly a mile in length, but owing to the irregularities of dip, which are peculiar in being usually not far from West and at a low angle (varying from W.  $< 30^\circ$  to W.  $20^\circ$  N.  $< 30^\circ$  and W.  $10^\circ$  S.  $< 30^\circ$ ), no opportunity is afforded for a determination of the thickness of the beds. The ribanded beds are similar to some of the strata, to be hereafter described, on Handford Brook, and also appear in the bed of Hammond River at Veysey's mill, where they dip W. N.-W.  $< 50^\circ$ , and are overlaid by Lower Carboniferous limestone filled with pebbles of the underlying rock.

Near this point there occurs a rather remarkable belt of true mica-schist of pale-grey or silvery aspect, and often somewhat gritty, which, first seen on one of the roads leading south to Saddle-back Settlement, thence extends easterly, with a surface breadth of over a mile, nearly to the head of the Hammond River valley. The beds everywhere dip northerly and lie to the north of the diorites and petrosilex rocks, but otherwise there are no facts from which their age can be determined.

To the south of these exposures, in Saddle-back Settlement, are numerous hills and ridges which are, for the most part, composed of very dense, dark-grey to black and porphyritic petrosilex, with which,

Sherwood's  
mill stream.

Mica Schist.

Saddle-back  
Settlement.

however, is a considerable mass of crystalline red syenite. The latter forms an irregular belt extending eastward through this settlement for about six or seven miles; while to the southward, with the exception of a small outlier of Lower Carboniferous conglomerate, the petrosilex beds (breccias, &c.,) occupy nearly all the area traversed by the north-east and north-west branches of the north arm of the Salmon River. At the falls on the north-east branch, the stream, in a distance of less than a mile, makes a descent of as much as 150 feet, producing a picturesque gorge, through which lumber is driven in considerable quantities, though only with great difficulty and danger. South of the falls another band of red syenite comes into view, separating the petrosilex from the schistose rocks of Division 4, and which is probably continuous with a similar belt crossing the Shepody Road near Cross Brook.

Shepody road. The Shepody road, between the valley of Hammond River and that of Crow Brook, intersects the Huronian belt nearly at right angles, and shows numerous exposures of the underlying rocks, but with the usual features of very variable and obscure stratification. Beyond the road, to the eastward, the belt has been traced through Long Settlement (where the petrosilex is covered by wide spread deposits of coarse amygdaloid), to the headwaters of Cedar-camp Creek. On the course of a stream flowing into the latter above Hazen's mill the following section, from north to south, has been made, and affords a good illustration of the features of the group in this region. The section includes a number of folds, but as a whole is a descending one:—

Section  
south of  
Hazen's mill  
(Hammond).

	FEET.
Red felsite-breccias, interstratified with red and reddish-grey very epidotic felsites. They are the same rocks as those of Titus's mill, on Hammond River, and on South Stream, and (with a dip varying from N. 50° W. to N. 20° E. < 60°) overlie dark grey felsites, also epidotic, and dipping N. 60° W. < 40°, declining to N. 28° W. < 30°;—the breadth of the whole.....	500
Similar beds, but bluish, and more petrosilicious, with high and variable northward dip, in part ash-like and amygdaloidal, and passing into dark grey and black petrosilex. The dip of these beds, which are also epidotic and brecciated, is regular (N. 30° W. < 60°) and their breadth about.....	950
Breccia-conglomerates, like those at mouth of stream, but with reversed dip—S. 20° E. < 70° .....	50
Dark grey to black felsite, breccia and conglomerate. Dip N. 30° W. < 60–80° .....	370
Space, including a succession of rapids and falls over petrosilicious rocks, but mostly inaccessible. Dip at the end, in brownish-red felsites, S. 10° E. < 60°.....	1100
Space, with beds at end, of grey epidotic ash-rock, or earthy dioritic sandstone.....	125

	FEET.
Hard grey and pyritous felsite, varying in texture from fine flinty to granular, well stratified, and dipping S. 5° E. < 60°.....	320
Space, occupied mostly by felsites as above, varying in dip, sometimes vertical or with slight inclination northward, but mostly southward. Falls at end over grey felspathic slates and slate-conglomerates, with red felsite fragments. Dip distinct S. 40° E. < 40°..	750
Space, including ledges of grey slaty felsite, holding numerous black slaty fragments.....	150
Fine-grained, massive felsite-breccias, grey to reddish in color; pebbles mostly of red felsite, both angular and rounded, embedded in a pale grey, bluish-weathering paste .....	400
Grey felsites. Dip at end S. 30° W. < 50°.....	560
The same, dip becoming S. 10° W. < 60°.....	350
Space, with ledge at end, of pale-grey flinty felsite. Dip N. 10° W. < 50°	1800
Fine grey, white-weathering, flinty petrosilex. Dip N. 10° W. < 60°, gradually changing to S. 30° W. < 80°.....	500

From the termination of this section southward there are no exposures along the road as far as the point where it is intersected by the road running east to Long Settlement. Occasional outcrops on the hills show them, however, to be chiefly composed of petrosilex rocks, with which, as in the last-named settlement, there are beds of ash-rock and amygdaloid, both more or less injected with veins and masses of syenite. At several points near Walton Lake these petrosilicious rocks, which are black and conspicuously porphyritic, have a distinct southerly dip (S. 20°-40° E. < 70°-80°), and are in the same direction followed by much softer, pale to bright red, white-weathering felsites, also dipping southerly (S. 40° E. < 70°). These are a portion of Division 4, whose superposition on the petrosilex group (Division 3) is thus clearly marked.

A still better view of the relations of these two groups is to be had about three miles to the eastward of the last traverse, along what is locally known as the Filamaro road, connecting the head-waters of Cedar-camp Creek with the Shepody road. In the deep and precipitous valley through which this creek passes out from the metamorphic hills the first rocks seen, south of the Lower Carboniferous conglomerates, are grey, red-weathering and distinctly crystalline felsites, associated with grey breccia-conglomerates full of pebbles of grey granular felsite. To these follow bluffs of fine grey, banded and ribbanded felsites, similar to those of Sherwood's and Veysey's mills, on Hammond River, and like them having a westerly dip (W. 10° S. < 70°), to which succeed grey banded and very fine-grained felsites, associated with reddish granular felsite, dipping regularly N. 25° W. < 60°. The whole series to this point has a breadth of about one mile. There is then a brief interval without exposures, beyond which a series of

## Cripp's Hill.

small but very prominent hills come into view, in one of which, known as Cripp's Hill, a very remarkable display, and one well exhibiting the peculiar circumstances under which the Huronian rocks of this region were deposited, may be seen. The general structure of the hill is synclinal, beds of bluish-grey fine-grained petrosilex at the southern end dipping N.  $10^{\circ}$ - $30^{\circ}$  W.  $< 60^{\circ}$ , and at the northern end S. E.  $< 60^{\circ}$ , while between, the rocks are exceedingly broken and irregular. This central portion is further peculiar for the variety of rocks which it exhibits, these embracing, in addition to grey and dark-grey petrosilex, heavy masses of ash-rock of grey, green and purple colors, which are highly epidotic and amygdaloidal, breccia-conglomerates filled with fragments both of petrosilex and ash-rock, grey fine-grained felspathic sandstones, and, finally, slaty and schistose beds, some of which are soft and unctuous, and others exceedingly hard, giving, when struck, a clear metallic ring. The whole section does not exceed in length five hundred feet, but in it is contained, as it were, an epitome of the entire Huronian series, as well as an indication of alternating conditions which were probably applicable over far wider areas, the deposition of the petrosilex beds having been apparently interrupted, as well as followed, by periods of general disturbance, in which a shattering of the strata occurred, together with numerous outflows of igneous matter and the formation of breccia-conglomerates, these outflows being repeated from time to time during the deposition of the later schistose beds, but becoming gradually less frequent as the period drew to a close.

## Synclinal.

South of Cripp's Hill the rocks, for a quarter of a mile, are chiefly grey felspathic sandstones, but near the Roman Catholic chapel beds of a somewhat different character appear, being greenish-grey slaty, felspathic and micaceous grits, together with fine, fissile, glossy slates, both dipping S.  $30^{\circ}$  E.  $< 80^{\circ}$ . These rocks resemble some of those in the upper part of Cripp's Hill, are like them, probably, a portion of Division 4, and here mark the northern margin of an overlying synclinal basin, its southern margin being marked by similar slates having a northerly dip a mile or so to the southward, while in the intermediate area are bright-purple conglomerates, together with a very coarse but schistose conglomerate, containing pebbles of petrosilex, red felsite, etc., and dipping N.  $10^{\circ}$  W.  $< 70^{\circ}$ - $90^{\circ}$ . In accordance with this structure the true petrosilex rocks come into view a little south of where the road crosses the boundary line between the parishes of Sussex and Hammond, beyond which to the Shepody Road the only rocks seen are granitoid and gneissic beds, to be hereafter alluded to in connection with the rocks of Division 4.

To the eastward of Cedar-camp Creek the belt of petrosilex rocks,



bending to the north-east, becomes greatly reduced in breadth, gradually passing beneath the Lower Carboniferous sediments which bound it upon the north. In the same direction the petrosilex appears to be largely replaced by diorite and syenite, which in Donegal Settlement Donegal. may be seen intimately associated with it, but further east, in the Mechanics' Settlement, occurs to its almost entire exclusion. Mechanics' Settlement. The diorites and syenites are much more crystalline here than the resembling rocks to the westward, and are probably connected with those which, to the south and east, cover large areas on the Pollet River and elsewhere in Albert county.

To the east of the Mechanics' Settlement, no rocks belonging to Division 3 have been observed.

*Division 3.—Micaceous and Chloritic or Schistose Group.*

The general character of the rocks of this division have already been Characters. given in the preliminary synopsis, as well as incidentally alluded to in connection with the strata of Division 3. From what has been stated, it will further appear that the two groups are intimately associated, and that the passage from one to the other is a gradual one. Between the two, as a whole, however, the contrast is very marked, the transition being chiefly seen in those volcanic and quasi-igneous deposits Contrast of Divisions 3 and 4. which are especially abundant along their line of junction, but which, to a greater or less extent, are characteristic of both. While in the second division, already considered, the rocks are rarely schistose, and often, through great thicknesses, very uniform and almost entirely destitute of stratification, as though largely of sub-aerial origin, those of the third division are much more clearly the result of ordinary aqueous deposition, being very distinctly stratified, and, in addition to large quantities of felspathic and chloritic schists, embrace numerous beds of true conglomerate, some of which contain pebbles derived from the underlying series. Petrosilex and felsites occur in both, but while in Division 3 these are usually in enormous masses, and very generally more or less brecciated, those of Division 4 are in comparatively thin beds alternating with schists and conglomerates, and not brecciated. The latter are usually also of lighter colors. But perhaps the most noticeable feature in the group, as a whole, is the possession by the latter, in nearly all its members, of a peculiar glossy or unctuous character, which is in part due to the frequent dissemination of chlorite, but chiefly to the abundance of a pale-yellowish (sometimes purplish) mineral resembling talc, but which, according to analyses by Dr. Hunt, is in reality a hydrous mica. In this as in other features, the group bears much resemblance to the so-called "altered

Indications of  
unconformability.

Quebec group" of the eastern townships of Canada. Like the rocks of the inferior division, those of Division 4 are very variously inclined, but along the line of contact between the two there is often a very marked, and sometimes an abrupt, diminution in the dip in passing from the lower to the higher beds, which, together with the abundance of amygdaloids at this horizon and the occurrence of coarse conglomerates (in part made up of pebbles from Division 3), seem to point to their partial unconformability. It is on or near this line of separation that the syenites to which reference has been made are chiefly met with, as well as gneissic and granitoid rocks, which are probably, in part at least, only a more altered form of the schistose series.

By far the most complete and instructive views to be had of the group under consideration are those afforded respectively by Handford Brook, a tributary of Hammond River, and by the line of the St. Martins & Upham railway near Henry's Lake—the one on the northern and the other on the southern side of the more southerly Huronian belt of St. John and Kings county.

Handford  
Brook.

The exposures on Handford Brook are mainly between the point of junction of its two principal branches on the one hand, and Upham's (now McAfee's) mill on the other. Owing to the broken and sinuous character of the stream, as well as from the irregularities of the rocks themselves, no exact section of the latter was found to be practicable, but the general order of succession, from south to north, is nearly as follows:—

Section on  
Handford  
Brook.

Grey felspathic and sandy rocks, containing numerous small slaty pebbles, dipping northward at low angles and followed by purplish-red and red claystones, into which the sandstones graduate both in color and texture. These rocks occur at and below the driving-dam where the south branch of Handford Brook is crossed by the road leading to Mount Theobald, and, with some grey amygdaloid and toadstone, occupy this branch to its junction with the main stream, a distance of about a furlong. The latter, for half a-mile, then runs nearly on the strike of the beds, which here consist partly of dark-purplish conglomerates and slates (the former containing specular iron.) and partly of purplish-brown striped and well-stratified felsites, which are more or less petrosiliceous, and sometimes pass into or include a true dark-grey petrosilex. The dip in this distance changes from N. 80° W. < 90° to N. 60° W. < 40°. Below the bend in the stream, where the latter begins to flow northward, the succession is as follows:—

Pale-grey and pink felsites and slaty felspathic rocks, often rusty-weathering. These are in part a repetition of the beds above described near the driving-dam on the South Branch, and, like the latter, have but little inclination, forming a series of low and open folds. Both are apparently unconformable to the petrosilex rocks, over which they lie in a series of more or less isolated basins, but with a general northerly

dip. They also include beds of conglomerate, in which are enclosed numerous pebbles of petrosilex, and are probably of the same horizon as the beds of similar composition on Cripp's Hill, in Filamaro Settlement, and elsewhere. Like the latter, they are associated with and followed by—

Fine-grained dioritic or ash-rocks, of grey, green and purple colors, containing much chlorite or epidote, and often very amygdaloidal, the amygdules being of calcite and milky quartz, with chlorite and epidote. They are in part an ash-conglomerate, like those of Golden Grove, and, as these, include numerous beds of ordinary conglomerate, of green, red and purple colors, together with some green chloritic and epidotic slates. The dip of the beds is very generally northward at moderate angles, varying usually from N. 40° W. to N. 60° W. < 60°, but at some points N. to N. 10° E. < 60°. In approaching McAfee's mill the dip becomes more westerly (N. 60° W. < 60°), and the amygdaloids and associated beds are followed by—

Coarse purple quartz conglomerates, dipping N. 20° W < 20°. These latter mark the base of the Primordial series, of which fossiliferous shales are found, as heretofore noticed, at McAfee's mill.

The section on the St. Martin's and Upham railway, at Henry's Lake, is closely parallel with that of Handford Brook, but exhibits still more clearly the character and relations of Divisions 3 and 4. Just north of the lake referred to, the older rocks are mostly concealed from view by heavy deposits of Lower Carboniferous conglomerate (which here occur far above their usual elevation, and have a low northward dip,) but on passing its western side there appear from beneath the latter, beds of a more crystalline character than are usually met with in this region, viz., dark grey syenite rocks, containing labradorite, associated with a coarsely crystalline, but much softer, friable rock, containing red felspar, mingled with soft acicular crystals. These are near the forks of the road at A. McCurdy's. From this point to the southern extremity of the lake there are no exposures, but just north of the saw-mill at the head of the lake similar rocks are again met with, and for a distance of nearly two miles are finely exhibited in the railway excavations. The succession in ascending order is as follows :

	FEET.	Section south of Henry's Lake.
Div. 3.—Dark grey flinty petrosilex. Dip S. 30° E. 90°.		
Div. 4.—Purple and green slaty conglomerates, with fragments of green and purple slate, pale grey felsite and red jasper. Dip. S. 45° W. < 30°. Interstratified with these rocks and graduating into them are petrosilicious and felsite beds, in part flinty and homogeneous, and in part a coarse conglomerate, full of petrosilex fragments, both greatly shattered and brecciated; also fine-grained sandy and dioritic rocks, containing much epidote. The surface breadth of the whole is about .....	2500	
Fine fissile dark green chlorite schists .....	50	

	FEET.
Very coarse amygdaloid, of grey, green, red and purple colors, the amygdules mostly of white quartz, with chlorite and epidote. These rocks are distinctly bedded with dip varying from S. 20° W. < 40° to S. 30° E. < 60°, and have a surface breadth of.....	3000
Measures concealed .....	775
Purple grits.....	225
Greenish sandstone or chloritic grit, overlying fine-grained sandy or slaty rocks, much seamed and broken, and having the flaws and crevices covered with chlorite and epidote. Dip in part E. 30° S. < 50°.	
Dark green, highly chloritic and epidotic, fine-grained rocks, with purple conglomerates, slates and fine sandstones, more or less talcoid; also including two considerable masses of felsite, the more northerly pale-red or flesh-colored, the second and smaller pale-purple, while both are pyritous and rusty-weathering. The dip in some parts is northerly, but usually to the south, and the total breadth about.....	3400

The succession exhibited in the above section applies, as regards its general features, to the whole belt of shistose rocks skirting the petrosilex band along its southern margin. The passage between the two divisions, as before observed, is very generally marked by a decided and often abrupt decrease in the dip, as well as by the occurrence of coarse diorites and breccia-conglomerates, and by thick beds of amygdaloid. This dip, though subject to much local irregularity, is also in both, as a whole, to the south, and the super-position of the shistose beds upon the petrosilex distinct and well-defined. At the same time there are some variations in the extent and special features of the beds at different points, a few of which may be noticed.

Upper  
Quaco road.

To the west of the Henry's Lake line of section the best exposures are those afforded by what are known as the Upper and Lower Quaco roads. On the upper and most easterly of these two thoroughfares the most noticeable feature is the abundance of a pale or white, very rusty-weathering, felspathic quartzite, or flinty felsite. It occupies about the same position as that of the felsite beds south of Henry's Lake, but is far more voluminous, having an apparent breadth of over 1,000 yards, with a southerly dip, which in some parts is as high as 85°. Similar but more sandy beds have already been noticed as occurring in Golden Grove and Barnesville. As at Henry's Lake, they lie to the southward of a considerable body of dioritic, epidotic and amygdaloidal rocks of grey, green and purple colors, which, with bright green, purple and grey sandstones, purple porphyritic felsite and bluish-grey petrosilex-conglomerate, occur between them and the main body of petrosilex to the north. To the south, near the head

of Quigley Brook, they are covered by Lower Carboniferous conglomerates.

The Lower Quaco road crosses the schistose belt obliquely. Here the dioritic and amygdaloidal rocks are less conspicuous, and in their place there is a much greater development of the true schists, with the associated sandstones and schistose conglomerates. These may be seen almost all the way from the crossing of Stony Brook to Donnelly's Inn, near which, as well as in the Hibernia Settlement, just to the east, they may be seen resting against the petrosilex ridges with the same marked decrease of dip already noticed. Along the Quaco road the inclination rarely exceeds  $60^\circ$ , and is often as low as  $30^\circ$ , generally S.  $10^\circ$ - $20^\circ$  E.  $< 60^\circ$ , the beds consisting of pale yellowish-green and purple talco-felspathic or hydro mica schists and green chloritic schists, with grey, flesh-colored and purple slaty felsites in repeated alternations. Many of the schistose beds are quartzose or gritty, though still retaining their glossy or unctuous aspect, and not unfrequently include beds of purple conglomerate and sandstone possessing the same feature. The breadth of the entire belt at this point, measured across the strike, is about two and a-half miles, but as there are undoubtedly faults repeating the measures, the actual thickness of the latter is only a matter of conjecture.

Another very complete view of the rocks of this series is to be seen on the Black River road, south of Bloomsbury Mountain, except that they are here obscured by association with Devonian rocks. The following section on the latter is in direct continuation of that given on page 10 DD, and will serve to exhibit the relations of these two groups:

	FEET.	
Grey slaty felsites at beginning, overlying dioritic and amygdaloidal ash-rocks. Space mostly concealed.....	575	Section south of Bloomsbury Mountain.
Pale yellowish-green felspathic schists, varying to grey and purple. Dip S. $15^\circ$ E. $< 50^\circ$ .....	250	
Measures concealed, except a ledge at end, of pale pink unctuous slaty felsite or felspathic schist .....	1300	
Grey porphyritic felspathic schist, occurring at intervals as far as the bridge over the east branch of Black River, where occur similar schists, together with pale grey, unctuous and rusty-weathering slates, conspicuously porphyritic with pale angular felspathic blotches. Dip S. $40^\circ$ E. $< 60^\circ$ .....	325	
Measures concealed.....	1870	
Bright purple slates and slaty sandstones, dipping S. $20^\circ$ E. $< 90^\circ$ and exposed at several points within a space of .....	1720	
Coarse purple conglomerate with beds of grey grit. The pebbles in this conglomerate are of red slate and sandstone, green diorite, purple amygdaloid, purple porphyry, white quartz and granitoid rock,—all evidently derived from beds of Division 4, and indicat-		

	FEET.
ing that these conglomerates (which dip S. 30° E. < 60°) are of Devonian age. Their breadth across the strike is .....	525
Coarse grey shales and purple sandstones. Devonian?.....	180
Measures concealed .....	300
Bright-purple slate .....	50
Talco-felspathic schists, with bright-green slaty beds. Dip S. 20° E. < 75° .....	40
Bright-green diorite, followed by greenish and purplish hydro-mica schists and glossy grits. Dip S. 10° E. < 50°.....	320
Bright purple-red, fine conglomerate, with white kaolinized specks. Dip N. 10° E. < 30°.....	180
Green dioritic and schistose beds .....	125
Purple schist. Dip S. 30° E. < 40°.....	50
Measures concealed .....	220
Grey sandstones, containing irregular beds of impure grey limestone, both stained with green carbonate of copper. Dip varying from N. 20° W. < 50° to N. 30° E. < 10°. (Devonian?).....	75
Schistose and ferruginous greenish-grey granitoid rock. Dip S. E. < 30°.....	140
Measures concealed .....	370
Greenish-grey and rusty schistose beds. Dip S. 50° E. < 40°.....	220
Measures concealed to junction of Mountain road with that leading west, to mouth of Black River .....	870

Devonian  
rocks.

The association of Devonian with Huronian strata, indicated in the above section, is still more marked on the main stream of Black River and in the region to the westward, the newer formation being here represented, in addition to other beds, by the grey "Dadoxylon" sandstone, which at St. John and elsewhere forms one of its most characteristic members. It is remarkable that through much of this region (from Black River westward to Mispeck) these two formations should accord almost exactly both in strike and dip, the Devonian being included among the Huronian rocks and both dipping southward at high angles; but, in addition to the fact that the conglomerates of the former are largely made up of the *débris* of the latter, there are points in which this concordance is clearly wanting. The most remarkable of these is on Black River, about half a mile from the bridge at its mouth, and near its point of confluence with the East Branch. At and above the bridge, for about a furlong, the rocks are bright purple highly micaceous beds, in part slaty, but mostly coarse grits, passing into conglomerates, with pebbles of white quartz, quartzite, red slate, etc., with large quartz veins, and varying in dip from S. E. < 70° to S. 15° E. < 40°. In approaching the mouth of East Branch the Dadoxylon sandstone is seen to rise from beneath these last named beds, with a dip S. 20° E. < 75°-80°. This, however, soon declines to S. E. < 40°, and gradually bends around to S. 20° W. < 20°, being

Black River.

East Branch.

followed closely by grey glossy slates having the normal dip (S.  $20^{\circ}$  E.  $< 40^{\circ}$ ) as well as the aspect of the Huronian rocks, while still higher up the stream are other shistose beds of grey and greenish colors, many of which are porphyritic with paler felspathic blotches, as already noticed in the case of those seen where the East Branch crosses the Mountain road. To the south of the Black River bridge, between the latter and the mouth of the stream, some of the rocks have the aspect of Devonian sediments, but the bulk of the beds are those of Division 4, being greenish, granitoid and micaceous schists, having a general dip S.  $50^{\circ}$  E.  $< 60^{\circ}$ , but much broken, and having irregular veins of mixed quartz and chlorite. West of the mouth of Black River the same granitoid and schistose beds, together with glossy grey and purple slates, grey sandstones and conglomerates, form the hills overlooking the shore at West Beach, between Beveridge's and Thompson's Coves, and are the beds described in the Report of Progress for 1870-71 as containing large beds of iron ore. These are conformably interstratified with the shistose beds, attain at some points a thickness of twenty feet, and occur at intervals as far as the mouth of Black River.

We may now return to the region east of the line of the St. Martins railway. On the main road leading from Upham to Quaco, south of Wood Lake, there are good exposures of ash-rocks and amygdaloids similar to those of the section near Henry's Lake, and with the same diversity of dips, while the schistose beds are concealed by overlying Carboniferous sediments (Millstone-grit). The schistone rocks, however, appear a few miles to the eastward, along the course of Vaughan's and Macomber's brooks. They here include several thick masses of felsite of various colors, from pale purplish red-and-pink to dark grey, and sometimes ribbanded, together with bright purple and red slate-conglomerates, purple grits and sandstones; they appear to form a series of folds, the dip being in some parts northerly and in others southerly, but with great irregularity. The observations during the past two seasons have not extended eastward beyond this point. From the general range, however, of the series as a whole, together with the course of the beds on Vaughan's Creek, it seems probable that the latter are directly connected with the somewhat similar beds described in earlier reports as occurring along the valley of Little Salmon River, and beyond in Albert county. It is to the north of the last-named valley and along the course of the Shepody road that the granitoid and gneissic rocks, described on a former page as here flanking the petrosilex belt, are met with. Among the beds there are many which bear much resemblance to those of Division 4, as before described, while others are more highly crystalline; but whether actually a portion of that division here greatly altered by syenitic

intrusion, or, on the other hand, a portion of an older formation coming to the surface, the writer had not the opportunities of determining. They may be seen along the Shepody road at many points between the head of Salmon River and the Albert County line, as also further north in the vicinity of Pollet Lake and the Mechanics' Settlement. Here ledges of grey gneissic rock, of talcoid or protogene aspect, and having bright felspar, may be seen alternating with beds of grey glossy or unctuous slates and greenish-grey hydro-mica schists, both dipping northerly (N.  $30^{\circ}$ - $35^{\circ}$  W.  $< 60^{\circ}$ ), while on the shores of Pollet Lake are numerous ledges of red syenite, the beginning of a large area of such rock extending southerly and eastwardly into Albert county. To the north of the Mechanics' Settlement, schistose rocks, in the form of grey unctuous slates, were observed on the Penobsquis road overlying diorite and dark grey petrosilex. They dip northerly, as does the petrosilex, and include the beds described in previous reports as containing beds of Albertite.

In the more northerly band of Huronian sediments described as extending from the vicinity of St. John to Barnesville, there are comparatively few rocks which can be distinctively referred to Division 4. They are not, however, wholly wanting, and, where found, hold the same relations to the associated rocks as in the region last described.

Among the localities to which the above remarks apply, one of the most noticeable is that of Carleton, just west of St. John Harbor, where the following section has been made. It is apparently an ascending one, but in reality, owing to an inversion of the beds, descending:—

Section in  
Carleton.

	FEET.
Grey Primordial slates, exposed along the course of Duke Street, with dip S. $40^{\circ}$ E. $< 60^{\circ}$ .....	75
Hollow filled with clay, with small ledge at end, of grey micaceous sandstone (Primordial) .....	400
Measures concealed .....	75
Grey sandy slate. Dip S. $10^{\circ}$ E. $< 70^{\circ}$ . (Primordial) .....	125
Purple sandy slate, dip S. $10^{\circ}$ E. $< 70^{\circ}$ (Primordial), and grey sandy slate, spotted with films of mica .....	160
Measures concealed .....	115
Purple (very ochreous) and micaceous, hard grey sandstone and sandy slate. Dip S. $20^{\circ}$ W. $< 70^{\circ}$ .....	50
Bright purple sandy slate .....	25
Massive greenish-grey, fine-grained diorites, more or less chloritic and amygdaloidal, with veins and amygdules of white quartz. (Division 3 or 4) .....	500
Measures concealed .....	160
Grey felspathic slates, about twenty feet in thickness, directly overlaid (with dip S. $10^{\circ}$ E. $< 60^{\circ}$ .) by massive greenish-grey diorites and ash-rocks .....	50
Measures concealed, to crossing of St. James' street .....	375



From St. James' street to the railway crossing near the bay shore, a distance of about 1,260 feet, there are no rock exposures along the line of the section, but a little to the eastward, at and about what is known as Blue Rock, are beds which, if extended, would fall into this space. They are greenish-grey, chlorito-felspathic schists, full of ochreous seams and blotches; grey and purple slates and dolomites with seams of calcite, and massive, imperfectly slaty and very chloritic dark green rocks containing much epidote, together with dykes of diorite and irregular lenticular bands, six to eight inches in width, of dense petrosilex. It is the same series which, extending westwardly through Manawagonish Island, reappears on the bay shore in the peninsula of Pisarinco.

The above exposures in Carleton lie to the south of the Primordial belt, and, with their continuation across St. John Harbor and Courtney Bay, are, as described in previous reports, overturned upon the latter. On the north side of the same belt the schistose rocks of Division 4 are very inconspicuous near St. John (forming a narrow band extending eastward from the Suspension Bridge through Reed's Hill), but become somewhat more prominent further east. On the road to Lily Lake Lily Lake they consist of pale greenish and purplish-grey felspathic rocks, obscurely stratified, and interwoven with grey limestones of Division 2, and purple sandy slates marking the base of the Primordial, both dipping southerly (S.  $60^{\circ}$  E.  $< 50^{\circ}$ ). Near the Coldbrook Coldbrook Iron Works there are heavy beds of coarse grey and purple slate-conglomerate, some of which evidently belong to the Primordial series, while others probably appertain to Division 4 of the pre-Silurian rocks. These latter, which are more or less chloritic, cross the Westmorland road about half a mile east of the nail factory and reappear on the old road from Coldbrook to Loch Lomond, Old Loch Lomond road. where they are associated with pale grey glossy and pyritous felsites, elsewhere common in Division 4, and dip S.  $10^{\circ}$  E.  $< 40^{\circ}$ . Farther south, and on the same road, are purple and grey ochreous felspathic quartzites (also dipping southerly), bright-purple slates with white talcoid blotches, and pale grey alternating with bright-purple slates, some of which contain small pebbles of grey, ferruginous ash-rocks. From the want of exposures the relations of the different groups in this region cannot be clearly made out, but it would appear that in approaching the petrosilex belt which forms the prominence of Ben Lomond, the rocks of Division 4 bifurcate, or form two belts, of which the more northerly extends up the valley of the Coldbrook Stream to Quinn's Lake Quinn's Lake (where they consist of schistose felspathic beds of grey, green and purple colors, with purple slates, grits and conglomerates, dipping S.  $20^{\circ}$ - $40^{\circ}$  E.  $< 60^{\circ}$ - $80^{\circ}$ ), and the more southerly in the

direction of Loch Lomond. The latter is of special interest from the evident unconformability between it and the Primordial belt, the rocks of which, to the south of Coldbrook and near the lakes of the Water Company, bend around a ridge composed of purplish petrosilicious rocks of Division 4, and are again found in isolated patches covering the latter near the western end of Loch Lomond.

The occurrence of schistose rocks and conglomerates resembling those of Division 4 in Golden Grove and Willow Grove settlements, has been already alluded to on an earlier page.

Pre-Silurian  
rocks of Kings

In connection with the revision of the pre-Silurian rocks of St. John and King's counties, of which the results have now been given, an opportunity has been embraced during the past summer to make a partial re-examination also of the sediments underlying or connected with the more northerly belt of Primordial slates, described in former reports as occupying portions of the Long Reach of the St. John River in King's county. The result of this examination was to show not only a larger development of the Primordial in the valley referred to, but to exhibit a marked parallelism between the inferior beds and those occupying a similar position nearer the coast.

The following section, measured nearly across the strike, from near the mouth of Jones's Creek to the shore of the St. John River, near Caton's Island, will serve to illustrate this point. The section is an ascending one:—

		FEET.	
Section Carleton	Section west of Jones' Creek.	Grey slates, with Upper Silurian fossils, and including beds of dark grey crystalline diorite. Dip S. $< 60^{\circ}$ – $80^{\circ}$ .	
		Division 2.	
		{ Red crystalline felsite, covered on southern side by grey light-weathering felspathic sandstone. Dip S. $< 70^{\circ}$ .....	100
		{ Measures concealed, with ledges of diorite at end.....	500
		{ Grey felspathic sandstone and diorite.....	125
		{ Measures concealed, with ledges at end, of grey, white-weathering, very felspathic sandstone, approaching felsite. Dip S. $< 80^{\circ}$ .....	830
		{ The same, with grey felspathic conglomerate.....	250
		{ Grey felspathic sandstone.....	770
		{ Measures concealed, with ledges of grey sandstone at end.....	875
		{ Measures concealed.....	450
		{ Grey felspathic sandstone.....	270
		{ Measures concealed.....	125
		{ Coarse grey diorite.....	75
		{ Measures concealed.....	400
		{ Grey rubbly felsite.....	50
		{ Grey amygdaloidal sandstone, or ash-rock, and dark purplish-grey amygdaloid. Dip S. $< 40^{\circ}$ .....	600

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lakes of the Water  
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Grove settlements,

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	FEET.
beds of dark	
by grey light-	
0.....	100
.....	500
.....	125
white-weather-	
felsite. Dip	
.....	830
.....	250
.....	770
at end.....	875
.....	450
.....	270
.....	125
.....	75
.....	400
.....	50
dark purplish-	
.....	600

	FEET.		
Division 4.	}	Measures mostly concealed, but including ledges of pale red talco-felspathic gneiss.....	400
		Space, with ledge at end, of red granulite....	250
		Purple, red and flesh-colored granulite or quartz-porphyry, composed of much felspar, small grains of quartz, and a pale green mineral, well stratified and dipping N. 10° W. < 80°.	
		These rocks form the greater part of a high ridge overlooking the river having an elevation of nearly 400 feet and a surface breadth of about.....	660
Primordial.	}	On the southern face of this hill the granulite last referred to is overlaid by very coarse purple-red conglomerates, containing large rounded pebbles of purple-red granulite in a reddish clay-stone base, and dipping N. 10° W. < 80°. They are believed to form the base of the Primordial series, and have an exposed breadth of .....	150

The Primordial rocks which succeed to the above and which form the shore of the St. John River near Caton's Island, are described beyond.

To the westward of the above line of section the rocks, with the exception of those constituting the continuation of the granulite ridge and the Primordial beds (purple sandstones and diorites) which overlie the latter, are mostly concealed from view. The granulite ridge is, however, traceable along the entire northern side of the Long Reach Valley, passing in the rear of the Devil's Back, near which its continuity is broken by a lateral dislocation, crossing the mouth of the Nerepis River not far from Nerepis Station. In addition to the granulites a few other rock exposures are to be seen at different points in the valley between the latter and the granite range to the northward, a portion of which are grey slates and sandstones containing Upper Silurian fossils, while others, by their highly crystalline character and general aspect, recall the rocks of the Huronian and Laurentian systems. These latter are most clearly exhibited towards the western extremity of the district, along the roads leading north from the lower part of the Reach, and especially about Long Lake and the stream leading thence to Elliott's mill on the Nerepis River. Along the stream in question the beds consist chiefly of a highly crystalline and granitoid or syenitic rock containing much chlorite, with which are some beds of pale red granular felsite, but further north there are with these, chloritic and felspathic schists, dipping northerly, and holding (at Belyea's) veins of white quartz stained with carbonate of copper. They are probably in part a continuation of the beds described in previous reports as exposed on the St. John and Maine railway (Western Extension), and are either of Huronian or Laurentian age.

*The Primordial or St. John Group.*

The general character and distribution of the rocks of this group, more particularly as exhibited near the city of St. John, have already been given in earlier reports. The observations made thereon during the two past summers have been partly to give completeness and accuracy to what was previously known, but chiefly to determine the relations of the Primordial to the associated strata, as already in part described in preceding pages.

Earlier  
Reports.

In the Report of Progress for 1870-71, the only rocks described as directly belonging to the St. John or Acadian group are the dark-colored sandstones and slates which make up its principal bulk, and from the lower beds of which, resting upon a white sandstone or quartzite, the fossils by which its age was determined were derived. A series of red and green argillites, sandstones and conglomerates, described under the name of the "Upper Coldbrook" group, was spoken of as forming an unfossiliferous portion of the same group, as were also certain beds of grey felspathic sandstone, with chloritic schist and breccia-conglomerate, at first described as No. 6 of the Coldbrook-Huronian group. There can be little doubt that these latter beds, which have been described in preceding pages, are really a portion of Division 4 of the pre-Silurian rocks, and that the real base of the St. John group is to be found in the red and purple sediments which succeed. Adopting this view, the unconformability of the two groups is marked and general.

Section  
Carlett

Unconformability of  
Primordial to  
Huronian.

Coldbrook.

Old Loch  
Lomond road.

Water Co.  
Lakes.

Loch Lomond.

In tracing the Primordial belt eastward from the city of St. John, the first point at which the unconformability referred to may be seen is in the district lying between the Coldbrook stream and the high-road to Loch Lomond. At the Coldbrook nail factory the dark grey shales holding trilobites, etc., may be seen resting as usual against beds of pale grey or white sandstone, and this in turn upon bright red and purple slates and conglomerates. While, however, the bulk of the latter beds have a dip S. 10° E. < 60-80°, and with a corresponding trend, may be traced eastward to the Old Loch Lomond road, the quartzites and connected beds show a tendency to sweep around to the southward, becoming at the same time broken and faulted. The cause of this change is probably to be found in the occurrence, just south of this point, of an area of Huronian rocks, over or around which the Primordial beds would appear to fold, for on crossing in the direction of the lakes of the Water Company, the white quartzites are again met with, now with a southerly dip (S. < 60°) just south of the ridge of these older rocks. In approaching Loch Lomond, similar discordances between the two groups may be seen, the Primordial beds at some

points resting upon the rocks of Division 4, and at others upon those of Division 3, besides being broken by numerous faults. Near the western extremity of the First Lake, the characteristic white quartzite below the fossiliferous beds may be seen dipping N.  $< 60^\circ$  towards, and only a few miles distant from, the dark grey petrosilex of the Ben Lomond range, and again a little to the westward similar quartzites, with grey sandy and micaceous shales, may be seen overlying purple sandstones and conglomerates with a similar, but much higher, northerly dip (N.  $10^\circ$  W.  $< 75^\circ$ - $80^\circ$ ). Near Allandale, however, on the Loch Lomond highway, coarse purple conglomerates (containing white quartz pebbles) which belong to this series and which are overlaid by dark grey slates, have a southward dip of  $45^\circ$ ; and again, on the Old Loch Lomond road, a similar southward dip of  $60^\circ$ . It would appear as if the Primordial beds were irregularly spread over ridges or among the hollows of the Huronian series, there having intervened both movements and erosion, though from the extent to which the country is here covered with drift the details of their relations cannot satisfactorily be made out.

Allandale.

The facts connected with the distribution and characters of the Primordial rocks south of the First Loch Lomond Lake have already been given in an earlier report, as also lists of the fossils found at Ratcliffe's mill-stream, three miles south of the head of the lake, by which their age was first determined. The beds below the fossiliferous strata at the latter point are as follow:—

Coarse grey shale and hard grey sandstone, nearly vertical.

Fine purple sandstones and grey sandy shales. Dip S.  $30^\circ$  E.  $< 90^\circ$ .

Fine sandstones, banded or ribbanded with grey and purple.

Fine olive-grey shale. Dip S.  $30^\circ$  E.  $< 90^\circ$ , declining to  $70^\circ$ .

Purplish-red sandy slate. S.  $20^\circ$  E.  $< 30^\circ$ .

Purplish conglomerate, with pebbles of quartzite, felsite, red jasper, etc.; the dip declining from  $10^\circ$  to  $0^\circ$ , and subsequently becoming N.  $70^\circ$  W.  $< 10^\circ$ . From this point the dip of the beds becomes exceedingly irregular, varying within ten feet from S.  $50^\circ$  E.  $< 40^\circ$  to S.  $10^\circ$  W.  $< 90^\circ$ , and forming a series of folds, in some of which the conglomerates or sandstones, in others the olive-grey shales, come into view. The beds are also much faulted. About half a mile above, the fossil-bearing beds may be seen to rest upon the syenites before described as extending thence across the Quaco road towards Negro Lake.

Section on  
Ratcliffe's mill-  
stream.

In tracing the Primordial belt to the eastward of Loch Lomond it soon shows a tendency to bifurcate, one branch, the northern, extending as far as the head of the Third Lake in the direction of Barnesville, while the main band trends more to the southward, sweeping around a high ridge of Huronian rock, and from the head of Ratcliffe's mill-stream extending eastward to the valley of Germain Brook. Along

Third Loch  
Lomond.

Fossils.

the highway south of the Third Lake the grey sandy shales of the series may be seen at several points with a dip which is at first N. 25° W. < 30°, but which gradually changes to N. 20° W. < 70°, N. < 80° and N. 10° E. < 50°. Along the course of a small brook at the head of the lake the beds are fossiliferous, and fossils (similar to those of Ratcliffe's mill-stream) may also be found a mile or so to the southward, on the farm of R. Stackhouse. The inferior coarse beds of the series, consisting of purplish-red conglomerates, full of white quartz pebbles, are finely exposed along the course of the post-road to Barnesville, where they dip S. < 30°, and are associated (as at Ratcliffe's) with very fine grey sandstones, banded with purple. The last beds visible in this direction are not far from the head of the Third Lake, but from their course at this point and the occurrence further eastward of numerous large blocks of purple sandstone, it is conjectured that a spur of Primordial rocks may at one time have extended through the valley of South Stream to its junction with Hammond River. The soft grey shales overlying the ferruginous sandstones and purple conglomerates at the mill in Barnesville may possibly be of this series.

Hardingville.

Seetic  
Carlet

Porter's Brook.

Handford  
Brook.

Fossils.

Between the head of Ratcliffe's millstream and Germain Brook there are but few exposures of the Primordial rocks, the valley which they occupy being mostly filled with drift as well as reduced in breadth by the approximation of the bordering Huronian belts and the occurrence of an extensive outlier of Lower Carboniferous sediments. They may, however, be seen in Hardingville and at many other points along the valley of Germain Brook nearly to Hammond River, consisting as usual of grey and dark grey (often pyritous) sandy shales and flags, exhibiting numerous and often abrupt corrugations, but having a general northerly dip, which decreases as the main stream of Hammond River is approached. In the valley of Porter's (or Harding's) Brook the lower beds of the series are well-exposed, and may be traced thence in a nearly north-east course across the valley of Handford Brook towards the settlement of Upperton. Both at Porter's and at McAfee's (or Upham's) mill the facilities for the collection of fossils are all that could be desired, but as the beds are here much softer and more fragile than at Ratcliffe's and other points to the westward, the obtaining of good specimens is more difficult. The beds at Porter's are especially remarkable for the abundance of minute trilobites *Agnosti*. Among the specimens collected from this locality during the past season, the following genera and species have been recognised by Mr. Whiteaves:

*Agnostus similis*. Hartt." *Acadicus*. "" *N. Sp.* (?)

A.

sandy shales of the  
 which is at first N. 25°  
 W. < 70°, N. < 80°  
 all brook at the head  
 (similar to those of  
 also to the southward,  
 the beds of the series,  
 white quartz pebbles,  
 road to Barnesville,  
 Ratcliffe's) with very  
 best beds visible in this  
 Lake, but from their  
 eastward of numerous  
 proved that a spur of  
 through the valley of  
 River. The soft grey  
 purple conglomerates  
 series.

Germain Brook there  
 the valley which they  
 reduced in breadth by  
 its and the occurrence  
 sediments. They may,  
 other points along the  
 River, consisting as  
 sandy shales and flags,  
 gations, but having a  
 main stream of Ham-  
 Porter's (or Harding's)  
 bed, and may be traced  
 the valley of Handford  
 both at Porter's and at  
 the collection of fossils  
 here much softer and  
 rests to the westward, the

The beds at Porter's  
 of minute trilobites  
 this locality during the  
 have been recognised by

*Hyalolithus*. N. Sp.

*Conocephalites orestes*. Hartt.

" *Halli* "

*Paradoxides Micmac*.

And from McAfee's Handford Brook :

*Agnostus Acadicus*. Hartt.

*Conocephalites Mathewi*. Hartt.

*Microdiscus punctatus*. Salter.

*Discina Acadica*. Hartt.

*Orthis Billingsii*. Hartt.

Beneath the fossil beds upon the two streams above-mentioned, the coarser fragmental beds which mark the base of the series are also well-exposed. Their unconformability to the Huronian is well seen in the fact that while on the post-roads meeting at McCoy's Corner they have a surface breadth of over a mile and a-half, with a nearly uniform dip of N. 30° W. < 20°, on Handford Brook, only half a mile distant, the same space is occupied almost entirely by Huronian sediments, and these with numerous corrugations. The succession as seen above McAfee's mill on the last-named stream is as follows, in descending order:—

	FEET.	Section on Handford Brook.
Fine soft and fragile shales, filled with fossils and containing bands of harder grey shale. Thickness about . . . . .	30	
Hard grey shales and sandstones, dip N. 10° W. < 40° . . . . .	150	
Pure white quartzite or silicious sandstone. The dip of the beds, in the extension of which, a little to the eastward, a quarry has been opened, varies from N. 10° W. < E. 30° to N. 20° E. Their breadth is about . . . . .	250	
Below these quartzites there is a space of about 1,100 feet occupied by the mill-pond, in which the measures are concealed. Grey sandstones then appear, with a dip N. 30° W. < 30°, beneath which are—		
Sandy and micaceous shales, in narrow alternating bands of grey, green and purple ;		
Purple sandstones, with scales of mica ;		
Purple grits and sandstones ; and		
Coarse purple and quartz conglomerates, with thin beds of white conglomerate.		

The general dip of these purple beds is N. 30° W. < 30°, varying to N. < 60°, but owing to the windings of the stream, which often runs with the strike, their thickness is uncertain. The conglomerates at their base, which are full of white quartz pebbles, rest, apparently unconformably, upon amygdaloidal diorites already described as being a part of the Huronian formation.

Eastward of McAfee's mill the Primordial rocks are mostly concealed from view. Lodges of purple sandstone may, however, be seen a little

## Hammond River.

south of the bridge across the Hammond River in Upperton, beyond which the entire formation passes beneath the Lower Carboniferous series, and is not again met with in this direction.

In addition to the main belt of Primordial rocks above described, reference has been made, both on an earlier page and in former reports, to the occurrence of beds of this age in the valley of Black River in St. John County, as also upon the St. John River in the valley of the Long Reach. At both of these points their relations to the Huronian are in the main similar to what has been above described.

## Black River.

The exposures in the Black River Valley are extremely limited, being confined to a few ledges of dark grey fossil-bearing shales occurring about midway between Willow Grove and Garnett Settlement. Their exposed breadth does not exceed 150 feet, and they are apparently overturned, being at one point directly overlain by purple sandstones which come in between them and the diorites of Bloomsbury Mountain, with a southerly dip (S. 30° E. < 20°). In the opposite direction, and on the north side of the river, there are ledges of a peculiar jet-black sandstone or black slate, filled with glassy grains of quartz, but whether there are a part of the Primordial series or not is unknown. A little farther to the eastward, in Willow Grove, a series of grey shales, which are probably Primordial, overlie the pre-Silurian schistose belts of Division 4.

## Primordial Belt on Long Reach.

When the Report of 1870-71 was published, the only point at which the St. John group had been identified in the valley of the Long Reach was on Caton's Island, about two miles below Oak Point, although certain dark-colored slates exposed on the western side of the Nerepis River were believed to be a part of the same series. Observations made during the past season not only confirm this view, but show that a belt of these rocks traverses, though with some interruptions, the entire length of the Long Reach valley from its western extremity to Gorham's Bluff, near the mouth of Belleisle Bay. The position and relations of the beds on Caton's Island as well as on the adjacent shore, with lists of the fossils here met with, have been given in earlier publications. To the westward of this point the beds are chiefly coarse purple sandstones and conglomerates, and may be seen at many points along the north shore of the reach as far as the Devil's Back, associated, however, with beds of more or less crystalline diorite and greenish-grey ash-rocks, all dipping southerly at an angle of 40°. The Devil's Back itself is a somewhat prominent ridge, composed of a very homogeneous and obscurely stratified grey felspathic sandstone holding numerous chloritic specks; on the north side of the eminence these felspathic sandstones may be seen to rest directly and conformably upon the purple sandstones, both with a regular dip of S. 30° E. <

## Devil's Back.



Upperton, beyond  
lower Carboniferous

ks above described,  
age and in former  
the valley of Black  
River in the valley  
air relations to the  
above described.

extremely limited,  
fossil-bearing shales  
and Garnett Settle-  
ment 100 feet, and they are  
overlain by purple  
diorites of Blooms-  
bury (< 20°). In the  
west, there are ledges  
of glassy grains  
of Primordial series or not is  
at How Grove, a series  
of the pre-Silurian

only point at which  
of the Long Reach  
at Oak Point, although  
on the side of the Nerepis  
series. Observations  
in view, but show that  
are interruptions, the  
at the western extremity to  
the west. The position and  
on the adjacent shore,  
as given in earlier publi-  
cations are chiefly coarse  
as seen at many points  
on the Devil's Back, asso-  
ciated with crystalline diorite and  
at an angle of 40°. The  
is composed of a very  
fine-grained sandstone holding  
of the eminence these  
lie directly and conformably  
at a dip of S. 30° E. <

20°. Notwithstanding this conformity, it is probable that the mass  
in question is of Upper Silurian rather than of Primordial age, no  
rocks of similar character having been elsewhere observed in con-  
nection with the last-named series, while they very closely resemble  
many of the beds forming portions of the Upper Silurian formation  
as exhibited on the opposite shore of the river.

As far as the Devil's Back, the Primordial rocks lie altogether to the  
southward of the felspathic and granulitic rocks described on an earlier  
page as extending in this direction from near Caton's Island. After  
crossing the creek, however, which on the western side of the first-  
named eminence flows into the St. John River, the ridge of these rocks  
lies much more to the southward, and the Primordial beds are found  
on their northern flank, now dipping northerly. They are well-  
exposed on the road leading north from the steamboat landing at Jesse  
Belyea's, and contain numerous remains of trilobites and brachiopods.  
Beneath the shales, and also dipping northerly, are grey micaceous  
and rusty-weathering sandstones spangled with mica, which appear to  
rest directly on the granulitic rocks. These latter would thus appear  
to form a ridge flanked on either side by Primordial rocks, and to  
occupy the position of the pre-Silurian rocks of Division 4 in the  
southern metamorphic hills, to portions of which they also bear much  
resemblance. The same relation is also indicated at other points along  
the Reach shore, the purple sandstones (with some shales,) being found  
on either side of the granulite ridge and dipping away from it. Near  
Elliott's mill, on the Nerepis, there are coarse, dark, greenish-grey,  
white-weathering conglomerates containing pebbles of white quartz,  
grey and red sandstone, mica schist, &c., and dipping northerly  
(N. 29° E. < 60°), overlain by dark grey, sandy slates dipping  
N. 10° E. < 50°. This is just south of the great body of syenitic and  
chloritic rocks, described on an earlier page as occurring on the eastern  
side of the Nerepis River, and which are either of Huronian or  
Laurentian age.

On the western side of the Nerepis, the character and relations of  
the different rocks have already been given in the Report of Progress  
for 1871. The beds which in position and character here appear to  
represent the shaly portion of the Primordial occur in the bed of a  
ravine about one mile above Belyea's Inn, but as far as could be ascer-  
tained are without fossils, and are greatly crumpled and broken. The  
next rocks to the south of these are conglomerates in heavy beds, in  
which both pebbles and paste consist largely of granulite or purple  
felspathic grit, similar to that of the range extending along the north  
side of the Reach. These beds dip northerly, and are underlain to the  
south by purple sandstones and felspathic grits, beneath which again,

after an interval, are green and red slaty beds and unctuous felspathic schists, dipping N.  $30^{\circ}$  W.  $< 70^{\circ}$ . These latter have the appearance of the pre-Silurian rocks of Division 4.

The representatives of the Primordial series at the head of the Long Reach are to be seen in a small cove forming a part of the southern shore of Gorham's Bluff, and consist of ferruginous grey sandstones containing poorly-preserved fossils. They have a southerly dip (S.  $40^{\circ}$ - $50^{\circ}$  E.  $< 50^{\circ}$ ), and are flanked on the south by recomposed quartziferous felsites of an older series, continuous through Rocky Island with the granulites of the north shore of the Reach, and on the north by rubbly, dark-purple and sandy beds, which form the base of the Upper Silurian formation.

