GEOL. SURVEY OF CANADA

REPORT OF PROGRESS

1852-

GEOLOGICAL SURVEY

OF

CANADA.

REPORT OF PROGRESS,

FOR THE YEAR 1852-3.

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1854.

GEOLOGICAL SURVEY OF CANADA.

MONTREAL, 1*st May* 1853.

SIR,

I have the honor to transmit the accompanying Report of the progress made in the Geological Survey of the Province, for the year 1852–3, to be submitted to His Excellency the Governor General.

I have the honor to be,

Sir,

Your most obedient servant,

W. E. LOGAN,

Provincial Geologist.

To the Hon. A. N. Morin,
Provincial Secretary,
&c., &c., &c.

TO HIS EXCELLENCY

THE RIGHT HONORABLE

JAMES, EARL OF ELGIN AND KINCARDINE, K. T.,

BARON BRUCE OF KINROSS AND OF TORRY,

ONE OF HER MAJESTY'S MOST HONORABLE PRIVY COUNCIL,

Governor General of British North America,

AND

CAPTAIN-GENERAL AND GOVERNOR-IN-CHIEF

IN AND OVER

THE PROVINCES OF CANADA, NOVA SCOTIA, AND NEW BRUNSWICK, AND THE ISLAND OF PRINCE EDWARD,

AND VICE-ADMIRAL OF THE SAME.

MONTREAL, 1*st May*, 1853.

MAY IT PLEASE YOUR EXCELLENCY:

I have the honor to submit to your Excellency a Report of the progress made in the Geological Survey of the Province, during the year which has just elapsed.

The exploration of my assistant, Mr. Murray, embraced the country lying between the township of Bedford, in what used to be called the Midland District, and the river Severn connecting Lake Simcoe with Georgian Bay; the object of it being to trace out the general outcrop of the lower fossiliferous rocks, along the more mountainous metamorphic group which comes from beneath them on the north, and to ascertain the nature of the economic materials associated with both, at moderate distances from their junction. The attention of Mr. Hunt has been bestowed upon the analyses of various minerals, mineral waters, ores and other substances collected on his own exploration, as well as on the explorations of Mr. Murray and myself, and his Report upon his labors, with that of Mr. Murray, upon the results of his examination, is now transmitted to your Excellency.

The district which has been the subject of my own investigation, is that which lies on the north side of the St. Lawrence, between Montreal and Cape Tourmente below Quebec. The

distribution of the fossiliferous rocks, and the economic materials accompanying them, have been the points chiefly attended to, but short excursions to gain facts illustrating the metamorphic series immediately supporting them, were made northwards in two or three places. The want of a good map of the seigniories, on a scale sufficiently large to permit the representation of the facts necessary to ensure a clear understanding of the structure of the district, has rendered the examination exceedingly laborious. The last edition of Mr. J. Bouchette's map is on too small a scale to be perfectly available, while that of Col. Bouchette, the only published one of the whole area, of which the scale (three miles to an inch) approaches the requisite measure, is too incomplete to be of much service. In some parts the latter is tolerably correct, but in the majority it cannot be at all recommended for accuracy. In the settled parts of the country, the roads of course afford the chief means of reaching the exposures of rock, and over large areas, roads which existed at the time the map was constructed, are not represented at all, and many of those which are represented (in so far as I could collect evidence) have never existed. In addition to this, a vast number of the roads over the whole region have been opened since the publication of the map. A good map of the environs of Quebec, on the scale of two miles to an inch, was published by Mr. J. Adams in 1822; it of course, wants all the newer roads, and I was not so fortunate as to meet with a copy of it until the examination of the surface it exhibits, constituting but a small portion of the whole, had been completed. The river St. Lawrence, in the whole distance, has been correctly mapped by Captain Bayfield, on the scale of nearly an inch to a mile; but above Portneuf there are no exposures of rock at the water's edge, and Bayfield's map extends little beyond the margin. In consequence of the want of a suitable map, it became necessary to go over the whole ground on foot, and to measure every road and line of exploration travelled. The bearings of these roads and lines were determined by prismatic compass, and the distances by pacing, care being taken to note in their proper places, all exhibitions of the strata, all

economic deposits and other objects worthy of remark. The weariness resulting from the attention required to count one's paces accurately every day, and all day long, for five or six months of assiduous exploration, is best understood by those who have made the attempt. In that part of the country between Montreal and Three Rivers, I was aided by Mr. Richardson, a diligent explorer, mentioned in last year's Report; and as saving me some time, I have to express my obligation to Mr. Hale, of Ste.-Anne-de-la-Pérade, who was so kind as to supply me with a detailed and accurate map of that seigniory, as well as of a part of the seigniory of the Grondines. The map resulting from our own measurements, when protracted on a scale of one inch to a mile, brings out the distances of marked points on the river, to correspond very well in general with the same as laid down by Bayfield.

The country which lies between the upper end of the island of Montreal and Cape Tourmente on the left side of the St. Lawrence, and occupies the space intervening between the river and the flank of the metamorphic hills, to which Mr. Garneau in his History of Canada has given the name of the Laurentides, has a length of about 200 miles, and it gradually widens from a a point at Cape Tourmente, to about thirty miles at Montreal, having thus an area of about 3000 square miles. It presents a general flat surface, rising in many places by abrupt steps, (the marks of ancient sea margins) into successive terraces, some of which are from 200 to 300 feet above the level of the river, and the whole have a general parallelism with it. These terraces are occupied by clay and sand, and the latter predominating, gives them as a whole, a light soil. In some parts extensive swamps prevail on the terraces, but there is not a lake in the whole area. The rivers which cross it, (some of them large streams, of which the St. Maurice is the greatest) descending the flank of the metamorphic hills, all give a succession of falls and rapids before reaching the plain, affording a great variety of picturesque and beautiful cascades, and yielding a vast extent of water-power, capable of application to sawing timber and other manufacturing purposes. Quitting the metamorphic rocks, these streams at once cut deep into the softer deposits of the plains, sometimes at a leap attaining nearly the level of

the St. Lawrence, and intersect the country by numerous nearly parallel ravines; they generally display steep banks of clay and sand, but in a few instances run in troughs, exposing perpendicular sections of slightly inclined strata of limestone or black shale, piled upon one another to the height of from twenty to eighty feet.

The name which has been given in previous Reports to the rocks underlying the fossiliferous formations in this part of Canada is the Metamorphic series, but inasmuch as this is applicable to any series of rocks in an altered condition, and might occasion confusion, it has been considered expedient to apply to them for the future, the more distinctive appellation of the Laurentian series, a name founded on that given by Mr. Garneau to the chain of hills which they compose.

The geological formations which underlie the district in ascending order would thus be as follows:

1. Laurentian series.
2. Potsdam sandstone.
3. Calciferous sandrock.
4. Chazy limestone.
5. Birdseye, Black-River and Trenton limestones.
6. Utica slate.
7. Hudson-River group.
8. Oneida conglomerate.

The general characteristics of these formations have been so often described in previous Reports, that it will be sufficient on the present occasion, merely to point out their distribution, and the attitude they assume in the physical structure of the region; and in doing this I shall take up the description where it was, in the last Report, interrupted by the limits of the season's exploration. In that Report, it was stated that at the White Horse rapids, on the river Des-Prairies, a patch of black bituminous shales of the Utica formation, about a mile long and not half that in width, occupies a position not far below Isle-Bizard, showing a narrow strip on each side of the stream, which cuts it in two lengthwise. This is the deepest part of a shallow trough; on the south side of the trough the Trenton limestone, including the Black-River and Birdseye,

coming from beneath the Utica slate, has a breadth of six miles extending to Pointe-Claire ; on the north it probably does not reach a mile. The Chazy limestone crossing Lake St. Louis from Caughnawaga, outflanks the Trenton, entering on the island of Montreal above Pointe-Claire, between which and the village of Ste.-Anne, the Calciferous sandrock and a small part of the Potsdam sandstone, in addition to the Chazy formation, occupy the interval. The Chazy is traceable to Ste.-Geneviève where it affords very fine building stone, and thence passes to Isle-Bizard, which it crosses about mid-length from the two ends, in a belt coming upon the Lake of Two Mountains at a point where a quarry is worked in it. In this quarry it is a grey limestone, exhibiting the peculiarity of pink or rose-red spots, and gives fine massive beds. The upper end of the island displays the Calciferous sandrock, and the lower the Trenton limestone, which is seen above and below the seigniorial mill on the river Des-Prairies. The Trenton is also displayed on the opposite side of this stream for some distance, commencing a little below the extreme upper point of Isle-Jésus. The Calciferous sandrock occurs a little below the same point on the opposite side of the island, on the river St.-Jean-au-Jésus ; so that the Chazy limestone, unless it is let down and buried by a fault, must enter on the island at the very extremity, in a very narrow band, which, widening as it proceeds eastward, sweeps round by St. Martin and the river Des-Prairies above and at La-Chapelle's bridge, the upper part of the formation crossing the river to the island of Montreal, somewhere in the vicinity of Isle-aux-Chats; the black limestone of the superior formation is seen a little to the westward of the quarries in the Chazy, which are near the bridge above mentioned, and from these quarries the Chazy gains the neighborhood of St.-Laurent church. It is seen again on the north side of the cross-road between Côte-St.-Laurent and Côte-Ste.-Catherine, running close along side of this cross-road to its junction with the Côte-Ste.-Catherine road, and then turning towards the Mile-End road, which it crosses about fifty yards on the city side of the first mile-stone beyond the toll-bar; here its junction with the Birdseye formation is plainly seen,

the one distinguishable by the abundant occurrence of *Atrypa plena* and the other of *Phytopsis cellulosum*. The two formations in close proximity are traceable thence to the road crossing from Côte-de-la-Visitation to Côte-St.-Michel, at the junction of the cross-road with the latter; they then make a sharp turn, and the upper part of the Chazy again reaches the river Des-Prairies a little above the Sault-au-Recollet. Crossing the river, it sweeps round probably about a mile behind Les-Ecors, and the rocks of St.-Vincent-de-Paul, which are of the upper limestones, and gains a position on Isle-Jésus, a little way south of the village of Terrebonne. It here makes another sharp turn, and is traceable to the westward, keeping some distance south of the river St.-Jean-au-Jésus, which is occupied from Terrebonne to Delisle's bridge, and above it, by the Trenton and associated formations. The Chazy proceeding westward on Isle-Jésus, probably crosses the river in the vicinity of the river Aux-Chiens, (a tributary joining on the north) whence it runs to Côte-St.-Louis, where it has been quarried about three miles north-eastward from Ste.-Thérèse.

Between Ste.-Rose, a little above the river Aux-Chiens, and St.-Eustache, there are on Isle-Jésus many exposures of the Calciferous sandrock, which as already mentioned, extends nearly to the upper extremity of the island, and between those two places it has a breadth of about two miles south of the river St.-Jean; above St.-Eustache, it runs on the left bank of this river and of the Lake of Two Mountains, certainly two, and probably four miles, where it would be limited by the Potsdam sandstone that surrounds Mont-Calvaire. With the thirteen miles between this point and Ste.-Rose, as a front, it extends back to within a short distance of the river Du-Nord, expanding as it proceeds, stretching on the west to form a junction with the same formation heretofore described on the Ottawa, and to the north-east to run its course further down the valley of the St. Lawrence. On the river Du-Nord, the white beds of the Potsdam sandstone emerge between the Calciferous and the gneiss of the Laurentian series, forming a belt sometimes over two miles wide, and sometimes less than one, which is exposed in many places between Lachute and the road from Ste.-Thérèse

to St.-Jerome; at Lachute, its presence was mentioned in last season's Report; the largest intermediate developments occur in the vicinity of Ste.-Scholastique, where huge angular fragments of the rock of a dazzling whiteness, probably in immediate contact with the parent bed beneath, are piled on one another, giving promise of quarries of fine building stone.

From this distribution of the formation over a level country, it will be perceived, that while a flat anticlinal arch, especially described in last season's Report, extends from the vicinity of Lachute to the state of New York, across the county of Beauharnois, bringing to the surface the Potsdam sandstone of that county, and carrying it north of Mont-Calvaïre, another and flatter anticlinal form exists to the eastward, projecting the Calciferous sandrock to Isle-Jésus, and the Chazy limestone eleven to twelve miles farther on, across this island and nearly across that of Montreal, to within three miles of the St. Lawrence at the city. The axis of this anticlinal, not quite parallel with the previous one, runs from the north end of the Montreal mountain to a point a little westward of Ste.-Thérèse, and the figure which the Chazy presents on the islands of Montreal and Jésus shows that this anticlinal is crossed by two others, one running along about the middle of each of the islands.

The main body of the Montreal mountain as stated in a former Report, is an intruded trap; the formation which is there entangled with it, is the Trenton and its associated limestones, which are found interstratified and overlaid by the igneous rock; but many dykes connected with the main body of the trap traverse the Chazy in various directions in the quarries and parts adjacent, and between the Chazy development and Lake St. Louis, no higher formation than the Trenton has been met with. The upper part of this latter formation crosses the St. Lawrence from the south shore at St. Louis Rapid, and is traceable by many exposures, all the way down the eastern front of the island of Montreal, in general removed about a mile from the edge of the water, and always dipping easterly at a small angle. The Utica slate succeeds, and can be followed at the margin of the river to Point St. Charles, while farther back its spread is

detected by the excavation made in it for the third lock of the Lachine canal, and by what appears to be a small outlying patch abutting against the trap of the Montreal mountain near McTavish's monument. It also occupies the opposite bank of the St. Lawrence, being seen at Laprairie, Longueuil and Varennes, and judging by the exposure at Longueuil in the section of the St. Lawrence and Atlantic railroad, it may there have a breadth of two or three miles. It may have the latter measure at Varennes, as the dip of the exposure there is westward, which probably changes to an eastward one to bring it under the superior rocks to the eastward; and this change would probably carry its width to the immediate vicinity of an exposure of the Loraine shales of the Hudson-River group, which is removed that distance from the shore. From the general strike of the formations, it is probable that the breadth of the Utica slate on the south side of the river, diminishes towards Verchères, and that the summit of the deposit strikes over from the vicinity of the church there, to that of St.-Sulpice on the north bank.

Traversing the country in a north-west direction across the general strike of the rocks, the black shales of the Utica formation are seen at a bend of the Achigan river, where it crosses the line between the seigniories of St.-Sulpice and L'Assomption, and black limestones appear farther up the same river, a quarter of a mile farther north-west on the same line of divsion. But still farther up the stream, and about half-a-mile south-west from these positions on the line, there is a considerable exposure of trap, the course of which would carry the intruded rock between them, though it is there concealed, and there may probably be some dislocation. The limestones, however, belong to the Trenton formation, and about two and a-half miles to the north-west of them, other limestones of the same formation are exposed on the river St.-Esprit, not far from where it crosses the same boundary line below Mr. Viger's mills, and thence at intervals, as far up the stream as the bridge on the road from St.-Jacques to St.-Rocque, and a short distance beyond. South-westward from this, black limestones, more interstratified with black shales, are exposed on the Achigan at the village of St.-

Rocque, and for a mile up to the junction of the Ruisseau-des-Anges. With *Orthis testudinaria*, *Leptena sericea*, *Calymene senaria*, *Ceraurus pleurexanthemus* characterising the Trenton, the interstratified shales shew a *Lingula* resembling *L. curta*, and *Graptolithus pristis*, given by Hall to the Utica slates, and it is probable that the beds may be not very far removed below the base of this formation. Toward the middle of La-Chenaye, beds of the Trenton formation are met with on the Mascouche river at Mr. Pangman's mills, and again on the road between these mills and the village of St. Henry, about three-quarters of a mile north-west of the latter place; and from this it would seem probable that the formation extends in a broad band from the development at Terrebonne, to those mentioned on the St.-Esprit. The dip, in all the exposures, is small; on the south-west side of the combined seigniories it is to the south-east, but on the north-east side it approaches more nearly to south.

Between this range of exposures and the next met with to the north-west, an expanse of about six miles, destitute apparently of any exhibition of the strata, crosses the seigniories and extends into the seigniory of Terrebonne. Whether in this expanse any undulation may bring in the Utica formation, it is difficult to say, but the formations that rise on the north-west side of it, appear to be the Birdseye and Chazy. The junction of these is displayed about a mile north of the church of Ste.-Anne-des-Plaines, and an escarpment, on the summit of which runs the road to St.-Lin for about a mile, is composed of the upper of the two formations. The junction crosses the road dividing the seigniories of Terrebonne and La-Chenaye, probably a short distance south-east of the point where this road is intersected by the one to St.-Lin, and it thence sweeps round to the vicinity of the village of St.-Lin on the Achigan. The Black-River is seen at the bridge just below Mr. Pangman's mills, marked by *Columnaria alveolata* and *Chætites lycoperdon*, and the Chazy to the north-west of the mills on the Little River, about half a mile above its junction with the Achigan, where entire thick beds of the formation, giving fine building stone, assume the pink or rose-red color mentioned as occurring in spots on Isle-Bizard. Where the river cuts the formation, it is paved

with trap for about fifty yards, and about ten feet of the thickness of the trap are seen in the cascade which occurs at the spot. This appears to be an intercalated mass, and a calcareous bed of fifteen inches lies on the top of it, converted into a highly crystalline rock. On the Côte-St.-Joseph road, at such a distance as would bring the beds into place a quarter of a mile behind the preceeding, there occurs an exposure of about eleven feet of strata, consisting of a buff colored arenaceous limestone, holding geodes of calc-spar, much resembling beds belonging to the Calciferous sandrock; but they are overlaid by a bed of about a foot of grey limestone, holding a bivalve shell resembling *Modiolopsis*, a genus not carried lower by Hall than the Trenton, and a *Cythere* similar to one found in the Chazy.

A mile farther, the Laurentian series presents itself, leaving the intermediate space, for what outcrop there may be of the Calciferous and Potsdam formations. No exposures of the Potsdam, however, have been met with between this point and St.-Jerome, a distance of ten miles, nor do any, known to me, occur, for as many miles to the eastward. Those of the Calciferous sandrock however are numerous, and they may be seen near Ste.-Téhrèse, St.-Janvier, the Grosse-Chaussée and on the Rang-Double road to New Glasgow.

Proceeding down the valley of the St. Lawrence across the seigniories of St.-Sulpice, La-Valtrie, La-Noraye and Dautraye to the river Bayonne in Berthier, a distance of twenty-six miles, I am not aware of a single exposure of rock for a breadth of between nine and ten miles from the margin of the first mentioned stream; in this breadth, two great parallel swamps exist, one of them occupying an area of three, and the other of about fifteen square miles, while in addition to them, a large portion of the 250 miles composing the whole space is still covered with wood. The consequent difficulties of exploration, make it impossible to say with certainty what the geographical distribution of the formations may be. But it appears to me probable, from the general strike of neighboring allied parts, that two or three miles of the front may be occupied by the Loraine shales, and the chief part of the remainder

by the Utica slate. In a traverse back from the village of La-Valtrie in a north-west direction, the first exposure of the strata occurred just ten miles in a straight line from the St. Lawrence on the river L'Assomption, where a large island splits its channel into two; and on this stream there is a great succeeding development, extending to the village of Industry. The distance across the strata, in a straight line, is a little over two miles and a-half; the dip, which is between S.S.E. and S.E. does not exceed two or three degrees, and the whole thickness reaches a little over 480 feet. This consists chiefly of the Trenton formation, but beds marked by the fossils of the Black-River and Birdseye limestone, occur at the base, and about thirty additional feet of what appears to be the Chazy, shew themselves under the foundations of the mill and upper bridge, at the village. Some of the lower beds of the Trenton, varying from six inches to a foot in thickness, give good grey building stones, which have been used on the spot, for the construction of the Railroad bridge over the river. This part of the formation is marked by *Leptena alternata* and *Ceraurus pleurexanthemus;* the Black-River and Birdseye beds display *Columnaria alveolata* and *Phytopsis cellulosum*, and the Chazy shew *Raphistoma staminea.*

A similar section giving about the same thickness, occurs on the Naquoarau river, from three to five miles to the south-westward, the summit of which is about two and a-half miles below the junction of this stream with the Red River, while the base reaches Les-Dales about a mile and a-half above. The general course of the Naquoarau river, which, like the river L'Assomption, has a very winding channel cut deeply through the rock, is in this part not so directly across the strata as the course of the latter; hence the section is longer, but the dip of the strata, varying from one to three degrees, being rather less, the formations have at the same time a greater direct breadth across the measures.

Between these two streams, there is a partial exhibition of the same beds from the Birdseye upwards, on the Red River, and at the village of St. Paul; but following the strike lower down the valley of the St. Lawrence, the whole mass constitutes a low ridge distinctly traceable for eight miles in a direc-

tion approaching E. N. E., the breadth of which gradually diminishes the whole way, until at this distance it comes to a point and disappears about a mile and a half south-west from Mr. Oliver's mills on the Bayonne. The Black-River and Birdseye strata running along the north-west side of this ridge, are exposed on the river Chaloupe, and so is the upper part of the Trenton beds; but the Chazy is seen only in the two sections already mentioned, and the display of this last formation being confined to perhaps a small part at the summit, it is difficult to say what its full breadth may be. North-west of these exposures, the strata appear to be completely buried beneath the looser deposits between the Naquoarau and L'Assomption rivers, for the width of about two miles, and the beds that then show themselves, appear to belong to the Calciferous sandrock. The exposure of these on the former stream occurs at Mr. Bergerin's mills, about two miles above Les-Dales, where light grey arenaceous layers, with small rounded grains of quartz held together by a small amount of crystallized carbonate of lime, shewing considerable cleavable surfaces, and studded with the grains after the manner of the Fontainbleau sandstone, alternate with beds of six inches or a foot of a more calcareous character, shewing ripple-mark and an abundance of fucoids. On the river L'Assomption, the Calciferous rocks are about two miles and a-half beyond the Chazy beds at Industry, and a short distance above the line between the first and second concession of Kildare, in the thirteenth lot, which is the last of the township. The total thickness exposed is about twenty feet, and the beds consist of yellow weathering arenaceous limestone, containing geodes of calc-spar, and presenting obscure fucoids and convoluted shells. Farther up the rivers Naquorau and L'Assomption the Potsdam sandstone makes its appearance in such positions as to be brought into place, about two-thirds of a mile in the first instance, and a mile in the other, in a direct measurement across the strata, from the Calciferous beds.

On the Naquoarau river, the Potsdam beds are exposed in two places; the lower is at Mr. Dorwin's mills, where they measure about ten feet in thickness, and consist of yellowish-white fine grained and very slightly calcareous sandstone; the upper

is a mile beyond, but would probably come in close beneath the previous exposure, and judging from great angular blocks prevailing in abundance, conglomerate beds with white quartz pebbles up to two inches in diameter, form part of the series. On the river L'Assomption, the Potsdam is at the mills of Madame Lefèvre, on the outside of the north-east line of Kildare, ranging with the front of the third concession, where there are twelve or fifteen feet of white and greyish beds, interstratified with one another.

The first appearance of the Laurentian series beyond, is on the rear of the fourth concession of Rawdon, in which it crosses the township from south-west to north-east. The rocks of this series proceed thence along that stretch of the L'Assomption river which forms the southern boundary of the seigniory of D'Aillebout-D'Argenteuil; farther on, they cut the Bayonne at Mr. Cuthbert's mills, three miles north of St. Elizabeth church; and from the division line between the seigniories of De-Ramzay and Berthier, gradually assuming a more easterly course, they reach the river Chicot, about a mile north-west of Mr. Cuthbert's mills on this stream. About a mile west of these mills on the Chicot, and not far removed from the gneiss of the Laurentian series, there is an exposure of fine grained white sandstone, belonging to the Potsdam formation, characterised by the same description of foot-prints as those discovered at Beauharnois, to which Professor Owen has given the name of *Protechnites.*

At the Chicot mills, and lower down the river Chicot, dark colored bituminous limestones are seen coming to within three-quarters of a mile of the gneiss. The more south-eastern exposures belong to the Trenton; those at the mills are lower bed of the same formation, and between the latter and the gneiss there is probably a north-east and south-west dislocation, letting down the measures on the south-east side. Of this dislocation there are indications where the Industry limestone ridge narrows to a point, as has been mentioned, south-westward of Mr. Oliver's mills on the Bayonne; and the evidence is clear at the mills where dark colored bituminous beds of the Trenton deposit are seen to abut against others of a light grey color, and arenaceo-calcareous character, holding geodes of calc-spar, and exhibiting

obscure convoluted shells, probably indicating the presence of the Calciferous sandrock ; a mile and a-quarter to the north-east of the mills the Calciferous sandrock is again observed forming a ridge with a level country to the south-east. This dislocation, no doubt, has its effect in bringing into view the range of Trenton developments on the rivers Chaloupe, L'Assomption and Naquoarau to the south-westward, which have been noticed above as those nearest the St. Lawrence, and it is probable the line of fault may have its position not far in front of them. The occurrence also of the trap near Mr. Viger's mills on the Achigan, may be due to some connection with this fault; the position would not be out of the course given to the dislocation by the previous points, and it is not impossible that a farther continuation of it may be indicated by a display of trap on the river Des-Prairies near St. Joseph, while the trap band, mentioned in a former Report as traceable from Côte-de-la-Visitation to the city of Montreal, might be supposed to connect the disturbance with those of which there is evidence in the Montreal mountain.

Down the valley of the St. Lawrence, the influence of this disturbance on the distribution of the formations, is perceptible for twenty-five miles below the river Chicot. Affected by it, the gneiss of the Laurentian rocks, which approaching the river Chicot had assumed an eastward direction, again becomes deflected to the north-east, and this course it maintains, as exhibited by many exposures, all the way to the river Du-Loup. This it crosses at a distance of between thirteen and fourteen miles from the margin of Lake St. Peter, measured in a straight line to the mouth of the Yamachiche, having about halfway between the rivers Du-Loup and Chicot, crossed the Maskinongé at a point about twelve miles in a straight line from its junction with the lake. Along the whole distance, the Potsdam sandstone appears to be lost in the fault, and following the road leading from Mr. Cuthbert's mills on the Chicot, through Côte-St.-Jacques and Côte-St.-Joachim, we meet with three exposures of black bituminous limestone in Côte-St.-Joachim, the whole of them belonging to the Trenton formation. The first one, with a dip of five degrees to the south-eastward,

reaches to within a little over a mile of the general range of the gneiss, and the other two, upon the river Cachée and one of its tributaries, to about half that distance, where they shew a scarcely perceptible inclination; that on the river Cachée is at Mr. Hamelin's mills, where the thickness displayed is ten feet. In a range with these three Trenton exposures, there is another with a dip of not over three degrees, in the fief Carufel, about a mile and a-half from the south-western boundary, again about a mile from the gneiss. On the Maskinongé river the Trenton is covered up, but at the foot of the cascade which this stream sends down the flank of the Laurentian rocks, calcareous beds containing a great amount of fine silicious grains, give evidence of the probable presence of the Calciferous sandrock, and their dip, still to the south-eastward, being raised to an angle of fourteen or fifteen degrees, seems to indicate a proximity to the fault.

In the sixteen miles between the Bayonne and the Maskinongé, it is not easy to decide with certainty where to draw a line representing the summit of the Trenton formation; no indition of the Utica slate has been discovered in the whole distance, nor indeed have any exposures of any of the formations under description, been heard of, between those already mentioned in this space, and the St. Lawrence, which thus gives another area destitute of indurated rock, of about 100 square miles. The nearest approach I am yet able to make to the upper limit of the Trenton in this area, is indicated by the upper beds of the formation on the Bayonne about a mile and a-half below Mr. Oliver's mills, (in which mile and a-half there is a section shewing about 420 feet of thickness,) and a development on the little river Du-Loup, two miles beyond the Maskinongé in the parish of Ste.-Ursule, a mile south-east of the church.

This last exposure is about seven miles, across the measures, from the margin of Lake St. Peter, and three or four from the gneiss, where the latter comes out upon the stream on which the limestone occurs. From this, the gneiss continues its general north-eastern course to the point where it has been mentioned as cutting the greater river Du-Loup, and beyond

it to the Great Yamachiche. Farther on however, its trend changes; for on the St. Maurice river we find it at the Grès rapids, where it constitutes the rock over which descends the cascade driving Mr. Baptist Hall's mills, and this position is south-east from that on the Great Yamachiche. Between the little river Du-Loup and the St. Maurice, the distance is nineteen or twenty miles, and the breadth from the first outcrop of the gneiss as it has been given, to the margin of Lake St. Peter and the St. Lawrence, is twelve or thirteen. The area may thus be considered to contain about 240 square miles. In the whole of this, only two exposures of the fossiliferous rocks have been met with. They both belong to the Trenton limestone; one of them is on the St. Charles brook, on the property of Mr. Honoré Plauder, in the seigniory of Grand-Pré, not far from the division between it and Dumontier, and about a mile and a-half removed from the gneiss; the other at the falls of the Little Yamachiche river, where this is crossed by the road leading from St. Joseph to the Grès. In the latter place the beds, which have a total thickness of about fifteen feet, and contain nodules and patches of black chert, are nearly flat, but the geographical position would appear to indicate a gradual turn in the strike, conforming with the trend of the gneiss.

On the St. Maurice the gneiss occupies the left margin of the river from the Grès to a spot three-quarters of a mile below the river Cachée, but for a part of the distance near the mouth of the Cachée and above it, it is concealed by clay. The gneiss occupies also the right side, to the height of about twenty-five feet in the bank opposite the mouth of the Cachée, but to less than this, farther up. Upon it reposes the Potsdam sandstone, which, in an escarpment at the bend of the river in sight of the fall, composes twenty feet of the cliff, while clay conceals what may be in addition to this thickness at the top. The base which is seen in contact with the gneiss, nearly on a level with the stream, is a four-feet bed of conglomerate, composed of white vitreous quartz pebbles, some of them as large as swans' eggs, and a few larger, in a matrix of fine sand. This fine white sand constitutes the beds above, and the stone they yield is freer in texture than I have anywhere else seen it in this forma-

tion. On the right bank of the stream, a little below the Cachée, at a height of eighty-two feet above the water, a quarry has been opened in a limestone rock of a rather arenaceous character, and it is probable that between this and the twenty-five feet of gneiss which comes to the water's edge, the Potsdam beds may exist, though covered up by debris and vegetation; the total thickness to be given to them would thus not much exceed fifty feet, the dip being S. S. E., and not over one degree in inclination. The fossils of the limestone are very obscure, and it has not yet been determined whether they belong to the Calciferous sandrock or the Chazy formation, though I am inclined to think it may be to the former. Opposite the point where the gneiss below the Cachée ceases on the right bank, the limestone gains the water, but farther down, no great mass of calcareous rock occurs.

Whatever portion of the superior limestone exists on the stream, must lie concealed between the position of the beds already mentioned, and some point above the St. Maurice forges; for at Pointe-à-la-Hache, on the left bank of the river, nearly opposite the forges, there occurs a development of the Utica slate. The exposure occupies a length of 200 yards along the margin of the river, and the dip varies from S. 15 E. to S. 30 E. with a slope of two degrees. The black bituminous shales of the deposit are interstratified with occasional bands of black bituminous limestone; the limestone has a smooth surface and smooth conchoidal fracture, and becomes reddish-yellow under the influence of the weather. The fossils which characterise the beds are *Triarthus beckii*, *Graptolithus* and a small *Orbicula*. It is probable the deposit extends farther up the stream; for 300 yards above on the right side, fragments of a similar rock are strewed on the bank, and there is here a ripple across the river, perhaps occasioned by the outcrop of the shales in the bottom; it may be remarked that similar broken water extends as far up the stream as L'Islet, a distance of about two miles, while there remains about an equal distance between this and the first appearance of the limestone already mentioned. I am not yet able to assign to the summit of the Utica formation, its position on the St. Maurice, but it

appears probable that a breadth of several miles from the margin of the St. Lawrence, will be occupied by the Loraine shales at the mouth of the tributary, as well as at the mouths of the Champlain and Batiscan. A set of fossiliferous strata, such as generally indicate an approach to the summit of these shales is met with on the south side of the main stream just opposite the St. Maurice, and rises into a ridge occupying the space between the shore and Lake St. Paul, on the south side of which lake the red shales, mentioned in former Reports as overlying these beds, constitute a marked escarpment. In this relation, dipping south at an angle of one or two degrees, the fossiliferous and the red strata are traceable down the St. Lawrence nearly as far as Gentilly River, and the red escarpment can be followed in an opposite direction to the Nicolet, four miles and a-half from the mouth of which, rocks of this color are exposed on its banks.

Between the St. Maurice and the Batiscan there is a distance of about eighteen miles, which for a breadth of from ten to twelve miles presents the same level surface of sand, clay and swamps, as other localities mentioned, occurring further up. The same character belongs to an additional space between the Batiscan and the Charest with that part of the Ste.-Anne-de-la-Pérade river which is below the junction of its tributary. The distance between these last limits is about seven miles, and thus the whole space from the St. Maurice may comprise about 260 square miles. In all this I have yet discovered but two developments of the fossiliferous formations. They both occur in the Ste.-Marguerite range, the first belonging to the Trenton in Cap-de-la-Madeleine seigniory, about four miles from the St. Maurice, and the other on the river Au-Lard, a tributary of the Champlain, about five miles and a-half farther on, in the seigniory of Champlain. In the latter development, the brook in which it occurs, cuts across the measures in a south-east direction for about a mile, and the strata, possessing a dip with the stream of from two to two and a-half degrees, may have a total thickness of about 200 feet. The chief part of the mass belongs to the Trenton formation, but *Columnaria alveolata*, occurring in abundance at the base, shews it to include portions of the Black-River limestone.

On the St. Maurice side of this part, a large portion of the Laurentian series appears to be covered up by sandy deposits, which rise in successive steps to a height of at least 300 feet above the St. Lawrence; but carrying a line, modified by the general strike of the strata, from the exposure of gneiss on the St. Maurice, to the next that may be considered as corresponding with it, which occurs at the termination of the Ste.-Marguerite range on another tributary of the Champlain, about two miles removed from the river Au-Lard, this line would pass about two miles to the north-west of the first calcareous exposure in the Ste.-Marguerite range, and about a mile of the second on the river Au-Lard. From the end of the Ste.-Marguerite range, the gneiss turns to a more easterly direction, and crossing the division line between the seigniories of Champlain and Batiscan, just opposite the great elbow in the Batiscan river above the old forges, it strikes upon the southern sweep of the bend, and crosses the river not far from the mill-dam. From this it runs in a straight line, and presents a moderately bold front as far as the Charest river, which it strikes not far from the elbow made in the stream by a change in its course from south to south-west, about three miles above the Brulé road. From this it still continues straight on, and crossing at an elbow of the Black river, outside of the seigniory of La-Chevrotière, it reaches the Ste.-Anne about a mile above the Three Rapids, close upon the line between the seigniories of Deschambault and Portneuf. Entering into the latter seigniory, it sweeps around an extensive flat surface, and returning to the Deschambault line about the middle of the fourth range, attains a position in the second range, about a mile and a-half from the western boundary of the seigniory, and a little over the same distance from the St. Lawrence. Turning here, it presents a moderately bold front, and a straight course across Deschambault, Portneuf, Jacques-Cartier and D'Auteuil seigniories, shewing itself in the latter on the St. Basil road about a mile north of the church. Farther on, it intersects the road leading north-westerly from the upper bridge on the Jacques-Cartier river, about four miles back. It continues across the seigniory of Pointe-aux-Trembles, and

entering that of Faussembault, veers round again to the former, following the general line of the Jacques-Cartier, and coming to a point on this river, about half a mile above the third bridge. Here it turns eastward, and gaining the neighboring elbow of the river Aux-Pommes, this stream may be considered its boundary across the seigniory. Just beyond this, it sweeps round to a south course, and comes to a point within a mile of Pointe-aux-Trembles church. From this it turns north again until it obtains a position about so far back as to come into a line with its previous eastward course, when it again gradually veers a little north of eastward, thus leaving the mountain of Bon-homme to form a conspicuous promontory projected beyond the main outline of the rock towards the St. Lawrence. In its farther eastward course, it maintains a conspicuous front, crossing the St. Charles river at St.-Ambroise and Jeune-Lorette, whence it passes about a mile north-west of Charlebourg and close by Bourg-Royal. Thence holding the same direction, it crosses Beauport seigniory and reaches the boundary between this seigniory and the parish of Ange-Gardien, about two miles from the St. Lawrence. It then turns back south, nearly to the bank of the St. Lawrence, at the mouth of the Montmorency river, and from it carries a course north of east, gradually receding from the margin of the main river, until reaching a position in the rear of Chateau-Richer church, where it is about a mile and a-quarter from the St. Lawrence. At the Sault-à-la-Puce it is again projected forward to the cascade on this river, which is about three furlongs from the St. Lawrence. It once more gradually recedes from the coast, and proceeding to the river A-la-Rose, where its distance from the St. Lawrence is over three miles, it crosses the St.-Féréol road, and making a sharp turn, appears to sweep round in the form of a letter S reversed, to the lower fall on the Ste.-Anne river, from which it maintains a nearly eastward course until it comes upon the St. Lawrence at Cape Tourmente.

From this description it will be perceived that the contour of the Laurentian rocks, from the river Ste.-Anne-de-la-Pérade to Cape Tourmente, is much more irregular and indented than higher up the valley of the St. Lawrence, and that six positions

occur where it is projected forward from the general trend, namely, at Deschambault, on the Jacques Cartier, at Pointe-aux-Trembles, Montmorency, Sault-à-la-Puce or Chateau-Richer, and the river A-la-Rose. These six positions mark the axes of six folds or anticlinal forms, and the zones of rock which succeed, affected by these folds, exhibit in their turn a rudely corresponding set of projections; some of the lower zones however are partially wanting.

On the Ste.-Anne-de-la-Pérade river, the exposure of the fossiliferous strata nearest to the gneiss is at the Three Rapids, where a black bituminous limestone is met with, about half a mile from it, and within ten acres of the boundary between Deschambault and Portneuf. The dip is down the river N.80 W.<7°; the beds visible have a transverse measurement of 650 yards, giving a thickness of 250 feet. The beds are rather thin, and those at the base are much loaded with nodules of black chert, and occasionally interstratified with very thin layers of the same mineral, while at the summit occasional crystals of blende occur. The fossils are, *Orthis testudinaria*, *O. lynx*, *Atrypa increbescens*, *Leptena sericea*, *L. alternata*, *Chætites lycoperdon*, *Lingula* ———, *Orthoceras* ———, some of which are replaced by cycloidal calcedony and beautifully weathered out; these remains place the beds in the Trenton formation. Three miles farther down the river, and over a mile and a-half from the gneiss, the same characteristic fossils, in the same state of silicification, occur at a spot called the Cascades, close upon the division line between Deschambault and La-Chevrotière, and from this to the St.-Olivier bridge (twenty acres) and for some distance below, the river is confined to a narrow channel, with vertical sides of limestone rock, between which the current is sufficiently strong in some parts to make them difficult of examination. Among the fossils at and immediately below the bridge, are *Orthis pectinella*, *Leptena alternata*, a *Lingula* like *quadrata*, but not so large as Hall's figure and a little more sloping from the beak, perhaps the *parallela* of Phillips, *Chætites lycoperdon*, *Stictopora acuta*, *Isotelus gigas*, and in crowded abundance on some surfaces, but rather obscurely developed, probably a *Cypricardia*. The

formation here also most probably belongs to the Trenton, and the distance from the bridge north-westerly to the gneiss, is between two and three miles. Rocks of the same formation are laid bare in many places farther down the river, the last of which is at a rapid some distance above the mouth of the Charest. The dip of the beds is about S. 25 W.<1° to 3°. The strike would run for a point a little way up the Charest, and not far from the spot, Trenton beds are seen, holding *Leptena sericea*, *L. alternata*, *Orthis testudinaria*, *O. lynx*, *Isotelus gigas*, and an unfigured species of *Avicula*.

From these last positions on the Charest and Ste.-Anne rivers, the summit of the Trenton formation sweeps round by an exposure near the south-western boundary of the fief Dorville, about a mile and a-half from the St. Lawrence. It crosses the river-side road to the Grondines, about a mile within the seigniory, and comes upon the water of the St. Lawrence at Pointe-à-Maçon, a little above the ruin of the old church and windmill at the Grondines village. The Utica zone is seen outside of it, in one or two places on the road from Ste.-Anne to the Grondines, and on the shore at the next point above that with the limestone, as well as between high and low water mark near the latter.

From Pointe-à-Maçon to the river La-Chevrotière, a distance of about four miles, the coast consists of a naked and often vertical cliff of the same limestone in slightly inclined strata, piled up in some parts to the height of 100 feet over the water, and the road on the summit runs on a bare ledge almost the whole way. From the mouth of the La-Chevrotière, a road runs back in a nearly straight line, across the ranges to St.-Olivier bridge on the Ste.-Anne; a parallel road runs from the mouth of the Belle-Isle brook, and on both of these and in various other parts of the seigniory of La-Chevrotière, the Trenton formation is largely exposed. Extensive quarries are worked in it on the first mentioned road, in the fourth range, where massive beds of a light yellowish-grey give a very excellent building stone, which somewhat resembles that from the Chazy at Montreal, but the La-Chevrotière, or as it is commonly called Deschambault stone, is more even colored, yellower, more granular and

softer than the other. Not having met with these beds in other developments of the Trenton, I am not yet prepared to state what their equivalents may be in other places. *Ceraurus pleurexanthemus*, *Isotelus gigas*, *Leptena alternata*, *Orthis testudinaria*, *Atrypa hemiplicata*, *Chætites lycoperdon* occur in the beds.

Following the upper part of the formation from the mouth of the La-Chevrotière, the rock crosses the Belle-Isle brook and the road near, over a mile from the coast, and is seen in a quarry recently opened on the land of Mr. Alphonse Perrault, for the supply of stone for the purposes of the Quebec and Richmond railway. It here shows massive beds of a dark grey colored stone which looks well when dressed, though rather deteriorated by thin patches of black shale; the shale is bituminous, and a black indurated purely bituminous mineral is occasionally met with in small cracks and druses in the beds, which resembling coal in its color and inflammable properties, has given rise in the vicinity to an erroneous report of the discovery of the latter species of fuel. The quarry is about a mile from the margin of the St. Lawrence, and rising the step in the land close in front of the limestone, the shales of the Utica formation present themselves, dipping S. 27 W.< 35°. Where this step comes upon the road between the first and second ranges of Deschambault, the limestone is again seen, with the shales in front of it, on the road which turns from the water-side to the interior, about half a mile below Deschambault church. The exposure is about a mile and a-quarter from the river-side road; as in the quarry just mentioned, the beds are massive, but there appears to be an irregularity at the spot, perhaps occasioned by a transverse fault; the dip being N. 70 E.< 46°, while the general extended course of the strata is north-eastward.

The gneiss of the Deschambault anticlinal comes out about a quarter of a mile behind the limestone, and continues in the relation indicated to it and to the Utica formation, up to the division line between Deschambault and Portneuf. On the Portneuf river the Utica formation is exposed at Mesrs. McDonnel and Logan's paper mill, about a mile from the St. Lawrence, and the Trenton in the seigniory of D'Auteuil, above and below the bridge on the St. Basil road, where it stretches along the river for between

twenty and thirty acres. South of the river, there are indications on the road, of a transverse breadth of from sixty to seventy chains, the dip at the bridge being S°. 30 E.< 2°. The gneiss rises about two miles to the north-west, but the interval is concealed.

On the axis of the Jacques-Cartier anticlinal, the gneiss is succeeded by a few calcareous beds of an arenaceous character resembling those of the Calciferous sandrock, but the Trenton formation makes its appearance at the upper bridge, and affords a deep channel for the river, down to the middle one. Here making a detour round a narrow neck of land, the water, confined by the solid masses of rock on each side, to a breadth of fifteen feet, rushes with great violence under the bridge, descending many feet in a short distance, and causing a considerable difference of level on the opposite sides of the neck. Across this neck, a body of water, sufficient to drive a mill, finds a subterraneous passage, and pours out from an opening in the vertical cliff on the lower side. A short distance below the mill which has been erected here, the summit of the Trenton formation leaves the right bank of the river, and the Utica slate occupies both sides, often giving high vertical sections, all the way from this to its mouth. The junction of the two formations must run on a line very nearly coincident with the road on the right side of the river, for rather less than three miles, and it then folds over the axis of the anticlinal, about half-way between this road and the next parallel with it on the north-west, and about half-way in a straight line between the upper bridge and Cap-Santé church. On the axis of the anticlinal, the distance between the base of the Utica slate and the gneiss, is about four miles and a-half. From the mouth of the Jacques-Cartier, the coast shews a bold and precipitous cliff of the Utica formation, all the way to Cap-Santé. The shales are occasionally found interstratified with a bed or two of black limestone, sometimes reaching a foot in thickness, and on the beach at Cap-Santé village there is a thickness of about twenty feet of argillaceous limestone, of a lighter color. In the vicinity, layers of this lighter colored argillaceous limestone, of from two to six inches are met with at intervals, above the twenty-feet band, and they afford in several places, close to

the cliff, and out between high and low water mark, beautifully even slabs, fit for door-lintels, window-sills, hearths and such purposes. Considerable areas are exposed on single beds, but they are often cut up by a jointed structure, the planes of division running in three principal directions. Above Cap-Santé village the same formation extends as far as the strata are visible, which is upwards of two miles, but a portion of the Loraine shales may be covered up by the clay banks between this and the mouth of the Portneuf river, over three miles more, about half-way in which would run the synclinal axis between the Deschambault and Jacques-Cartier or Cap-Santé anticlinals, the position being opposite to Pointe-à-Platon, which is composed of the Loraine shales, and would also stand upon the synclinal axis.

Below the Jacques-Cartier, the Utica shales are seen in the cliff for about a mile and a-half, and the coast farther down, still exhibiting a bold vertical front, is occupied for about four miles and a-half by the less bituminous shales of the Loraine portion of the Hudson-River group. The village of Les-Ecureuils is situated about equi-distant from the extremes of this stretch of the coast, and north-easterly from this, the formation has a breadth of upwards of two miles. In this part, the passage from the Loraine shales to the Utica shales is so gradual that the division has to be somewhat arbitrarily assumed, and the position which has been taken as indicating this below Les-Ecureuils, would allow about a mile and three-quarters for the Utica shales, between the Loraine shales and a great development of limestone existing at Pointe-aux-Trembles.

This limestone occupies less than three miles along the margin of the St. Lawrence, presenting a low cliff, and the promontory near Pointe-aux-Trembles church stands almost in the middle of it. The fossils, which are abundant, shew the rock to belong to the Trenton formation, and it here constitutes that part of the Trenton zone which folds over the Pointe-aux-Trembles anticlinal. On the north-westerly side of the axis, the summit of the formation, striking into the country at the spot already indicated, appears to run in a north-easterly direction, and to cross the St. Nicholas road about two miles from the St. Law-

rence, which would give about a mile and a-half as its distance from the gneiss on that side of the axis; and judging by the position of the same part of the formation on the Jacques-Cartier and the trend of the gneiss, it would sweep round and again cross the same road, less than two miles from the river Aux-Pommes, in its course to gain the position on the former river. Between the Trenton formation and the Loraine shales of Les-Ecureuils, there would be left in the vicinity of the river Aux-Pommes, a breadth of nearly three miles for the Utica shales. On the north-west side of the anticlinal, and not far removed from the gneiss, massive beds of limestone of a grey color and granular texture occur, on the land of Mr. J. Gagné and others, affording excellent building material. The stone resembles that of Montreal, but I have not yet been so fortunate as to meet with fossils in it sufficiently characteristic to enable me to determine whether the formation is the Chazy.

On the south-east side of the anticlinal, the dip is more precipitous than on the north-west, and the strata on that side are broken, and let down by a fault. The position and course of this dislocation are plainly seen on the beach at and near a spring a short distance above Mr. Dubord's ship yard, where strata of the Utica formation are brought up against those of the Trenton, without any of that interstratification of calcareous and argillaceous layers which indicates the passage from the one to the other. The course of the dislocation in its continuation strikes the south-east side of the Bon-homme mountain, and near the line of division between Pointe-aux-Trembles and St.-Augustin, the Trenton formation is wanting, and the Utica slate comes in contact with the gneiss. In this relation these rocks cross the seigniory of St.-Augustin, the breadth of the Utica slate, which on the west side of the seigniory is not much more that the sixth of a mile, gradually increasing to over a mile on the east; and a considerable distance further on, a narrow strip of Trenton limestone becomes interposed between it and the gneiss, both fossiliferous rocks being tilted up to a high angle as they approach the gneiss. Arriving at St.-Ambroise, the limestone gets wider, and a few beds of white sandstone of the Potsdam formation, in all about twenty feet

thick, present themselves. They are overlaid by a bed or two of grey granular limestone resembling the Chazy, with a *Cythere* of the same species as is found in this formation, but at the same time there occurs a fragment of an *Atrypa* resembling *A. extans* or perhaps *A. hemiplicata*, and *Orthis testudinaria*, which are both Trenton species. These grey beds are succeeded by black limestones, with an *Ormoceras* seen in section resembling *O. tenuistriata*, and a convoluted shell resembling *Lituites convolvans*, belonging to the Black-River limestone, but in the same fragment of rock with the former, there is *Orthis testudinaria*, and with the latter a portion of a *Trinucleus* and of *Conularia granulata*. On the river St. Charles close by, these black limestones rest upon the gneiss without the intervention of the Potsdam formation, and they are followed by beds belonging to the Trenton, shewing with them a breadth of about 700 yards, dipping at an angle varying from fifteen to thirty degrees, and giving about 600 feet of thickness. Through the effect of an undulation, the breadth of the Utica slate on this stream appears to be upwards of a mile and a-half.

On the river Des-Mares, the Utica slate, getting free from the undulation mentioned, is reduced to not over one fourth of this breadth, while that of the limestone increases, the junction of the two formations being below the mill on the Jeune-Lorette and Charlebourg road. At Charlebourg it would pass near the church; on the Bourg-Royal road, it is about half a mile from the gneiss, and beyond this, the fossiliferous formations sweep round in accordance with the anticlinal of Montmorency, the limestone attaining a breadth of four miles, and the slate nearly a mile and a-half on the synclinal axis, which would cross the road from Beauport to Laval, about two miles and a-half from the St. Lawence; but on the anticlinal axis, while the limestone continues to maintain about the same breadth, that of the slate becomes very much reduced, the summit of the lower formation crossing the Quebec and Beauport road a little west of the river Beauport, and that of the upper a short distance east of the turn up to Bourg-Royal. As might be expected, while the breadth diminishes as we follow the strike, the dip greatly increases. On the Beauport road it rises

to an angle of fifty-three degrees; following the road, however, which beomes transverse to the measures, the dip suddenly changes and diminishes, where the limestone first comes in, at a small quarry on the north side of the road at the turn to Beauport bridge. From S. 30 W.< 28° on the west side of the quarry, it becomes N. 67 W.< 6° on the east, and a dislocation may exist.

From Mr. Dubord's ship-yard, near Pointe-aux-Trembles, the shore for upwards of two miles is occupied by a collection of gneiss boulders, but the Loraine shales are seen in many places where water-courses have worn their way down the face of the steep bank, which occurs about half a mile back. Farther on, this bank approaches nearer to the St. Lawrence, and continuing so for two miles, it becomes more precipitous and broken, and the exposures of the strata increase. But from the ruin of the old church at St.-Augustin, high water washes the foot of the precipice, and these shales, occasionally interstratified with thin bands of sandstone and one or two beds of conglomerate limestone, present a bare bold vertical cliff, reaching to a point about two miles below Mr. Scott's mill, or one and a-half above the mouth of the Cap-Rouge river. Approaching this point, the shales become more striped with thin bands of olive-green, and one or two thick beds of a hard jaspery character of this color present themselves, with short cracks in various directions, occasionally holding black indurated bituminous matter. Arriving at the point, a change takes place in the character of the rock, and though it may probably be brought in by a dislocation, producing a down-throw on the north-east side, the amount of which is not known, yet there is no doubt that the strata constituting the coast to the eastward, overlie those to the westward already described. In the lower or first part seen, these strata appear to consist of slightly calcareous sandstones of a light grey color and a hardness approaching to quartz rock, which are interstratified with green and black shales, and frequently become coarse conglomerates with calcareous pebbles, often so abundant as to convert them into conglomerate limestones. In the first 650 yards from the point where they come upon the coast, they are rather obscurely

developed, but at a sharp projection of rock then occuring, the following section is observable in ascending order, and I am not yet quite certain whether to consider the strata composing it as a repetition of the more obscurely developed portion, or a distinct band running above it; the dip is about S. 25 E.<50°.

	Feet.
Sandstone approaching in hardness to quartz rock, of a light grey color and slightly calcareous character,	9
Sandstone of the same character, becoming a conglomerate in the strike by the occurrence of limestone pebbles,	6
Sandstone of the same character,	11
Limestone conglomerate, consisting of calcareous pebbles of various sizes, up to several pounds in weight, imbedded in an arenaceous matrix,	5
Sandstone of the same character as before,	15
Calcareous conglomerate,	5
Concealed,	5
Limestone conglomerate, with an arenaceous matrix,	3
Sandstone of the same general character as before, with scattered pebbles of limestone,	13
Black glossy shales and thin sandstones,	8
Sandstone of the same general character as before,	10
Black shale and thin sandstone beds,	13
Sandstone in a solid mass of a light grey color, approaching quartz rock in hardness,	21
Sandstone of the same character,	8
Sandstone of the same character, but in thinner bands,	4
Sandstone in thin beds, interstratified with shale,	4
Sandstone in two beds, with two alternating beds of shale equal to the sandstone in thickness,	4
Sandstone interstratified with shale, the sandstone beds swelling into great knots on the slope,	22
Grey argillaceous shale with thin beds of sandstone,	43
Sandstone in thin beds interstratified with shale,	59
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In the next half-mile to the eastward, there occurs an additional amount of sandstones of a flaggy character interstratified with black and greenish shales, and one or two thin bands of red shale. The measures being rather irregular, the exact thickness cannot be stated with certainty, but the whole, including the previous section, may probably equal 400 or 500 feet. On the surfaces of some of the beds, parallel groves or striæ in

the direction of the dip, give evidence of a sliding of the beds on one another when those movements occured which have given the strata their present inclination.

Above this group of arenaceous strata, with a small amount of black shale interposed, there occurs a fifteen-feet band of iron-grey sandstone, with dark colored silicious grains, which on the strike breaks into large amorphous masses, longer in the strike than in a direction vertical to the bed, and varying in size from five yards by four, to two yards by one. These lumps are imbedded in the shale, which is much twisted in the vicinity, and the band is followed by grey, black and greenish shales with a few interstratified beds of red. After an interval of concealment reaching to the Cap-Rouge river, a great mass of red shale occurs with bands of green, and these red and green shales become interstratified with greenish sandstones. The sandstones then exceed the shales, and become a conspicuous succession of fine and coarse grained rocks, sometimes assuming the character of fine conglomerates, with white quartz pebbles as large as peas. Thick beds of these sandstones separated by thinner bands of red and green shale, occupy the coast from Cap-Rouge to Pointe-à-Piseau, and they are outflanked on each side by the underlying red and green shales, which extend to the Cap-Rouge river on the one hand, and to the vicinity of Ance-des-Mères on the other. What the true thickness of these deposits may be, it would be hazardous to pronounce with confidence, from the probably contorted condition of the strata, by which beds may be repeated. In regard to the sandstones however, (supposed to represent the Oneida conglomerates,) no folds have been detected, and the total breadth they possess inland, including the interstratified bands of red and green shale, taken from a point about half-way between the extremes of the stretch they occupy on the coast, appears to be about 600 yards; the dip, which is to the eastward of south, ranges from fifteen to sixty degrees, and may be assumed at thirty; this would give a thickness of 900 feet. The breadth of the underlying red and green shales taken across to the vicinity of Ste.-Foye church, would be upwards of a mile, including a band seen on the descent of the hill, where the road runs from the church towards Ancienne-Lorette.

The calcareous conglomerates, sandstones and black shales, which underlie the red and green shales, are seen as they come out to the eastward, in the cliffs and precipices of the fortress and upper town of Quebec. The calcareous conglomerates are conspicuous on both sides of the promontory which stands between the river St. Charles and the St. Lawrence, and in the section across the measures at the point of this promontory, it can be perceived that several contortions exist in the strata. These appear also to be the rocks of Pointe-Lévy, where some good workable beds of limestone are included in the group. Where cracks occur in these beds, as well as in the upper greenish sandstones, it often happens that they hold black indurated bituminous matter, and in some of the quarries in the vicinity of Cap-Rouge, as that of Mr. Hamel, a vein of two or three inches is sometimes met with, holding fragments of wall rock, with crystals of quartz and calc-spar, the interstices of which are filled with the bitumen, exactly as metalliferous lodes are (with the exception of crystalline condition,) by the ores which characterize them. It has already been stated in a former Report, that this indurated bitumen holds no analogy whatever in the mode of its occurrence to mineral coal, for which some persons have been disposed to mistake it.

In the plain, on the north side of the elevated ground which holds these rocks, the Loraine shales in the vicinity of the river St. Charles, have a breadth of about three miles, and the fossils which characterise the upper part of the formation, are seen towards the foot of the hill below Ste.-Foye church. Not far from this church will probably run the axis of the Montmorency anticlinal, though I cannot give any precise fact by which to determine its position, other than the general course it has more to the eastward. In regard to this anticlinal, as in that of Pointe-aux-Trembles, the dip is more precipitous on the south-east side than on the north-west, and it seems also, as in that instance, to be accompanied by a dislocation throwing the measures down to the south-eastward. This fault is traceable north-easterly from Beauport church, from which the road to Montmorency runs nearly the whole way on a bare ledge of limestone with a very small dip, while close on the south-eastern

side of the road, the Utica slate is in many places seen in narrow strips, tilted up at a high angle. The details of the fault are well displayed at Montmorency Falls; here the channel of the river is cut down through the black limestone beds of the Trenton formation, to the gneiss of the anticlinal ridge, and the water at and below the bridge, flows down and across the gneiss, and leaps at one bound to the foot of a precipice, which immediately behind the water, is composed wholly of this rock. At the summit of the cascade, the Trenton beds on each side have a thickness of almost fifty feet, and they are marked by *Trinucleus concentricus*, *Calymene senaria*, *Conularia quadrisulcata*, *Leptæna sericea*, *L. deltoidea*, *Orthis testudinaria*, and *Lingula*. The dip of these beds is down the stream at a very small angle; but at the foot of the precipice, and in immediate contact with the gneiss, about the same thickness of limestone is tilted up to an angle of fifty-seven degrees; it is followed by a similar amount of black bituminous shale with the same slope; in this attitude these rocks climb up the face of the precipice, presenting their edges to the chasm on each side. They are followed by about eight feet of strong hard grey sandstone, weathering brown, in beds of ten to eighteen inches, interstratified with black shales, to which again succeed grey arenaceo-argillaceous shale, composing the sides of the chasm, out to the waters of the St. Lawrence. The limestones belong to the Trenton, the black shales to the Utica formation, and the grey to the Loraine shales.

About half a mile beyond the bridge, the tilted limestones and black shales cross the road, immediately on the north side of which the gneiss rises from beneath them, here shewing the point around which the basset edge of the limestone sweeps as it folds over the anticlinal arch. These two fossiliferous formations keep close on the north side of the road for nearly a mile and a-half, when they suddenly become removed between one and two furlongs to the north-westward, by a twist or a transverse dislocation, proceeding beyond which, they gradually increase in width, while the gneiss gradually recedes from the coast, until becoming affected by the anticlinal of Chateau-Richer, they sweep round to the road. The upper part of the

Utica slate comes upon the road about half-way between the churches of Ange-Gardien and Chateau-Richer, and that of the limestone, about three-eights of a mile above the latter. Along the north-eastward running flank of the gneiss, which rises into a moderate hill, the limestone reposes on this rock at a considerable angle. It is of the Trenton formation, and continues so until reaching the synclinal curve, where it comes upon the Sault-à-la-Puce river; a few beds of a calcareo-arenaceous character are here brought into view, which may belong to the Calciferous sandrock, though no fossils were observed to support the evidence given by the mineral constituents of the rock.

On the south-eastern side of the anticlinal of Chateau-Richer, the measures are broken by the effects of a fault, which again throws them down on that side, bringing the Loraine shales to abut against the gneiss. At the cascade on the Sault-à-la-Puce, the water is precipitated over gneiss rock with a fall of sixty-six feet, and above the cascade for some short distance, this rock occupies the left bank of the river, while the calcareo-arenaceous beds above mentioned are seen on the right. At the foot of the cascade the stream makes a sudden turn to the eastward, and the rock on the right bank, in face of the fall, is composed of the Loraine shales, which constitute both banks of the stream, for the remainder of the distance to the St. Lawrence. In the course of the fault to the north-eastward, these shales continue in contact with the gneiss for about a quarter of a mile. The Utica slate then begins to intervene; it continues in contact with the gneiss for upwards of two miles farther; a thin strip of the Trenton limestone is then interposed, and continues with but little augmentation in its breadth, all the way to the river A-la-Rose. Both formations maintain a high angle of inclination, but they diminish in slope and increase in width, as they fold over the anticlinal of this vicinity, again however narrowing, and becoming more precipitous as they proceed eastward on the south side of the axis. On the Ste.-Anne river, the limestone is seen leaning on the gneiss at the foot of the lowest cascade. At the contact it has a southern dip of from thirty to seventy degrees, and the breadth of the band does

not exceed some twenty or thirty yards, representing only the upper part of this formation; but farther down the stream the total thickness of the Utica slate is well displayed, and it appears to occupy all that part of the stream which runs between the limestone at the foot of the fall, and the junction of its tributary the river A-la-Rose. In its windings, the Ste.-Anne cuts the formation twice, and the following is the detail of its component parts in ascending order —

	Feet.	
1. Black brittle bituminous shale, with *Lingula and Graptolithus.*	19	
Black brittle bituminous shale, with two bands of yellow weathering limestone, black within	8	
Black brittle bituminous shale	23	
Black brittle bituminous shale, breaking into small fragments in consequence of a cleavage independant of the bedding	11	
Black brittle bituminous shale, with *Graptolithus*	245	
Grey, hard sandstone, interstratified with bands of black shale.	5	
Black brittle bituminous shale, interstratified with beds of sandstone	7	
		— 318
2. Light grey, yellow weathering sandstone, with black argillaceous nodules at the top; in some parts the sandstone beds hold fossils, which are obscure, but appear to be *Orthis testudinaria* and *Leptæna sericea*	10	
Concealed	13	
Black brittle bituminous shale	6	
Dark grey argillo-arenaceous shale	51	
Dark grey argillo-arenaceous shale	192	
Dark grey argillo-arenaceous shale, with thin beds of sandstone	8	
Light grey sandstone in a massive bed, weathering greenish in the air and reddish in the water; two bands of conglomerate occur in the middle, holding pebbles of limestone and of quartz; some parts appear to weather faster than others in bands conformable with the bedding	18	
Dark grey, slighly greenish argillo-arenaceous shale	58	
Light grey conglomerate bed, with about two feet of fine grained sandstone at the bottom; the conglomerate parts hold pebbles of limestone and quartz, of various sizes up to two inches in diameter, those of limestone being in greater abundance than the quartz	5	
Grey sandstone, a massive bed becoming of a conglomerate character in parts	14	
Grey calcareous conglomerate, as before	3	

	Feet.	
Light grey sandstone, weathering brownish	3	
Grey calcareous conglomerate, with soft shaly sandstone as a matrix	2	
Greenish argillo-arenaceous shale, striped with dark grey bands	84	
Greenish argillo-arenaceous shale, striped with dark grey, and having a six-inch band of hard, light grey, reddish weathering sandstone at the top, and another at the bottom	18	
Greenish argillo-arenaceous shale, striped with dark grey, with occasional bands of hard, light grey sandstone, weathering reddish-brown as before	125	
Greenish argillo-arenaceous shales, striped with dark grey, with thinner and finer bands of light grey sandstone	39	
Greenish argillo-arenaceous shale, with dark stripes, without any bands of sandstone	70	
	—	719
3. Black brittle bituminous shale, weathering reddish and yellowish-brown, and holding *Graptolithus ramosus* and *G. bicornis* with a small *Orbicula* and *Triarthus beckii*,	16	
Black bituminous, and slightly arenaceous shale, not quite so brittle as the preceding, except in a few hard black bands which have *Graptolithus*,	17	
Black bituminous and slightly arenaceous shale, with two bands of the harder, more brittle and more bituminous character, the latter with *Graptolithus*,	4	
Dark grey bituminous and slightly arenaceous shale finely striped with black lines,	33	
Black brittle bituminous shale, weathering a light or yellowish-brown, without grit, and holding *Graptolithus* and *Orthoceras*,	7	
	—	77
		1114

The second division of this section presents characteristics which agree rather with those of the Hudson-River group than the Utica slate, but the occurrence in the third of so large an amount of black bituminous shale characterised by Utica fossils, makes it doubtful to which formation the middle portion, though the largest, should be referred. There is but little doubt that the measures which overlie the third, belong to the Hudson-River group, and the shales of this group occupy the distance between the mouth of the river A-la-Rose and that of the

Ste.-Anne, exhibiting in it more than one undulation, and thereby rendering it difficult at present to determine with precision the thickness to be given to them, though it is certain that it is considerable.

Between the river Ste.-Anne and Cape Tourmente, both the Trenton and the Utica formations are seen once more, on the road from St.-Joachim to Bay St. Paul, where the road rises from the plain between the rivers Blondelle and Marsolette; and the limestone is seen for the last time where the river Friponne descends from the gneiss. In both localities, the limestone, dipping nearly south, rests on the gneiss at an angle of about thirty degrees, and at the Friponne the strata are abundantly stored with characteristic fossils, such as *Orthis testudinaria*, *Conularia quadrisulcata*, *Calymene senaria*, *Trinucleus concentricus* *Lingula curta*, and *Orbicula filosa*.

In the physical structure of the country between Ste.-Anne-de-la-Pérade and Cape Tourmente, it will be perceived that the anticlinal forms which have been described, have apparently a rude parallelism to one another, that every one of them shows a more precipitous dip on the south-east than on the opposite side, and that in two instances the strata, where they take their south-eastern plunge, have been torn asunder, the slope becoming a step in the stratification, giving what is called a fault, with a down-throw on the south-eastern side. The effect which these undulations have produced on the physical geography of the district, is shewn in the distribution of its rocks, and the courses of the main streams which drain it, such as the Ste.-Anne-de-la-Pérade, the Jacques-Cartier, the Montmorency, and the Ste.-Anne-de-Montmorency, which run parallel with them; these river-courses are thus the means of demonstrating that the undulations continue much farther to the north-eastward than the examination has been carried. To the south-west also they produce marked effects upon the contour of the formations on the right side of the St. Lawrence, and can be traced to great distances, even to the boundary of the province in the valley of Lake Champlain; but as these effects have been described in former Reports, it is not necessary to allude to them farther on the present occasion.

ECONOMIC MATERIALS.

The materials bearing an economic value which have been met with in the district, the geology of which has been under investigation, appear to be almost wholly confined to bog iron ore and iron ochres, together with stone fit for the purposes of construction and flagging, as well as limestone for burning, clays for common bricks and pottery, and peat in some parts fit for fuel; to these and one or two other substances, which have come under my observation from parts of the country heretofore reported upon, it remains for me to draw attention.

Bog Iron Ore. Indications of this ore were observed on the road between Ste.-Anne-des-Plaines and St.-Lin in the Petite-Chaussée, but the quantity did not appear to be important. The ore was again observed on the same road not quite half-way between the rivers Ste.-Marie and Achigan; the thickness was about six inches, but it was not ascertained that the extent was considerable.

An area which spreads over a part of the township of Kildare, and an adjoining portion of the augmentation of the seigniory of La-Noraye and Dautraye, comprising a superfices of about nine square miles, exhibits patches of bog ore in so many of those parts which have been cleared, while there is much still covered by primœval forest, as to induce the expectation that it may become worthy of attention as a profitable source of the ore. One of the spots in this area in which the mineral occurs, is on the line between the first and second concession of the township, where it intersects the seventh and eighth lots; the principal part of the deposit is on the lots of Messrs. François de-Boncœur, Baptiste La-Chapelle, and Narcisse La-Chapelle, on which there may be between fifteen and twenty acres yielding the ore in patches, the thickness of which varies from three inches to one foot. Another of the spots is situated on the seventh lot of Kildare, where it is intersected by the road between the fourth and fifth concessions; here the principal patches observed were on the land of Mr. J. Landry, but they were not ascertained to be considerable. Between these localities much of the country is covered with wood.

In the augmentation of La-Noraye and Dautraye, one of

the localities is close upon the left of the river L'Assumption, a little above the road leading from the line between the second and third ranges of Kildare ; here, on a lot belonging to Madame Lefèvre, five patches of the ore, varying in thickness from two inches to one foot, were observed in an area of about two acres. North of this, about half a mile, in Côte-Ste.-Emilie, bog ore was observed on the lots of Messrs Norbert Berri and Charles Berri in four patches of three inches to one foot thick, running eastwardly across the lots. A continuation of such patches may extend to another ascertained locality in the same range, shewing itself about three-quarters of a mile to the eastward ; here a succession of patches exists, having a collective length of about a mile and and a-half farther eastward, and a breadth in the middle of about 1200 yards, diminishing in opposite directions, and giving to the whole space a lozenge or diamond shape ; the patches occupy areas of from ten to fifty square yards, and appear to be in general about three inches thick, but they do not seem to constitute over a-twentieth part of the whole ground. A considerable portion of the general area being still covered with wood, the limits could not be ascertained with precision, and they may exceed those given ; the largest breadth of the area is upon the land of Mr. Louis Beauplein. South from this, about the sixth part of a mile, a triangular shaped area of about fifty acres occurs in the adjoining range of lots, that of Côte-Ste.-Rose, in which the patches of ore, with a thickness similar to those in Ste.-Emilie, make up about one-fifth of the ground. The greatest breadth, which may be about 600 yards, occurs on the land of Mr Cyrille Blanchard, and the mineral area diminishing eastward, crosses the lands of Mr. Léon André and Mr. Barbel.

These various mineral areas in Kildare and La-Noraye and Dautraye, may be stated to be between four and five miles from the village of Industry ; the only other locality in this vicinity, in which bog ore was ascertained to exist, is close upon the right bank of the river L'Assomption about half a mile below the village, on the land of Mr. Alexis Larivière, where indications extend over half an acre, in patches of three to six inches thick, occupying about one-third of the ground ; this locality was not visited.

The next group of localities yielding bog iron ore is that connected with the sources from which, for a great number of years, the forges of St. Maurice have been supplied. One of these is situated in the augmentation of the township of Caxton, about half a mile south-east from the point where the line bounding the augmentation on the south-west, cuts the Great Yamachiche river. About a hundred acres at this place, on the property of Mr. Pierre Boivin, have given an abundant supply, but the locality is now nearly exhausted; the ore is still obtained, however, in spots along the windings of a small creek which flows through the land, and which once abounded with it, for three-quarters of a mile. At the time the locality was examined, about 600 barriques had been collected from about half an acre along the creek, and the thickness of the deposit appeared to vary from six to fifteen inches.

North-east of this locality about four miles, there is a considerable swamp, in the fourth range of the fief St.-Etienne, which has a south-westward length of about a mile and three-quarters, with a breadth diminishing from about forty acres at the north-west end, to ten acres at the opposite extremity; it may thus have an area of about 1200 acres. Ore is found and has been collected at uncertain intervals of space along the north-western edge of the swamp, and it probably occurs in patches over the most part of it, but the swamp being always covered with water, except for a few months in summer, is not very easy of access, and has only lately been resorted to for the mineral. At the south-eastern end of the swamp, ore was lying in piles which had been collected for the forges, and as shewing the yield of the ground, it may be stated that three patches occurring in the area of about 500 square yards, produced the following quantities:

1st	patch	measuring	12	feet	by	15 feet	10 barriques.
2nd	"	"	30	"	"	7	12½ "
3rd	"	"	35	"	"	6	50 "

About two and a-half miles south-east from this locality, in the second range of St.-Etienne, on the property of Mr. Louis Bellefeuille, bog ore is met with in patches over a surface of from thirty to forty acres. One pile recently collected and lying on

the ground was estimated to contain about 1000 barriques, and another about thirty barriques, the latter being the produce of seven patches occuring in a space of thirty yards by from two to three yards across. The thickness of the mineral patches in this ground, which has only recently been resorted to for ore, appears to range from six to nine inches.

Two miles south from the last spot, and within the seigniory of Pointe-du-Lac, a considerable quantity of ore has heretofore been taken from an area of about thirty acres, lying in the woods. Little however appears to be left, but about fifty barriques had been recently obtained from the waste of the workings of former years. The expediency of resorting to this refuse may be taken as an indication of an increasing scarcity of the ore.

From a point about a-quarter of a mile farther south, and from another about 600 yards still farther south, there start two bands or strips of ore-patches, which varying in breadth from sixty to one hundred yards in the one case, and ten to 220 yards in the other, run to a common point about a mile to the eastward; with the exception, however, of a small portion of the patches at the point of union, the ore is pretty nearly exhausted; the thickness of the patches that remain, appears to be from six to twelve inches.

The last mentioned locality is about three miles from the margin of Lake St. Peter, at the mouth of the river A-la-Glaise; and two miles nearer the lake, in the range St.-Nicholas of Pointe-du-Lac, on a small branch of the stream just named, and within a-quarter of a mile of the end of the range, there is on the land of Mr. Cyrille Vincent, an area which appears to have yielded a considerable quantity of ore in former years; it has a north-east and south-west length of about 350 yards, by a transverse measure of about 100 yards, and the ore is said to have been from three to six inches in thickness. About 120 barriques collected from the waste of former workings were in piles at the time of examination.

Intelligence was obtained of another exhausted area in this vicinity, on the property of Mr. Etienne Berthiaume, and other lots adjoining, situated near the range Garceau, about a

mile and three-quarters north of Pointe-du-Lac church. It has a measure of three-quarters of a mile in length north-eastwardly, by a breadth varying from half an acre to an acre. Small quantites of the ore are still collected from the waste; this place was not visited.

The country between the St. Maurice and the Batiscan appears to be an ore-field of some importance; several extensive areas abounding in the mineral are known to exist in it, and much of the ground being still covered with wood, it is probable more will be discovered. In this district, indications of the ore were noticed not far from the bank of the St.-Maurice, on the land of Mr. Macaulay, about a mile and a half below Pointe-à-la-Hache, but the ore-ground of an important character, nearest the forges, on this side of the river, is situated to the north-east at a distance of between six and seven miles. It occupies a triangular area lying in the St.-Felix and Ste.-Marguerite ranges, partly in the seigniory of Cap-de-la-Madeleine, and partly in that of Champlain. Its superficies may extend over about six square miles; it has a pretty uniform level and may stand 180 or 200 feet over the level of the St. Lawrence. A road leads from the Ste.-Marguerite to the St.-Felix range, between the forty-eighth and forty-ninth lots; on this road, in the vicinity of its junction with the road of St.-Felix, five or six patches of ore belonging to the area in question, were met with, of from two to four inches thick; and about a mile to the north-east from this, additional patches were observed running in a zig-zag course in the same general direction for half a mile, which appeared to be unusually abundant sources. They have been worked for some years for supplying the forges, and considerable quantities which had been collected, lay in piles on the spot at the time of examination. Twenty-four piles which were the produce of several patches included in about three-quarters of an acre, were estimated by measurement to contain about 390 tons; two large piles from different surrounding places gave about 750 tons, and several parts examined appeared to shew that over a considerable extent in the neighbourhood, areas of from a-sixteenth to three-quarters of an acre were more or less occupied with patches of from two to four and

occasionally six yards across, and from six to ten inches thick. The position is about the thirty-fifth lot on the north-west half of the St.-Felix range, and the ore is traceable by the thirty-fourth lot on the south-east half, to the Ste.-Marguerite range, where it is known on the thirty-fourth and thirty-third lots, on the north-west side of the Ste.-Marguerite road, as well as on the twenty-fourth, and it was met with still farther to the north-eastward, about a quarter of a mile beyond the river Au-Lard, on the lot of Mr. Ibert Rault.

Mr. McFarlane, who, while the St. Maurice forges were in the possession of the Hon. J. Ferrier, made several explorations in search of ore, has informed me that the mineral is met with in some quantity in the vicinity of a small sheet of water called Lac-aux-Tourtes, tributary to the St. Maurice and falling in by a short stream on the left bank. The distance back to the lake is uncertain, but it is supposed to be about six or seven miles from the St.-Felix range, and near the division between the seigniories of Cap-de-la-Madeleine and Champlain.

In the seigniory of Champlain a considerable field of the ore exists on the south side of the river which goes by the same name. According to the information received, it extends in a band from within fifteen acres of Mr. Richardson's mills, (which are situated on the Champlain, about mid-breadth of the seigniory), in a north-easterly direction to the settlement on the river A-la-Lime in the seigniory of Batiscan, a distance rather less than three miles, and has a breadth of twelve to eighteen acres; its superficies would be about 1100 square acres. The north side of the band is ten or twelve acres to the south of the road at the river A-la-Lime, and there is another and parallel band north-west of it, and separated from it about ten acres, which commences fifteen acres within the boundary of the Champlain seigniory on the north-east side, and extends about fifteen acres in the opposite direction; the breadth is from three to six acres, and it would thus have an area of about seventy-five square acres. The ore, as in other instances, occupies these bands in numerous patches, the thickness of which varies from three inches up to a foot. From that part of the band which lies in the vicinity of the river A-la-Lime, the forges, which some thirty-five years ago

were in operation on the Batiscan river, were supplied with ore, and in the woods there, many good piles of the mineral were seen remaining, which had been abandoned when the forges were blown out. I have been informed that the quantity thus abandoned is estimated at 20,000 barriques.

On the eastern side of the Batiscan river, bog ore is found in the vicinity of Mr. Marchand's mill on the river A-Veillette, upwards of a mile and a-half from the bend in the Batiscan, below the old forges. It occurs on the land of the three brothers Messrs. Desaulniers, in several patches, one of which appeared to extend over about the third of an acre, with a thickness of from three to six inches, and sometimes a foot. Upwards of a mile and a-half beyond the mill on the road to St. Prosper, it occurs not far from the boundary between the seigniories of Batiscan and Ste.-Anne-de-la-Pérade, on the lots of Msssrs. Bte. Violette and Archange Baril; the patches are small, and the thickness does not exceed three to four inches.

In the seigniory of Ste.-Anne-de-la-Pérade, indications of the ore were met with on the south-west side of the road, which turns up from the Ste.-Anne river and runs parallel with the Charest, but the patches do not seem to be numerous; the thickness is from three to four inches.

Another locality in which bog ore was met with, was on the road between Portneuf and St. Basil, in what is called the Bois-de-l'Ail, on the land of Mr. F. Marcotte, where I was informed by the proprietor, patches occurred for the breadth of four acres. This area I was given to understand belonged to a general band, extending from the land of Mr. William du-Chemin, Petit-Bois-de-l'Ail, by those of Messrs. F. Marcotte and F. Suzor, to the land of Mr. Jean Tourangeau at St. Joseph, but it was not ascertained whether the quantity was abundant.

Indications of the ore are said to exist also on the Jacques-Cartier in Bois-Brulé, Cap-Santé, on the land of Mr. Amable Tourangeau, but the place was not visited.

Iron Ochres. Indications of these substances were observed in a great many of the localities which have been mentioned as yielding bog iron ore, and in others in the vicinity of ore beds, though unmixed with ore; in some few cases

where no bog ore was observed in association with them, the ochres may perhaps be taken as suggestive of the probable existence of the ore in the neighbourhood, seeing that both substances have the same origin, and nearly the same composition, with a difference chiefly in condition.

On the lands of Madame Lefèvre, Messrs. Norbert and Charles Berri, Cyrille Blanchard, Léon André and M. Barbel, in the Ste.-Emilie and Ste.-Rose ranges of the seigniory of La-Noraye and Dautraye, already mentioned for bog iron ore, ochre also was met with in small patches of from one to five yards in diameter, and one to three inches thick; it was yellow in color and appeared to contain a good deal of sand, while wide intervals existed between the patches.

About 300 yards from the left bank of the Great Yamachiche river, at the first bend, above the south-west line of the augmentation of Caxton, five patches of yellow ochre were observed in a distance of 250 yards; the largest patch had an area of six square yards, with a thickness of twelve or fifteen inches, and it is not improbable that others may exist in the vicinity, though it is not supposed that they are numerous. The ochre was not much mixed with sand.

A very large ochre-bed is situated on the St.-Nicholas range of Pointe-du-Lac, on the property of Mr. Pierre Chaillon and his brother. It is crossed by the range road, running north-westward, over a mile from the point where this starts from the water-side road; the deposit extends on each side of the road, about ten acres to the south-west, and forty acres to the north-east; the breadth is irregular, and varies from one to twenty acres, and the whole area may be about 400 acres; the thickness of the deposit ranges from six inches to four feet, and may have an average of about eighteen inches. The prevailing colors of the ochres are red and yellow, but there occurs also in some parts a beautiful purple tinge, and in others a blackish-brown. At the Industrial Exhibition which took place in Montreal, in October 1850, some of the ochres of this locality, presented to public view by Mr. D. G. Labarre, attracted the attention of persons acquainted with the commercial value of such products, and arrangements were subse-

quently made with the proprietors of the land, by Messrs. H. A. Munroe & Co., of New York, for the purpose of entering upon such a preparation of the crude material as should fit it for sale. With this view a couple of furnaces have been erected in the vicinity of the ochre bed, and an agent established to carry out the details of the manufacture, and attend to the forwarding of the article to New York, where the sale of it is effected. I was given to understand by the agent that 400 barrels of the ochre had been disposed of at five dollars each, and that as many as twelve barrels had occasionally been prepared in a day. From the few natural colors that have been mentioned, eight tints are said to be prepared. The deposit being but little mixed with sand, the chief impurity to be got rid of, consists of the roots of those plants which have been growing on the surface, some of which penetrate to a considerable depth. Two modes are resorted to for this purpose; one is by dry sifting, which is used where the natural colors of the ochres are to be preserved, as in the case of the yellow variety, of the purple, and of the blackish-brown. The yellow is a hydrated peroxyd of iron, the purple also is probably in some peculiar state of hydratation, but the red is the anhydrous peroxyd. By exposure to a sufficient heat in the furnace, the water of combination is driven off from the yellow and purple, and both becoming anhydrous peroxyd, assume the tint of the natural red ochre, from which, as from the other two, the vegetable matter in this operation is burnt out. The blackish-brown variety is scarcer than the others, and affords colors of a more valuable description; purified from roots without fire, it is sold under the name of raw sienna; it is admirably adapted for graining, and brings in retail, I am informed, so much as a shilling the pound. When subjected to fire it assumes a brown of less intensity, and it is sold as burnt sienna. As it does not turn red from burning, it is probable that there may be in this ochre, an admixture of manganese.

Further to the north-west, on the road of the same range, patches of ochre were observed in considerable abundance for upwards of a mile; but they were not in general so pure as the great one just described, and the thickness by no means so considerable, being no more than from three to six inches.

About a mile and a-half below the forges of St. Maurice, but on the opposite side of the river, a patch of ochre was observed associated with the bog iron ore already mentioned there. It might have an area of about 200 square yards; its thickness, did not appear to exceed from three to six inches, but the ochre was free from all impurities with the exception of those of vegetable origin.

On the north-west side of that part of the road through the range Ste.-Marguerite, which runs south-west fron the river Au-Lard, patches of yellow and brown ochres are met with for a distance of six miles; they do not exceed from three to four yards in diameter, and the observed thickness rarely went beyond four inches. They all contain more or less sand, but by washing, the quality and quantity would be sufficiently good and extensive, to supply the wants of the inhabitants in the vicinity for a great number of years.

In the St.-Malo range of the seigniory of Cap-de-la-Madeleine, a great deposit of ochre occurs opposite to the end of the road which turns up from the margin of the St. Lawrence, about two miles below the Cap-de-la-Madeleine church. The locality is upwards of two miles back from the river, or about half a mile from the front of the St.-Malo range; its breadth on a line continued from the road is about eleven acres, and it extends rather more to the north-east than to the south-west, with a length altogether equal to about two miles; the area would thus be upwards of 600 acres. A section was examined across the deposit on the farm of Mr. David Bruyère, near the mid-length, partly by sounding with a boring rod and partly by excavation; the following is the result of the trials:

For 50 paces forward,			Six inches of yellow ochre rested upon six inches of peat, below which an equal quantity of ochre was followed by two feet of peat.
For 50 paces farther,			One to two feet of ochre rested on four feet of peat.
45	"	"	One to two feet of ochre rested on eight feet of peat.
26	"	"	One to two feet of ochre rested on four feet of peat.
100	"	"	Nine feet of peat rested on about six inches of brownish-white colored fresh-water shell marl.
160	"	"	Two feet of yellow ochre of superior purity, rested on alternations of peat, marl, and ochre, to the thickness of seven feet.

For 320 paces farther, Twelve feet of peat occured, gradually thinning out to the margin of the sandy plain at the edge of the deposit.

An almost inexhaustible quantity of red and yellow ochres might be obtained from this locality, and when the ochres are mixed with peat, masses of the mixture might be cut out and dried, and afterwards burnt with facility, experiments on a small scale shewing that the quantity of peat in the mixture is often sufficient to calcine the ochre.

In the parish of Ste.-Anne-de-Montmorency, on the property of Mr. E. Caron, about a mile and a-quarter above the mouth of the Ste.-Anne river, there is a deposit of ochre extending over about four square acres. The locality is on the top of the bank which overlooks the main road, from which it is removed about a quarter of a mile. The surface of the deposit has a slope to the south-east of about fifty feet in about 150 yards, but the bottom of the deposit keeps nearly on a level with the lower side for some distance back, and then rises quickly up to the higher side. The thickness of the deposit is thus about seventeen feet in the deepest part, and varies from that to four feet. The form of the deposit would give great facility in excavating the ochre, as by beginning on the lower side, a considerable face of it would be exposed, and the water would run from it without the necessity of cutting drains. Three colors exist at the surface, yellow, red and blackish-brown, similar to those of the deposit at Pointe-du-Lac; but the lower and by far the larger part, is an ochre of a whitish-green color. In this green portion the iron is in a lower state of oxidation than in the yellow, but like it, becomes red upon ignition.

On the road to St. Stanislas, at Lac-Capabusca or Corsettes on the river Des-Ennies a tributary of the Batiscan, and about seven leagues from Ste.-Geneviève, iron ochre is said to occur in some abundance.

Iron Sand. The margin of the St.-Lawrence between the Batiscan and Champlain rivers, is frequently blackened by the occurrence of magnetic iron sand, which in some spots near the Batiscan appears to be in such abundance, that it might be collected with facility to be used instead of blotting paper for absorbing ink, for which purpose it is sold by stationers.

Wad or Bog Manganese. On the St. Louis road, about four and a-half miles from Quebec, there is a small deposit of this ore on the property of Mr. Michel Hamel. It occurs in black honey-combed masses imbedded in sand, and occupies an area of about sixty yards in an east and west direction, by five yards wide ; it has a thickness of about one foot in the middle, and gradually thins out all around.

Clay for Common Bricks and Pottery. Of the terraces that have been mentioned in a previous part of the Report, as succeeding one another in steps between the flank of the Laurentian series of rocks and the St. Lawrence, the upper ones are to a great extent occupied by sand, but clay fit for the manufacture of common bricks, coming from beneath the sand is of such frequent occurrence, that in addition to a vast number of localities in which it is met with on the margin of the main river, or not far removed from it, there is scarcely a tributary when its channel is cut deep through the drift formation, that does not hold it in some part of its banks ; bricks might thus be manufactured in the vicinity of almost any part where a demand for them might arise, and the places chosen for carrying on this branch of industry, are therefore chiefly dependent on the convenience of carriage to a market.

The following is a list of such localities as came under observation during the season, including several on the south side of the St. Lawrence. The quantities of bricks manufactured at them, are derived in many cases from the manufacturers themselves, and in others from common report in the neighbourhood :—

At the upper extremity of St. Antoine Suburbs, Montreal, bricks were made for several years by Mr. Tully, but the field is not at present worked.

In a field on Ste. Elizabeth Street, Côteau Baron, Montreal, Messrs. Peel and Comte manufacture annually, and sell chiefly in Montreal, from 2,500,000 to..... 3,000,000

On the Papineau road, Montreal, Mr. J. Richardson makes and sells in Montreal..... 300,000

On Colborne Avenue, Montreal, Mr. C. Adams makes and sells chiefly in Montreal, from 2,500,000 to..... 3,000,000

On Parthenais Street, St. Mary Suburbs, Montreal, Mr. John Bowden manufactures and sells in Montreal,..... 800,000

On the left bank of the Naquoarau river, about two miles below Dorwin's saw mill, Mr. Lafon manufactures for sale in the neighbourhood, about..... 13,000

On the river Richelieu, one mile below the village of St.-Ours, bricks are made and sold in the neighbourhood to the extent of between 40,000 and..... 50,000

On the right bank of the same stream, five miles above Sorel, Mr. W. Jenkinson makes and sells in the neighbourhood, about..... 100,000

On the right bank of the same stream, about a mile and a quarter above Sorel, Mr. James Sheppard manufactures and sells chiefly in Montreal, 400,000 to..... 500,000

On the same bank of the river, about a mile above Sorel, Mr. Charles Sheppard makes and sells generally in Montreal, about..... 700,000

At Yamachiche, Mr. François Pichette makes and sells in the neighbourhood, about from 400,000 to..... 600,000

At Pointe-du-Lac, Mr. Duval manufactures and sells chiefly in Montreal and Quebec, about..... 100,000

At the same place, Mr. C. Dupras makes and sells at Montreal and Quebec, about..... 100,000

Above Three Rivers a few miles, the following persons are said to make the following quantities which are sold between Montreal and Quebec.

Mr. J. Lalancette,.....	600,000
" Michel Barbinas,.....	450,000
" Olivier Boisvert,.....	375,000
" Joseph Lamérise, père,...	375,000
" Joseph Lamérise, fils,....	200,000
" Elzéard Abraham,.....	525,000
" Joseph Gouin,.....	200,000
" Louis Boisvert,.....	100,000
" Joseph Dugé,.....	175,000
" Elzéard Aubry,.....	500,000
" Henri Felix,.....	200,000
" Joseph Lotinville,.....	200,000
	3,900,000

At and near Cap-à-la-Roche, St. Jean, there are seven brick makers, who are said to manufacture on the average, about 300,000 each,..... 2,100,000

On the Batiscan river, two miles up from the mouth, bricks have been manufactured.

On the Charest river, not far from its junction with the Ste.-Anne-de-la-Pérade, bricks were at one time made, but the manufacture was given up for want of demand.

On Isle-au-Sable, and also upon Isle-au-Large at the mouth of the Ste.-Anne, there was once a manufactory of bricks.

On the Little River road, Quebec, Messrs. W. & D. Bell manufacture and sell, chiefly at Quebec, from 1,500,000 to..... 2,000,000
Near the same locality, Mr. Ward makes and sells in Quebec, from 700,000 to..... 1,000,000
At St. Pierre, on the Island of Orleans, Mr. Modeste makes and sells chiefly in Quebec, from 80,000 to..... 100,000

In addition to bricks, roofing and drain tiles are made at several of the principal brick-fields. A large number of the latter are manufactured by Messrs. Peel and Comte of Montreal, and Messrs. W. Steele and McLaren at the mouth of the Yamaska; Messrs. W. & D. Bell of Quebec besides tiles, manufacture various vessels for the use of the dairy and garden, as well as water-pipes, chimney-tops, and ornamental glazed bricks.

On the river L'Assomption, about a mile below the village of the same name, Mr. Michael Porteous, makes all such articles of common pottery as are used in the neighbourhood, and of the same description of articles, there are three makers at Yamachiche, Messrs. B. Brière, A. Dumont and J. Féron. The clay here used for the purpose of this common pottery is an eighteen-inch bed of a light brownish-red color, which in thinner bands, is extensively found interstratified with a very fine and unctuous clay, of an ash-grey when dry. Instances of it were observed at St.-Rocque and Ste.-Anne-de-la-Pérade; and on the right bank of the St. Lawrence, a short distance below the lesser river Du-Chêne, a vertical cliff of eighty-five feet, shews a fine example of the interstratification of the two kinds of clay. The brownish-red beds have a tendency to split into thin vertical slices and prisms, and are in consequence called by the pottery manufacturers at Yamachiche, *terre à grains*. Common pottery used to be manufactured at Gentilly, nearly opposite to Three Rivers, as it is at Baie-de-Fêbvre, on Lake St. Peter, and at St.-Denis, on the Richelieu.

Building Stones and Flagging Stones. In the neighbourhood of Ste.-Scholastique, fine grained white sandstone fit for building purposes is displayed in some abundance. It belongs to the Potsdam formation, and has a general similarity to that heretofore described as existing at Beauharnois. The beds are very even and of various thickness up to two feet; and the more massive ones are frequently marked on the sides

by striæ, shewing the edges of subordinate planes of lamellation, in which it is probable the rock would split with facility by the use of wedges. Although harder than the various calcareous rocks so commonly used for building purposes, it is capable of being dressed to a good face, even across the beds, and possesses the valuable property of resisting the effect of fire. Though the interior of a house built of this stone were consumed by fire, the walls would still remain sufficiently sound to permit the reconstruction of the wood-work within them.

In the vicinity of Montreal the lower part of the Trenton formation holds massive beds of grey granular limestone, from which a very large amount of the best building material used in the City has been obtained. The quarries opened on them run obliquely across that portion of the Côte-de-la-Visitation road, which is southward of the Papineau road, their general direction in respect of one another, being about north and south; they are situated chiefly on the properties of Messrs. Hughes, Smith and Lacroix, and are rented to various parties. The beds vary in thickness from three inches up to three feet, and present an aggregate of from eight to twelve feet. In successive quarries, from the one to the other of which the beds can be traced with considerable certainty, individual beds appear occasionally to change in thickness, a massive one gradually dividing on the strike into two or more, or several thin layers uniting into a solid mass. Slight changes in the color also occur, giving shades of lighter or darker grey. The different quarries are usually separated from one another by trap dykes running in directions varying from N. N. E. to E. N. E., on the opposite sides of which the beds are generally found to be dislocated by up-throws or down-throws, of from one or two inches to one or two feet. There does not however appear to be any difficulty in identifying the beds on the opposite sides, with the exception of one instance on the land of Mr. Smith, where the aggregate thickness is twelve feet on the one side, and is represented to be only eight feet on the other. The quarry in which the latter thickness is said to prevail, being filled with water, it was not in my power to ascertain whether the change was sudden, or sufficiently gradual to be taken as a

case in which some of the beds had thinned out. If the beds on the opposite sides of the dyke are equivalent, there must be a down-throw on the northwestward side, of eight or ten feet ; but it appears to be the opinion of the quarrymen that they are not equivalent, in which case there must be two sets of grey strata towards the base of the Trenton formation, of nearly equal amount—a fact which has not been ascertained by any individual section in the workings of the quarries. Above and below the grey beds, the color of the stone is black, and from three to eighteen inches of a similar color are in some places interstratified among the grey. The black stone is used for inferior buildings and for *backing*, and with the fragments resulting from the dressing of the grey stone, is burnt for lime.

Another and parallel range of grey granular limestone beds quarried for building purposes, exists three-quarters of a mile to the westward of those just mentioned. This stone even when freshly cut is not quite so uniform in color, and it is more liable to become affected by a yellow tinge from the action of the weather, but the beds yield large blocks, and have in consequence been much resorted to for the massive masonry of the quays and canal docks of the city. These beds are in the Chazy formation, the distribution of which in the islands of Montreal and Jésus has been described in a previous part of this Report. The superficies under which it lies in each island, is about three square miles, and the drift covering it does not in general appear to be very great. It is probable that a large amount of good building stone would be obtained in these areas, but it appears to be those beds which are near the summit of the formation, that have hitherto been chiefly resorted to for it. It is in this part of the formation that are situated the quarries belonging to Dr. Beaubien, which have been a considerable time in operation on the east side of the Mile-End road, beyond the first milestone from the toll-bar, and material of the same character, as yet nearly untouched, is to be met with on the west side of the road as far as Madame Nolan's farm, Côte-Ste.-Catherine, where massive beds, lying in a nearly horizontal attitude, would supply a large quantity of good stone. In the strike of the formation north-ward from Dr. Beaubien's quarries, the same beds have been worked by various parties for the supply of the city, at intervals extending to a distance of three quarters of a mile.

On the road between Mile-End and Sault-au-Recollet, a quarry, not quite half a mile beyond the second mile-stone, and another about a quarter of a mile short of the third, are excavated in the Chazy formation. They shew beds of from one to two feet of good grey granular building stone, and large blocks may be obtained from them.

On Isle-Jésus, a mile and a-half south from Terrebone, a quarry has been worked in the Chazy formation. Two massive beds of five feet each, have yielded blocks of the largest size of excellent grey stone, granular in texture, and composed of a cemented aggregation of comminuted organic remains. The stone was highly esteemed by the officers of the Board of Works, and heavy blocks were brought round to Montreal from the quarry, and used by them in the construction of the enlarged locks at the lower end of the Lachine canal.

On the L'Assomption river, at the village of Industry, good building stone occurs near the red bridge, where beds of six inches to one foot, belonging to the Trenton formation, have been quarried and used in the construction of the bridge for the railroad. The color of the stone is gray, of rather a darker tinge than that of the Montreal stone, and the texture is more compact, but the beds appear to occupy a position very nearly equivalent to the place of those mentioned as quarried in the front part of Messrs. Smith's and Lacroix's properties, near the city. At the village of Industry they appear to be between sixty and seventy feet from the base of the Trenton. Near the upper bridge at this village, the Chazy formation would yield massive blocks of good grey granular stone in beds of from two to three feet thick, but they have not been worked.

On the Naquoarau river, about a quarter of a mile below Mr. Dougal's mills and just below Les-Dales, beds exist, corresponding with those at the red bridge of the village of Industry, and giving building stone of equally good quality.

Just below Mr. Dorwin's saw mill, on the last mentioned stream, a short distance from the south-east boundary of the township of Rawdon, and opposite the line between the twenty-third and twenty-fourth lots, the white sandstone of the Potsdam formation, for a thickness of four feet, would yield material fit for the purpose of flagging. The beds are from two to

three inches thick, and though no quarry has been opened on them, to enable it to be determined with certainty what size of flags might be obtained, it appears probable they would measure four or five feet square, and in some instances more.

In the same formation, on Côte-Ste.-Catherine in the parish of St. Cuthbert, on two farms adjoining one another, belonging to Messrs. Maxime Durand and Jacques Nicolas, four and a-half feet of good flagstones are exposed; the thickness of the slabs being as before, between two and three inches. With care, slabs of seven feet by three and four feet may be got out. They are easily squared, and are used in the neighborhood for hearth-stones, door-flags and such purposes.

Still in the same formation, on the St. Maurice river, at a place called the Grès, probably from the presence of the sandstone, a mass of eleven and a-half feet would answer for the purpose of flagging; the beds are one to three inches thick, and they are of a good white color. A subjacent thickness of ten feet, resting on the gneiss, would, from the freeness of its texture, yield an easily worked and handsome building stone, which might be dressed to the thickness of six inches to one foot, and even eighteen inches.

Near the village of Grondines, a large amount of limestone is exposed, which does well for burning into quicklime, but no beds requiring to be especially noticed as giving material for the best purposes of construction, were observed, though no doubt there is a great amount capable of application to common buildings.

In the seigniory of La-Chevrotière a very excellent calcareous building stone is obtained in the fourth range of lots from the St.-Lawrence. It usually goes, however, under the denomination of the *Deschambault* stone, though I am not aware of any exposure of the same beds in the latter seigniory. The stone is of a yellower or warmer grey than that of Montreal; it is more even in its tint, and does not become so much discolored by weathering; it is more granular and more easily cut, being softer and tougher, but it does not take so fine and sharp an edge, nor does it *pick* so well. Three beds are worked, of pretty uniform quality; the top and bottom ones are eighteen inches each, and the middle one three feet; and there is said to

be a fourth bed beneath, which has not been quarried, with a thickness of four feet. The strata are so nearly horizontal that it is difficult to say which way they dip; it is therefore probable that the stone will spread to a considerable extent in the vicinity. Along the concession it is known for twenty-six acres to the westward and five acres to the eastward, and on the road across the concession it has a breadth visible for ten acres, beyond which, in sinking wells to a depth of twenty feet in blue clay, no rock is met with. The produce of the quarries of La-Chevrotière has a deserved celebrity in Quebec, where it has been used in the construction of churches and other buildings.

At the St.-Olivier bridge, over the Ste.-Anne river, in the same seigniory, there is limestone of the same color as that of the fourth range, but it is closer in its texture; it would yield good stone for building purposes, but not in such massive beds as the previous quarries. Both exposures are supposed to belong to the Trenton formation, though the fossils observed are not so characteristic as to make it quite certain.

In the same seigniory a quarry has been opened on the property of Mr. Alphonse Perrault in the first range, from which stone was last summer obtained for the purposes of construction on the Quebec and Richmond railroad. The beds are thick and yield massive blocks, which, when freshly dressed, look well; thin bituminous leaves however run through them in patches, and these will be very apt to injure the aspect of the stone when it has been for some time exposed to the action of the weather.

At Cap-Santé, the black bituminous shales of the Utica formation are at intervals interstratified with calcareous layers of two to three inches thick, and sometimes a little more. They are of two colors, dark grey and light grey; the former are the more bituminous, the latter the harder and more calcareous, giving, I was informed, good lime when burnt. From the remarkable evenness and smoothness of these layers, they are greatly resorted to by the inhabitants for stones for hearths, chimney-jambs, window-sills and door-lintels, and they would yield excellent material for the paving of dairies, cellars, hall-floors and such like purposes; but it is to be feared they are scarcely strong enough for foot-pavements in public thorough-

fares. They are too much jointed in various directions, and great weights, after the stone had been exposed to the weather for some time, might crack them in these joints, which are often with difficulty perceptible. I was informed by workmen who were quarrying the stone at the time of my visit, that slabs had sometimes been procured of twelve feet square without joints, but none such came under my observation. The joints are vertical to the plane of the beds, and they run chiefly in three directions, giving rise to two sets of rhomboids, one much more acute than the other. There seem to be no regular intervals at which these parallel joints occur, and they are occasionally so close as to cut up a bed into square prisms; sometimes the prisms are twice as broad as thick, and when squared at the ends and broken into equal lengths, would afford a building material of as great regularity as bricks. These beds are conspicuously displayed on the beach at Pointe-à-l'Abri, and I was informed that they are also met with in several places between high and low water mark for a considerable distance out from the cliff, the foot of which is washed by the flood of spring tides.

At Pointe-aux-Trembles, on the land of Mr. Joseph Gagné, and several other lots to the eastward, there is a grey limestone in massive beds, in which quarries have been worked. It has a colder tint than the stone of La-Chevrotière, and is less granular; it is not so soft, but can be worked to a sharp edge, and a good deal resembles the Trenton grey beds of Montreal. The beds yield good large blocks, and the stone has been used at Quebec in the construction of public buildings.

Along the coast from Cap-Rouge to Pointe-à-Piseau, near Quebec, several quarries have been long worked in the sandstones, which have been described as probably equivalent to what is called the Oneida conglomerate in New York. A good example of these quarries is that of Mr. Michel Hamel on the St.-Louis road, about four miles and a-half from the city. The beds are massive, and dip to the south-south-east, at an angle of about fifteen degrees, and those which have been quarried would make up a thickness of about forty feet. The upper beds are even, and split well both with the layers and across them, but at the bottom there is a surface which sinks

into great pits, some of which are three or four feet in diameter, and rises into smooth swells; the rock below this is valueless, as it will not split evenly. The stone is of a greyish-green color; it is moderately fine grained, but becomes coarse in patches, and consists of grains of transparent and translucent quartz, mingled with a few of opaque white feldspar; where the beds separate from one another, they are slightly micaceous. In some parts of the quarry, spheroidal masses of a coarser grain and lighter color occur, and the whole rock is slightly calcareous; nodules and fragments of green shale are occasionally seen, and it is probably from a small amount of this argillaceous material finely mixed up in the rock, that its general color is derived. The stone, though hard, yields readily to the chisel, and is capable of being dressed to a moderately fine face. It has been used in the construction of many of the houses in Quebec, as well as of various parts of the walls of the fortress; but it does not appear to me to be a stone of a very durable character; it is slowly disintegrated by the action of the weather, scales of it peal off, and it wears into irregularities of surface, which in time very much disfigure the structure in which it is used.

In the range of the limestone from St. Ambroise to Beauport, and from that to Montmorency, a great quantity of stone is quarried for the purpose of being burnt into quick-lime, but from the extent of the excavations at the village of Beauport, it seems probable that this spot has heretofore been resorted to for material for building also, though there does not appear to be any great demand for the stone at the present time. Some of the beds give good blocks of black stone capable of being dressed for ordinary purposes, but none of them were observed with the grey color and granular texture usually marking the best stone.

At Chateau-Richer, about fourteen miles below Quebec, several quarries are actively worked in the limestone of the Trenton formation for supplying the city with building stone for ordinary purposes. Although there does not appear to me to be any great difference between the stone of Chateau-Richer and that of Beauport, I am informed that architects give the former a preference, and generally insert a condition in their

contracts, for the construction of the better houses, that the Chateau-Richer stone shall be used.

All the building and flag stones which have been mentioned, belong to the fossiliferous formations, but a great abundance of lasting material, though more expensive to work, might be obtained in many places from the gneissoid masses of the Laurentian series. A bed of this character has been resorted to for the stone used in building the dam and reservoir of the Quebec water-works on the St. Charles river, and it is the first instance, that I am aware of, in which the harder constituents of this series have been applied to the purposes of construction. The reservoir on the St.-Charles is situated about three-quarters of a mile above the village of Jeune-Lorette, and the quarry is about a quarter of a mile farther up the stream. The gneiss is here hornblendic, being composed of transparent and translucent colorless quartz, transparent, translucent and opaque white feldspar (the feldspar predominating over the quartz,) and black hornblende, all running in irregular parallel plains, the arrangement of which shews the gneissoid structure very distinctly, while the proportions which the minerals bear to one another give, at a little distance, a general grey color. The rock splits in several, indeed in almost any direction, by means of wedges, but most easily in that in which the gneissoid structure prevails, particularly when this is even. The gneissoid structure, however, is occasionally affected by undulations and contortions, but these contortions do not materially deflect the splitting force of the wedges, though they sometimes do so to a small extent; in these instances, the rock splits less in conformity with the irregularities of the gneissoid planes, than with the rending power applied. The rock splits and dresses with most difficulty at right angles to the gneissoid structure ; and of course, with most ease in the direction of the structure, causing the expenditure of a great amount of steel in both cases. It is capable of receiving fine smooth faces, giving sharp edges and corners where these faces meet. Masses of almost any size can be blasted out from the rock, and large blocks have been dressed and applied in the masonry work of the reservoir, which will no doubt prove a structure of the most lasting character.

On the left bank of the Batiscan river, not far from the site of the old forges, an old quarry exists in a band of micaceous gneiss, from which I was informed stone had been taken for building purposes in connection with the smelting establishment once existing there, but no traces remain of the structures in which it was employed. There is little doubt it would constitute an excellent building material, as it would split and dress well, and the beds in the quarry would yield good heavy blocks. The flank of the mountain all the way from this to the Charest river, consists of the same material, and in the vicinity of St.-Prosper and of the St.-Charles range, approaching the Charest, it is so evenly and regularly stratified, and rendered so fissile by the arrangement of the mica, that it would yield good flagging as well as good building stone; a great supply of flags two to three inches thick might be obtained.

At the St.-Joachim Falls, on the St.-Anne-de-Montmorency, the rock consists of micaceous gneiss, of which the stratification is most beautifully and remarkably regular, without any twists or undulations, the dip being up the river N. 70 E.$<$ 40°. The rock is thin bedded, and though the beds appear to adhere pretty firmly together, it is probable that by the aid of wedges, large slabs might be split off of any required thickness, down to two or three inches, and would constitute an excellent material for foot pavements.

Refractory Sandstone. The sandstone of the Potsdam formation at the Grès, on the St. Maurice river, which has already been noticed as yielding beds fit for flagging and building, appears to be of a freer texture than the rocks of the same formation in other parts of the province; it has been found capable of resisting a very strong heat without injury, so much so, that the deposit has been resorted to for the material used in the construction of the hearths and other parts of the St. Maurice forges. The stone in thicknesses of from twelve to eighteen inches, is found to answer the purpose admirably, not requiring renewal oftener than once in two years. The masses used in the construction of the hearth and dam, with the thickness above stated, measure about four feet by eighteen to twenty inches. The spot where the stone has been quarried for the furnace, is on the right bank of the river at the foot of the Gabelle rapid, below the mouth of the Cacheé.

Stones suited for such purposes are obtained from the same formation in the State of New York, in the vicinity of Potsdam; a trade of some importance is carried on in them, and in addition to being used in the smelting establishments on Lake Champlain, they are exported to considerable distances.

Millstones.—The Potsdam beds, fit for flagging, which have been mentioned as existing on the properties of Messrs. Maxime Durand and Jacques Nicholas, in Côte-Ste-Catherine, in the parish of St. Cuthbert, are overlaid by seven and a-half feet of conglomerate sandstone, in beds of from one to two feet, which are used for the purpose of millstones. A pair supplied to Mme. Lefèvre's mill, on the L'Assomption river, is said to have answered well for grinding wheat and other grain, and a pair intended for Mr. Parent's mill, on the Bayonne river, was lying in a half-completed condition when the quarry was inspected.

Sandstone for Glass-Making.—The white sandstone of the Potsdam formation, mentioned as existing in the vicinity of Ste.-Scholastique, appears to be sufficiently free from iron to be fit for the manufacture of glass; but to the north-eastward, the exposures are in general more charged with iron, which appears in the frequent discoloration of the surface, and they would not give material suitable for such a purpose.

Marble.—Some beds of the Chazy limestone in the neighbourhood of Montreal are known to take a moderately good polish, and they are cut into slabs for the purpose of chimney pieces and occasionally for tables, one of which, manufactured by Mr. Hammond, of Montreal, and sent to the London Industrial Exhibition of 1851, attracted attention, and was readily sold. The color of these slabs is a dark grey; in some parts of the district the grey shews occasional spots of red, as on Madame Nolan's farm at Ste.-Catherine, and on Isle-Bizard; but in the seigniory of La-Chenaye, on the Little River, about a mile from St.-Lin, massive beds of the formation become almost wholly red, and give large slabs of a very handsome aspect. The beds are composed of a mass of comminuted organic remains, consisting of shells and corals, the latter predominating, and the prevailing species being *Chætites lycoperdon.* The corals are colored ochre-red, while some of the shells approach

rather a rose-red, and parts of the stone are mottled with a greyish-red running irregularly over the surface. A large supply of this marble might easily be procured.

Peat.—Many peat bogs of large and small extent exist in the area which has been examined, but the surface of them being usually covered with wood, and from this cause, and the nature of the deposit, difficult of exploration, a detailed inspection of them all would have required more time than it was expedient to devote to them. One of these peat bogs is met with about a mile and a-half on the road from St.-Janvier to St.-Jerome, in the Rang-Double of Mille-Isles. Its breadth on the road is about half a mile, and it extends three-quarters of a mile to the north-east, and half a mile to the south-west, giving to the bog a superficies of about five-eighths of a square mile. The depth was ascertained at several spots on the road; it ranged from two to eighteen feet, the latter depth being near the south-east side; the average of the trials is about eight feet. A smaller area occurs about half a mile nearer to St.-Janvier; it is about a quarter of a mile wide, but its superficies and depth were not ascertained.

About a-quarter of a mile north of the church of St.-Anne-des-Pleines, on the north-east side of the road between it and New Glasgow, a peat bog, which is in the same plain as the previous ones, but considerably to the north-east of them, spreads over an area of about a square mile; its depth was not tested, though it was in some parts on the south side ascertained to be over four feet, as much as this being exposed in ditches cut through it; the average depth is not supposed to exceed five feet. The peasants are in the habit of annually burning the peat in different parts of the bog, and then applying the ashes as a manure to the portion beneath, until by repeated burnings they reach nearly to the subjacent clay, which mingled with the last thin layer of the peat and part of the ashes of the previous burnings, constitutes a very fruitful soil.

About a mile and a-quarter to the north-west of that part of L'Assomption river which is below the penisula of L'Assomption village, a peat bog extends for three miles and a-half, south-west of the St.-Sulpice and L'Assomption line: it has an average breadth of about half a mile, giving it an area

of about a mile and three-quarters. Its depth varies from two to fifteen feet, and the results of ten trials taken in two lines across the deposit, give an average of ten feet.

In the seignories of La-Valtrie and La-Noraye, two extensive peat bogs occur, running parallel to one another; the northern is the larger, and is called the Grande Savanne. Across this two sections were made, one of them on the road which runs up the middle of La-Valtrie seigniory from the village of La-Valtrie, and the other on the line of the railroad between La-Noraye and Industry. The breadth of the bog in the former is about half a mile, extending a furlong beyond the south bank of the river Pointe-du-Jour, about five miles from the St.-Lawrence, and the depth, varying from seven to fourteen feet and a-half, averaged in seven trials, eleven feet. In the other section, the breadth is about two miles and a-half, reaching to within four miles of the St.-Lawrence, and the depth, from four to fourteen feet, averaged in a dozen trials about eleven feet. The distance between the two sections is four miles, and the bog may extend three miles south-west of the one, and a mile north-east of the other, which would give it a superficies of about from twelve to fifteen square miles.

The smaller peat bog lies between the former and the St.-Lawrence. The river St.-Jean which empties at La-Valtrie, runs through the middle of its whole length, at a distance of about two miles from the main stream. Only one section was made across it, which was on the line of the railroad, where its breadth was upwards of half a mile, with an average depth of about five feet. It extends about three-quarters of a mile north-east and four and a-half miles south-west of the railroad, and possesses a superficies of about three square miles. The peat in both these bogs appears to be such as would hold together when dried, but no analysis has yet been made to determine how much combustible matter and how much ashes it may give.

In the fief St.-Etienne, about a mile and three-quarters south west from the Grés, on the St. Maurice river, the main road crosses a peat bog, which there shews a breadth of about half a mile, with an average depth of about six feet, but its length south-west and north-east was not ascertained.

Another was met with in the seigniory of Champlain, about

three miles back from the St. Lawrence, on the road leading from Champlain church to Champlain river. Its breadth on the road is upwards of three-quarters of a mile, and its average depth in this part, five feet; as far as could be ascertained, its length from south-west to north-east is about two miles, which would give a superficies of about a mile and three-quarters.

In the fief D'Auteuil, there is a peat bog on the road between Cap-Santé and the village of L'Enfant-Jésus, with a breadth of about a quarter of a mile, but its area and depth were not ascertained.

Mineral Springs. Independent of the mineral springs of Pointe-du-Jour, Caxton and St.-Léon, which have been analysed and described by Mr. Hunt in previous Reports, several others exist, of which, as they will all come under his attention at some future time, it is at this moment not necessary to give more than a catalogue:

1. On the Bayonne river, about four miles above Berthier, and close to the margin of the stream, on a farm belonging to Mr. Charles Boucher, there is a spring giving a considerable quantity of water, which is saline. It issues from the ground in jets, and gives a slight hissing or crackling noise. The formation beneath is the Trenton limestone.
2. On the same stream, about two miles above the previous spot, and below the mill occupied by Mr. Elzeard Olivier, four separate issues were observed within the space of twenty yards, just below the fault or dislocation noticed farther up, with which they are probably connected. Their site is in the bed of the river, and they appear above the level of the stream only in the dryest part of the season. The water which comes from them is saline, but less so than in the previously mentioned spring. The formation beneath is the Trenton limestone.
3. There is said to be a saline spring on the property of Mr. Antoine Normandais, on the river Champlain.
4. Half a league below St.-Geneviève church, on the right bank of the Batiscan, a strong saline spring is reported to exist on the property of Mr. Ambroise Tiseau.
5. About the same distance from the same church, a saline spring is said to exist on the Little Champlain river, on the property of Mr. François Normandais.
6. Half a mile from the same church, there is said to exist a sulphurous spring on the left bank of the Batiscan. Its strength is not spoken of as being very great. It is on the property of Mr. Abraham Massicotte.
7. On the right bank of the Batiscan, nearly opposite to St.-Geneviève church, there is a saline spring on the property of Mr. Blaise Trudel. It is said to be of considerable strength.

8. About a league above the same church, on the right bank of the Batiscan, there is said to be a saline spring on the property of Mr. Louis Pronoveau.
9. A saline spring is reported to exist on the river A-Veillette, a tributary of the Batiscan, about three-quarters of a league from St.-Geneviève church, on the property of Mr. Charles Massicotte.
10. Another saline spring is reported on the same stream, on the property of Mr. Olivier Trudel.
11. In the fief Belair, on the right bank of the Jacques-Cartier river, close by the mill of Mr. Louis Marcotte, a sulphurous spring, giving about a gallon a minute, issues from the black bituminous shales of the Utica formation just above the bed of the stream ; it has a strong taste and smell of sulphuretted hydrogen. Through the water of the spring there escapes every few seconds, several bubbles of gas, which the people of the mill have collected in small quantities, and have found to burn with a blue flame. When the water of the river is high it covers the spring, but from this it would be easy to protect the source by a wall.
12. On the north-west side of the island of Orleans, and nearly three-quarters of a mile from the upper end, there is a spring said to give out a strong sulphurous odor when completely free from surface water by which however it was covered at the time of inspection. It gives a blackish deposit, and discolors the grass, and to some depth the ground about the issue. The peasantry of Lower Canada have a general impression, that wherever there is a mineral spring or any spring of uncommon appearance, it must be connected with some mine. In this instance they suppose that the spring indicates the preence of coal ; and confirmed in the opinion by the color of the black shale and limestone (belonging to the Hudson-River group) which are exposed on the south-east edge of the spring, one of the inhabitants had expended about fifty dollars in a fruitless search for the fuel.

Bituminous Shale. Of this material, which appears to be gradually attracting increased attention as an economic source of bituminous products, the description given in the geological division of the Report, shews the existence of a very large amount in the distribution of the Utica formation. With various degrees of thickness, up to 300 feet, the bituminous shales of this formation run the whole length of the district examined, and become occasionally displayed in a very conspicuous manner, particularly between Ste.-Anne-de-la-Pérade and Ste.-Anne-de-Montmorency. In those parts of the distance which lie in the vicinity of Cap-Santé, the Jacques-Cartier river, and Les-Ecureuils, they form extensive cliffs on the St.-Lawrence of from thirty to eighty feet in height, and the river St.-Charles

near St.-Ambroise and the Ste.-Anne-de-Montmorency below the St.-Joachim falls, make deep incisions through the rock; but it would require practical experiments to decide whether the shales are sufficiently rich in bitumen to give promising results.

Copper Ore. In the augmentation of La-Norraye and D'Autraye, on the left bank of the river L'Assomption, about three miles above the point where it enters the fifth range of the township of Kildare, an evenly bedded mass of micaceous gneiss, dipping N. 44° W. $< 26°$, is cut by a vein running N. 24° W., which consists of calc-spar mingled with pearl-spar, and has a breadth of about nine inches; three reticulating strings of iron pyrites, associated occasionally with copper pyrites, run through the vein, and spots of both of these minerals, with blende are observed sparingly scattered through the spar. Mr. Gravel, who has a farm in the vicinity, has sunk a pit upon the spot about sixteen feet, and the character of the vein appears pretty uniform throughout. On each side of the nine inches, several strings of an inch and less in thickness, intersect one another and run into the main vein; these also hold specks of copper pyrites, and the whole may be included in a breadth of about nine feet, which is that of Mr. Gravel's pit. Though the vein does not by any means look like a promising one, it yet bears too many of the characteristics of a regular lode to be passed over without notice.

Tripoli Earth. This substance which is extensively used as a polishing powder, is an infusorial deposit; it consists of the silicious remains of microscopic animals so very minute as to give the earth nearly the fineness of flour. From the hardness of the silica and the smallness of its grain, the earth becomes a very delicate and effective grinding material for cleaning and polishing metals, for which chiefly it is sold in commerce. Of this earth there is a very considerable deposit at Laval, about twenty miles from Quebec. It is to be seen on the lot of widow Corcoran, (the twentieth lot of the second range of the settlement,) which is on the right bank of the Bras, just at its junction with the Montmorency, about ten acres above the chapel. A trickling stream of water, issuing from a spring on the summit of the bank, has worn the face of it into a small ravine,

and exposed several of the beds of which the bank is composed. About fifty feet at the top consists of yellowish sand, mixed with boulders of gneiss and other rocks from the Laurentian series, which supports in that vicinity the looser deposits. Then occur about fifteen feet of tripoli earth, which is partly yellowish and partly lead-grey, the colors being sometimes arranged in different layers, and sometimes irregularly intermixed in spots and patches. Beneath this the edges of the beds are concealed, but for forty feet farther, the high slope of the infusorial part of the escarpment is continued, and this may be an addition to the amount. A much more gradual slope, giving about forty feet more of vertical height, brings us to the margin of the river. The beds of the infusorial deposit are horizontal, and the escarpment in which they occur is traceable for some distance up the Bras and down the Montmorency, but no other section exposing them was observed.

The material from this deposit has for some time been used as a plate powder by jewelers in Quebec, and one of a similar character, from the vicinity of Albany, is sold in Montreal under the name of American tripoli.

Gold. In the month of December, a few days were devoted to a farther examination of the distribution of this metal in the Eastern Townships, and particles of it were found in the valley of the St. Francis at various intervals from Richmond to Hunting's mills on the Salmon river, flowing into the Massawippi a little above Lenoxville. Though the weather was rather adverse to the examination, on account of the cold and frost, yet the results were much the same as those of similar previous explorations farther to the east. One of the positions examined was on the road passing to the north of the mill-pond on the Magog river above Sherbrooke, where particles were met with in an ancient hard bound gravel, which probably has never been disturbed since the time when the surface arose from beneath a tertiary sea. The position is about 156 feet above the level of the St. Francis at Sherbrooke, and would probably be over 600 feet above the St. Lawrence in Lake St. Peter; this fact serves to shew that the metal is not confined to the lowest parts of the valleys, but will have a distribution co-extensive with the original drift of the district.

It may be considered that the auriferous drift has now been shown to exist over 10,000 square miles on the south side of the St. Lawrence, comprehending the prolongation of the Green Mountains into Canada, and the country on the south-east side of them. In following the range of this drift north-eastwardly, the researches of the survey have not extended beyond Etchemin Lake; but the general similarity of the rocks beyond, renders it probable that little change will be found for a distance extending much farther; perhaps to the extremity of Gaspé. It may be proper to remark that though the ascertained auriferous area is thus so much increased beyond the measure given to it in a previous Report, no fact has come to my knowledge of sufficient importance to authorise any change in the opinion that has already been expressed, *that the deposit will not in general remunerate unskilled labor, and that agriculturists, artizans, and others engaged in the ordinary occupations of the country, would only lose their labor by turning gold hunters.*

In the examination of the valley of the St. Francis, one of the spots tried was in the immediate vicinity of the quartz vein holding copper pyrites, mentioned in the Report for 1847-8, as occurring in the seventeenth lot of the seventh range of Ascot, belonging to Mr. Moes. In that Report it was stated that the copper pyrites was auriferous, and in corroboration of the fact, a small unworn but loose octohedral crystal of gold was on this occasion, obtained from a crevice, in a two-inch string of quartz spotted with copper pyrites, which appeared to be subordinate to the principal vein.

This vein occurs in a mass of talcose slate, supposed to belong to the Lower Silurian series; but from a vein on the river Du-Loup, specimens of quartz and iron pyrites have lately been brought me derived from the clay slates of the Upper Silurian series, and in some of these, traces of gold have been met with. The metal thus appears to belong to the veins of both the lower and upper series. If Sir R.I.Murchison's theory be well founded, that the gold when it was originally placed in the veins, occupied only that part of them which was towards the then existing exterior of the earth's crust, the presence of it in Upper Silurian veins would lead to the conclusion that it should be more abundant in them than in the Lower. For it is probable that

those parts of the lower rocks now found exposed, were once covered by the upper, which have been removed by denudation, and the veins of the lower rocks, being but the remaining inferior, and therefore less productive parts of those veins which once cut both, should be surpassed in richness by those of the upper rocks, which present parts nearer the original surface. The line of division between the two series of rocks has been given in a former Report, and according to the theory in question, the more productive veins should be met with rather on the south-east of the Green Mountain range, than in it.

Roofing Slates. The conflagration which destroyed so large a portion of Montreal last summer, having determined the corporation of the city to interdict wood-built houses and shingle-covered roofs, caused public attention to become directed to the advantages of slate; at the recommendation of and in association with Mr. Joseph Scobell, of this City, a quarry was in consequence opened by Mr. R. A. Hubert, in the band of slate rock which was mentioned in the Geological Report of 1846-7, as existing on the fourth lot of the first range of Kingsey, samples of which, such as could be obtained from the weathered part of the exterior, had been deemed worthy of being sent as part of the Canadian contribution of economic minerals to the London Industrial Exhibition of 1851.

The slates obtained from the quarry are better than was anticipated, and they are, in my opinion, equal to the best which I know to be worked on this side of the Atlantic. They are of a purplish-blue color, have smooth, even, silky surfaces, and are free from iron pyrites or other impurities; when struck they give a ringing sound, and they are cut and pierced with facility, without shewing ragged edges or splitting.

The specific gravity of this slate is 2·88, and its chemical composition as determined by the analysis of Mr. Hunt is as follows:

Silica,	54·80
Alumina,	23·15
Protoxyd of iron,	9·58
Lime,	1·06
Magnesia,	2·16
Potash,	3·37

Soda,	2·22
Water,	3·90
	100·24

The lime which is but in small quantity, exists as a silicate; it is only when present in the form of carbonate of lime, that this ingredient is prejudical to the quality of slate. For the purpose of comparison, I give below two analyses by Mr. Hunt, the one being of the best description of Welsh slate, and the other a slate from Angers in France, which has been on the roof of the seminary buildings at the corner of Notre-Dame and St.-François-Xavier Streets, for upwards of 100 years, and has been but little affected by the climate. It is scarcely necessary to point out the strong resemblance between these and the Kingsey slate. Their specific gravities were respectively 2·824 and 2·882.

	Welsh.	French.
Silica,	60·50	57·00
Alumina	19·70	20·10
Protoxyd of iron,	7·83	10·98
Lime,	1·12	1·23
Magnesia	2·20	3·39
Potash,	3·18	1·73
Soda,	2·20	1·30
Water,	3·30	4·40
	100·03	100·13

Now that the Kingsey quarry is opened, it is plainly discernable, that as in the case of all good slates, the cleavage of the rock is independent of the original bedding; and in the quarry the cleavage joints stand at an angle of fifty-seven degrees to the horizon, facing to the north-west. The locality of the quarry is on the river St. Francis, and a turn in the river at the spot, carrying the stream for nearly a mile in the strike or direction of the cleavage, while the bank rises rapidly to a height of upwards of 100 feet, offers great facility for extensive working. The quantity that can be obtained on the lot may be considered inexhaustible. It is not to be supposed, however, that the slate band is confined to this lot; on the contrary, it is probable that in the general strike of the rocks of the country, it will extend to the south-west and north-east for many miles.

In former Reports it has been shown that clay slates are extensively distributed through the Eastern Townships, though not always possessed of the proper cleavage for roofing purposes, but there is no doubt, now that a quarry on this band is opened, and the nature and use of the rock practically displayed, the inhabitants will quickly discover other bands in various parts across the strike, that will prove equally available.

I have the honor to be,

Your Excellency's

Most obedient servant,

W. E. LOGAN,

Provincial Geologist.

REPORT

OF

ALEX. MURRAY, ESQ., ASSISTANT PROVINCIAL GEOLOGIST,

ADDRESSED TO

W. E. LOGAN, ESQ., PROVINCIAL GEOLOGIST.

MONTREAL, 15*th March*, 1853.

SIR,

During the past summer and autumn I have been engaged, as you were pleased to direct last spring, in pursuing a geological examination of the country lying north of Lake Ontario, in a general line between the neighbourhood of Kingston and that of Lake Simcoe, comprising portions of those parts formerly distinguished as the Midland, Victoria and Newcastle Districts.

Before commencing operations in the field, a visit was paid to Ogdensburgh, where through the politenes of Mr. Hazlewood, C. E., who had been previously employed on the survey of the contemplated railroad from Prescott to Georgian Bay on Lake Huron, much valuable information was received, particularly regarding the levels ascertained through the country I was about to explore. These levels were found of the greatest service, and I was enabled by means of them, to determine with tolerable accuracy the relative elevation of most of the principal lakes, and particular points that were visited.

The neighbourhood of Kingston having already been partially examined, no time was spent there, further than was sufficient to furnish myself with a few necessary supplies, and I proceeded with as little delay as possible to Loughborough Lake, where my operations fairly began. There on enquiry, I was informed that the country to the north was an almost uninterrupted succession of navigable lakes, many of them connected by streams capable of floating canoes or small boats, and that by far the better method of making an exploration of it, was by water. A small boat was accordingly pur-

chased and a guide hired, and my subsequent experience fully proved that I had been correctly advised.

My plan of operations was to effect a set of north and south traverses between the shore of Lake Ontario and the rear of the surveyed lands, making east and west offsets from the general course on all convenient occasions; and with a few slight modifications this plan was carried out. The first traverse extended northward through Bedford into Oso, from which latter township I crossed over to the head of Salmon River, in Olden and Kennebec. The second traverse descended the Salmon river to Beaver Lake in Sheffield, below which the river was rendered unnavigable by the accumulation of pine logs on their way towards the front, as well as the low state of the water in the rapids. From Beaver Lake, the traverse was consequently continued by land through part of Camden, returning thence and crossing through the west part of Sheffield to the Clare river, and following its course in Hungerford down to Stucco Lake. A third traverse was made to the front, by pursuing the Moira river to Belleville. My attention was then turned to the townships of Rawdon, Madoc, Marmora and Belmont, and a fourth traverse was effected to the front, by following down the Crow river, and the Trent to Trent Village, on the Bay of Quinte. My course was then directed to Cobourg and thence to Rice Lake, where having provided an assistant and an Indian with two canoes, the examination was continued up the Otonabee to Stony Lake, from which we followed the chain of lakes up to and north of Balsam Lake, taking the Scugog river and lake on our return.

In the first part of the first traverse, particularly after leaving the village of Sydenham, the country passed through was thinly settled in general, and indifferently adapted for the pursuits of agriculture, but abounded in many places with pine timber, which, however, has already been culled to some considerable extent, south of the boundary line between Bedford and Oso; and in the latter more remote township also, the work of the lumberman was occasionally perceptible, wherever the advantages of water communication could be rendered available for transportation of the timber to the settlements.

This part of the country appears to have been but imperfectly and partially surveyed, and in consequence, its topographical features being often either misrepresented or not represented at all on any of the published maps, it was found necessary to continue a series of measurements along the general course pursued, checking positions as advance was made, whenever an opportunity offered, by concession and lot lines, when such could be identified. The measurements were effected as in former years by the use of the micrometer telescope, and the bearings by a prismatic compass or theodolite, and by the latter instrument I was enabled to carry a series of levels from one lake to another all through. To indicate in a general way, the line of country thus examined and partially measured, the following table shewing the lakes surveyed, the townships in which they are situated, their heights over the surface of Lake Ontario, and the waters to which they are more nearly or more remotely tributary, may be found more serviceable than a detailed description.

Name.	Townships.	Height in ft.	Falls into
Loughboro' Lake.....	Storrington & Loughboro'	166·12	Rideau River.
Sloat's Lake.....	Loughboro', ...	189·05	Lake Ontario.
Knowlton Lake.....	"	217·53	Mud Lake.
Mud Lake.....	"	217·53	Desert Lake.
Desert Lake.....	Bedford, ...	217·53	Birch Lake.
Birch Lake.....	"	217·53	Devil Lake.
Devil Lake.....	"		Rideau River.
Canoe Lake.....	"	229·97	Desert Lake.
Batting's Mill Pond....	"	287·00	Wolf L. & Rideau R.
Green Bay & Bob's L..	"	384·80	Tay & Rideau Rs.
Crow Lake.....	"	398·88	Mud Lake.
Sharbord Lake.....	Oso and Olden,.....	505·29	Madawaska & Ottawa Rs.
White Lake.....	Olden,.....	555·29	Sharbord Lake.

From White Lake a portage of between four and a-half and five miles in a W. N. W. direction brought me to a small lake lying towards the north-west corner of Olden, which falls into a long narrow lake stretching from the west boundary of Olden nearly half-way across the township of Kennebec; it is known as Cross Lake by the lumberers, and is the source of the main body of the Salmon and Clare rivers. The country between Sharbord Lake and Cross Lake consists alternately of low rugged ridges, and long narrow strips of marsh or prairie

land, the former frequently supporting a stout growth of white pine, the latter bearing in many places, a profusion of long coarse grass, which in new settlements might be very profitably preserved as winter fodder for cattle.

The bearing of Cross Lake is a little south of west, and the Salmon river flows out of it, as I was informed by my guide, within two miles from its western extremity on the south side, and immediately assumes a course nearly parallel with the lake, so that a portage which leaves a small bay about two miles east of the exit and about mid-length of the lake, and bears southward nearly at right angles to the lake, strikes the river in little more than half a mile, where its level is 30·38 feet below that of the lake.

From this the Salmon river maintains a nearly straight general course S. 25° W. to Beaver Lake in Sheffield. At one point, which appears to be in the fourteenth lot of the tenth concession of Kennebec, there is a sudden bend in it with strong rapids, giving a fall of 11·37 feet within the distance of three-quarters of a mile. A short distance below these rapids the river opens into an extensive sheet of water known as Bull Lake, which lays across less than half the township of Kennebec, in a direction nearly parallel with Cross Lake, contracting again about the sixth lot of the sixth concession, and then immediately opening into a small marshy sheet called Horse Shoe Lake ; from this it flows sluggishly in a nearly straight line for about seven miles, forming towards the end of the distance a narrow expanse called Long Lake, about a mile above the foot of which on the right side, it branches into the Clare river on the twenty-second or twenty-third lot of the tenth concession of Sheffield. Below Long Lake there is a succession of rapids and small leaps, giving in all a fall of 57·87 feet to the level of Beaver Lake. The river leaves Beaver Lake at its eastern extremity, and after flowing about eight miles southward, (cutting the line between the townships of Sheffield and Amden about half-way,) it turns to the south-eastward, and crossing Richmond and Tyendenaga obliquely, falls into the Bay of Quinte on the east side of the latter township near Shannonville. Though the lower part of

the river was not examined, it is evident from the difference of level between Beaver Lake and Lake Ontario, that it must have considerable rapids in its course. A list of these Salmon River lakes is as follows :—

Name.	Township.	Height.	Falls into
Cross Lake, ...	Kenebec,.....	412·84...	Long Lake.
Long Lake, ...	Sheffield,.....	365·69...	Beaver Lake.
Beaver Lake,....	Sheffield,.....	307·22...	Salmon R.& B. of Quinte.

The Clare river taking its origin as above indicated, flows through the township of Sheffield into Hungerford, and falls into Stucco Lake in the sixteenth lot of the ninth concession of the latter township, making several extensive meanders in its course, the general direction of which in a straight line is about S. 65° W., with a length of not quite fifteen miles, and a fall of 155 feet, the level of Stucco Lake being 210 feet above Lake Ontario. A large portion of the tract on either side of the Clare appears to be unproductive near its head, where the river passes among a succession of almost bare ridges of gneiss ; and from Mr McDonell's mills on the sixteenth lot of the second concession of Sheffield to the mouth, it may be said to divide the productive land on the south, from a less productive area as far as examined on the north.

The upper Moira or western main branch of the river flows through the eastern part of the township of Marmora, receiving the contributions of several minor streams in its course, crosses through the north-east angle of Rawdon and enters Huntingdon about the middle of the twelfth range ; from this point after making a considerable southerly bend, it runs north-easterly and empties into Hog Lake, an extensive sheet of water situated between the twelfth and fourteenth ranges, and the seventh and eighteenth lots of the township. From Hog Lake the river pursues a north-easterly course for about four and a-half miles, and then turning abruptly to the southward, falls into Stucco Lake below Hungerford mills, in the twelfth lot of the tenth range of Hungerford township. The waters of Stucco Lake discharge themselves through a large and frequently very rapid stream still called the Moira, which passes through the western portion of Hungerford,

cuts across the north-west corner of Tyendenaga into Thurlow, and flowing through the centre of this township, empties into the Bay of Quinte at Belleville, about seven miles east of the Salmon river; the country between the Salmon river and the lower Moira is thus a great island.

The Crow river is an important tributary of the Trent, and is the connecting link joining Belmont Lake, in the township of that name, and Crow Lake in Belmont and Marmora. Flowing from the latter lake through the south-west part of Marmora, where it is joined by a considerable stream called Beaver Creek, it crosses the north-west corner of Rawdon, and joins the main body of the Trent at Crow Bay about a mile below Healy's Falls in Seymour. Belmont Lake was estimated to be 367 feet, and Crow Lake 350 feet above the level of Lake Ontario, Crow Bay being according to the levels of the railroad engineers, 310 feet.

A great chain of lakes extends across the northern part of what used to be called the Colborne District, one connected with another by streams usually of inconsiderable length, the waters of which are poured into Rice Lake through the channel of the Otonabee river, and finally by the main body of the Trent into Lake Ontario. The relative positions and heights of the most important of these lakes are as represented in the following table :—

Name.	Township.	Height.	Falls into.
Balsam Lake	Bexley & Fenelon,	588	Cameron's Lake.
Cameron's Lake	Fenelon,	583	Sturgeon Lake.
Sturgeon Lake	Fenelon & Verulam,	561	Pigeon Lake.
Pigeon Lake	Harvey	556	Deer Bay.
Buckhorn Lake	Ennismore, Smith, & Harvey.	556	Deer Bay.
Chemong or Mud Lake	Ennismore & Smith,	556	Buckhorn Lake.
Deer Bay	Smith,	553	Salmon Trout or Clear Lake.
Stony & Salmon Trout Ls.	Dummer & Burleigh,	526	Otonabee R. & Rice L.
Rice Lake	Monaghan, Alnwick, Hamilton, Otonabee,	364	Trent R. Ontario L.

Scugog Lake also, in the township of Cartwright, of the Newcastle District, contributes its water to the Otonabee; its elevation above Lake Ontario was estimated at 565 feet, there being only an inconsiderable fall on the river of the same

name, issuing from it at the village of Lindsay in Ops. The Scugog falls into Sturgeon Lake about the fourth lot of the eighth range of Fenelon.

DISTRIBUTION OF THE FORMATIONS.

The rocks of the area whose principal geographical features are given in the above sketch, belong to two distinctly different periods; one set being fossiliferous and nearly undisturbed, and the other unfossiliferous and greatly disturbed, contorted and altered. The fossils of the former are all of the Lower Silurian age, and the strata to which they belong, as may be inferred, rest unconformably on the tilted edges of the latter. By drawing a straight line from about the middle part of Loughborough Lake, across the heads of Knowlton and Beaver Lakes, to Round Lake in Belmont, a small sheet of water a little beyond Belmont Lake, and then another from Round Lake to the northern extremity of Balsam Lake, a tolerably fair representation of the junction of the two series of rocks will be indicated; the metamorphic, to which you have given the name of the Laurentian series, keeping on the north, and the fossiliferous on the south side of the lines. There will, however, be several deviations from the regularity of the straight lines, occasioned by undulations in the more ancient rocks, bringing them occasionally to the surface on the south, while a number of outlying patches of the more recent formations are spread over portions of the country to the north.

Laurentian Series.

The description which you have given of the rocks of this series in your report for the year 1845–6 on the Ottawa region, where they are extensively exposed, would equally well apply to them in the country examined by me last season. They consist of masses of micaceous and hornblendic gneiss, and masses of crystalline limestone interstratified by gneiss. In the great masses of gneiss the prevailing color appears to be reddish, but they are frequently striped with interstratified bands of grey, the reddish part taking its general aspect from the reddish feldspar which is the principal constituent, while the grey is chiefly made up of small grains of white quartz and feldspar, with small scales of black mica, and occasionally grains of black hornblende. The rock is for the most part fine

grained; there are however masses of a coarse texture, which may be veins, but apparently maintaining a parallelism with the bedding, cannot with certainty be considered so. These latter masses were found in general to be chiefly of feldspar, sometimes white and sometimes red, more frequently the former, which weathering often to an opaque white, causes them to contrast strongly with the other associated rocks. Beds also occur, of which almost the only constituent is white quartz, and these often alternate with thin layers of yellowish-white feldspar. Loughborough Lake, lying N. E. and S. W. in the strike, exhibits rocks of these characters from its northern extremity, for about three-fourths of its length on the N. W. side, and nearly one-half of its length on the S. E.; to the south and west of which positions on the lake, the Laurentian series is covered over and concealed by the unconformable fossiliferous formations. At the northern end of the lake, where the gneiss is of the red and grey variety, the general dip is about S. E.<55° ; and on the eighth lot of the tenth concession of Storrington (formerly Pittsburgh) on the N.W. side of the lake, where the rock is a very fine aggregate of white quartz, white, and in smaller proportion pinkish feldspar, having small veins and segregated nodules of black tourmaline, the dip is S. E.< 68°. At the south-west horn of a bay, on the opposite side of the same lake, on the division line between the twenty-third and twenty-fourth lots of the fifth concession of Loughborough, the rock is of a similar character to the last described, being a very fine grained aggregate of quartz and white feldspar, with minute scales of white mica sparingly distributed between the layers, alternating with layers of coarser grained gneiss, containing pink feldspar, and intersected by veins holding black tourmaline, quartz and feldspar, which continue irregularly through a fine grained mica schist underlying the whole; at this place the dip is N. W.< 35° to 40°, and going S. E. across the measures between Vanluvin's mills on the eleventh lot of the ninth concession of Storrington, and the dead water of Dog Lake about the sixteenth lot of the same concession, red gneiss, which is occasionally seen, also indicates a N. W. dip.

At Vanluvin's mills, there is an intrusive mass of red granite upwards of 200 yards wide; the general course of

which, tranverse to the strike of the gneiss, is a little north of west and south of east, until it is lost sight of beneath the fossiliferous rocks; the prevailing mineral is red feldspar in rather coarse grains, with quartz and mica in smaller proportion and in finer grains.

Crossing to Sloat's Lake, about two miles transverse to the measures from the general line of Loughborough Lake, we find red and grey gneiss along its eastern shore, until we come to a point about a mile and a-half farther, on Eel Lake, (which is a long, northward running bay from Sloat's Lake), in the tenth lot of the eighth concession of Loughborough, where alternations of thin beds of white quartz and feldspar, again occur, which are succeeded, in about 200 yards to the north, by crystalline limestone, both dipping rather irregularly to the N. W. If these alternating beds of quartz rock and feldspathic rock are to be considered the same as those seen on Loughborough Lake, there would exist an anticlinal form between that lake and Sloat's Lake. Overlying the alternating quartz rock and feldspathic beds, the following section in ascending order occurs on Eel Lake on the same lot.

	Ft.
White quartzo-feldspathic rock, composed chiefly of white translucent crystalline feldspar (orthoclase), some of the individuals of which measure an inch across, with disseminated grains and nodules of milk-blue, partially opalescent and translucent quartz, and dispersed crystals of brilliant black tourmaline and clove-brown sphene, with a few spots of green pyroxene,.....	60
Not well seen,.....	70
Very coarse grained red rock composed of large individuals of red feldspar (orthoclase) and irregularly disposed greyish translucent quartz; possibly a vein, but running parallel with the stratification,.....	140
White crystalline magnesian limestone, with nodules and patches of serpentine and aggregated individuals of dingy green pyroxene, a large amount of brown mica, and small spangles of graphite,.	30
	300

Crystalline limestone is seen on the opposite side of the lake, near the mouth of a small brook, on the ninth lot of the eighth concession, and again towards the north end of the lake, on the eleventh lot near the line between the eighth and

ninth concessions, and it is not improbable that all these exposures belong to one band, which may occupy the bed of the lake. The exact breadth of the band was not determined with certainty, but in a line transverse to the measures, across from Eel Lake to Gold Lake, by the stream which empties the latter into the former, gneiss, holding disseminated pink garnets in abundance, was met with in the ninth lot of the eighth concession, the distance from the dolomitic exposure being about half a mile; about a-quarter of a mile beyond this another small exposure of crystalline limestone occurred, and farther on, the north bank of a pond called Long Lake consists of gneiss, which runs in the strike to Bull's Eye Pond on the south-west, and another lake on the north-east, while garnetiferous gneiss re-appears on the seventh lot of the ninth concession, and an exposure of white crystalline limestone dipping to the south-east occurs beyond, near the shore of Gold Lake, the distance between this lake and Eel Lake being about a mile and a-half. The limestone is magnesian, but the quantity of carbonate of magnesia is not sufficient to constitute the rock a dolomite, being only about seven per cent. The rock is massive and small grained, and holds sparingly disseminated small crystals of white, green and blue apatite, golden and silvery mica and graphite, with a few small grains of rose colored quartz, and of greenish serpentine. Apparently below this mass, but close to it, there is a band which holds in great abundance grains and nodules of serpentine of a color intermediate between pistachio-green and oil-green, and of various sizes from that of snipe to swan shot. These exposures are on the north side of the brook, while on the south, in a position which would probably come in still beneath them, an exposure of white dolomite with pinkish streaks and spots was seen, containing a large amount of disseminated graphite, with irregular forms of quartz, and small grains and patches of serpentine. The whole of the south-eastern side of Gold Lake appears to be occupied by these calcareous rocks, from the south part of the sixth lot in the ninth range, to the north part of the tenth lot in the tenth range, a distance of about two miles. A small island in the middle of the lake is composed of white crystalline limestone, holding much mica and a small quantity of graphite; it is associated with masses of

large grained greyish feldspar and dull green pyroxene, stained with oxyd of iron, and it probably underlies the limestone on the south-east side, while it is again underlaid by a quartzo-feldspathic band, consisting of white translucent feldspar and milk-blue, partially opalescent quartz; this occurs on a small island on the north-west side of the lake, and the north-west shore is composed of gneiss. It seems probable that the breadth of the limestone in Gold Lake may be about the breadth of the lake, which would be a little over a-quarter of a mile; and all the facts on the line of section across from Eel Lake, appear to indicate that a synclinal form exists between the two lakes.

South-west from the Gold Lake limestone, in the continuation of the general strike, an exposure was met with on the fourth lot of the eighth concession; the rock was white and crystalline, but did not appear to give evidence of much magnesia; it held abundance of golden colored mica, with a few nodules of steatitic pyroxene studded with graphite. From the vicinity of this exposure, crystalline limestone is traceable, emerging from beneath the fossiliferous formations, for a mile and a-half, to the south part of the first lot of the seventh concession, and although there is an interval of nearly a mile south-west of Gold Lake, in which no exposure was observed, there appears a great probability that the rock is the same all the way. From the most southern part just mentioned, crystalline calcareous rock is traceable at intervals along the whole western side of Knowlton Lake, with fossiliferous rocks immediately overlying it, to the second lot of the ninth concession, and the same numbered lot in the tenth concession, as well as to the first lot of the same two concessions, where it is accompanied by tremolite, but whether in a bed or a vein is uncertain; at the south end of the lake there is white crystalline dolomite with grains of pea-green and yellowish-green serpentine in some abundance, and a few disseminated scales of graphite; and on the stream which empties the lake, in the fourth lot near the line between the tenth and eleventh concessions, dolomite again occurs; it is not here so white as before, being mottled with pinkish specks, but it holds the same golden colored mica, with oil-green serpentine in small grains

and patches. From the most southern exposure to this point, the distance is three miles and three-quarters, and the dip, with a few turns which compensate one another, appears as a general rule, to be westward all the way. The breadth of Knowlton lake is nearly half a mile, and it is not unlikely that it may indicate the breadth of the limestone. On the eastern shore of the lake, the rock in so far as examined, is composed of fine grained hornblendic gneiss, dipping to the southward of east; it is not improbable that this and micaceous gneiss constitute the country between Knowlton and Gold Lakes, in the continuation of the line of section carried up from Eel Lake to Gold Lake; on this line the distance between Knowlton and Gold Lakes would be three-quarters of a mile, while on the line between the tenth and eleventh concessions, the distance between the diverging bands of limestone would be about double that amount.

It is plain that these two bands of crystalline limestone, converging to a point at the southern extremity of Knowlton Lake, are in equivalent positions on the opposite sides of an anticlinal form, and the Gold Lake and Eel Lake bands, being on the opposite sides of a synclinal, and converging in an opposite direction, will probably meet also. Although their point of union was not ascertained by observation, it probably occurs south of Otter Lake, which lies chiefly in the twelfth range between the sixth and thirteenth lots. For though the axis of the synclinal form would cross the upper or eastern part of this lake, the north shore, from the eastern extremity to the eighth lot, a distance of about two miles, is composed of gneiss, and so is the southern shore on the tenth lot. The western extremity of the lake, however, from the middle of the ninth lot on the south, and of the eighth on the north side, consists of crystalline limestone, which was observed to extend down the stream emptying the lake, to the middle of the sixth lot. But this mass appears to be too far westward to belong to the synclinal in question, unless it suffers an extraordinary turn in that direction; it appears also to be too far to the eastward for the continuation of the Knowlton Lake band, and it may therefore be an outlying patch.

It is uncertain what course the Knowlton Lake band takes

from the line between the tenth and eleventh concessions. The stream on which the exposure there was observed, flows into Mud Lake, which runs diagonally across the third and fourth lots of the twelfth concession, its length being about a mile. Both banks are composed of fine grained micaceous gneiss, and stand apart about a quarter of a mile. The strike is with the lake, and the dip vertical, but it could not be ascertained whether the bed of the lake was composed of limestone. On the north-west side of the lake about half-way down, a thirty-feet dyke was observed consisting of flesh-red feldspar, and translucent colorless quartz, the individuals of the former being very large. The course of the dyke was N.W. cutting the strata nearly at right angles, its attitude was vertical, and lateral branches from it were seen running with the strike of the gneiss. A little lower down Mud Lake, between the third and fourth lots, veins of quartz run parallel with the feldspar dyke, in two of which, from two to six or eight inches wide, plumbago was seen in considerable abundance, running in irregular strings of from an eighth to half an inch, while small spangles of the mineral characterised the gneiss on each side.

Between Mud Lake and Desert Lake, into which Mud Lake empties, there is scarcely the eighth of a mile, and the second named lake, which is a nearly straight continuation of the other, lies in a depression extending to the N.N.E., from the fifth lot of the thirteenth concession of Loughborough to the fifth lot of the fifth concession of Bedford, where by a short stream, it receives the waters of Canoe Lake, lying in a continuation of the depression, between the lot in Bedford just mentioned, and the fifteenth lot of the eighth concession of the same township. Both lakes are long and narrow, and Desert Lake about mid-length branches into a deep narrow bay, which extends to the south-west, from the first lot of the fourth concession of Bedford to the third lot of the fourteenth concession of Loughborough. The exit of Desert Lake occurs in a bay on the east side, in the sixth lot of the fourteenth concession of this township, and its waters run to Birch Lake, which begins to open out on the ninth lot of the last mentioned concession, and extends in a N.E. direction to the third lot of the seventh concession of Bedford.

From the northern end of Desert Lake to the extremity of the south-west branch, the shore is composed of crystalline limestone, and an exposure of the same description of rock on a small lake in the first lot of the thirteenth concession of Loughborough, being in the general strike from the other, is probably an indication of a continuous outcrop, which would thus be traceable for three miles and a-half. The dip on Desert Lake appears to be to the north-west. On the opposite side of the lake, from the exit to within a short distance of the north end, the margin is again crystalline limestone; so also in continuation is the east side of Canoe Lake to the eighth lot of the sixth concession of Bedford, the distance altogether being four and a-half miles, and the dip in general appears to be from the lakes, or south-eastward. Near the north end of Desert Lake the bands of limestone on the opposite sides come to within a-quarter of a mile of one another, but gneiss appears at the very extremity of the lake, to separate them, and runs into the lower end of Canoe Lake, on each side of the stream which empties it. Gneiss also forms the west side of Canoe Lake from the one end to the other, and the east side as far down as a bay which occurs on the ninth lot of the seventh concession of Bedford. It composes likewise the west side of Desert Lake from its southern end, and the south-east side of the south-west branch or arm, from its extremity, to the point where these sheets of water unite, the rock being at the point marked by abundance of garnets. Gneiss seems also to extend across from Desert Lake to the calcareous exposure on the first lot of the thirteenth concession of Loughborough, within a few hundred yards of which, as well as of Desert Lake, it was again marked by garnet bands. Garnets were also observed on a peninsular point a-quarter of a mile out from the limestone, on the east side of the lake, in the first lot of the fourth concession of Bedford, and again beyond the limestone on the east side of Canoe Lake.

From the exit of Desert Lake, crystalline limestone can be traced by exposures, on the brook which conveys away its waters, and on the north shore of Birch Lake to its eastern extremity, where it composes a promontory about three-eighths of a mile wide, with a deep bay on each side, the distance

from Desert Lake being about three miles and a-half, and the dip appearing to be in general to the N.W. ; while the east side of Desert Lake from its south end to the exit, and the south-west side of Birch Lake, consist of gneiss, in the latter lake characterised by garnets in two positions bearing for one another, the one at the eastern end coming to within a hundred and thirty yards of the limestone.

The transverse exposure at this end of Birch Lake being considerable, a section was measured across the promontory in which the limestone is there found, beginning from the south side of the south-east bay, and the following are the rocks in ascending order.

Ft.

1. Somewhat thinly bedded red and grey gneiss, with layers of mica schist, seen at the stream which falls into Birch Lake on the south side towards its eastern extremity ; the dip is about N. W. $< 65°$ to 70° 132
2. Beds of which a large part is concealed, but supposed to be chiefly mica schist ; a portion is coarse grained feldspathic rock, perhaps a vein, and of this about thirty yards are seen on the north side of the stream, and on a small island near 300
3. Thin alternating layers of white quartz and fine grained feldspar, in which a series of very sharp corrugations are exhibited, but which show a general dip N. W. $< 35°$ 130
4. Gneiss, of which the chief constituent is quartz, holding mica of a black or brown color, and garnets in abundance ; the rock weathers to a rusty yellow ; the dip is irregular, on the whole nearly N. W. as before ; this is to the water's edge on the south side of the south-east bay 260
5. The narrowest part of the bay is five or six chains in width, the upper part of it is swampy, and the rock is concealed. Supposing that the dip is regular, and that there is no repetition or dislocation, the thickness resulting from the width would be about 231
6. Coarse grained crystalline limestone with small spangles of graphite, nodules and angular fragments of quartz, giving it a sub-brecciated character ; an interstratified six-inch band of a bright red, fine grained, slightly calcareous rock, resembling sandstone or quartz rock, passing into jasper, exists near the bottom 100
7. Coarse grained disintegrating crystalline limestone, being an aggregation of large sized crystals of calc-spar, but not exceeding a-quarter to half an inch across 30
8. A red ferruginous mass, having a brecciated appearance ; it seems to be chiefly composed of coarse red feldspathic rock, passing occasionally into a sub-jaspery condition ; much of this is carious

or vesicular, and the vesicles are coated with small brilliant steel-grey crystals of specular iron, sometimes accompanied by colorless transparent quartz ; all the cracks and some of the vesicles are coated with a thin film of the ore, in the form of a shining red powder, staining the fingers ; the rock is micaceous, and the mica becomes occasionally aggregated in bunches of six to eight inches in diameter, and more or less calcareous matter permeates the whole bed. Nearly in the strike of this rock, one resembling a conglomerate was met with on one of the small islands to the southward, and it was there supposed to be interstratified with crystalline limestone, but being seen only close to the water's edge, the fact could not be satisfactorily made out..... 10

9. Alternations of red feldspathic quartz rock, and coarse disintegrating crystalline limestone, generally stained of a red or dirty brown color, derived from specular iron..... 50

10. Coarse disintegrating crystalline limestone, not well exposed, the debris being a mass of calc-spar, with angular fragments of white quartz..... 40

11. Fine grained mica slate, of a greenish-grey color dividing into thin layers, with bands of coarse disintegrating crystalline limestone, and some of red ferruginous feldspathic quartz rock, holding scales of brown mica ; a red unctuous ochreous earth is fonnd near the outcrop of the ferruginous rock, holding among it fragments having a vesicular slag-like character, similar to the rock of No. 8..... 86

1369

On the north side of the north-east bay of Birch Lake, alternate bands of light and dark grey gneiss, with much quartzite holding garnets, is exhibited, which near the outlet at the entrance of the bay, dips N. 10° to 20° W. > 62°, and at the head of the bay, N. 23° E. > 40°; white crystalline limestone comes up from below it on the south side, but an interval of drowned land concealing the rock between this bay and the termination of the section, it is difficult to say whether the whole breadth should be taken as additional strata. If so, the corresponding thickness would be about 330 feet, which would probably be limestone, making the whole amount of the section about 1700 feet.

The exit of Birch Lake is on the north-west side and not far from the east end, being close by the mouth of the bay in which the above section terminates, on the third lot of the sixth range of Bedford. The stream which receives its waters flows

to the north-east for exactly three miles, and enters Devil Lake at Mr. Woolworth's mill, on the eighth lot of the ninth concession of Bedford. Devil Lake lies between the eighth and fourteenth concessions and the third and twelfth lots; it has a very irregular form which is projected into many deep narrow irregular bays, and an island of about the tenth of a square mile in superficies, appears about the middle of it; this island is intersected by the lines dividing the seventh and eighth lots and the eleventh and twelfth concessions. The coast of the lake and the south side of one of these deep bays run from the sixth lot of the twelfth, to the fifth lot of the tenth concession, the course being W. S. W., and the distance about a mile and a quarter. The rock composing it consists of contorted gneiss bearing abundance of pinkish garnets, and the strike would carry it to the garnetiferous band in the south-east bay at the east end of Birch Lake, with which it is not improbably identical. As a proof of the truth of this supposition, on the north side of the Devil Lake bay mentioned, and not more than 120 yards from the garnetiferous gneiss, there is an exposure of crystalline limestone.

To the eastward of these positions, the coast of the lake was not examined, but crystalline limestone was found to compose the island in the middle, and also the north side of a long stretch of the lake on the eighth lot, from a strait occurring on the line between the tenth and eleventh concessions, to the entrance at Mr. Woolworth's farm, the distance between the farm and island, being about two miles and a-half. The south side of this long stretch of the lake, is composed of gneiss, which at the strait assumes the character of a slaty quartz rock. Exposures of crystalline limestone were also met with at intervals, on the road from Woolworth's farm across to the position on the east side of Canoe Lake, where it has already been mentioned as limited by garnet-bearing gneiss.

From the distribution of the rocks on Canoe, Desert, Birch and Devil Lakes, it must be inferred that the two bands of crystalline limestone diverging south-westerly on the second of these lakes, are in equivalent positions on the opposite sides of an anticlinal form, the axis of which runs through the length of Canoe Lake, while the two bands diverging north-easterly from the

exit of the same lake, are in equivalent places on the opposite sides of a synclinal. Each of these latter bands is probably prolonged into Devil Lake, where they appear to sweep round and join one another, thus forming a complete basin. The east side of Devil Lake, however, not having been examined, and no exploration having been made between this lake and the northern extremity of Canoe Lake, subordinate undulations may prolong the trough to the north-east, and give that portion of its perimeter a very irregular form. The probability of these subordinate undulations is the greater, as exposures of crystalline limestone which may be due to them, were met with in the interval between Desert and Birch Lakes; one of these was on the second lot of the fifth concession of Bedford, at the south end of a small sheet of water called Eel Lake, which is tributary to Canoe Lake.

In the same general depression which holds Canoe Lake, at about a mile and a-half to the north-east, we meet with an arm of Upper Rideau or Wolf Lake, which for four miles runs on an extension of the anticlinal axis passing through the former; this axis has thus been traced altogether for about seventeen miles. The rock between Canoe Lake and this arm of Wolf Lake, appears to be gneiss, but on reaching the latter lake, limestone is met with on the north-west side, a short distance below a stream which flows into it, on the eighteenth lot of the ninth concession of Bedford. This limestone was traced about three-quarters of a mile down the lake to the north-eastward, and about as far in a contrary direction to the old Bedford road, on the seventeenth lot of the eighth concession. For about three-quarters of a mile to the north-west on this road, however, there are one or two alternations of gneiss and limestone, resulting from subordinate undulations, which appear to carry the outcrop of the limestone by minor zig-zags to the north-west side of a small sheet of water tributary to Wolf Lake, on the eighteeenth and nineteenth lots of the eighth concession; from this it was traced to a position on Hunt's Lake, (supplying the previous pond,) on the eighteenth lot of the seventh concession. On the road which runs to the south-westward on the left or west side of this lake, and of Potspoon Lake feeding it, the rock was further traced to the twelfth lot of the fifth

concession. Gneiss was observed to bound it to the eastward in the last place, and in an intermediate one on the seventeenth lot of the sixth concession, where the dip was north-west, and the calcareous rock was supported by a band of gneiss characterised by garnets. Between the upper end of Hunt's Lake and Canoe Lake, to the south-east there is a distance of about two miles, of which a part only was examined, being the interval between the latter lake and Garter Lake, a straight and narrow sheet of water, with a length of two miles; the distance across on the line examined is three-quarters of a mile, and the rock consists wholly of gneiss, dipping from the lakes on each side; the lakes converge slightly to the south-west, and this convergence accords with the dips, to prove an intermediate synclinal, the axis of which would run for the corresponding part of the first undulation of the limestone mentioned as existing to the north-west of the arm of Wolf Lake. The interval between Garter and Hunt's Lakes, is supposed to consist of gneiss, but not having been examined, the fact cannot be affirmed with certainty.

That the band of limestone traced to the twelfth lot of the fifth concession, has a continuous outcrop connexion with that on the west side of Desert lake is extremely probable, but they have not yet been followed to a junction, and the undulations which have just been alluded to, it is very probable, will give to the intermediate portion an irregular indented form, corresponding with that near Wolf Lake.

Green Lake is a long straight narrow sheet of water, removed about two miles to the north-west of Hunt's Lake; it extends from the sixteenth lot of the third, to the twenty-fifth lot of the fifth concession of Bedford; the general bearing is N. N. E. and S. S. W., and beyond its southern extremity, about half a mile in the same general bearing, is Tett's Lake. Green Lake falls into Bob's Lake, from which it is separated on the west side, for nearly its whole length, by a strip of land scarcely exceeding two-fifths of a mile; Bob's Lake by a rectangular turn outflanks the northern end of Green Lake, and then by another turn is carried northwardly, in a continuation of the same depression as that holding the latter lake.

In the country between Hunt's Lake and Green Lake, crys-

talline limestone is very largely displayed, and it appears to be kept at the surface all the way across, by repetitions of the strata occasioned by undulations. On Wolf Lake as has been already stated, the dip of the limestone is to the north-westward, and in following the twenty-first lot of the township of Bedford, from the rear of the ninth concession to the fifth, which comes upon Green Lake, various changes were observed. About nine or ten acres from the rear of the ninth concession, a band of gneiss crosses the lot. The dip is here still to the north-west, but there may be a reverse dip between the position and the western side of Wolf Lake. A transverse dislocation cuts the gneiss, and produces a horizontal displacement of about 150 yards to the south-east, on the south-west side. At the junction of the limestone and gneiss, there occurs a bed of magnetic iron ore of a few feet thick, on the north-east side of the fault; but no trace of it was observed on the south-west. In the eighth concession, the dip changes to S. 73° E. < 30°, and there is brought to the surface, a thickness of strata equal to 535 feet. The mass consists chiefly of crystalline limestone, enclosing in some places many fragments which often appear to be portions of bands of quartz, some of them folded and corrugated, giving to the beds enclosing them a sub-brecciated character. Thick masses of a mixture of white feldspar and colorless translucent quartz are now and then interstratified with the limestone, generally in such an irregular manner as to render it not quite certain whether they are beds or veins, but the limestone is the great prevailing mass. Transverse veins of calc-spar holding galena, cut these strata, and are occasionally traceable to some distance; one of them is on the twenty-first lot, and two of a similar character are met with in the same range, near the line between the eighteenth and nineteenth lots. In the run of the vein on the twenty-first lot, about 500 yards east of the spot where a shaft was sunk on it for ore, a dark grey crystalline limestone was found holding mica, and small spangles of graphite; the position of this limestone gave the impression of its forming part of the vein; it appeared to fill a crack or hollow in the crystalline beds about two or two and a-half feet wide, and small cubic crystals of galena were strewed about the ground near,

as if derived from it, or from the walls on each side. Continuing the line on the twenty-first lot, the dip, which is still to the south-eastward in the rear of the seventh concession, changes to the westward towards the front. It again changes to eastward towards the rear of the sixth concession, the exposures being all of crystalline limestone. On the fifth concession the dip is still eastwardly, but there may occur an unobserved contrary dip in the intermediate distance; a band of gneiss with an eastward dip is seen within 200 yards of Green Lake, and crystalline limestone beyond on its margin in a bay, with gneiss still farther on, forming part of the eastern side of the lake and an island near; the observed exposures of this gneiss on the lake run in the strike from the nineteenth to the twenty-second lot, but limestone may lie outside of them again in the bed of the lake.

The west side of Green Lake appears to consist almost wholly of rugged ridges of contorted reddish and grey gneiss, with the exception of a point in the nineteenth lot, on the line between the third and fourth concessions; this point is composed of crystalline limestone, and the same rock forms a point immediately opposite on the east side, and an island between the two. From this, the limestone continues along the east side rising into high bold cliffs towards the southern extremity, and it is continued across to Tett's Lake. Crystalline limestone overlying gneiss, is seen on the eastern side of Green Lake towards the north end also, and again on the west side of that part of Bob's Lake, which was mentioned as lying to the N. N. E., in the same depression, while gneiss forms the east side. Between the most northern and the most southern exposures of crystalline limestone, which have thus been indicated in Bob's, Green and Tett's Lakes, it seems to me probable that there exists a continuous outcrop connexion, though it would require a few additional facts to make the details of its course certain, and the whole distance thus traced would be about six miles.

If a line be drawn in a direction W. N. W., from the twenty-fourth lot of the fifth concession of Bedford, to the twenty-sixth lot of the third concession, it will run from the east side of Green Lake across Bob's Lake, (which is here divided into two

parallel limbs running S. S. W.), to the exit of Crow Lake, falling into the western limb of Bob's Lake. On this line, which starts from an exposure of crystalline limestone, (part of the outcrop just traced,) and has a length of about a mile and a-half, gneiss is met on an island in Green Lake, on the land separating Green from Bob's Lake, and on the long tongue-like peninsula running southward and separating the two limbs of Bob's Lake, all with an easterly dip; the western side of the western limb was not examined, but on a point which would be in the strike of it to the northward, toward the upper end of the lake and on the east side, crystalline limestone was again met with, but its course was not traced out. Beyond it about one-third of a mile, at a fall by which the waters of Crow Lake are precipitated into Bob's Lake, the rock, again with an easterly dip, (S. 69° E. $<80^{a}$) consisted of gneiss filled with garnets and overlaid by mica schist. Although the dip all the way appears to be easterly, at angles varying from forty to seventy degrees, it would be hazardous in a country shewing so many undulations, to say that there are no repetitions through reverse dips, which may have been either passed over altogether without observation, or may have been mistaken from being inverted. If there were no reverse dips or dislocations running with the stratification, the thickness would be about 6000 feet.

The course of Crow Lake is nearly north, and it extends from the twenty-sixth lot of the third, to within a short distance of the thirty-fifth lot of the fifth concession of Bedford. It has a length of about three miles, with a breadth at the southern extremity of about three furlongs, gradually widening to a mile and three-eighths at the northern, where it is divided into two bays. The eastern side was not examined, but the western, which is the straighter, was found to be composed of gneiss, of which the dip varies in direction from S.70° E. to S.60° E., and in inclination from thirty to forty degrees.

From the northern end of Crow Lake a portage was made to Sharbord Lake; in a straight line, the bearing of the portage was N.20° W., and the distance nearly two miles and three-eighths. Gneiss was the only rock observed upon the portage; the exposures in the first third of the distance were in the

strike of those on the west side of Crow Lake, and the breadth of the remaining two-thirds, measured in a direction at right angles to the strike, would scarcely reach three-quarters of a mile; the dip of this appeared to be easterly.

Sharbord Lake is a considerable expanse of water; its length is about five miles and a-half, the first half of which lying in the township of Oso, bears N.72°W., and the other in Olden runs parallel to the south line of the township, which bears S.74°W. The breadth is very irregular; towards the eastern end of the eastern half, two transverse belts of water occur, the more easterly of which, with a small bay on the northern side, makes a deep indentation on the southern, and measures from the bight of the one bay to that of the other, about three miles; while the second belt of the same character, measures two miles. The lake on the line dividing the two townships that have been mentioned, is cut into two nearly equal parts by a peninsula projected from the north side, while the western extremity is cut into two branches by a promontory, and two long parallel islands nearly touching one another, which are a continuation of it.

The eastern transverse belt of water appears to rest upon crystalline limestone, which is seen all along the west side of it to the south, where it is associated with beds of white quartzo-feldspathic rock; and on the east side to the north, beyond which it is continued to the exit of the lake, about half a mile farther in the same direction; the bearing of the whole is a little north of north-east, while the dip on the one side, as indicated by the gneiss bounding it, is to the eastward, and on the other to the westward; from which it would appear, if there be no inversion, that the limestone runs upon the axis of an anticlinal. The limestone is white, holding graphite and mica, and in some parts tremolite with grains of quartz.

Proceeding up the lake, the promontories on each side, that divide the two belts of water, are composed of gneiss, and so are others which succeed on the north side; but the islands which occur immediately east of the great peninsula dividing the lake into two, consist chiefly of fine grained black hornblende slate, with dark brown mica between the layers, and the rock in parts is slightly calcareous. The whole of the peninsula itself

consists of crystalline limestone, and at this point displays a very important mass of the rock. The breadth of the exposure is about twenty chains, and the direction of the dip varies from S.60°E. to S.67°E, while the inclination is from eighteen to forty-five degrees, which would give a total thickness of about 700 feet. Towards the base, the great mass of limestone is underlaid by fine grained mica slates, which alternating with some thin calcareous beds at the bottom, pass into slaty limestone, and shew the planes of division very distinctly.

The promontory which splits the western extremity of the lake into two branches or bays, exhibits mica slates on the north side, and crystalline limestone on the south side and at the extremity; a small island in the mouth of the south bay, as well as the two long islands projected from the promontory, are also of limestone. The dip shewn by the promontory and islands, varies in direction from S. 55° E. to S., and in inclination from twenty-eight to forty degrees; and it seems not improbable, that the limestone of the promontory and its islands, and that of the peninsula, may form a junction under the waters of the lake, though there are still wanting a few facts on the south side of the lake, to determine it positively. The islands in the great bay on the north-west side of the peninsula, shew gneiss, interstratified in the parts nearest the limestone, with bands of quartzite, and gneiss composes points and islands to the westward, on the north side of the lake.

The western extremity of Sharbord Lake is about half a mile from White Lake, which empties into it. On the portage from the one to the other, which runs a little to the westward of north, gneiss was the only rock observed, the exposures occurring near to White Lake. This lake may be called a square with a deep bay on the western side, and including this, it is rather less than a mile and a-half long, in an east and west direction, and rather more than three-quarters of a mile wide. Gneiss was observed on a narrow island running along the south side for half a mile, and crystalline limestone on a point on the east side, which would be north of the strike of the narrow island. Crystalline limestone constitutes also the north shore of the lake, and if the trend of this may be taken as an indication of the strike, it is east and west, but it was found difficult to determine the direction of the dip.

A portage was made from White Lake to a small lake which flows into Cross Lake. The bearing of the line was W. N. W., and the distance about four miles and a-half. The first exposure of rock on this was a mile and a-half from White Lake; it consisted of mica slate, dipping about S. S. E., half a mile beyond which, at a small meadow called the Beaver Dam, crystalline limestone with a conformable dip, and holding much tremolite, was met with, resting on mica slate. It occurred again three-eighths of a mile farther on, and gneiss beyond it as much farther.

The small lake at which the portage terminated, is about a mile long, in a direction a little south of west, and it is fed by a stream which flows into it from the east. On the north side of this stream, about 1200 yards eastward of the lake, a large dyke was observed, composed chiefly of reddish feldspar in large individuals, with which colorless translucent quartz was mingled in smaller quantity, with a very sparing amount of mica. In the widest part, the dyke measured upwards of a hundred yards; its course was S. 7° W., and it obliquely cut the strata, which consisting of hornblendic and micaceous slate, dipped about E. S. E. Lateral branches from the dyke on either side, cut the strata, generally in the direction of the strike; small strings and patches of magnetic iron ore were found in various parts both of the main dyke and the branches. The distance between the portage lake and Cross Lake is about three-quarters of a mile in the general course of the stream uniting them, and the direction south. The intermediate rock observed was hornblende slate, dipping about E. S. E.

Cross Lake is a long narrow sheet of water, running S. 74° W. for two miles, with a breadth of 200 to 400 yards, and about four more S.30°W, with a breadth of half a mile; of the first two miles, three-fourths are in the township of Oso, and one-fourth in Kennebec. The part in Oso consists of mica slate on the south side, and that in Kennebec on both sides. The western four miles were not examined, but the bearing of the lower part of the lake coinciding with the strike of the rocks, it is probable that mica slate will be found to compose its banks. The strike is a little oblique to the

coast on the upper part of the lake, and on this and on the portage, (where the lake was abandoned for the Salmon river,) a great development of the mica slate was observed to exist; the measurement across it, including ten chains for the breadth of the lake, was forty-three chains, and the dip with great regularity was S. 20°to 25°W. < 30° which would give a thickness of about 1400 feet. On the summit of the slate rested a thirty-feet band of crystalline limestone, again followed by mica slate, of which a thickness of about seventy feet was seen, making the section about 1500 feet in all. On striking the Salmon river about fifteen chains farther on, mica slate was again displayed, a good deal contorted, dipping much more to the eastward than at the lake, and twenty-five chains further about S. S. E. down the stream, it was again followed by crystalline limestone which appeared to be in great volume.

The course of the river here changes to S. 10°W., and for nearly a mile and a-half there is no exposure of rock; seven-eights of a mile further in a straight line in the same direction, reaches Bull Lake, but the river first veering to the eastward, and then serpentining by two subsequent sharp turns, measures a distance of two miles and a-half. In this crooked part of the stream, crystalline limestone is largely exposed in the rapids which it occasions. In the upper bend it is of a slaty character, and it is interstratified with a band or two of mica slate; at the lower, supposed to be on the fourteenth lot of the tenth concession of Kennebec, it is arranged in very regular alternate layers of white and bluish-grey; the bluish-grey layers are thinner and harder than the white; they appear to owe their color to the presence of a multitude of very fine scales of plumbago, each so small as scarcely to be discernible by the naked eye, and their hardness to an aggregation of fine rounded grains of quartz, not distinguishable on weathered surfaces from quartz sand; with these are present a small number of very small modified cubes of iron pyrites. In the action of the water upon the rock, the hard thin bluish bands offer a greater amount of resistance than the white, which being purer limestone are more readily dissolved. The result is, that the latter stand out in relief, presenting sharp edges, while the intermediate more

calcareous part is worn into rounded grooves, and the contrast of colors and forms, presents a very distinct and striking picture of the stratified character of the rock. The grain of the calcareous part of the rock is generally rather coarse, but patches of it are tolerably fine and very white; these however rarely afford more than hand specimens, which are of a quality resembling statuary marble. The exposures in this part of the river, which so distinctly afford the evidence of stratification, appear to be in a nearly horizontal attitude, and hence in the square mile they occupy, very little thickness is seen. A few local and very limited contortions were observed however, and in the neighbourhood of these, tremolite was usually found in abundance.

Bull Lake has a length of about four and a-quarter miles, and a breadth varying from a-quarter to half a mile; it is divided into two nearly equal parts by a very narrow strait, and from the entrance, the upper part bears east, the lower about S. 30°W. The entrance to it is three-quarters of a mile above the middle on the north side, and here crystalline limestone is seen dipping southward; but from the strait to the exit, which is at the western end on the south side, the only rock observed was gneiss, and this prevailed to Horse Shoe Lake, a small sheet of water about three furlongs to the south; while at the exit from it, about three furlongs farther, mica slate was met with, and half a mile farther to the south, crystalline limestone again made its appearance.

From this point to Beaver Lake, a distance of about twelve miles, the Salmon river runs on the strike of the rocks in a nearly straight line to the S. S W. Ridges of gneiss and occasionally mica slate occupy the west side, and mica slate in a large part of the distance was seen immediately on the east side, all generally dipping E.S.E.; but the crystalline limestone is probably not far removed from the left bank. It was observed in the river for the first mile, and at the end of that distance, it gave support to mica slate filled with garnets. Six miles farther down, it was seen below the exit of Long Lake, where it is brought in by a dislocation, indicated by a coarse grained quartzo-feldspathic dyke, transverse to the stratification; the mica slate abutted against the dyke on the north-east, and the

limestone on the south-west. The limestone is here interstratified with mica slate, and upwards of a mile farther, on the eighteenth lot of the eighth concession of Sheffield, some beds of limestone occur of a dark blue color and compact texture, holding small rounded grains of quartz, with some of feldspar, which stand out in relief on weathered surfaces, and appear as if loosely scattered over them. The rock has a conchoidal fracture, and in freshly broken parts exhibits small spots, presenting a soft greenish cleavable mineral, supposed to be decomposing pyroxene. The bluish beds are overlaid by thin alternating layers of blue and white limestone, succeeded by thicker layers of a similar color, the white part being more crystalline, but containing the same grains of quartz and feldspar, with the addition of serpentine and mica; in one part they are found to envelope a few large nodules, some of them six inches in diameter, of pure white granular limestone, the blue and white layers being slightly bent at the point of contact with the nodules, and partially accommodated to their form. These beds are associated with a set of variegated mica slates of a calcareous character, of which the colors are red, green, and brown or blackish. They keep near the margin of the river on the east side, to its entrance into Beaver Lake, a distance of two miles, and are again seen on a tongue of land running south-west, which divides the lake into two unequal parts longitudinally, beyond which they pass under the unconformable fossiliferous rocks.

Between the north-east end of Beaver Lake at its outlet, and the bridge across the Salmon river, on the twelfth lot of the seventh concession of Sheffield, there is another large exposure of crystalline limestone, shewing a dip to the south-east; and at the town line between Sheffield and Camden, on the twentieth lot of the latter, a band of very white dolomite comes from beneath the fossiliferous strata, and forms a well marked ridge running N. 70° E. It is bounded on the south by gneiss, which continues on the road up to the nineteenth lot of the ninth and part of the eighth concession; a small exposure of crystalline limestone appears on the farm of Mr. Neil Stewart, on the second lot of the fourth concession of Sheffield, where it

protrudes through the flat beds of the fossiliferous formations, in the form of a dome, the base of which is not more than twenty yards in diameter.

On the Clare river, gneiss was observed in several spots to the sixteenth lot of the third concession of Sheffield, dipping to the south-east, and in continuation on the same strike to the fourteenth lot of the second concession. It also appeared near the line between the ninth and tenth concessions of Hungerford, on the thirty-second, twenty-eighth, twenty-third and twenty-second lots, associated in the last locality with mica slates, and dipping to the S. E.; on the twenty-first and twentieth lots at Doak's Mill, crystalline limestone occurs, as in former instances, associated with mica slates. On Stucco Lake, gneiss appears on both sides towards the western end, dipping S. W.; it occurs also on the south and the west sides, and from the south-west corner of the lake it is continued in a ridge to the road between the fifth and sixth concessions of Hungerford, on the fourth lot, where a moderately high escarpment of the superior, unconformable fossiliferous rocks rises at no great distance on each side.

In Huntingdon, Madoc, Marmora and Belmont, many interesting diversities occur in the Laurentian series, but the rocks belonging to it become so frequently and unexpectedly covered up by projecting and outlying masses of the unconformable fossiliferous formations, in the part investigated, that it is as yet impossible to give any connected view of their arrangement. In the first named township, a rock composed chiefly of red feldspar and translucent colorless quartz, with a small amount of greenish hornblende and small disseminated crystals of iron pyrites, is seen at both ends of Hog Lake, and on an island in the middle of its breadth towards the east end. It is without observed stratification, and is probably intrusive; to the westward it becomes covered up by the fossiliferous rocks, but a rock of a similar character was observed running from the twelfth to the twenty-second lot of Madoc, in the second and third concessions. If the two have any connection, the latter mentioned mass might be supposed to come from beneath the fossiliferous formations, about the ninth lot of the third concession of the township. In that part of its course between the last named

lot and the twenty-second of the second range, it would run obliquely transverse to the general direction of the stratification to the westward, which is about north-east and south-west.

On the bridge-island in Hog Lake on the eleventh lot of the thirteenth concession of Huntingdon, calcareous mica slates are seen dipping to the north-west, and on the road in the same lot farther north, there is crystalline limestone. If the observed strike of these is continuous north-eastwardly, it would carry them into the lake. On the north side of the lake, in a position which would appear to overlie the previous mentioned exposures, are contorted gneiss and talcose slates, cut by red syenitic veins; the dip of the stratification is northwestward. Proceeding northward, gneiss occurs on the first lot of the sixth concession of Madoc, and white crystalline limestone beyond it in the same numbered lot in the sixth and seventh concessions. In a field a little way north from the village of Madoc a ridge of a somewhat talcose slate occurs; it is slightly calcareous, of a bluish color, weathering greenish, and holds numerous fragments of rock, different in character from the matrix, being all without calcareous matter, some of them resembling syenite or greenstone. North from this ridge, another succeeds, consisting of talcose slate, beyond which for 300 yards, ridges of a decided conglomerate with distinctly rounded pebbles enveloped in a matrix of talcose slate, alternate with ridges of slate with few or no pebbles. The exact dip of the beds could not be ascertained to my satisfaction, but crystalline calcareous beds, portions of which appear to be pure dolomite, with small crystals of yellowish mica, and a few small grains of serpentine and thin reticulating strings of magnetic iron ore, were found at the village on the south side of the ridges, while black or dark bluish calcareous and pyriteferous slate was found to the north of them, and these usually indicated a northerly dip. On the fourth and fifth lots of the fifth concession, another band of conglomerate occurs associated with a fine grained silicious clay slate, which has been used for whetstones, and fine grained mica slate. The matrix of the conglomerate weathers white, and appears to be a dolomite; the pebbles, which are frequently large, the largest being equal in size to an eighteen-pound cannon ball, are chiefly quartz,

but there are also pebbles or patches of feldspar, and a few of calcspar; the quartz pebbles are for the most part distinctly rounded, and their colors various, some being on fracture bluish, some white and others pinkish; the feldspar is red and white, and the calc-spar white. The whetstone slate and the mica slate appear to pass into one another, and in both are occasionally seen disseminated crystals of magnetic iron. The dip of these beds appears to be in a direction southward of east, but the slope is irregular, and may probably be thirty-five or forty-five degrees. Rocks of a similar character were crossed on the road between the seventh and eighth concessions of the township, on the fifteenth and sixteenth lots, which may possibly be a continuation of the same strata, as the position is not greatly out of the general strike from them; but whether the conglomerates near the village are to be considered as a repetition of these beds, or a distinct set in the same formation, sufficient evidence has not yet been collected to determine. South from those mentioned as being found on the road between the seventh and eighth concessions, a fine grained, compact, dull white sandy dolomite occurs, weathering to a brownish-yellow, with a scaly conchoidal fracture. Bluish calcareous slates appear on the seventeenth, and crystalline limestone on the twentieth lot of the eighth range. On the eleventh lot of the fifth range, a black micaceous rock occurs, the stratigraphical relation of which, in respect to the other rocks of the formation, has not yet been made out, but it possessess an interest from the fact that there is associated with it a twenty-feet bed of magnetic oxyd of iron, part of which possesses polarity. It has been mined for the ore, and farther allusion will be made to it in the economic division of this Report.

Belmont Lake lies between the twelfth and twenty-first lots and the third and sixth concessions all inclusive, of the township from which it derives its name. It has a triangular shape, and its western side runs about N. N. E. and S. S. W. At the northern extremity, it receives the waters of the Deer river on the twenty-first lot of the third concession, and its exit is on the fifteenth lot, near the line between the second and third concessions. The general dip of the strata upon it, appears to be about E. S. E. Mica slates form the more western

indentations of the western side, showing an inclination of about forty degrees, upon which rests crystalline limestone in a band of some importance, seen on a promontory on the seventeenth lot of the fifth concession, where some of the beds appear to double completely over on themselves, and shew an inverted dip with as great a slope as the true one; it occurs again on an island in the twentieth lot of the second concession, and once more in the Deer river, a little above its entrance into the lake. On the Deer river, the crystalline limestone rests upon fine grained slightly calcareous mica slate, and the lower beds of limestone are in thin layers, and shew an alternation of colors, which are rose-red or pinkish, grey or bluish, and white; golden-yellow mica is distributed in small scales on the divisional planes. Mica slates succeed the limestone in ascending order; they are seen on a projecting part of the west side of the lake, in the fourteenth lot of the fifth concession, where they slope at an angle of sixty degrees, and on the western side of the islands which are on the strike of it to the N. N. E. On the east side of the largest of the islands, and on a small one to the N. N. E., there occur beds of conglomerate, which according to the dip, would overlie the previous rocks; they are interstratified with talcose slate, and the matrix of the conglomerate exhibits a slaty structure and talcose character, at the same time that it is calcareous or dolomitic; feldspathic portions appear to run through it, the feldspar being red, and small crystals of magnetic iron ore are frequently disseminated through the mass. The general color in fresh fractures is greenish or reddish white, but the external surface weathers to a dark brown. The pebbles are distinctly rounded and flattened, the flat sides usually but not always lying parallel with the bedding; they are of various sizes, the largest being about five or six inches in diameter, while the smallest do not exceed the size of snipe shot. The prevailing color of the pebbles is very dark grey; they have a flat conchoidal fracture, with a very close impalpable grain; they are harder than steel and appear to be quartz rock. The inclination of the beds on the larger island is sixty-nine degrees, and the successive islands which are in the strike of them, stand in a distance of about three miles. The transverse distance from

the east side of the islands to the more western belt of mica slates, is just a mile. On the eastern side of the lake, the rocks are dark colored, and appear to be hornblendic gneiss, or perhaps syenite, the aggregate being chiefly fine grained quartz with some hornblende and feldspar; at the rapids at the outlet, they assume somewhat the character of hornblende slate, the general dip of which appears to be still easterly.

On Crow Lake in Marmora the proximity of the overlying fossiliferous rocks to the margin, gave but little opportunity of ascertaining the stratigraphical relation of the great bed of magnetic iron ore, which is on the eighth lot of the first concession; it was however determined to be conformable with the strata in contact with it, which appear on one side to be crystalline limestone, and to dip to the north eastward; but little more can be said of it and other masses in the neighbourhood, than belongs to economic considerations.

Between Belmont Lake, and Stony Lake which divides the townships of Dummer and Burleigh, no facts were ascertained in connexion with the Laurentian series. Stony Lake lies between the sixth and twelfth concessions of the two townships, and occupies nearly two lots on each side of the town-line common to both. Its direction is W. S. W. and it appears to run on the crown of an anticlinal form in the Laurentian series of rocks. Gneiss constitutes the east of the lake at Boshing's, and some of the islands in the middle of it, as well as a part near the coast at the entrance of Jacque's Creek in the second lot of the eleventh concession of Burleigh, and it appears to extend to a very picturesque lake called by the Indians Kah-sey-bah-gah-mog, which lies between the sixth and eleventh lots of the seventh and eighth concessions of Methuen. At the eastern extremity of Stony Lake there is a considerable display of crystalline limestone, but there the dip is W.<75°, an irregularity which is probably due to a dislocation running in a nearly north line across the lake up Jacque's Creek. Slates of a calcareo-micaceous character are seen on the south side of the lake, dipping S.S.E. and S.E., and crystalline limestone with the latter dip is seen farther to the westward, on the south side of Salmon Trout Lake, into which Stony Lake is discharged, the exposure occurring on a small island on the line between the

fourth and fifth concessions of Dummer. On the north side of Stony Lake, crystalline limestone is met with on the second lot of the seventh concession of Burleigh, and again at the mouth of Eel Creek, where it is of a disintegrating character, and contains a large quantity of black mica, while at the falls a little higher on the creek, white crystalline limestone alternates with blackish-grey gneiss, showing a dip N.87°W.<18°. At Eel Creek the slates and limestone are intersected by a set of parallel veins or dykes chiefly of fine-grained pale red or flesh colored syenite, the largest about three feet thick; their general course is N.24°E., and the underlie of the largest S.66°E. <45°. At the same place a vein cutting the others occurs, its course being N.60°E.; it is a fine grained mixture of quartz and reddish-white albite, some of the albite being in large cleavable masses exhibiting a bluish opalescense. The vein holds occasional patches of fine granular black tourmaline, and is slightly calcareous in parts.

About four miles up Jacque's Creek on the east side, a mountain rises probably 1000 feet above the level of Stony Lake; it appears to be situated somewhere about the fourteenth and fifteenth lots of the tenth concession of Methuen; it was found to be composed of disintegrating crystalline limestone, interstratified with mica slate and bands of dark colored gneiss, and it stands on the north side of the anticlinal axis.

On Salmon Trout Lake, a considerable island opposite the fourth concession of Dummer, consists of gneiss, and this rock with mica slate composes the point between the lake and Burleigh Rapids. A large island opposite Deer Bay is composed of gneiss, but beyond this the Laurentian series was not seen until getting north of Balsam Lake. Following up a stream called Gull River to Little and Big Mud Turtle Lakes, which are expansions of it, crystalline limestone again occurs on the west side of the latter lake towards the lower end, about five miles above Balsam Lake; it is here cut by a quartz vein, holding molybdenite, and dipping east-ward, keeps the west side of the lake to the head, where the examination terminated.

Fossiliferous formations.

The fossiliferous series of the area under description, is as before observed all of the Lower Silurian epoch, the Potsdam sandstone being the lowest formation, while the Trenton limestone is the highest, coming within the limits of the season's examination.

Potsdam sandstone. The Potsdam sandstone is not largely developed, the greatest thickness of it observed at any one place, being certainly not over forty or fifty feet, while west of Knowlton Lake in Loughborough, it appears gradually to decrease in thickness, and eventually to die out altogether. The largest spread of the formation is in Storrington, (formerly Pittsburg), where it comes out from under the limestone escarpment, and terminates in an irregular outcrop, running from Brass's Point on Loughborough Lake in the ninth lot of the tenth concession of Storrington, to the twelfth lot of the eighth concession on Vanluvin's creek, a short way below Daly's Mills. The rock is for the most part of red and greenish colors, generally fine grained, having pebbles of opaque white quartz distributed scantily and irregularly through it. At some parts it is of a pale greenish color, striped with reddish or yellowish layers, and at others it is a nearly pure white, fine grained silicious sandstone. Some portions also are bright red and very ferruginous, and others are a coarse quartz conglomerate. Near the road leading from Vanluvin's Mills to Dog Lake landing, in the twelfth lot of the ninth concession of Storrington, a cliff of sandstone exhibits the following section in ascending order:

	Ft.	In.
A solid bed of grey sandstone, moderately fine grained, holding angular pebbles of white quartz, the largest of which is from six to seven inches in length,	4	0
Dark grey, rather coarse grained sandstone, with frequent very red stains, and weathering of a rusty red color,	2	0
Fine grained yellowish sandstone,	0	6
Dark grey, rather coarse grained sandstone, mottled and striped with red and yellow, holding pebbles of opaque white and bluish-grey quartz, usually angular, sparingly distributed through the bed,	2	0

	Ft.	In.
Dark grey, yellow weathering, very hard, silicious sandstone, striped yellow and reddish,	0	6
Rock of the same character, with spots of bright red,	1	9
	10	9

At intervals for about eight chains, the road east from this section exposes flat surfaces of grey sandstone, sometimes ripple-marked rather obscurely, and sprinkled with quartz pebbles; four chains to the south, another cliff rises, showing strata, supposed from their position to be higher beds, which in ascending order, are as follows:

	Ft.	In.
Alternate beds of grey and red coarse grained sandstone,	8	9
Coarse grained red and white sandstone, with small pebbles of white quartz distributed over the divisional planes of the bedding,	4	0
A confused mass of conglomerate, composed of large pebbles of quartz, loosely and irregularly imbedded in a sandy matrix...	8	0
Red and grey coarse grained sandstone in a set of thin beds, with small quartz pebbles scattered over the divisional planes,	3	0
	23	9

At the place where the conglomerate occurs, the dip as indicated in the overlying beds is S. E. $< 10°$, but that dip is only local. On the north side of the road, the rocks are very nearly flat, and no conglomerate resembling the eight-feet bed in the above section was observed at all. At Daly's Mills on the eleventh lot of the eighth concession, there is an exposure of about thirty feet of sandstone, the upper beds of which dip about N. 10° W. $< 10°$ to 12°; and in the same stream a little higher up, on the the twelfth lot of the tenth concession, similar beds dip S. 60° E. $< 15°$. But the strata between are nearly flat and these comparatively high angles of inclination appear only near their junction with the inferior Laurentian series, abutting against which, the fossiliferous beds seem almost universally to be slightly tilted. At Brass's Point the sandstone is very white and fine grained, and it is frequently penetrated by slender cylindrical holes, for the greater part vertical; these are tinged of a dirty brown or rusty color, and contrast strongly with the white stone; they are supposed to be occasioned by organic remains, and are probably the *Scolithus linearis* of Hall.

Below the white sandstone there is a fine silicious conglomerate, and that is underlaid by grey sandstone, which was occasionally seen resting on the gneiss, the whole thickness displayed not exceeding from five to six feet.

At a point on the south side of Loughborough Lake, in the seventh lot of the ninth concession of Storrington, a cliff exposes about twenty feet of sandstone, sloping gently south-west towards the foot of the calcareous escarpment, which rises abruptly on the south side of the bay, west from this point; and at Knapp's point opposite, and a small island near, there are similar strata. The formation was next met with in the township of Loughborough, where it occurs occasionally in outlying patches, resting upon gneiss or crystalline limestone. One ef these outliers is on the eleventh lot of the ninth concession, at the northern end of Eel Lake, where a cliff about forty or fifty feet high is capped by red or purplish and white silicious sandstone, arranged in regular beds of from six inches to one foot thick, the whole thickness being about sixteen feet. The lower part of the cliff is concealed by debris from the sandstone beds, but the patch, which does not appear to exceed a few acres in extent, is surrounded by gneiss. Other small outliers occur near the base of the fossiliferous escarpment, on the fourth and fifth lots in the rear of the seventh, or the front of the eighth concession of Loughborough, some of which occupy an area of about an acre, and rest immediately on crystalline limestone. On the west side of Knowlton Lake, sandstone strata come out from below an escarpment of fossiliferous limestone, and rest upon crystalline limestone. At the south end of the lake, there is an exposed thickness of fourteen feet of red and grey or greenish massive sandstone, in beds of from three to four feet, over which the ground is level for about fifty yards, and then rises rather abruptly on the talus of the escarpment of the fossiliferous formation. One portion of the red bands here is very ferruginous, almost passing into a hæmatitic iron ore; the unctuous powder resulting from it imparts its red color to the soil around, and the surface of the hæmatitic bed is marked by the occurrence of sub-globular, concretionary ferrugino-arenaceous masses, sometimes as large as an orange, but oftener about the size of a walnut, giving it a mammillated

character. At the north end of Knowlton Lake, on a bold square shaped bluff, which comes out between the outlet and a long bay on the east side, there is a considerable display of sandstone. The cliffs rise at some points to the height of sixty feet, but the strata making some gentle undulations, the thickest accumulation is probably not over forty feet. The upper part is red or red and green, in rather thin beds, some under three inches in thickness, and the upper surface is mammillated as before. The lower beds are mostly massive, being nine to eighteen inches thick, and their colors are red, green and drab, in some parts alternating in very thin stripes: the lowest of these beds appears to rest on a rather fine silicious conglomerate; but the latter being seen only just at the edge of the water, its relation was not satisfactorily ascertained, although the impression at the time of examination was, that it belonged to the Laurentian series below. The same measures come out at a little distance north from the lake, on the second lot of the tenth concession, and are again seen on a small brook, on the road between the ninth and tenth concessions near to the town-line between Loughborough and Portland, immediately west of which, the fossiliferous limestone rises in an escarpment.

Calciferous sandrock, Chazy, Birdseye, Black-River and Trenton limestones. For the sake of convenience these formations are arranged together; the whole series being sometimes found in partial exposures in one continuous transverse section, and occasionally occurring in a single vertical cliff. Along the line of outcrop, the inferior formation usually constitutes a low and gently rising escarpment, surmounted by table land extending to the base of the higher limestones, which most generally rise in a bold rocky cliff. The attitude of the series is for the most part horizontal, the inclination in many instances being so small as to be almost inappreciable, and in consequence it so happens that except at the terminal outcrop, and in sections worn out in the course of rivers and streams, the rock is seldom seen, being covered over and concealed by great deposits of drift. The general strike is about west by north, and the dip on an average about two degrees to the southward; but there is a series of gentle parallel undulations which

affect the strata, running nearly at right angles across the general strike, their usual bearing being about N. N. E. and S. S. W. Where the undulations occur, the lower rocks come to the surface in long narrow ridges, sometimes extending for several miles to the southward, and on either side of them, the fossiliferous escarpments rise, usually at no great distance, sloping gently in directions opposite to one another. These features were most particularly observed in Loughborough, Camden and Sheffield, and in Hungerford, Madoc and Marmora, extending thence on the Crow river into Seymour. The most conspicuous of these undulations are between the townships of Camden and Belmont, where the terminal outcrop is in consequence, although tolerably straight in its general bearing, extremely irregular.

At Vanluvin's mills on the tenth lot of the ninth concession of Storrington, where the series rests on intrusive red granite, the sequence of the beds in ascending order, is as follows:

	Ft.	In.
Green shaly conglomerate; the pebbles are of white quartz chiefly, and generally rounded, the largest being about the size of a walnut; they lie in a green calcareo-arenaceous matrix	0	6
Beds of the same general character; the conglomerate however is finer, and some angular fragments of quartz about two inches long occur; a reddish tinge pervades some of the parts, and divisional planes occur of a bright green color	2	0
Calcareous sandstone, with small rounded grains or pebbles of white quartz, seen on the road towards an escarpment	1	0
Concealed by drift	20	0
Fine grained compact dark brownish-black bituminous limestone, with a somewhat nodular surface where exposed to the action of the atmosphere, and somewhat shaly towards the top; organic remains are seen on the upper surface, consisting chiefly of an obscure turbinated shell resembling *Maclurea*; *Cythere* is also present	5	0
Compact dark brownish-black bituminous limestone, with small crystals of calc-spar disseminated	2	6
Concealed	5	0
Slightly arenaceous limestone	0	3
Grey compact limestone, a good building stone	0	10
	37	1

Brownish dark grey bituminous limestone, with fossils consisting chiefly of a small *Leptæna*, and a straight limbed, reticulating fucoid on the upper surface; the bed makes good building stone, and yields good lime of a darkish color.....	0	11
Thin bedded dark grey bituminous limestone, with large fucoids on the upper surface.....	0	3
Pale bluish-grey very compact bituminous limestone.....	0	9
Dark brownish-grey bituminous limestone, with broken fragments of fossils, chiefly the same *Leptæna* as before, and large fucoids on the upper surface. Minute crystals of calcspar are disseminated through the bed.....	0	10
Dark brownish-grey bituminous limestone, with large fucoids, and some small bivalve shells, all *Leptænæ*, one of them three-quarters of an inch broad.....	0	2
Compact dark grey limestone with one division of calcareous shale; the beds hold many specks of white iron pyrites.....	2	9
A parting of grey, brown-weathering, slaty limestone	0	3
Pale grey limestone.....	1	1
Bluish-grey calcareous shale, weathering a rusty brown color...	0	9
Brownish-black bituminous limestone, with small translucent crystals of calcspar.....	1	6
Black shaly limestone approaching calcareous shale.....	2	0
Dark grey or blackish thin bedded brittle limestone, with a splintery fracture.....	1	8
Dark grey or blackish brittle limestone of very fine texture, with a conchoidal fracture.....	1	0
Concealed.....	30	0
Brownish dark grey bituminous limestone having a conchoidal fracture; the exposed surfaces and edges are peculiarly marked with sharp deep angular cavities, supposed to have held lenticular crystals of calcspar.....	0	8
		44 7
		81 8

These rocks keep the south side of Loughborough Lake; the lower portion comes out to the shore, and is seen resting on the Potsdam sandstone at Knapp's Point; the upper forms a sharp escarpment at no great distance south from the other, and is traceable to a bay on the twenty-sixth lot of the sixth concession of Loughborough, where the Laurentian rocks come up, and run back to a small sheet of water called Round Lake, situated on the town line between Storrington and Loughborough. On the west side of the bay, the corresponding escarp-

ment rises over the gneiss, and continues to run nearly parallel with the lake, at a distance south of it from 200 to 300 yards, to the eighteenth or nineteenth lot of the fourth concession, where it strikes the lake. On the north side of the lake, the continuation of the escarpment was traced to the south-east end of Sloat's Lake. At the base of the cliff at Sloat's Lake, a calcareous conglomerate occurs, resting upon red gneiss; the pebbles of the conglomerate are chiefly of gneiss of the same character as the rock it rests upon, with some of white quartz, imbedded in a matrix of green and reddish calcareo-arenaceous shale. A conglomerate, sometimes of a sub-brecciated character, was observed in many other parts, coming out from below the limestone; its pebbles and general composition were evidently more or less derived from the Laurentian rocks, with which it frequently was found in contact. On the rear of the third and fourth lots of the seventh and eighth concessions of Loughborough, there is an outcrop of coarse conglomerate, resting on crystalline limestone, which in ascending order is composed as follows:

	Ft.	In.
The lower bed touching the crystalline limestone, is of a green color, and holds many small pebbles of white quartz; the matrix is very calcareous	0	6
A coarse boulder breccia or conglomerate, consisting of large masses of red gneiss, crystalline limestone and quartz, imbedded in a green and sometimes reddish calcareous matrix	4	0
Beds of from three to four inches thick, of green calcareo-arenaceous rock, with small rounded pebbles of white quartz	1	6
	6	0

The escarpment being traced to the head of Knowlton Lake, the section in ascending order is as follows:

	Ft.	In.
Fine grained red and greenish or grey sandstone, in strong massive beds of from three to four feet thick; this is on the lake shore; (*Potsdam sandstone,*)	14	0
Concealed	35	0
A strong compact bed of bluish or brownish-grey bituminous limestone	1	4
Dark grey, very compact bituminous brittle limestone of very fine texture, with a conchoidal fracture; it holds organic remains, among which are a pentacrinite and many indistinct minute fossils	2	0

Dark grey limestone, with small translucent crystals of calc-spar	1	8		
Dark grey limestone of a texture coarser than the beds below; it holds *Cythere* at the top	2	0		
Dark grey limestone with crowds of small fossils on weathered surfaces, among which a pentacrinite is frequent	0	6		
Similar beds, in solid strata of from six inches to one foot thick.	7	0		
Black or very dark grey limestone, dividing into thin slaty laminæ	1	8		
Black calcareo-arenaceous shale	1	0		
A light grey argillo-calcareous bed resembling hydraulic limestone	2	0		
Greenish calcareo-argillaceous shale,	2	0		
			21	2
			70	2

The following is a section behind Switzer's tavern, at the village of Sydenham, on the third lot of the fifth concession of Loughborough, in ascending order:

	Ft.	In.		
1. Green shales ascertained to be in the lower part of the well behind Switzer's, and supposed to be the same as the shales which crop out on Sloat's Lake, at the end of the road between the fifth and sixth concession; the depth of the well is,	20	0		
2. Black bituminous limestone of very fine texture, dividing into beds of from four to seven inches thick, with a conchoidal fracture; the bed weathers drab or yellowish,	2	6		
3. Green shale,	1	4		
4. Alternations of black bituminous shale, and thin bands of black bituminous limestone, both weathering of a greenish tinge,	1	2		
			25	0
5. Three solid beds of dark grey brittle limestone of close texture, with a conchoidal fracture; the surfaces of the upper beds exhibit *Pentacrinus*, *Cythere*, and fragments of *Leptæna*,	1	3		
6. Very thin bedded dark grey bituminous limestone, and black calcareous shale,	1	0		
7. Thin bedded black bituminous limestone, weathering bluish-grey, parted by thin divisions of black shale; the limestone is very compact and brittle, and holds *Cythere* in abundance,	0	9		
8. Beds of a similar character but thicker; where not weath-				

ered, the planes of division are not discernable, and the whole appears one solid bed; *Cythere* is present in abundance	2 6	
9. Grey bituminous limestone of a texture less compact than the beds below; its structure appears to be somewhat oolitic; many small obscure fossils are weathered out on the surfaces; the most conspicuous are the same *Cythere* and the same *Pentacrinus* as before	1 6	
10. Concealed,	2 0	
11. Grey bituminous limestone of rather fine texture,	1 6	
12. Concealed,	5 0	
13. Dark grey nodular bituminous limestone,	1 0	
14. Bluish-grey bituminous limestone, with small disseminated crystals of calcspar; it holds a small *Leptæna* and fucoids on the upper surface, which weathers to a bright yellow color,	2 0	
15. Not distinctly seen,	4 0	
16. Blackish limestone of a rather shaly structure, weathering brownish,	2 0	
17. Not well seen, but supposed to be all green calcareo-argillaceous shale,	5 0	
18. Pale blue limestone splitting into thin and very regular laminæ, the upper surface peculiarly weathered, and having forms composed of sharp reticulating upright plates in relief,	1 6	
19. Not well seen; beds of blue limestone come out occasionally,	5 0	
20. Pale bluish limestone weathering brown,	0 6	
21. Pale bluish limestone, with shale-like patches on the upper surfaces, supposed to be fossils,	0 7	
22. Thin bedded shaly blue limestone,	4 6	
23. A solid bed of dark grey limestone, weathering bluish-white,	0 8	
24. A similar bed, but less compact in texture,	1 0	
25. Concealed,	3 0	
		46 3
		71 3

North of the above section there is a quarry between the third and fourth lots of the sixth concession, in which a light grey yellow-weathering argillaceo-calcareous rock, holding geodes of calcspar, is underlaid by a compact greyish-drab limestone, the beds of which interlock into one another; the interlocking

parts present on their sides a columnar structure, and are generally bevelled at the extremities, while a thin film of bituminous matter lies between them. How these beds are related to those of the section is not quite certain, but they probably form a part of the lower division of it.

On the third and fourth lots of the third concession of Loughborough, beds of dark brownish-grey or black bituminous limestone crop out; among other fossils they hold a very broadly foliated *Stictopora*, *Leptæna deflecta* or *filitexta*, *L. deltoidea*, *Modiola*, the cast of a univalve resembling a very depressed *Pleurotomaria umbilicata*, *Bucania expansa*, a large *Orthoceras* of which a fragment shews chambers resembling in their proportions *O. fusiforme*, *Ormoceras tenuifilum*, with fragments of a trilobite supposed to be *Isotelus gigas*. These rocks, which appear to resemble the Birdseye and Black-River limestones, strike over to the first or second lot of the eighth concession of Portland, and beds resembling them are met with on the road between Portland and Loughborough in the ninth concession, at a little distance west from the calcareous escarpment already noticed on Knowlton Lake; in these beds are found the same broadly foliated *Stictopora* as before, *S. acuta*, *Chætetes lycoperdon*, a finely and regularly striated *Leptæna* perhaps *L. tenuilineata*, *L. deltoidea*, with *Ormoceras tenuifilum*, and *Orthoceras multicameratum*.

A small section on the farm of Mr. Purdy, in the eleventh lot of the eighth concession of Portland on the bank of Pond-Lily Lake, exhibits *Cythere* at the base, abundant in black bituminous limestone, and at the top *Stictopora acuta*, *Chætetes lycoperdon*, two species of *Leptæna*, one like *L. alternata* or *deltoidea*, and the other resembling Hall's figure of *L. recta*, with *Orthoceras*. From their position, it is probable that the beds are nearly equivalent to those last mentioned.

From this, the formations that include the rocks that have been mentioned, pass diagonally through Camden, the lower parts extending out more and more from the main or superior escarpment, and striking for Beaver Lake in Sheffield, while the limestones of the latter trend to the north-west angle of Camden, thence crossing into Hungerford. The main escarp-

ment in its course runs close by Centreville, which is situated on the twenty-fifth and twenty-sixth lots of the sixth concession of Camden. At the foot of it, there are beds of compact limestone with a conchoidal fracture, having a mottled aspect, and a color between a drab and a darkish grey, weathering to a light grey, which hold *Cythere* in moderate abundance; the beds exhibit a suture-like interlocking at their junction, with the same columnar structure already mentioned in the lower beds. The summit of the escarpment is composed of brownish-black bituminous limestones, which in their fossils resemble those of Pond-Lily Lake.

About a mile and a-half south of the village of Tamworth, which is situated upon the intersection of the lines between the fifth and sixth lots and the sixth and seventh concessions of Sheffield, the following section in ascending order, was met with on the Kingston road, in the channel of a brook:

	Ft.	In.
Green calcareous sandstone in thin irregular beds, with forms bearing an imperfect resemblance to *Scolithus*, filled with calcspar,.....	0	10
Irregular beds of light grey impure limestone with numerous small masses of quartz, chiefly pebbles; the beds hold calcspar, and are each about six inches thick.....	2	0
	—— 2	10

A little way beyond where this section was seen, a ridge of the Laurentian series, with crystalline limestone, rises to a higher level, and the surface of the limestone is occasionally patched over unconformably with a greenish calcareous paste, cementing together fragments of the more ancient rock, and pebbles of compact grey limestone. It has already been stated that a dome-shaped mass of crystalline limestone rises on the farm of Mr. Neil Stewart, on the second lot of the fourth concession of Sheffield. It is entirely surrounded by nearly flat beds, which in their general mass resemble the paste of the ridge. The rock is extended into the third lot of the same range, where it holds *Cythere*, and on the fourth lot of the same range there is a compact greyish-drab limestone, a good deal resembling that at the foot of the Centreville escarpment, but rather lighter in color, and holding the same *Cythere* in about the same abundance,

with *Isotelus gigas*. The flat rocks of Mr. Stewart's farm are probably equivalent to the patches on the ridge, and in their stratigraphical relation belong to a series that is intermediate between the above section and the Centreville escarpment; they may perhaps be considered to represent the base of the Chazy formation, while the *Scolithus* bed may be near that of the Calciferous sandrock.

Various places in the vicinity of Tamworth shew similar calciferous strata. At the village there is a bed of compact drab-grey limestone with a conchoidal fracture, weathering into deep vertical cylindrical holes; in the solid parts of the rock they are filled with yellowish calcareous matter, which appears to be more crystalline in the centre of the cylinders, than at the sides. About six feet of greenish calciferous strata in strong beds, the lowest one a fine greenish conglomerate, occupy the south-eastern side of the long tongue of land in Beaver Lake, and rest upon the upturned edges of the mica slates which come out on the north-western.

The lower formations sweeping round by the western end of Beaver Lake and turning northward to Clare River, take a course somewhat parallel with the latter, to Sugar Island, on the south side of Stucco Lake, but occasionally cross over to the north side of the river on the way. The greatest thickness of the beds observed in one mass along the Clare country, was on the line between the third and fourth concessions of Sheffield, where there is a cliff of about forty feet, the upper beds of which hold *Cythere* in compact brownish-grey limestone, while on the bank of the river within seventy yards, the rock is gneiss.

Below Hungerford mills on the twelfth lot of the tenth concession of Hungerford, the beds at the edge of the river, in ascending order are as follows:

	Ft.	In.
Dark blue limestone,	0	7
Drab colored limestone of very fine texture, in courses of three inches thick, supposed to be of a quality fit for lithographic purposes,	0	9
A bed of bright red arenaceous limestone passing into a red calcareo-arenaceous shale at the top,	0	8
Beds of grey limestone occasionally coming out on the bank, ...	4	0
	6	0

At the termination of the Laurentian ridge, at the third lot of the fifth and sixth concessions of Hungerford, an escarpment rises from forty-nine to fifty feet high, in nearly horizontal strata. The lower beds of this, exposed at a distance of about a hundred yards from the gneiss, consist of a pale bluish-drab calcareous rock, apparently without fossils, and are supposed to belong to the Calciferous sandrock formation, while the strata at the summit are dark brownish-grey or blackish limestone in pretty regular courses of from two to three feet thick, holding *Cythere* and some small univalves.

On the Moira, where the road between the second and third concessions strikes the river, the beds exposed in ascending order are as follows :

	Ft.	In.
Dark brownish-grey very compact limestone in the bed of the river,	0	2
Similar rock in one solid bed,	0	7
A parting of grey colored shale,	0	1
Dark brownish-grey or blackish limestone, with fragments of trilobites and other very obscure fossils on the top,	0	4
Drab colored shaly limestone,	0	3
Dark brownish-grey or black limestone, hard and brittle, with fragments of shells and *Cythere*,	0	7
A bed of compact brownish limestone, which occasionally divides into thin equal courses ; it holds among other fossils *Chætetes lycoperdon*, a small encrinite, *Leptæna deltoidea*, and fragments of other species of *L.*, *Orthis testudinaria*? a small spiral univalve like *Murchisonia*, *Cythere*, *Isotelus gigas*, and *Asaphus extans*, which is a Birdseye species...	1	8
Greenish calcareous shale with thin beds of dark grey limestone,	0	8
Dark brownish limestone with a few obscure fossils	0	6
Dark brownish-grey limestone of fine texture, with small glittering specks of calcspar,	0	6
Beds of dark brownish-grey or blackish limestone, penetrated by thread-like forms of calcspar ; the beds divide into thin regular courses,	2	8
Similar rock to the last, with very obscure fossils and calcspar, the upper surfaces exhibit small corals and other forms,	0	8
Concealed,	5	0
Brownish dark grey limestone of very fine texture, with crystals of calcspar	0	6
	14	2

Concealed by the talus of the escarpment.....	55	0
Massive dark brownish-grey and drab colored limestone in beds of from two to three feet thick, weathering to a nodular aspect on the surface; the beds hold numerous fragmentary fossils, for the most part only obscurely weathered out on the upper surfaces; among the most conspicious are *Chætetes lycoperdon, Leptæna sericea,* and a spiral univalve probably a *Murchisonia;* this may represent the base of the Trenton formation.....	20	0
	89	2

Commencing two and a-half miles further down the Moira river, the following section in ascending order is obtained between Coleman's mills, on the fifth and sixth lots of the ninth concession of Tyendenaga, and Wilson's mills, on the twenty-fourth lot of the seventh concession of Thurlow:

Blackish-green calcareous shale, weathering green, covered over by large reticulating fucoids; this is below the bridge at Coleman's Mills,.....	0	7
Blackish limestone and shale, with a small *Cythere, Orthoceras multicameratum,* and numerous fucoids.....	2	0
Brownish-black limestone of very close texture, in solid and regular beds of from six inches to one foot thick, with numerous obscure fossils; there is a shaly band at the base, covered with fucoids.....	10	0
Brownish-black limestone, weathering white, of very fine texture in very regular strata, the beds averaging one foot thick,.....	18	0
Dark grey or blackish brittle limestone of very fine texture with a conchoidal fracture; fucoids are displayed on weathered surfaces, but no fossils were perceived on breaking the rock,.....	8	0
Dark grey limestone with some obscure fossils in the lower part of the bed,.....	1	0
Dark grey limestone with encrinites and small broken fossils weathering out on the upper surface; the bed holds small crystals of calcspar,.....	2	0
Greenish-drab limestone, weathering very white, very full of fossils, chiefly convoluted or turbinated shells, resembling *Pleurotomaria,*.....	4	0
Compact brownish-grey limestone,.....	0	6
A single compact bed of greyish-drab limestone, weathering white; on the upper surface are weathered out in strong relief, many small fossils replaced by silica; the bed holds		

black chert in nodules, and is cut up by joints into great square blocks, the joints running N. and S., and E. and W.	5	0	
Brownish-black limestone with large encrinite stems,.....	0	6	
Dark brownish-grey limestone in a strong bed, with a great many nodules of black chert; it abounds in fossils, chiefly of two species, the *Columnaria alveolata* and *Stromatocerium rugosum* of Hall,.....	3	0	
Dark grey earthy limestone dividing irregularly into thin beds,	2	0	
Brownish-grey compact limestone very full of fossils, among others *Leptæna filitexta*, notched on the ridges and punctured in the furrows of the radiating striæ; with *Ceraurus pleurexanthemus*.....	0	10	
Brownish-grey limestones in thin beds, shaly towards the top,.....	1	6	
Brownish-grey thin bedded limestone, weathering very white,	2	6	
Brownish-black limestone of a crystalline texture, in beds of three to six inches thick, with occasional nodules of black chert, and silicified fossils, weathered strongly in relief on the upper surfaces, among them *Stromatocerium rugosum, Leptæna alternistriata, Orthis tricenaria*,.....	4	0	
			65 5
The next exposure on the river is at Latta's mill on the twenty-sixth lot of the seventh concession of Thurlow, where thin alternations of beds of grey limestone with a crystalline texture, and grey calcareous shale, are seen in a cliff. The limestone weathers yellowish, and the strongest beds are at the base, and about eight inches thick; those above are not over six inches, and the upper part of the section is shale; the fossils here are *Chætetes lycoperdon, Streptoplasma cornulitum, Schizocrinus nodosus, Echinoencrinites anatiformis, Porites, Leptæna sericea, L. deltoidea, L. alternata, Orthis testudinaria, O. lynx, Murchisonia* and small fucoids, all belonging to the Trenton formation,.....			20 0
			85 5

At Reid's mills, on the seventh lot of the fourth concession of Thurlow, the lowest strata consist of thin bedded blue limestone of a granular texture, weathering white; the fossils are replaced by silica, and being weathered out, and blackened by vegetable matter, are brought into strong relief. The most abundant fossil thus exposed is *Orthis testudinaria*, but in the beds there are also *Leptæna alternata* and other

fossils of the Trenton limestone. From Reid's mills to the front on the Bay of Quinte, the river exposes a continuous section, accumulating the strata by a dip at a very regular rate of about two degrees. The rocks consist of blue limestone in thin beds, frequently of a nodular structure, and shale, the latter increasing towards the top; both are filled with the fossils of the Trenton limestone, and the whole thickness is estimated at 594 feet.

At the lower end of Hog Lake, on the south side, on the nineteenth lot of the thirteenth concession of Huntingdon, beds nearly corresponding with the section at Hungerford Mills, form a low cliff close to the beach. They are in ascending order as follows:

Red shale,.....	0	6
Green calcareous shale,.....	0	7
Thin bedded drab colored limestone, of very close texture, but holding numerous specks of calcspar,.....	1	7
A single bed of very fine grained drab limestone, with specks of translucent calcspar,.....	1	2
Similar beds in very even and regular courses of six or eight inches thick,.....	2	0
	5	10

A short distance south from this, the limestone escarpment rises to the height of about eighty feet, and approaching the lake to the westward, keeps the south shore up to its head, where crossing the inlet, it strikes northerly into Madoc. The outcrop through Madoc and Marmora is very irregular, and a number of large outlying patches extend far north in both townships. In almost every exposure examined, a portion of the beds which have been classed as Calciferous sandrock, was found at the base of the cliffs forming the main outcrop, as well as in the lower part of the outlying patches; but while the upper beds of the main outcrop were usually found to display the recognised fossils of the Birdseye or Black-River groups, none of the fossils in the upper beds of the outliers, seemed to indicate a more recent age than the *Cythere* beds, which are about the base of the Birdseye, or may belong to the Chazy.

A fine conglomerate or coarse sandstone was found in some parts at the base of the horizontal rocks; it was usually of a red

color, the pebbles were seldom larger than musket balls, and were for the greater part of white quartz; the matrix, although chiefly of silicious sand, was found in every instance to be slightly calcareous. This rock was observed near the village of Madoc, about the second or third lot of the seventh concession of the township, and at the fifth lot of the fourth and fifth concessions. A rock of precisely the same description and in the same geological position, was likewise found in Marmora, particularly on Mr. B. John's farm, the nineteenth lot of the fourth concession, where there is probably altogether a thickness of from four to five feet. In ascending order the section is as follows:

	Ft.	In.	
Sandstone of a red or green color, or green mottled with red spots, and moderately fine grained, occasionally holding small rounded pebbles of white quartz,.....	1	0	
Compact buff or drab colored limestone, with small translucent crystals of calcspar,.....	0	4	
Compact drab limestone of finer texture, supposed to be fit for lithographic purposes,.....	0	2	
Green calcareous shale,.....	1	6	
Red and green calcareo-arenaceous shale, giving a red soil to the surface,.....	1	0	
			4 0

The section at the Marmora iron works, on the bank of the Crow river, in ascending order, is as follows:

1. At the base of the cliff, the rock is contorted gneiss with beds or veins of fine grained reddish syenite; the rock has an irregular surface, and the depressions are filled up with shaly limestone,.....	1	0
Red sandstone, soft and calcareous; the color is deep red in the divisions of the beds, and lighter towards the middle of them; there is probably a good deal of clay in the beds, which are of a marly character,.....	5	9
Rock of the same character; about an inch at the top is greenish, and about half of it is green twenty yards to the left; internally the green is whitish, and is much more calcareous than the red, and more shaly,.....	2	6
Very smooth nearly white or rather yellowish-white limestone of the lithographic character; this increases to four inches, about twenty yards to the N. N. W. on the strike, where however it appears to have too many crystals		

of calcspar to be serviceable for lithographic purposes; it has rough slightly dentated inter-fitting surfaces, with a greyish film between, in some parts; it has also small light green and some dark or olive-green patches,..... 0 1

Greenish calcareo-arenaceous shale, spotted with red; in this layer there are some quartz pebbles, and there are a few cavities, as if calcareous pebbles had been worn out of them,..... 1 5

Greenish calcareo-arenaceous shale; there are some small red spots in it, and a few small quartz pebbles..... 1 0

Green shale, softer than the previous, particularly at the top,..... 0 9

Soft clay, becoming green shale at the bottom, between which and the former bed, there is a thin layer of snuff-brown earth, probably manganesian,..... 0 3

Argillaceous limestone, slightly bituminous; it is of a mottled aspect, being a mixture of grey and greenish white,..... 1 5

Moderately dark grey bituminious limestone,..... 0 7

Rock of the same character, rather lighter grey and more shaly,..... 1 7

Light grey compact slaty limestone; this would probably form good building stone; it is strong and very even, but thin bedded; some of it appears to be fine enough for lithographic stone,..... 2 0

Light brownish-grey compact limestone in a single bed; this is apparently fine enough in the texture for lithographic stone, but not of the right color; it has some small quantity of bitumen in it; though apparently one bed, it splits apart in some places, and shews surfaces with short tooth-like inter-fitting columnar projections, having a thin film of bituminous matter between,..... 1 7

—— 19 11

2. Light brownish-grey calcareous shale, the last inch and a-half of which becomes a hard limestone in an even bed,..... 0 10

Light brownish-buff compact very fine limestone, the grain wholly impalpable; the lower half is much better than the upper, which is much affected by thin lenticular crystals of calcareous spar, often intersecting; the upper inch, which is just above the most crystal-studded part, fits upon it in tooth-like projections of a marked character, the projections having

columnar sides at right angles to the bed, of an inch long in some places; a thin film of bituminous shale darkens the surfaces; in the lower part there are obscure tooth-like divisions; this is the *Marmora lithographic bed*, the best stone being in the lower part. Where exposed to the weather, this part is generally affected by cracks or gashes, which appear to terminate both ways, and run in two general directions, dividing the mass into rhomboidal forms; but there are other gashes which run at a small angle to these; the stone weathers nearly white,..... 2 0

Light grey limestone; the fracture is conchoidal and slightly scaly, the stone is strong and tough, and it would make a good building stone; it weathers slightly yellowish at the joints and bed divisions; the beds are three to four inches thick, but aggregated beds of a foot and more occur; some of them separate in tooth-like projections with a film of bituminous shale between; large slabs may be obtained, some of them six feet square; some of the surfaces are wavy,..... 5 0

Light greyish-brown compact smooth limestone, weathering into gashes like the lithographic stone, and more divided by joints than the bed immediately below,..... 1 2

Rock of the same character,..... 1 0

Rock of the same character, rather lighter in color, with intersecting lenticular crystals of calcspar. This would make lithographic stone, were it not for the crystals,... 0 7

Brownish-buff compact limestone with a conchoidal fracture; the crystals are much finer than before; this might yield lithographic material, but there are perhaps too many crystals of calcspar in it,..... 0 7

Moderately dark grey very smooth limestone, with a conchoidal fracture,..... 5 8

Concealed,..... 5 0

21 10

3. Limestone not well seen, but fossiliferous,..... 30

Brownish-grey bituminous limestone with fossils,..... 5 0

Brownish-grey bituminous limestone with nodules of chert and various fossils, among others *Phytopsis cellulosum, Streptoplasma, Columnaria alveolata, Leptæna, Murchisonia gracilis, Pleurotomaria, Orthoceras;* some of them are replaced by silica,..... 4 0

39 0

80 9

The upper beds of the previous section are evidently part of the Birdseye formation, but in what part of the eighty feet to draw a line as its base, it is not easy to say. The lowest fourth of the section is supposed to belong to the Calciferous sandrock; and it may be the case that the second quarter, including the beds marked by the intersecting lenticular crystals of calcspar may belong to the Chazy, but there is as yet no satisfactory way of proving it. The upper beds of the section shew a slope a little west of south, and they reach the level of the Crow river at the falls, on the north side of the town-line of Marmora and Rawdon, giving a dip of forty-two feet in a mile, but an undulation, on the axis of which the river flows, brings up the inferior beds farther south, where they again rest on members of the Laurentian series. On the line between the thirteenth and fourteenth concessions of Rawdon, there is an exposure of fine grained reddish syenite on the right bank of the river, while on the left side, a little way below, there are beds of limestone, resembling those of the second twenty feet in the previous section. At Allans' mills, on the twenty-fith lot of the twelfth concession of Seymour, the Laurentian series appears on the left bank, holding magnetic iron ore, while on the right bank the following section of limestone was measured in ascending order:

1.	Greenish-drab colored limestone with small translucent crystals of calcspar,.....	1 4
2.	Grey and greenish thin bedded shaly limestone, weathering yellow,.....	1 6
3.	Strong beds of buff colored brittle limestone, with a conchoidal fracture; fossils occur among which are pentacrinites, and some small, very obscure shells; some of the fossils are replaced by calcspar,.....	1 3
4.	Drab colored limestone of close texture, with small indistinct fossils replaced by calcspar, being a convoluted shell, fucoids, and corals,.....	0 4
5.	Similar rock but darker in color, very brittle and apparently without fossils,.....	0 4
6.	Similar rock rather coarser in texture, with small crystals of calcspar,.....	0 2
7.	Brownish-black bituminous limestone with crowds of small indistinct fossils; this divides into three pretty regular beds,.....	0 7

8. Grey fine textured limestone, which sometimes appears in one solid bed, at others divides into two or more; the strata are very regular and weather a bright yellow,...	1	10	
9. Dark grey fine grained limestone; calcspar is abundant in small crystals and crowds of fossils are weathered out on exposed edges, all of a yellow color; the fossils seem to be chiefly corals and some turbinated shells,...	0	8	
10. A strong compact bed resembling the last,.....	1	4	
11. A drab coloured bed of fine texture, holding numerous small specks or crystals of calcspar,.....	1	6	
12. Dark brownish-grey brittle limestone with calcspar,.....	1	0	
13. Strong massive beds of limestone, which weather very white, and are slightly nodular at the top; numerous corals are exhibited on the upper surfaces,.....	5	6	
14. Beds like the last, with abundance of fossils, among which are *Phytopsis cellulosum, Chætetes lycoperdon, Orthoceras* and *Crinoidea*,.....	5	0	
			22 4

The fossils of the upper part of the above section appear to belong to the Birdseye formation, but those of the lower are too indistinct to determine with certainty whether they are Birdseye or Chazy. The upper beds shew a dip S. 15° W. $<5°$, and come to the level of the river on the twenty-third lot of the eleventh concession of Seymour, where, as well as on the twenty-second lot, strata with black chert and silicified fossils are conspicuously displayed, the best recognised being *Columnaria alveolata* and *Stromatocerium rugosum*. At the Crow rapids, on the twenty-first lot of the eleventh concession, Laurentian rocks again appear, patched over and surrounded by beds of limestone, with chert and fossils similar to the preceding, among which *Columnaria alveolata* is the most frequent; beds also occur thickly covered with silicified bivalves, among which *Orthis testudinaria* is very abundant. The general character of the older subjacent rock here, is a greenish-grey, fine grained augitic trap, holding small disseminated crystals of iron pyrites; large fragments of the trap cemented together by limestone, form a breciated bed at the base of the fossiliferous rocks. Near the junction with the trap the limestones are of a variety of colors—red, orange, blue, green and yellow, and it sometimes occurs that all these colors are displayed upon one surface, giving an appearance a good deal resembling rude mosaïc. In the strata south from the trap, the black chert and silicified

fossils, which from the adhesion of vegetable matter are black, lie on a ground of white-weathering limestone, in great abundance ; *Columnaria alveolata*, *Stromatocerium rugosum*, and *Streptoplasma* occur with *Orthoceras*, a fragment of one of which was three feet long, the diameter of the upper part being about ten inches; besides these, the genera *Leptæna* and *Orthis* are met with.

The banks of the Trent below Healy's falls rise in vertical limestone cliffs, sometimes upwards of forty feet; the strata are all filled with the fossils of the Trenton limestone. The lowest beds of the cliffs are from four to six or eight inches thick, the surfaces being covered over with black weathered fossils chiefly an *Orthis*, and over them is a strong bed about three feet thick, holding *Leptæna sericea*, *L. alternata*, and *Orthis testudinaria*. The rest of the exposure consists of thin beds of dark grey or blackish and blue limestone, alternating with dark green calcareo-argillaceous shale; these beds are all very fossiliferous, *Leptæna sericea*, *L. alternata* and *Orthis testudinaria* being the most numerous species. From Crow Bay to Ramsay's falls on the ninth lot of the sixth concession of Seymour, the measures accumulate at the rate of about forty feet in a mile, and at the latter place they rise in vertical cliffs on each side of the river, to the height of from forty to fifty feet. All the beds are filled with Trenton fossils, and some are almost a mass of *Leptæna sericea*. At Chisholm's rapids on the Trent, on the eighth lot of the eighth concession of Sydney, a section of about six feet is exposed, of thin bedded bituminous grey limestone, the prevailing fossils of which are *Orthis testudinaria*, *Leptæna sericea*, *L. alternata*, *Chætetes lycoperdon* and *C. rugosus*. Below Chisholm's rapids the rock is occasionally seen in small sections on the bank of the river, in all parts holding abundance of the characteristic fossils of the Trenton limestone, and dipping gently a little west of south, at an average rate not exceeding forty feet in a mile. If this dip be continuous, and there be no undulations, repeating the strata, the thickness from Healy's falls to the front, would be about 960 feet. I am of opinion, however, that there is at all events one slight undulation, on the east and west reach of the river, north of the town-line between Murray and Seymour, and that

the total thickness is probably not more than 750 or 800 feet.

In its western run, the outcrop of the formations we have been following, approaches Stony Lake in two escarpments, the lower, of small elevation, reaching to within about one mile south of the lake, and the higher in an abrupt rocky cliff, from a mile to a mile and a-half farther removed. After sweeping round a small sheet of water, called White Lake, in the township of Dummer, the two escarpments partially unite, striking Salmon Trout Lake about the fourth concession of that township, and keeping the southern shore of the lake to its western extremity. The corresponding escarpment rises on the northwest side of Salmon Trout or Clear Lake, and then follows the sinuosities of the chain of lakes and the river, up to Buckhorn Lake, keeping on the south side at a distance seldom exceeding a-quarter of a mile; it crosses Buckhorn Lake at the strait, about two miles above the falls, and then strikes nearly straight, by the head of Sandy and Pigeon Lakes, to Little Mud Turtle Lake, north from Balsam Lake. In their general course westward from Belmont, the lower formations appear to thin out, and before reaching the western end of Salmon Trout Lake, the portions supposed to belong to the Calciferous sandrock have disappeared altogether. The base of the escarpment is there composed of very regular beds of buff colored limestone, bearing the general lithological characteristics of the succeeding portion, supposed possibly to represent the Chazy, while the upper tier of beds contains the black chert, and silicified corals of the species which peculiarly distinguish the Birdseye and Black-River groups, the whole height of the escarpment seldom exceeding fifty feet. On the Otonabee a thick bedded coral-bearing stratum with chert, the chief fossils being *Columnaria alveolata* and *Stromatocerium rugosum*, crops out on the twenty-second lot of the sixth concession of Douro, where the river opens into a small lake called Kaw-che-wah-nook, below which there is a continuous section of limestones and shales all the way to Peterborough, holding many of the characteristic fossils of the Trenton limestone. Below Peterborough, the Otonabee nowhere exhibits a rock section, nor was the rock observed *in situ* at any place between Rice Lake, and the shore of Lake Ontario at Cobourg; but at the latter place, and between it and

Port Hope, there are some small exposures of blackish-grey thin bedded nodular limestone and shale, which hold fossils of the Trenton limestone.

The limestone escarpment south from the Burleigh falls, in the township of Smith, is about eighty feet high. On the summit, thin beds of limestone and shale occur, holding one or two species of *Leptæna*, with fragments of trilobites, encrinites and corals, but not sufficiently characteristic to determine the formation. Except at the top, the rock is generally more or less concealed by moss and small trees, but about twenty-five or thirty feet below, strong beds of limestone occasionally come out in points, which probably represent the chert beds of the Black-River or Birdseye. In the continuation of their course westward, the chert beds, with their characteristic corals, are displayed at the top of the cliffs, which rise over the exit of Buckhorn Lake, and striking from these to about the middle part of a small intermediate tributary sheet of water, called Sandy Lake, and to Pigeon Lake beyond, they reach Bobcaygewan Rapids, at the foot of Sturgeon Lake. From Bobcaygewan, the same beds strike diagonally across the township of Verulam to the north part of Balsam Lake, in a great bay on the west side of which they were observed, with *Columnaria alveolata*, and *Stromatacerium rugosum*, on the property of Mr. Stephenson, in block E of Bexley, inclining at a very small angle to the southward. The base of the inferior beds was seen at the foot of Little Mud Turtle Lake, near where the continuation of the line between the eighth and ninth concessions of Somerville would cross it, about three miles due north from the N. E. Bay of Balsam Lake. It consists of pale drab colored limestone of fine texture, in very regular layers of from three to six inches thick, without fossils, and over it an escarpment rises, a little way south, to the height of from forty to fifty feet; the upper beds are massive and fossiliferous, but the fossils are very obscure. Among the fossils a small *Leptæna* was observed to be very abundant, and another bivalve was occasionally found with encrinites and fucoids, but the specimens are too ill-defined to be easily identified. Their position with relation to that of the chert beds, is all that can be taken to indicate that they may belong to the upper part of the Chazy formation.

At the rapids at the outlet from Balsam Lake, there are flat surfaces of limestone exposed just over the edge of the water, with fossils weathering in relief, among which *Chætetes lycoperdon*, *Schizocrinus nodosus*, *Leptæna sericea*, *Orthis testudinaria*, *Isotelus gigas*, were observed ; and at Fenelon Falls, where there is a section of about twenty feet, in the gorge of the river below the falls, in addition to those Trenton fossils just mentioned, there occurred *Stictopora acuta*, *Leptæna alternata*, *Orthis pectinella*, with *Murchisonia* and *Orthoceras*.

On Sturgeon Lake, opposite the mouth of the Scugog river, where the strata are greenish calcareous shale with very thin beds of limestone, the fossils in greatest abundance are *Chætetes lycoperdon*, *Streptoplasma corniculum*, *Schizocrinus nodosus*, *Leptæna sericea*, *Orthis testudinaria*, *Atrypa increbescens*, *Calymene senaria*, and *Ceraurus vigilans*.

At the village of Lindsay, on the Scugog river in Ops, there is a small exposure of blue limestone in beds of from six to seven inches thick, interstratified with blue calcareo-argillaceous shale holding abundance of fossils, among which turbinated shells of two species, one of them *Pleurotomaria bellicincta*, and the other *P. lenticularis* are very frequent, associated with *Leptæna sericea*, *Orthis testudinaria*, *Schizocrinus nodosus*, *Atrypa increbescens*, *Chætetes lycoperdon*, and fucoids.

Drift.

Having been engaged for the greater portion of the season in parts removed back from the more level country on the borders of Lake Ontario, and situated where the more recent formations are but little developed, it has not been in my power to bestow upon the relations of these, the attention which they merit. A large area of the more southern portion of the country partially within the limits of the season's investigation, is spread over with deposits, consisting of clay, sand, gravel and boulders, but their arrangements may be the result of so many independent causes, that the precise relation of one mass to another can only be ascertained by careful and minute examination. No organic remains of any kind belonging to these deposits, having been found within the area, except in the alluvial fresh-water shell-marls, by which light might be

thrown upon their origin, it has been extremely difficult in most parts to discriminate between those portions which pertain to the tertiary drift, and those which have at a later period been arranged by the local influences of rivers and lakes.

Belonging probably to the more ancient drift, boulders and rock fragments were found in many parts, associated with the clays, and strewed extensively over the surface, and their characters were with but few exceptional cases, recognized as identical with the rocks observed *in situ* in one place or other among the ranges of the Laurentian series on the north. In various parts also parallel grooves and scratches on the rounded and polished surfaces of the solid rocks, were met with, invariably bearing westward of south, and these two facts leave little doubt that the general direction of the drift has been from north-east to south-west in the area examined.

At Belleville an excavation that was in progress in front of the new court house, at the time of my visit, laid bare the following ascending section:

	Ft.	In.	
Clay filled with large boulders and pebbles almost all of limestone, some round and some angular, the largest boulder having a diameter of about two feet.....	6	0	
Very tenacious drab colored clay in regular strata, but tilted at one place N. 30° E.< 40°; the boulder formation below shows an uneven surface, the clay filling up hollows,.....	8	0	
Brown clay, the top of which is horizontal, and passes into clay mixed with sand,.....	2	0	
Brown sand partially mixed with clay,.....	1	0	
Very fine yellow sand to the surface,.....	4	0	
			21 0

It is probable there are other alternations of clay and sand still higher; as at a higher level, on the road at the upper part of the town, near the Roman Catholic church, clay and sand were observed, the latter being uppermost. At one part of this road, the ancient limestones and shales, instead of presenting the usual horizontal attitude, were observed to be turned up on edge almost vertically; this may be occasioned by a fault affecting the whole formation; but within twenty yards eastward of this place, the rocks are apparently quite flat

again; and the very local character of the disturbance suggests the possibility of the attitude of the strata being attributable to the falling of an overhanging cliff, at some period of the drift epoch, probably about the time the clays and sands below were being deposited.

A great accumulation of drift, chiefly a fine yellow silicious sand with calcareous material mixed through it, rises into a high ridge in the township of Sydney, and crossing the Trent above Frankford, runs through the townships, thence westward keeping a nearly parallel line with Lake Ontario. Near the summit of this ridge in Sydney, there is a remarkable lake, which, without any apparent inlet, supplies a stream sufficiently large to keep a saw-mill which has been erected on it, in constant operation. It appears to me to be most probable that the lake receives its supply by under-ground currents, guided thither on the surface of some of the more impervious beds which support an aggregation of gravel and boulders, giving an easy passage through large interstitial spaces, for the flow of the water. This supposition is to a certain extent strengthened by the fact, that the water in escaping from the lake, runs for a considerable distance under ground. A similar lake was observed in 1843 near the Pinnacle house on the Toronto and Holland Landing road, situated on the continuation of the same ridge, near the summit of the water shed.

The low ground between this ridge and Lake Ontario, was usually found to possess a soil of clay or loam, under which, particularly near the lake, are beds of brown and blue or drab clay. Near Cobourg, on the property of Mr. Geo. Castle, a drab or buff colored clay occurs about four feet thick, which on a neighbouring farm where there is a brick yard, was found to be overlaid by a dark brown clay of about four feet.

On the north side of the ridge, on the shores and islands of Rice Lake, the drift is clay with boulders of limestone and gneiss, the limestone most numerous, but the gneiss in the larger masses; the whole is covered over by a fine yellow sand.

The country, near the terminal outcrops of the fosiliferous limestones, is generally strewed over with large boulders, in many parts so thickly as to render the land difficult of cultiva-

tion. The boulders of Laurentian rock are usually smoothed and rounded, while those of limestone, being at no great distance from their source are often angular. It was remarked on several occasions, that some of the largest sized boulders were situated on or near the top of the highest ridges of the surrounding country; one instance of this occurs on the twelfth lot of the third concession of Sheffield, about the highest point between Beaver Lake and the Clare river, where the whole ridge is covered by huge rounded masses of gneiss and crystalline limestone; one boulder of the latter was found by measurement to contain about 6,500 cubic feet.

In the month of February, previous to the commencement of the season's operations, a visit was paid to Hamilton, C. W., for the purpose of examining a cut in the drift of Burlington Heights, made on the line for the Great Western railroad, where some large fossils bones had been exhumed, afterwards pronounced by Mr. Thos. J. Cottle, of Woodstock, on comparison with Professor Owen's work on comparative anatomy, to belong to the extinct species of elephant, *Eliphas primigenius* or mammoth. The sequence of the beds in the cut in descending order is as follows:

	Ft.	In.
Soil,	3	0
Coarse limestone gravel, cemented pretty strongly together,	7	0
Limestone gravel, coarse at the top, finer below,	2	0
Coarse sand mixed with gravel, with a layer of large pebbles of limestone at the bottom,	4	0
Fine gravel with layers of large pebbles,	2	0
Alternate layers of limestone gravel, and sand,	2	0
Fine limestone gravel cemented together,	1	0
Coarse sand,	2	0
Very coarse limestone gravel, strongly cemented together,	5	0
Coarse sand with mammoth bones at the base,	19	0
	47	0

The level of the sand bed, holding the remains, is sixty feet over Lake Ontario.

The gravel drift of Burlington Heights has evidently at one time formed a bar or spit at the mouth of an estuary of a river flowing from the west. It extends in a narrow ridge from the Desjardins canal under Flamborough heights, to the heights opposite in Barton, having a great marsh to the westward called the Dundas marsh, west of which the valley is all clay. In

the clay of the marsh, near the canal, some bones were found about eight feet below the surface, which Mr. Cottle supposed to have belonged to some ruminating animal, probably a species of deer, but the specimens were not such as to enable him to identify them specifically. The bar across the mouth of Burlington bay, extending across from Wellington Square to Stony creek, in Saltfleet, affords a good modern illustration of what Burlington Heights were, when the relation of land and water in the vicinity was from sixty to one hundred feet different in level from what it is now.

We have no direct evidence associated with the remains, to show whether the deposit is of fresh or salt water origin, but it appears probable, that as an additional height of one hundred or even sixty feet, would carry the waters of Lake Ontario over a large tract of country farther down, where remains of marine testacea are abundantly found, that it is of the latter.

The remains that were found at the time of my visit, were a jaw bone with two molar teeth and a nearly whole tusk, but since then I learn that many more have been met with.

ECONOMIC MATERIALS.

The substances met with under this head were the magnetic and specular ores of iron, galena, plumbago, and molybdenite; grindstones and flagging, scythe-stones and whetstones, lithographic stone, building stones, limestone, marble, water-lime, brick-clay, shell-marl and peat.

Magnetic and Specular Iron Ores. Ores of iron are very generally disseminated through the rocks of the Laurentian group, and when existing in large workable masses, appear to be usually either in contact with or at no great distance from the crystalline limestones. The localities where the magnetic oxyd was chiefly met with, were in Bedford, Madoc, Marmora, Belmont, and Seymour; and although the information received by me from time to time, makes it appear probable, there must be many more places where it abounds, I did not see, except in these townships, any instance where the material was in sufficient quantity to warrant the experiment of working it. One of the localities visited was on the twenty-first lot of the ninth concession of Bedford, where the magnetic oxyd occurs

at the foot of a ridge of gneiss, associated with a greenish rock consisting of an aggregate of greenish feldspar, and numerous large prismatic crystals of greenish hornblende in a pale fawn colored calcareous base. The bed to which it belongs is not well exposed, as it lies in a hollow, the greater portion of which at the time I was there, was covered with growing grain; but its presence was indicated in the same position and associated with the same minerals, by the fragments strewed upon the surface for about a-quarter of a mile in a north-east direction from where it was first seen. To the westward there is a fault running N. 25°. W. and S. 25° E., which throws the ridge of gneiss about 150 yards to the south-eastward on the south-westward side, but although a careful search was made for the continuation of the ore both in the direction of the dislocation, and on the south-western continuation of the ridge, it was nowhere found. The bed of ore did not appear to be over three or four feetth ick. Immediately on the south-east of the ridge, crystalline limestone comes in with its associated beds, dipping on the average N. W. < 30°.

Another exhibition of the ore occurs in Bedford, near the north-east end of Bob's Lake, supposed to be in twenty-fifth lot of the fifth concession. It was found in small fragments near the foot of a ridge of crystalline limestone, but nowhere in place, and is probably of no economic importance.

I was informed by an Indian that iron ore had been found a little way to the north of the portage, about half-way between a place called the Beaver Dam, and Cross Lake in Olden, but although a whole day was expended in the search, it was nowhere found, except in small specks or crystals, in the feldspathic rock of the country.

The deposits of iron ore in Madoc, Marmora and Belmont, some of which have long been known and have been worked, will probably hereafter become of great commercial importance. The ore which was formerly smelted at the village of Madoc, by Messrs. Seymour & Co., and produced an excellent quality of iron, was mined on the eleventh lot of the fifth concession of the township. The bed appears to run through a black soft micaceous rock, and holds a course which as far as it was traced, was about W. by N., and E. by S., while the slope of

the bed which is towards the south, was between seventy-five and eighty degrees. The greatest observed breadth of the bed appeared to be about thirty feet, and its average would probably not fall short of about twenty feet. A material similar to the soft black micaceous rock which accompanies the bed of ore on each side, appears every now and then to cut it diagonally in thin belts. In one place the bed is said to have been thus cut at distances of from every three to ten feet, and in another there was an unbroken part with a length of fifty feet. The ore is very black and very fine grained, and while the whole body of it is magnetic, some portions of it have polarity, one end of a fragment repelling and the other attracting the north end of the mganet. When the ore is bruised with a hammer on these portions of the bed, or on fragments taken from them, the particles adhere to one another and stand up on the mass as they would on a magnet, the ore being in short a natural magnet or loadstone. The portions which have polarity appear to run across the ore-bed at right angles. Nodules of actynolite or green fibrous pyroxene, made up of radiating crystals, are disseminated in the ore, and yellow uranite is found investing small cracks.

I was informed that in the general direction of the bed, traces of ore have been met with twice to the eastward, in the tenth lot of the sixth and the ninth lot of the seventh concession, and to the westward in the twelfth lot of the fourth concession, the distance between the extreme points being about two miles.

On the eighth lot of the first concession of Belmont is situated the bed of magnetic oxyd, which yields the ore formerly smelted at the Marmora iron works. It is commonly known as the *big ore bed*, and has usually been called a hundred feet thick; it appears however not to be a single bed, but a succession of them interstratified with layers of greenish talcose slate and crystalline limestone, occupying a breadth across the strike and back from Crow Lake, into which it obliquely runs, of about eight chains. The general strike of the strata appears to about S. 40° E., and the slope toward the north-eastward from twenty-five to fifty degrees. At one place on a surface of greenish colored mica slates, underlying coarse disintegrating

crystalline limestone, the dip was N. 62°. E. $<$ 50°., but surrounded by the strong magnetic attraction of the ore-bed, the compass could not be relied on as giving a true bearing. Crystalline limestone overlies the mass, and the first hundred feet of the metalliferous strata shew a vast bulk of ore, the upper portion of which chiefly was mined for smelting; of the lower part, thirteen feet towards the bottom were also mined, but not to the same extent. Associated with the ore and the talcose slates accompanying it, diallage rock and serpentine occur, and a pale green rock, translucent on the edges, and harder than serpentine, deriving its character from the presence of pistachio green epidote; through this green rock, the ore is usually very thickly disseminated. The upper metalliferous beds suffer in quality from the presence of iron pyrites, from which the lower beds appear to be wholly free, thus yielding a much finer quality of ore. This part of the mass was not resorted to while the smelting works were in operation, until a short time before they were abandoned; but when the ore from it was used, the daily yield of iron, I am informed, was increased in the ordinary process of smelting, from three and a-half up to four and a-half and five tons.

On the north side of Crow Lake, about 300 yards from the shore, on the twelfth lot of the third concession of Marmora, magnetic oxyd of iron occurs, thickly but irregularly disseminated in a pale green epidotic rock, similar to some portions of the rock of the big ore-bed. At the time the Marmora works were last in operation, an opening was made at this place, which shows a breadth of twenty to thirty feet, all of which contains the ore, sometimes distributed in patches in the direction of the stratification, and sometimes in large irregularly shaped lumps and solid masses. The bed runs nearly east and west, apparently dipping south, and was readily traced for about 300 yards to a clearing where it terminates in a sharp cliff. Such of the ore as was used at the works, is represented to have proved of excellent quality, and to have added considerably to the daily yield of smelted metal; it seems to be peculiarly free from pyrites.

The rock along the north shore of Crow Lake is frequently of the pale green color and epidotic character, which marks this

ore-bed, and has grains of magnetic iron ore diffused through the mass, from which circumstance it appears probable that the ore-bearing portion is continuous, although it may not in all places be equally productive. Tthe course of this ore westward would at length carry it to an intersection or junction with the north-westward course of the big ore-bed, and the dip of the one bed being south and the other north-east, it seems probable that they may prove to be different parts of the same bed, on the opposite sides of a synclinal form.

At Allan's mills on the twenty-fifth lot of the twelfth concession of Seymour, where the dome of Laurentian rock protrudes through the fossiliferous limestone, magnetic iron ore is thickly disseminated in the rock, over all the area exposed, which is about two or three acres. The rock on the left bank of the river appears to be a conglomerate of the Laurentian series, in which the presence of rounded forms, supposed to be pebbles, is perceptible on the smooth polished surfaces, where they display various colors; but these pebbles, when the mass is broken across, are so intimately blended with the matrix as to seem almost perfectly homogeneous with it; the iron ore in the conglomerate is disseminated only in small crystals and thin strings at wide intervals, but the succeeding rock, which seems to overlie it, (the dip being to the south-east,) and is a strong and tough mixture of whitish feldspar with dark green pyroxene, yellowish-green epidote, and occassional patches of red feldspar, holds magnetic iron ore in considerable quantity. The breadth of the ore-bearing portion is at least thirty yards, and the run seems to be nearly parallel with the river; but although the distribution of the ore is pretty general, it scarcely appears to be in sufficient abundance, so far as may be judged from surface specimens, to be worked with advantage.

There are other places in Marmora and the adjoining townships, where iron ore has been found, and some that have been partially worked, one of which was on the ninth lot of the eighth concession of Marmora, in which a fine grained hæmatite in patches constitutes the ore. Near the ore-bed are large loose masses of rock with dark red garnets in cavities or druses, associated with pyroxene and calcspar.

Specular oxyd of iron is known to exist at some place near

the Deer river, north of Belmont Lake; I procured a few specimens of it from a person who had been diligently working the ore under the delusion that it contained from forty to sixty per cent of silver. What the character of the vein or bed in which it occurs may be, it is not in my power to say, as I did not succeed in finding the place, nor could I get any satisfactory account from those who had visited it. In almost all parts visited this year, but more especially in the back settlements, a great number of the inhabitants are possessed with the delusive belief, that the precious metals abound among the rocky ridges of the Laurentian country, and that they, by their own individual exertions, are capable of realizing vast wealth. Iron pyrites, mica, plumbago, specular iron, galena and other bright or metallic substances are indiscriminately collected, barrelled and buried in the woods, with the full impression by those engaged in such business, that they have stored away so much gold and silver; and although every second person met with, had a specimen of some sort to present, with anxious enquiries as to its nature, hardly a single individual could be found who was willing to give the smallest information as its locality. It was in vain to argue with such persons that the consequences of a proper examination, might possibly be more advantageous to the common interest than any thing they were likely to accomplish in secret and unassisted; such an argument was only regarded as the result of a governmental scheme to deprive them of their imagined wealth; and an appearance of anxiety to procure information only rendered their secrecy the more profound.

The specular oxyd of iron was seen during the season's examination in a few places, but in no one instance in any thing like sufficient quantity, to be of any economical importance.

Galena. This ore of lead was met with in veins, cutting the crystalline limestone of the Laurentian series, in the township of Bedford. One of the veins is situated on the twenty-first lot of the eighth concession. Its general course is about N. 85°. W. and its underlie N. 5°. E. < 80°. The lode is about four feet thick and is composed chiefly of calcspar, which in druses appears in the form of dog-tooth spar, but in some

parts scapolite and tremolite are present. The galena occurs in detached aggregations of crystals, and in strings, some of which are occasionally one or two inches thick, and usually run parallel with the underlie. To ascertain what might be the yield per fathom of ground would have required a much more expensive test than it was in my power to give, but a shaft was sunk on the lode several years ago by Messrs. Hunt and Brooke to the depth of about to twenty-five feet, and the work having been abandoned after a trial which continued for some time, it is to be inferred that the quantity was not sufficient to pay the costs. Since that time, means of a more economic character for separating the ore from the gangue than then existed, having been invented, it would require a farther trial to ascertain whether the lode could now be made available. Some of the refuse specimens at the mouth of the shaft, appeared to hold a sufficient amount of galena to pay for separation, but not enough to defray also the charges for mining and raising; but it is probable all the best lumps of ore were carried away to be crushed, and no sound opinion can be founded on what remains.

Towards the line between the eighteenth and nineteenth lots of the same concession, there are two more veins of the same character, one running N. 15° W. and the other N. 32° W., upon which trials had been made by the gentlemen already mentioned. Specimens collected among the refuse about the mouth of the shaft on the latter vein, appeared to hold more ore than any obtained on the twenty-first lot. If these two veins continue their course south-eastwardly, they would apparently meet in a spot towards the eastern end of the eighteenth lot, and their junction would be a favorable position to test their value, did it not unfortunately appear to be in the midst of a small lake or pond.

Plumbago.—This mineral is almost universally disseminated through the crystalline limestone, and frequently occurs in veins, in the latter case occasionally giving the expectation that the quantity may be workable. A vein was observed in crystalline limestone near the outlet of Gold Lake, on the sixth lot of the ninth concession of Loughborough, running slightly oblique to the stratification, in a course N. 60° E., with a

nearly vertical attitude, the dip of the strata at the same place being S. 40° E. < 80°; the matrix of the vein is chiefly calc-spar, of a similar character to the walls of the lode, with vitreous translucent quartz running irregularly through it, all very highly charged with scales of plumbago, while patches of the purer mineral are irregularly distributed in the quartz. The width of the vein varies from three feet to eighteen inches. A small excavation had been made on it by some persons belonging to the silver hunting fraternity, who having removed a few shovels-full of what, as I was informed, they supposed to be the part richest in the precious metal, had abandoned the place to make another such experiment elsewhere.

Another vein of a similar character occurs on the south side of a small island at the east end of Birch lake. The course of the vein appears to coincide with the stratification, running through a mass of coarse disintegrating limestone, which is overlaid by white limestone of a more coherent character, holding geodes and nodules of white quartz. Where the plumbago is in greatest quantity, it is associated with translucent white quartz, and is distributed in lumps or patches. On the north side of Birch lake, at a short distance from the inlet, plumbago occurs in disintegrating limestone, where loose fragments of quartz were observed to be numerous, and this possibly may be a continuation of the vein seen on the island.

Plumbago, I was informed had been obtained at a place on the bank of a small creek, in the eighteenth lot of the ninth concession of Bedford, on the property of Messrs. Hunt and Brooke, by their agent Mr. Edward Botting, or one of his neighbours, in sufficient quantity for ordinary household purposes, such as blacking stoves. It occurs in lumps and patches in the crystalline limestone, but whether in a bed or a vein I could not determine.

The same mineral was found in a small vein, cutting the gneiss at right angles on the west side of Mud Lake in Loughborough, which was only remarkable as being associated with gneiss instead of crystalline limestone; the vein in its thickest part, is not over one inch, and is totally valueless in an economic point of view.

Molybdenite. The white crystalline limestones north of Balsam

Lake, are intersected by huge veins of white quartz, in one of which small masses of sulphuret of molybdenum were found, on a small island in Big Mud Turtle Lake; it occurs disseminated in the vein, accompanied by greenish scapolite, green cleavable pyroxene, sometimes assuming a radiating form, and iron pyrites, which is abundantly disseminated in some parts. Specimens were shown to me by an Indian on the same lake, apparently of the same character as those procured by myself, which he stated had been found a few miles higher up the Gull river. The ore was mistaken on the spot for plumbago, (which it very much resembles,) and although the quantity, judging by the specimens brought away, does not appear to be of any economic importance, yet the metal in some of its combinations being valuable as a chemical reagent and as a pigment, and at the same time of rather rare occurrence, the position is worthy of remark.

Grindstones. Some parts of the Potsdam sandstone formation, in the townships of Loughborough and Storrington, yield an inferior description of grindstones. The beds best suited for such a purpose were met with on the north end of Knowlton Lake, at a spot called Grindstone Point, where the stone is an aggregate of small rounded grains of quartz, with mica sparingly scattered through it. It is usually more or less of a red color, and frequently presents alternating stripes of red and yellowish-white. There are beds of sandstone near Vanluvin's mills in Storrington, which I believe, have also been tried for grindstones; but although the rock is silicious and the grain fine and regular, it appears to be too hard to be suitable for the purpose.

Flagging. Flagging of excellent quality can be obtained from the same formation as the grindstones. The beds at a low cliff on the road from Vanluvin's mills, on the twelfth lot of the ninth concession of Storrington, are very regular, and some of them divide into layers of from one to two inches thick, and may readily be procured in slabs of any ordinary dimensions. The thin beds at Grindstone Point on Knowlton Lake are also well adapted for such purposes, and the same may be said of some of the beds at the outlying patch of the Potsdam formation on Eel Lake.

Where easily obtained, the thin beds of the Trenton limestone are occasionally used for flagging, though they cannot be considered of the best description. An example is met with at Belleville, where the side-walks are all laid with stone from that formation.

Scythe-stones and Whetstones. The mica slates associated with the crystalline limestones of the Laurentian series are frequently of the quality used as scythe-stones. The localities where the material appeared best situated for that purpose, are on the south side of Cross Lake, in Kennebec, near the portage to the Salmon river, and on the south side of Stony Lake. In both instances the slate may be procured of fine and uniform grain, and is probably as well adapted for use as the stones usually sold, most or all of which are imported.

The finest quality of whetstones that came under my observation was in the fifth concession of Madoc, on the property of Mr. O'Hara. The stones may be procured by careful selection from the silicious clay slates, which have been mentioned as associated with the dolomitic conglomerate. Mr. O'Hara, at one time, cut and wrought the rock into whetstones for sale, and I was given to understand that they were found unobjectionable, but that the price at which it was necessary to sell them, did not prove remunerative. I was informed that a slate of similar character to that at Mr. O'Hara's, had been found in the back part of the township of Lake, but not having visited the place, or seen any specimens from the rock, it is not in my power to state any particulars regarding it.

Lithographic stone. Limestone suited for the purposes of lithography has already been stated by yourself to exist in the township of Marmora, in the immediate vicinity of the iron works, and the opinion pronounced by the jury on mineral products, on the specimens of this stone sent to the London Industrial Exhibition of 1851, leaves little doubt as to its excellent quality. The presence of the same material in Rama was reported to you by myself in 1844; and during the last season, stone of a similar character, which has not yet however been tested, was found in one or two places more.

Along the whole range of the basset edge of the calcareous portion of the Lower Silurian series, from what has been

considered the Birdseye limestone, downwards, the more calcareous strata are in general of a close compact texture, with a conchoidal fracture, and of a color almost universally partaking of a brownish tinge, varying from dark brownish-grey or brownish-black, to greyish-drab and nearly buff. These beds for a certain distance down, are often marked by *Cythere*, and are sometimes associated with argillo-calcareous strata, occasionally fit for the purpose of hydraulic lime. This portion of the series is supposed to represent the Chazy limestone, and it is toward the bottom of this, or perhaps the summit of the Calciferous sandrock, that the light drab or buff color prevails. When these lighter colored beds are free from organic remains, which are usually replaced by calcspar, and from silicious grains, they frequently have the character required in lithographic stone, and they become fit for use when not too thin.

At Hungerford Mills, on the eleventh lot of the tenth concession of the township, a bed of this character occurs, and the specimens from it very much resemble those already tried from Marmora; very minute silicious grains however are partially disseminated in it, and it might perhaps be difficult to procure large slabs quite free from them.

In the bottom of a brook, on the seventh lot of the third concession of Madoc, there is a bed of the same character, but unless its thickness, which is there not over one and a-half or two inches, increase a little to one side or other of the spot, slabs from it would scarcely be strong enough to resist the pressure necessary to be used in the process of printing.

The stone in Marmora being already known, it is only necessary for me to refer to its stratigraphical position, which will be found in the section of the strata in the vicinity of the Marmora iron works, given in the geological part of the report, where its thickness will be seen to be about two feet.

Building-stones. Along the whole range of country examined from Storrington to Bexley, the Black-River, Birdseye and Chazy formations afford building stone, which exists in courses of from four feet, to one foot thick or less. The line of country through which these formations are principally exposed, being for the greater part still in an unreclaimed state, the material best suited for purposes of construction has hardly yet

been tested, but when communication is once established to the rear of the more level lands, by means of railroads, which seems likely soon to be the case, there is no doubt that its value and importance will be fully appreciated.

The stone buildings of Kingston are derived from the beds of what is supposed to be the Chazy limestone, and the beautiful market building of that city affords a good example of the rock. After being dressed it has a good appearance, but it is a brittle stone and is very subject to break off short where used for lintels, nor does it seem to have great strength in resisting pressure.

The lock below Peterborough on the Otonabee, is constructed of the strong beds of the Black-River formation; the whole of the stone was drawn from quarries in the neighbourhood of Warsaw in Dummer, a distance of about fourteen miles, and were a canal to be cut, as was at one time intended, to connect the back lakes with the Trent, the same beds would be found on all occasions the best adapted for the construction of locks, or other structures where stone is required.

It was a little surprising to observe however at Bobcaygewan, between Sturgeon and Pigeon lakes, where a lock had actually been built, that while the Black-River bands of limestone, are laid bare on the banks of the river, a great portion of the construction was of wood. This lock is likely to be rebuilt in order to admit of communication by steamers, between Scugog and Chemong Lakes, the landing at the latter being within three miles of Peterborough, and I am not aware of any better material for such construction, than the limestones on the spot itself.

The thinner beds of the Chazy, where the texture is very close, are usually too brittle to stand dressing well, and although handsome slabs may frequently be procured, their value is much depreciated by the tendency to crack or break under the hammer.

The thicker beds of the Potsdam sandstone in Loughborough, and Storrington, would doubtless give a strong durable material, which would probably be easily quarried in large blocks, and readily dressed; being however in hardly any instance of a uniform color, but generally more or less striped or spotted

with red or green, it would produce by no means an agreeable effect in the appearance of a well finished building.

Beds suitable for building occur in the Trenton limestone, near the base, but the upper portions of the formation, which occupy a great breadth, are usually too thin, irregular and shaly to be well adapted for the purpose; it is for this reason that the houses of large towns along the front, such as Belleville, Trent, and Cobourg, standing upon beds of Trenton limestone, are yet chiefly built of brick.

Marble. The objections to the use of the white crystalline limestone of the Laurentian group, given in my report of 1851-2 apply equally to by far the greater portion of similar strata examined last season, and although occasionally a limestone of fine and compact grain was observed, it seldom was sufficiently thick or continuous in that state, to afford much more than small hand specimens.

Near the road between the seventh and eighth concessions of Madoc, about the thirteenth lot, a very fine grained white and yellowish rock, probably a dolomite, occurs in a ledge of thirty yards wide, much of which would take a good polish; and a number of broken pieces of similar rock was observed lying about the iron works, below the village of Madoc, which I was informed were derived from strata in the neighbourhood. Mr. Seymour had polished a specimen of this; it appeared to be very hard, and would probably be difficult to cut, but when a smooth surface is once obtained, it affords a handsome marble.

A small specimen was presented to me by the Rev. Mr. Bower of Sydenham, of a pure white saccharoidal dolomite, said to have been obtained from the Madawaska river, above a lake called Crotch Lake, but to what extent it exists he was unable to inform me. It is precisely similar to the specimens obtained from Mazinaw Lake on the Missisippi, mentioned in your Report of 1845-6, and may possibly be from the same place.

Water-lime. Associated with those strata which are characterised by *Cythere*, and are supposed to represent the Chazy formation, there were occasionally met with one or two interstratified beds of an argillo-calcareous character; a specimen from one of these, near the top of the escarpment at Knowlton Lake on the first lot of the eighth concession of Loughborough, upon

being burnt and pulverized, set under water, and there is not much doubt that the bed would yield a good hydraulic lime; the rock bears a strong resemblance to that near Bytown, from which what is called the Hull cement is derived; and although other specimens obtained from the formation in other places, supposed to be equivalent in position, and to have the same character, failed to set under water, it is reasonable to expect that in more parts than one of the distribution of the formation, where beds of this aspect present themselves, they will yet prove available for hydraulic purposes.

In the ditch surrounding the fort at Kingston, there is a three-feet bed of the same appearance, which has been successfully used as a water-lime, and is very probably in the same geological position.

Brick-clay. Bricks are manufactured along the shore of Lake Ontario, at almost every place of any importance between Napanee and Cobourg. The clay used for the purpose is of two kinds; one of a bluish or buff color, the other brownish, the former, where both are found in contact, being the lower stratum. This was particularly remarked at several places near Cobourg, and especially on a farm adjoining the property of Mr. Geo. Castle, where there is a brick-yard.

The same sort of arrangement is met with in the superposition of the clays yielding red and white bricks at Toronto, as may be seen on the properties of Mr. Sheriff Jarvis and the Honorable Mr. Caley, being the nineteenth and twenty-first lots of York, in the second concession from the bay; these deposits which have no doubt a great extent throughout the region, might readily be met with, wherever the courses of brooks have cut ravines through them.

In the brick-field on Mr. Sheriff Jarvis' land, the following descending section was obtained:

	Ft.	In.
1. Yellow clay fit for the manufacture of red bricks,.....	3	0
2. Yellow clay in layers of from a-quarter to an-eighth of an inch, with thin leaves of calcareous material between some of the layers. This is used to mix with the white brick clay beneath, and gives to the white a cream-yellow,.....	1	6
3. Yellowish sand,.....	9	0
4. Yellow clay, the same as No. 2. The yellow clay and sand		

of Nos. 3 and 4 look into each other, and each is consequently of unequal thickness,..... 1 9

5. Bluish clay, when dry of an ash-grey. This is used for making white bricks. It is stated to be of inferior quality towards the bottom, and to be in thickness..... 60 0

——— 75 3

Another descending section in the same brick-field is as follows.

	Ft.	In.
1. Yellow clay giving red brick,.....	3	0
2. Yellow clay making cream-yellow bricks by mixture; there are small calcareous concretions in it,.....	1	3
3. Yellow sand with a thin layer of calcareous material at the bottom,.....	0	9
4. Yellow clay giving white brick,.....	1	3
5. Bluish or ash coloured clay, giving white brick; the clay is calcareous,.....	0	9
6. Yellow sand,.....	1	3
7. Ash colored clay, burning white,.....	1	6
8. Yellow sand,.....	0	9
9. Ash colored clay, burning white,.....	2	0
10. Bluish sand,.....	0	2
11. Ash colored clay, burning white; it has a jointed structure and the thickness is said to be,.....	60	0
	72	8

The bluish or ash colored clay fit for white bricks, is said to have been cut to a depth of between seventy and eighty feet in a well in the neighbourhood, where it was as well suited for the purpose at the bottom as at the top. Boulders are occasionally found throughout it, but the number is not great. Pebbles and boulders occur in the red brick clay; on its surface it supports large gneissoid boulders of a red color, and boulders of crystalline limestone from the Laurentian series are met with near Mr. Jarvis' house.

The bed immediately under the red brick clay is called too strong for bricks, that is it holds too little sand, and it is sold at half a dollar the cart-load, for the manufactory of common red pottery.

A circumstance worthy of observation is that the potter's clay, with occasionally a layer of sand, and the red brick clay above, appear to undulate with the general surface, (not however decending to the bottom of deep ravines,) while the white brick clay lies in very even horizontal strata; from which it would appear that the one must have been worn down into gentle

hollows before the other, which may be much more recent, was deposited. The red and white brick clays, which were mentioned in the Report made to you in December 1850, as existing near London in the western Peninsula, have the same order of superposition as those now brought under your notice. The lower strata invariably produce white bricks, while the upper always produce red.

All the clays met with, were found to be more or less calcareous, and in consequence the bricks made from them, although of a good durable quality, would not be suited for furnaces, when a more than ordinarily strong heat is to be applied.

Shell-marl and Peat. A great portion of the bottom of Loughborough Lake is a thick deposit of shell-marl, and the bottoms of all the lakes from this to White Lake in Olden, are more or less of the same substance. It was also found in White Lake in Sheffield, and on the brook which flows from it to Beaver Lake, but the largest and most available deposits met with, were on Mr. McDonell's property, on the fifteenth and sixteenth lots of the second concession of Sheffield, and on the twelfth lot in the third and fourth concessions of the same township. The deposit on Mr. McDonell's place, extends over an area of 200 acres and perhaps more, with a thickness over the greater portion, of at least ten feet, which was proved by pushing a pole of that length through in various places, without striking any other material. On the surface there is a thin soil, bearing a luxuriant growth of prairie grass.

The marl on the twelfth lot of the third and fourth concessions, extends over at least 300 and perhaps 400 acres or more, but its thickness I could not ascertain. The place where it occurs is mostly a marsh or swamp, and the deposit is covered over by an accumulation of peat averaging about four feet in thickness. Some of this peat I saw dried, and procured some specimens for examination and illustration, which unfortunately have not arrived; but my impression on the spot was, that the quality was superior for fuel to any I had seen elsewhere.

I have the honor to be,
Sir,
Your most obedient servant,
ALEX. MURRAY.

REPORT

OF

T. S. HUNT, ESQ., CHEMIST AND MINERALOGIST

TO THE

PROVINCIAL GEOLOGICAL SURVEY.

ADDRESSED TO

W. E. LOGAN, ESQ., PROVINCIAL GEOLOGIST,

LABORATORY OF THE GEOLOGICAL SURVEY,

MONTREAL, 1*st May*, 1853.

SIR,

In a previous Report, I have had occasion to call your attention to the importance of an extended inquiry into the composition of the mineral waters of the Province, considered in connection with the different rock formations through which they rise. I have been encouraged in this inquiry, by a hope that the results might lead to generalizations which would throw light upon some obscure points of geological chemistry. While geologists have seldom taken into account the nature of the soluble matters yielded by the strata, to the springs flowing through them, it is not less true that the chemists who have examined these springs have neglected to note their geological position, or to trace any connection between the composition of the waters, and the rock formations in which they have their source. The extended researches of Bischof, and those of Von Walterhausen in Iceland, among others, have however been pursued with especial reference to these relations, and have given a new interest to inquiries in this direction. The Silurian rocks of this Province present such differences in mineral character, and afford such a great number of mineral waters, that their connected study might be expected to yield results of general interest.

As I have examined during the last winter a considerable number of waters, I shall first give the results of their analyses, and then proceed to arrange and classify the mineral springs of the Province, as far as they have yet been investigated.

Chambly. Having in the month of October last, collected a farther supply of the alkaline water from the Grand Coteau at Chambly, described with an incomplete analysis, in my Report for last year, I was enabled to confirm the results before obtained, and to make a more extended examination. It will be recollected that it was described as a strongly alkaline water, containing besides chlorid of sodium, with traces of the iodid and bromid, and carbonates of lime and magnesia, a large proportion of carbonate of soda, besides silica in some soluble state. To these must be added, carbonates of baryta and strontia, and borate of soda. It is but a few months since Professor H. Rose, of Berlin, pointed out a reaction which enables us to detect borates, even when present in minute quantity. It depends upon the power of free boracic acid to change to red, the yellow colour of paper stained with turmeric. The liquid suspected to contain a borate is neutralized with hydrochloric acid, and slips of turmeric paper are dipped in it and allowed to dry, when they are to be moistened with somewhat diluted hydrochloric acid, which at once produces a red-brown colour when boracic acid is present. By the aid of this test, Fresenius, Bouis, and Filhol, have just succeeded in discovering the presence of boracic acid in many of the mineral springs of Germany and France, and the same means have enabled me to detect it in several springs in this Province. When the Chambly water is evaporated to one-tenth, and neutralized with hydrochloric acid, turmeric paper which has been three or four times dipped in it and dried, becomes very red when moistened with diluted hydrochloric acid. Our present processes do not afford us any direct means of determining the amount of boracic acid when associated with carbonates and chlorids; but some experiments to be mentioned farther on, serve to give an approximate notion of the proportion in which it exists.

One thousand parts of the Chambly water gave of chlorine ·5241 parts; the alkalies in the state of chlorids equalled 2·040, of which ·0324 was chlorid of potassium; the remaining chlorine corresponds to ·8387 of chlorid of sodium, leaving still 1·1693 of chlorid, equal to 1·0604 of carbonate of soda. The carbonate of lime from 1000 parts was ·0380, and the carbonate of magnesia ·0765, with carbonate of iron ·0024, carbonates of

strontia and baryta ·0045, alumina with some phosphoric acid ·0063, and silica ·0730. We have then as the ingredients of 1000 parts of the water:

Chlorid of Sodium,.....	·8387
" " Potassium,.....	·0324
Carbonate of Soda,.....	1·0604
" " Lime,.....	·0380
" " Magnesia,.....	·0765
" " Iron,.....	·0024
" " Strontia and Baryta,.....	·0045
Alumina, with a little phosphate,.....	·0063
Silica,.....	·0730
Iodid and Bromids, traces,.....	
	2·1322

The colour assumed by this and other alkaline waters when boiled, has been noticed in a previous Report, and referred to the probable presence of an organic acid. On evaporating a litre of the Chambly water to one-sixth, and filtering to separate the precipitated earthy carbonates, it appeared of a bright clear brown colour, which was made paler by the addition of a slight excess of acetic acid, but remained perfectly clear. On adding acetate of copper, a brown precipitate appeared, which was collected after twenty-four hours, and weighed when dried ·010 grammes. It was completely soluble in ammonia, and had the characters of apocrenate of copper, corresponding to ·0043 of apocrenic acid. The filtrate treated with carbonate of ammonia, gave no trace of crenate of copper.

In an analysis of Gillan's spring in Fitzroy, published in my Report of May, 1851, I have remarked that the precipitate of earthy carbonates, thrown down on boiling that water, contained silica in combination, and dissolved in hydrochloric acid, with a subsequent separation of gelatinous silica. It was also stated that even when the water of that spring was evaporated to one-tenth, the filtrate, which was strongly alkaline, became turbid on further boiling, and yielded a flocculent precipitate which contained lime and magnesia, combined with a large proportion of silica. I had already observed similar facts in an examination of the alkaline waters of Varennes, and Dr. J. Lawrence Smith in a series of analyses of the thermal waters of Broosa, in Asia Minor, published in the American Journal

of Science for Nov., 1851, vol. xii, p. 377, has remarked that these alkaline waters when concentrated by boiling, still retain in solution a portion of silica, together with some lime, which he suggests may be dissolved in the alkaline liquid, as a silicate of lime and soda. He did not farther examine the subject.

I had observed that in certain cases, the whole amount of silica appears to be separated when the water is evaporated to entire dryness, but it is so probably, only when the evaporation is completed in presence of the previously precipitated earthy carbonates, for I have since found, that when the concentrated liquid is decanted from the precipitate, a portion of silica remains soluble in water, even after evaporation to dryness. This in one experiment thus conducted upon one litre, amounted to ·0275 grammes, while ·0455 remained in combination with the lime and magnesia, which are rendered completely insoluble by the evaporation to dryness. On evaporating the same quantity of water to one-twentieth, the silica precipitated amounted to ·031.

In comparing the analysis above given, with that of the preceding year, it will be seen that while the quantity of chlorine remains unchanged, the carbonate of soda, as calculated from the amount of alkaline bases, has diminished from 1·1744 to 1.0604, and the carbonates of lime and magnesia from ·0540 and ·0908 respectively, to ·0380 and ·0765, while there has been a similar decrease in the amount of silica.

The addition of caustic ammonia to the water, effected no apparent change, even after standing many hours, or heating to the boiling point; nor did a solution of carbonate of ammonia produce any sensible effect. Chlorid of baryum did not disturb the transparency of the water, nor produce any precipitate after sixteen hours, at 60° F. The mixture was then gradually heated to 140° F., when it became troubled, and slowly deposited a granular precipitate of carbonate on the sides of the glass. Chlorid of calcium gave in the same way a crystalline precipitate on heating. When however a portion of the recent water was boiled down to one-eighth, filtered, and the original volume made up by adding distilled water, the cold liquid immediately gave a copious precipitate of carbonate of baryta, on the addition of a solution of chlo-

rid of baryum. When half a gramme of carbonate of soda was dissolved in a litre of the recent water, the solution was also at once precipitated by a solution of barytic chlorid.

When the solid residue obtained by evaporating to dryness a litre of the water, was dissolved, and the filtrate mixed with a solution of chlorid of baryum, the precipitate of carbonate of baryta, after being well washed, weighed 1·882, corresponding to only 1·0156 grammes of carbonate of soda. A similar difference between the quantity thus calculated, and that deduced from the amount of alkaline bases present, is always observed in these alkaline waters, and is probably due to the borates, which do not form an insoluble precipitate with baryta salts, but a sparingly soluble borate of baryta, which it however requires long continued washing with water, to remove from the carbonate.

St. Ours. In constructing the lock at St. Ours, some years since, a mineral spring was found, which was carefully enclosed in the bank, so as to exclude the waters of the river, and render it accessible from above by a pump. The well having however been filled up with stones, I applied to the Hon. John Young, Commissioner of Public Works, who was pleased to order the well to be cleared, and the spring put in order. This was done under the direction of Mr. Harrison, who at two different times in the month of November last, sent me specimens of the water. It is like that of Chambly, alkaline, and although it does not contain so large an amount of fixed ingredients, is remarkable for the great proportion of alkaline carbonate, and the unusually large quantity of potash salts which it contains. Evaporated to one-twentieth, it affords by Rose's test, distinct evidence of the presence of borates. 1000 parts of the water give ·03857 of chlorine, and ·2250 parts of alkalies in the form of chlorids, of which chlorid of potassium constitutes ·0565 parts. The water contained besides, ·0037 of sulphuric acid, equal to ·00805 of sulphate of potash, leaving ·0496 for chlorid of potassium. The residual chlorine equals ·02075 of chlorid of sodium, leaving ·14775 of chlorid of sodium, equal to ·1340 of carbonate of soda. The water gave besides, ·1740 of carbonate of lime and ·1287 of carbonate of magnesia, with traces of carbonate of iron, and ·016

parts of silica. The above results give for 1000 parts of the water:

Chlorid of Potassium,.....	·04960
" " Sodium,.....	·02075
Sulphate of Potash,.....	·00805
Carbonate of Soda, with borate,.....	·13400
Carbonate of Lime,.....	·17400
" " Magnesia,.....	·12870
" " Iron,.....	traces,
Silica,.....	·01600
	·53110

If we take the two alkalies as chlorids, the proportion of chlorid of potassium equals 25·11 per cent; in another determination it was found to be 24·52 per cent. A portion of the water obtained from the spring immediately after it was re-opened, and three weeks before the specimen whose analysis has been given, yielded a larger weight of mixed chlorids, equal to ·340 in 1000, of which ·0596 or only 17·53 per cent. were chlorid of potassium, while the amount of this salt from the same quantity of water, was but little more than that previously obtained, (·0565,) showing an admixture of a more strongly saline water, containing principally soda salts.

The determinations of the chlorid of potassium were repeated with great care, the mixed chlorids being combined with chlorid of platinum, and the soda salt then removed by spirit of wine. The reagents, whose purity was previously tested, were the same as those used for the Chambly spring, and the other waters whose analyses follow. The proportion of potash salts in natural mineral waters is generally very small; in the Chambly water the chlorid of potassium equals only 1·58 per cent of the mixed chlorids, and in the water of the Mediteranean Sea, according to Usiglio, it amounts only to 1.7 per cent.

The amount of carbonate of baryta, obtained by precipitating with chlorid of baryum the solution of the solid matters obtained by evaporating to dryness 1000 parts of the St. Ours water, was (deducting the sulphate,) ·1890, equal to ·1125 of carbonate of soda. The difference between this and the calculated amount given above, may probably be considered as in

the case of the Chambly water, to correspond to the amount of soda combined with boracic acid.

The water which you brought to me from a spring at Marcotte's mills, on the Jacques Cartier River, belongs to the same class as the preceding ones. The spring is, as you have informed me, strongly sulphurous, and the water in well corked bottles still retained a portion of sulphuretted hydrogen. When evaporated to one-twentieth, it is strongly alkaline to the taste, while the saline flavor is scarcely perceptible. The concentrated water gives with chlorid of baryum a copious precipitate, which dissolves in hydrochloric acid with effervescence, leaving but a very small residue of sulphate. 1000 parts of the water gave ·0247 of chlorine; the sulphuric acid was not determined. The same quantity yielded ·257 of alkaline chlorids containing ·0076 of chlorid of potassium. There was obtained from the portion rendered insoluble by evaporation to dryness, ·071 of carbonate of lime, and ·0278 of carbonate of magnesia, with ·011 of silica; there was besides a portion of silica remaining in solution, which the small quantity of the water remaining at my disposal, did not allow me to determine. Neglecting the small amount of sulphuric acid, and estimating as in the previous analyses, the excess of alkaline bases over the quantity required to form chlorids, as carbonate and borate, we have for 1000 parts of the water:

Chlorid of sodium,.....	·0347
" " Potassium,.....	·0076
Carbonate of Soda, with borate and traces of sulphate,.....	·1952
Carbonate of lime,.....	·0710
" " magnesia,.....	·0278
Silica (in part),.....	·0110
	·3473

The weight of solid matters obtained by direct experiment was ·355. The proportion of chlorid of potassium to the mass of chlorids equalled 2·95 per cent. By treating the aqueous solution of an evaporated litre of the water, with acetate of baryta, a precipitate weighing ·247 was obtained, which, not deducting the sulphate, corresponds to ·147 of carbonate of soda, leading us to infer the presence of a large proportion of borates.

The seigniories of Nicolet and La-Baie-du-Fêbvre afford a number of saline and alkaline springs, three of which I visited last summer; after my departure, Mr. Desaulniers of the College of Nicolet, made further inquiries, and was so kind as to collect and send me the waters of three other springs, informing me at the same time of the reported existence of two more. Of these six springs, two are simply saline, and four are alkaline.

The first of these is in the seigniory of La-Baie, about one and a-half leagues from the church, and near the line of Nicolet, in the Grand Rang, upon the land of Mr. Antoine Loizeau, and about ten arpents south of the high road. The spring is in a ravine near a small rivulet, and evolves no gas. The water is pleasantly saline to the taste; its qualitative examination showed besides alkaline chlorids, a large amount of chlorids of calcium and magnesium, but no sulphates. There is a considerable precipitate of earthy salts on boiling, consisting of carboates of lime and magnesia, with a little strontia; iodine and a trace of bromine were found in the alcoholic extract of the water. 1000 parts gave 5·44 of solid matter, and 4·54 of alkaline chlorids, of which ·0916 or 2·0 per cent. were chlorid of potassium.

Another spring of this kind occurs in the same concession, about a mile above the church of St. Antoine, on the land of Mr. Lafort, and about eight arpents north of the road. I am indebted for a specimen of this water to Mr. Desaulniers; it is strongly saline, and contains like the last, earthy chlorids in abundance, besides a portion of strontia with the other earthy carbonates. 1000 parts of the water yield 15·94 of solid residue. When evaporated to one-tenth and mixed with a slight excess of hydrochloric acid, a strong reaction of boracic acid was obtained with turmeric paper; the red color was distinct after one immersion.

About half a league east of the church, and ten arpents south of the road, there is another spring upon the land of Ignace Courchêne. It is at the foot of a hill in a little ravine, and is surrounded by a large cask, which is full, but has no perceptible discharge. Large bubbles of carburetted hydrogen gas escape from time to time. The water which is somewhat turbid, is plea-

santly saline. When evaporated, it deposits an abundant earthy precipitate, and becomes very alkaline to the taste; it gives a strong reaction of iodine, and distinct evidences of bromine. Traces of baryta and strontia were found in the earthy precipitate. 50 grammes of the water gave ·1476 of chlorine, and ·330 of alkaline chlorids, including ·00305 of chlorid of potassium; while a litre yielded ·218 of carbonate of lime, ·4623 of carbonate of magnesia, and ·212 of silica. Calculating the carbonate of soda from the excess of alkaline bases over the chlorine, we have for 1000 parts of the water:—

Chlorid of Sodium with bromid and iodid,.....	4·8334
" " Potassium,.....	·0610
Carbonate of Soda (with borates ?).....	1·5416
" " Lime,.....	·2180
" " Magnesia.....	·4263
" " Baryta and Strontia, traces,.....	
Silica,.....	·2120
	7·2923

The amount of solid matter obtained by evaporation was 7·040, but a large part of the earthy bases here represented as carbonates, are by that means obtained in the form of silicates, the carbonic acid being expelled. The chlorid of potassium amounted to ·92 p. c. of the alkaline chlorids obtained.

Another alkaline spring is met with on the land of Mr. David Houlé, which adjoins on the east that of Mr. Antoine Loizeau above mentioned. It is in a little ravine about four arpents south of the road, and constantly evolves bubbles of carburetted hydrogen gas. Like the last it is strongly saline, and contains in addition, a portion of carbonate of soda, abundance of carbonates of lime and magnesia, and a trace of strontia. It yielded 4·96 parts of solid matter to 1000.

I am indebted to M. Desaulniers for the following description of an alkaline spring which is found upon the farm of the widow Honoré Hébert of Nicolet, in the concession known as the Quarante-arpents, and upon the line of St. Grégoire. In a cultivated field there is a nearly circular area about fifty feet in diameter, entirely destitute of vegetation except in the centre, where there is a clump of reeds. The surface is a soft yielding mud, covered at the season, which was the middle of July,

by a thin crust, apparently of dried saline matter. The water which impregnates this spot, issues from among the reeds; a small portion collected by digging a hole in the earth, was sent me. It was coloured brownish-yellow, and had a disagreeable slightly alkaline taste. When concentrated by boiling, it deposits but very little earthy matter, and is strongly alkaline, but scarcely saline to the taste; mixed with hydrochloric acid it effervesces strongly, a brownish precipitate of organic matter separates, and the filtrate gives with a solution of chlorid of baryum, a slight precipitate of sulphate. A half-litre of the water gave ·838 of alkaline chlorids, and ·0159 of chlorid of potassium, equal to 1·89 per cent; while 50 grammes boiled, acidulated with nitric acid and filtered, gave with nitrate of silver, ·051 of chlorid, equal to ·2522 of chlorine to a litre. From these data, neglecting the small amount of sulphate, we deduce for 1000 parts of the water:

Chlorid of Sodium,.....	·3920
" " Potassium,.....	·0318
Carbonate of Soda with a little sulphate,.....	1·1353
	1·5591

A half-litre of the water having been evaporated to dryness, the filtered solution of the residue gave with chlorid of baryum a precipitate, which blackened on ignition, and then weighed ·929 grammes. It dissolved with a slight odour of sulphuretted hydrogen in hydrochloric acid, leaving a little carbonaceous matter. The filtered solution precipitated by carbonate of ammonia gave ·906 of carbonate of baryta, which would correspond to 1.078 grammes of carbonate of soda in a litre.

Mr. Desaulniers also sent me a bottle of water from a spring on the land of Olivier Roy, in Nicolet, not far from the line of La-Baie, and about half a league from the farm of Antoine Loizeau, near the high road. The water was colorless and nearly tasteless, but when concentrated, deposited some earthy salts, and became strongly alkaline; it then gave with chlorid of baryum, a copious precipitatate of carbonate, which when dissolved in hydrochloric acid, left a trace of sulphate. This water was not further examined.

The number of mineral waters described in this and the preceding Reports is in all fifty-four. Of these twenty-two

have been subjected to a quantitative analysis, while the others have been qualitatively analyzed, the entire amount of solid matter having generally been determined, together with some points of special interest. The great abundance of springs almost identical in composition, seemed to render the complete analysis of the whole of them unnecessary.

These waters may be divided into two classes, namely, the saline and the acid; and the saline springs may be arranged in two divisions. The first includes such as contain in addition to the alkaline chlorids, sulphates or hydrochlorates of lime and magnesia. These we shall designate as group A, and shall arrange them in the order of their saline strength, that is, according to the amount of solid matter which they afford. Of the twenty-seven waters in the list, twenty-two of them contain iodids and bromids, which I have never found absent in the proper saline waters of the country, whose characteristic ingredient is common salt. The five at the bottom of the list are very feebly saline, containing only traces of chlorids, with some sulphate of lime and magnesia.

A great number of the proper saline waters contain small portions of salts of baryta and strontia; they are found in part dissolved as chlorids, and are in part thrown down as carbonates, with the precipitate of carbonates of lime and magnesia, which all of these waters afford when boiled, and which are dissolved in the recent water as bi-carbonates. The two bases baryta and strontia are generally, if not always found together, and they are seldom wanting except in those waters which contain sulphates. Small quantities of carbonate of iron are generally found with the earthy carbonates, but it is in no instance in sufficient quantity to give a marked chalybeate character to the water; I have never failed to detect traces of manganese when it was searched for, and I find that phosphates in small portions are seldom wanting. When evaporated to dryness with an acid, these waters always yield a portion of silica. I have recently detected boracic acid in a water of this division from La-Baie (No. 3), and it is probable that it may be found in many others. None of the waters yet examined, contain that excess of carbonic acid which gives to the Seltzer and Saratoga waters their sparkling appearance

and acidulous taste. Many of the springs however give off carburetted hydrogen gas, in greater or less quantities; the most remarkable instances are 5, 6 and 7 of division A, and 2 and 4 of division B.

In the following list, the amount of solid matter for 1000 parts of the water is given, while in each instance reference is made to the page of the Report in which the analysis may be found, and a star (*) marks such as have been quantitatively analysed. Those containing sulphates are marked with the letter S, and those in which baryta and strontia have been found, with B.

CLASS I. SALINE WATERS.

Division A. Containing Chlorids of Earthy Basis.

	LOCALITIES AND NAMES.		In 1000 Parts.	See Report for
1	Ancaster (Salt Well),	S	36·67	*1848 p. 161
2	Bay St. Paul,	..	20·68	1851 " 53
3	La-Baie-du-Fébvre (Lafort's Spring,)	B	15·94	1853 " 160
4	Alfred,	B	14·50	1852 " 112
5	Caledonia ("Intermittent"),	..	14·63	*1848 " 149
6	St.-Léon,	B	13·83	*1849 " 53
7	Caxton,	..	13·65	* " " 55
8	Rivière-Ouelle,	S	13·36	1852 " 113
9	Plantagenet (LaRocque's Spring,)	..	13·16	*1849 " 57
10	Lanoraie,	B	12·88	*1851 " 48
11	Gloucester,	B	11·20	1852 " 112
12	Plantagenet (Georgian Spring,)	S	10·98	*1851 " 47
13	Kingston,	S	10·16	1852 " 117
14	Point-du-Jour,	B	7·36	1850 " 103
15	L'Orignal (Langlois' Spring,)	..	6·40	1851 " 53
16	La-Baie-du-Fébvre (Loizeau's Spring,)	B	5·44	1853 " 160
17	Ste.-Anne-de-la-Pocatière,	S	5·06	1852 " 114
18	Pike River (Saline,)	B	4·76	1849 " 59
19	Ancaster (Sulphur,)	S	....	1848 " 162
20	St. Benoit,	S	....	1849 " 60
21	Pike River (Sulphur,)	S	....	1849 " 59
22	St. Eustache,	S	1·88	1850 " 103
23	Les-Eboulmens (Sulphur,)	S	·70	1851 " 53
24	Fitzroy (Grant's Sulphur Spring.)	S	....	1847 " 124
25	Pakenham Village (Sulphur Spring,)	S	....	" " "
26	Westmeath (Petrifying Spring,)	S	....	" " "
27	Matan River Gaspé,	S	....	" " "

The amount of solid matter in 19 and 20 was not determined, but their observed specific gravities were near that of 18. The proportion of the chlorids of calcium and magnesium combined, to the entire amount of solid matter, varies greatly in the above waters; in the Ancaster Salt Well, it is equal to one-half,

making the water bitter and disagreeable to the taste like sea-water, but far more intense; those chlorids are also present in large proportion in the waters of Kingston, Bay St. Paul and Rivière-Ouelle, and render them unpalatable. The waters from 3 to 12, that of Rivière-Ouelle excepted, are very much alike in character, and are all agreeably saline to the taste. Of the waters among these last, which have been quantitatively analyzed, the Intermittent of Caledonia will be seen to contain the largest amount of these earthy chlorids, after which follow the St.-Léon and Georgian Springs, then those of Lanoraie, Caxton and Plantagenet, which contains the least of all.

In the second division of saline springs, these earthy chlorids are wanting, and we find instead, a portion of carbonate of soda, which gives to the waters when concentrated, an alkaline or soapy taste. Some of these are at the same time strongly saline, but in others the alkali predominates, and renders the taste of salt in the evaporated waters, hardly perceptible. They all afford the reactions of bromine and iodine, and many, perhaps all of them, contain a portion of borate of soda. Carbonates of baryta and strontia are found in all those which do not contain a portion of alkaline sulplate.

CLASS 1. SALINE WATERS.

Division B. Containing Carbonate of Soda.

	NAMES AND LOCALITIES.		IN 1000 PARTS.	SEE REPORT FOR
1	Varennes, (Outer Spring,)	B	10·72	*1849 p. 49
2	" (Inner Spring,)	B	9·58	* " " 51
3	Fitzroy, (Gillan's Spring,)	B	8·34	*1851 " 49
4	Caledonia, ("Gas" Spring,)	S	7·77	*1848 " 141
5	" ("Saline" Spring,)	S	7·34	* " " 143
6	Belœil,	B	7·33	*1851 " 51
7	La-Baie (Courchêne's Spring,)	B	7·29	*1853 " 161
8	Chambly (Rang-des-Quarante,)	B	5·74	1852 " 116
9	Ste.-Hyacinthe (Providence Spring,)	B	5·16	1850 " 102
10	La-Baie (Houlé's Spring,)	B	4·96	1853 " 161
11	Caledonia (Sulphur Spring,)	S	4·94	*1848 " 145
12	Chambly (Grand-Côteau,)	B	2·13	*1853 " 154
13	Ste.-Martine,	S	1·98	1852 " 114
14	Nicolet, (Hébert's Spring,)	S	1·56	*1853 " 162
15	St.-Ours,	S	·53	* " " 157
16	Ste.-Anne-de-la-Pocatière,	S	·36	1852 " 113
17	Jacques-Cartier River,	S	·34	*1853 " 159
18	Nicolet (Roy's Spring,)	S	....	" " 162

The quantity of alkaline carbonate bears no constant proportion to the whole amount of saline matter, for while the waters of Varennes, Caledonia, Fitzroy and Belœil, contain but from ·05 to ·58 parts in 1000 parts of carbonate of soda, equal to from 1 to 12 per cent. of the whole amount of soda salts present, the Jacques-Cartier Spring contains 1·95, that of St.-Ours ·134, that of the Grand-Coteau of Chambly 1·06, and Hébert's Spring in Nicolet, 1·13 parts, equalling 82, 63, 52, and 72 per cent of the whole amount of alkaline salts present. These less saline waters then contain not only relatively, but actually, more alkaline carbonate than the more strongly saline springs. It will be understood that a small undetermined portion of the soda represented as carbonate, exists combined with boracic acid.

The second class of springs consists of a small number containing free sulphuric acid, together with sulphates of lime, magnesia, alumina, protoxyd of iron, and small portions of alkalies, without any trace of chlorine; they all contain sulphuretted hydrogen. Of these four are known, all being in the same region of Western Canada; they are the Tuscarora Sour Spring, containing 1·87 parts of sulphates and 4·29 of free hydrated sulphuric acid, in 1000 (See Report for 1848 p. 152); another in Niagara with about ·6 parts of sulphates of the above bases, and two parts of free acid in 1000; besides a third from near Chippewa, described by Dr. Mack, of St. Catherines, C. W., in the British American Journal, vol. v. p. 63, which in composition and strength is very much like that of Tuscarora, and a fourth furnished me by Dr. Chase of St. Catherines, from the vicinity of St. Davids, and similar to the last, although weaker. (Report for 1850, p. 100.) The connection of these springs with the gypsiferous rocks, and their supposed relations to the deposits of gypsum, have been discussed in the Report for 1848.

The Charlotteville Spring is not included in either of the above classes, as its saline ingredients are principally earthy sulphates and carbonates, with but a very small proportion of chlorids; its solid ingredients amount to 2·49 parts in 1000. This water is remarkable for the great quantity of sulphuretted hydrogen gas which it holds in solution, amounting to 32·1

cubic inches to an imperial gallon. (Report for 1848, p. 157.) The quantity given in that report, 26·8 cubic inches, was calculated for an American standard gallon of 231 cubic inches. The feebly saline and sulphurous waters 23, 24 and 25, of division A, resemble this in the predominance of sulphates.

All of the springs of division A, with the exception of those of Ancaster, which belong to the Niagara group, issue from Lower Silurian rocks; the water of Ste.-Anne, No. 17, comes from the Oneida conglomerate, and of the others, Nos. 3, 8, 16, 18, 21, and perhaps 6 and 14, issue from the Utica slates or the Hudson River group, while the others belong to the Trenton limestone, or to inferior Silurian strata. Of the springs of division B, the three of Caledonia belong to the Trenton limestone, and that of Fitzroy to the Chazy or Calciferous sandrock, to the latter of which the water of Ste.-Martine is probably to be referred. Of the remaining thirteen, Nos. 1, 2 and 17 rise from the Utica slates, and the others from the Hudson River group, with the exception of 16, which issues from the conglomerates immediately above.

ANALYSES OF MINERAL SPECIES.

Labradorite.—Among the mineral species examined during the past year, none has a greater interest than a felspar which forms the great bulk of some specimens of a crystalline rock, brought by yourself from the townships of Morin and Abercrombie, where it is very abundant. It often yields large cleavable masses which show the spar to belong to the trilicnic system of crystallization; two of the lateral faces of the prism are delicately striated longitudinally, like the albite (peristerite) of Bathurst. The color is greenish-gray, passing into lavender-blue, occasionally with a pearly-gray opalescence; hardness, 6; density, 2·684–2·695. An analysis of a specimen from Morin gave,

Silica,	54·20
Alumina,	29·10
Peroxyd of Iron,	1·10
Lime,	11·25
Magnesia,	·15
Alkalies, by difference,	3·80
Loss by ignition,	·40
	100·00

From this result, as well as from its physical characters, the mineral is shown to be labradorite, identical with that whose analysis I have given in the Report for 1850–51, p. 40. That specimen was from a boulder found in Drummond, C. W. The species has long been known to occur in rolled masses from the coast of Labrador, where it was first found, to Lake Huron, but this is the first instance in which we have been able to examine this peculiar rock *in situ*, so that it is to be hoped that the present discovery will afford an opportunity for studying the relations of a species, which is so interesting both in a mineralogical and geological point of view.

Associated with the felspar are grains of magnetic iron, and a greenish amorphous material having a hardness of about 5, and a density of 2·690—2·708. Digested in powder with dilute hydrochloric acid, a slight effervescence ensued from the solution of an admixture of carbonate of lime, which amounted to 4·8 per cent; no magnesia was taken up by the acid, and but ·85 per cent of alumina and oxyd of iron. The insoluble residue did not differ much in composition from the felspar.

Scapolite.—The following results were obtained with a scapolite which was found with black mica, forming a boulder, near Perth. It had a hardness of 5·5, and a density of 2·640—2·667, and was of a greenish-gray color, sub-translucent, with a waxy lustre, pearly upon the cleavage surfaces, which were very distinct in two directions at right angles to each other; it was exceedingly tough:

Silica,	46·30
Alumina,	26·20
Protoxyd of Iron,	·60
Lime,	12·88
Magnesia,	3·63
Potash,	2·88
Soda,	4·30
Loss by ignition,	2·80
	99·59

It differs from ordinary scapolite in the large proportion of potash, and in a partial replacement of the lime by magnesia.

A specimen said to be from the second lot of the ninth concession of Bathurst, furnished by Dr. Wilson of Perth, to Pro-

fessor Williamson of Kingston, to whose kindness I am indebted for the opportunity of examining it, has afforded me two very interesting species. It consists of a white crystalline pyroxene, or diopside, with copper pyrites, small crystals of silvery-gray mica, prisms of bluish-green apatite, and portions of a milk-white cleavable calcite, together with a rose-red mineral, having in its general aspect some resemblance to a common variety of wollastonite or tabular spar.

It occurs massive, with cleavages which indicate an oblique system of crystallization; according to Prof. E. C. Chapman, of the University of Toronto, who has examined a specimen in the collection of the Canadian Institute, the cleavage prism is apparently right rhomboidal, and the inclination of M : T= 110°—115°. The cleavages with M and P are perfect and easily obtained, giving to the mass a fibrous aspect; with T the cleavage is imperfect. Hardness, 3·5; density, 2.765—2.776. Lustre vitreous, shining, occasionally pearly on the cleavage surfaces. Color, rose-red to peach-blossom-red; sub-translucent; fracture uneven.

Before the blow-pipe it becomes white and opaque from the loss of water, and fuses easily with intumescence into a white enamel. When pulverized and boiled with hydrochloric acid, it is partially decomposed with separation of pulverulent silica. A qualitative analysis showed the presence of silica, lime, magnesia, alumina, with a little iron and traces of manganese, besides a large amount of potash. The results of three quantitative analysis are subjoined; the earthy ingredients were determined by fusion with carbonate of soda. The alkalies in the first analysis were separated by a method for which I am indebted to Dr. A. A. Hayes, of Boston; it consists in fusing the pulverized mineral for half-an-hour, with one part of pure lime and four parts of chlorid of calcium in a platinum crucible; the fusion was effected over a spirit lamp. After cooling, the fused mass was digested with water, and the solution then contained all the alkalies as chlorids, mixed with chlorid of calcium. The lime salt was decomposed by carbonate of ammonia, and the sal-ammoniac separated by sublimation from the evaporated mass, leaving the alkaline chlorids in a state of purity. The whole amount of water in the mineral is only

expelled by a heat which produces incipient fusion. The small portion of silica, which in the ordinary process of analysis, adheres to the alumina, was not separated except in the third of the following analyses:

	I	II	III
Silica,	42·90	43·00	43·55
Alumina,	28·10	27·80	27·94
Oxyds of Iron and Manganese,		·70	·20
Lime,	6·94	6·72	6·50
Magnesia,	3·99	3·83	3·81
Potash,	8·27	8.27	8·37
Soda,	·95	·95	1·45
Water,	9·00	9·40	8·61
	100·15	100.67	100.43

As this interesting mineral appears to constitute a new species, I have named it *wilsonite*, after its discover Dr. Wilson, who has long been known as a zealous student of the mineralogy of his district. It is to be wished that farther examination may detect distinct crystals of the mineral; a single imperfect one, having its angles rounded, was found in the calcite. Small masses of wilsonite are often completely imbedded in the accompanying pyroxene. This pyroxene is massive, crystalline, and affords cleavage prisms having the ordinary angles of the species; in a crevice it was observed in small crystals. Its hardness, is 6·5; density, 3·186—3·192; lustre vitreous, pearly on the cleavage surfaces. Colorless or grayish-white; translucent to semi-transparent, fracture uneven, sub-conchoidal. Before the blow-pipe the grayish portions become colorless; it retains its transparency and lustre, and fuses with some difficulty and with intumescence, into a colorless glass. The results of two analyses were as follows:

	I.	II.
Silica,	51·50	50·90
Alumina,	6·15	6·77
Peroxyd of Iron,	·35	
Lime,	23·80	23·74
Magnesia,	17·69	18·14
Loss by ignition,	1·10	·90
	100·59	100·45

This pyroxene is peculiar from the amount of alumina, which has not hitherto been observed in any considerable quantity,

except in the dark colored ferruginous varieties. The alumina in these is supposed to replace a portion of silica, and admitting a similar relation in the present variety, we have the ordinary formula of pyroxene. The silica of the first analysis corresponds to 27·28 and the alumina to 2·87 of oxygen= 30·05, while the oxygen of the other constituents, including the water, amounts to 14·95. The ratio of 30·05 : 14·95 is very nearly 2 : 1, conducing to the formula $2(SiO^3, Al^2O^3)$ 3(MO.)

Lievrite. A mineral which is to be referred to this rare species was received from C. Billings Esq. of Bytown, a gentleman whose zeal and activity in the pursuit of mineralogy and geology give promise of valuable results. It was found as a rolled mass of some ounces in weight, coated with a hydrated oxyd like limonite, resulting from a superficial decomposition. Within, the mineral is unaltered, and has a hardness of 5·5, and a density of 4·15—4·16. Lustre sub-metallic, shining, occasionally iridescent; color velvet-black; streak and powder yellowish ash-grey; it is slightly translucent on the edges, very thin scales transmit a brownish light. Fracture uneven, brittle, strongly attracted by the magnet. It cleaves imperfectly in two directions oblique to each other.

Before the blowpipe on charcoal the mineral intumesces and yields a black slag, which is still magnetic. It gelatinizes readily with hydrochloric acid, but the silica which separates retains a small portion of iron. The solution contains protoxyd with some peroxyd of iron, besides a little magnesia, lime, and a trace of manganese. For its complete analysis the mineral was decomposed by fusion with carbonate of soda.

The amount of peroxyd of iron was determined by decomposing the finely powdered mineral with hydrochloric acid in a vessel filled with carbonic acid gas, and after adding recently boiled water, digesting it with a weighed plate of metallic copper, in the manner prescribed by Fuchs; the amount of copper dissolved, corresponded to 9·93 per. cent. of peroxyd. Another determination was made with similar precautions, by adding to the diluted hydrochloric solution, phosphate of soda, and then acetate of soda in excess. The precipitated perphosphate of iron gave 10·80 per. cent. of peroxyd, while the entire amount of iron as peroxyd was 73·6 per. cent, giving

56·52 for the amount of protoxyd in the silicate. The results of analysis were as follows:

Silica,	27·80	28·20
Protoxyd of Iron,	56·52	
Peroxyd " "	10·80	9·93
Magnesia,	2·59	
Lime,	·64	
Loss by ignition,	1·20	
	99·55	

The ratio between the oxygen of the silica and that of the other constituents, the water included, is 14·72 : 18·21, or very nearly 4 : 5, which is that required by Rammelsberg's formula for lievrite. In the present specimen, the lime ordinarily present, is replaced by protoxyd of iron and magnesia.

Celestine. I have examined the mineral from Kingston, to which Thompson gave the name of baryto-celestine, on the ground that it contained 35 per. cent. of sulphate of baryta. This celestine is white or bluish-white; translucent; hardness 3.5; density 3·962—3·967, (3·921, Thompson,) which is that of pure sulphate of strontia. A portion of the mineral was decomposed by fusion with carbonate of soda, and the separated carbonate was completely soluble in hydrochloric acid. The solution having been evaporated to dryness, the redissolved chlorids were mixed with an excess of hydrofluosilicic acid; after twenty-four hours not a trace of baryta salt had separated, showing the absence of that base. The solution gave the reactions of a pure strontia salt, from which it was concluded that the mineral is nothing more than celestine or sulphate of strontia.

Apatite. As mineralogists have seldom observed this species in trappean rocks, the following notice of a locality of the mineral detected by Mr. J. Richardson on the Achigan river, is not without interest. About two miles below St. Roch there is a mass of grayish trap, composed of black hornblende and white glassy felspar, generally in small grains, but occasionally in crystalline individuals of half an inch in length; in this rock occur abundantly disseminated, hexagonal prisms, apparently regular in form, with an imperfect basal cleavage. They have a hardness of 5, are transparent or translucent, with a

vitreous lustre, a conchoidal fracture, and an amethyst-purple color, passing int opink and reddish-white, rarely colorless. The crystals are sometimes an inch in length, and from one to two lines in thickness, but their surfaces are seldom polished; the mineral also occurs in rounded grains. In powder, the crystals dissolve readily in hydrochloric acid without effervescence or separation of silica, and are found to consist of phosphate of lime.

In the Report of last year, I had occasion in speaking of the masses of phosphate of lime found in the Calciferous sandstone at the Lac-des-Allumettes, to call your attention to the fact that the lingulæ which occur in the same stratum, seemed to be encrusted with the phosphate. It appears upon farther examination, that the fossil shell itself is composed of that material. Specimens of *Lingula quadrata,* from the Trenton limestone on the Naquoarau river, were separated from the adhering rock, and appeared as thick brownish scales, retaining the form of the fossil. They yielded a brown powder, which was soluble with scarcely any effervescence in hydrochloric acid. The solution gave with ammonia an abundant white precipitate; this was soluble in acetic acid, and oxalic acid threw down from the solution, abundance of oxalate of lime. With molybdate of ammonia a very copious precipitate of the yellow molybdo-phosphate was obtained. The shell therefore consists chiefly of phosphate of lime. The shale which is found between the layers of the limestone holding the fossil lingulæ is bluish-black, giving a white powder, and is partially soluble with strong effervescence in hydrochloric acid; the solution contains besides lime, with some iron and alumina, a notable amount of phosphates.

A fragment of a trilobite *Isotelus gigas*, which was grey, sub-translucent and finely granular, was readily soluble with effervescence in hydrochloric acid, and was pure carbonate of lime, without a trace of phosphate.

Some beds of the Trenton limestone at Bytown, contain casts in dolomite, of the interior of species of *Orthoceras*, *Pleurotomaria*, *Murchisonia*, and fragments of perhaps other species. The limestone is compact, dark bluish-grey, and bituminous; it dissolved in acids, leaving an insoluble residue of sand and

clay, amounting to 3·9 per. cent; the solution gave ·6 per cent. of oxyd of iron and alumina, and not a trace of magnesia. The fossil casts, which are very abundant, are coarsely crystalline, and white or bluish-white within. Upon the weathered surfaces of the rock they appear in high relief, and are reddish-brown externally. By the aid of dilute hydrochloric acid, which is almost without action upon the dolomite, the limestone matrix is removed, and it is seen that the fossil is in many cases but partially replaced by the dolomite; that portion of the fossil which was uppermost in the stratum, is often filled by pure carbonate of lime, in some instances to the extent of one-third or one-fourth of the whole, while in other specimens the replacement is entire. Small veins of dolomite no thicker than paper, are also found cutting the rock. In the interior of some of the large casts, are found drusy cavities lined with imperfect crystals of dolomite; in one of these were found two small terminated prisms of smoky quartz, implanted upon the dolomite crystals.

A fragment of the cast of an *Orthoceras* from this locality, was found when pulverized, to be completely soluble in heated hydrochloric acid, and the solution contained a considerable portion of a proto-salt of iron, but no manganese; its analysis gave for 100 parts;

Carbonate of Lime,.....	56·00
" " Magnesia,.....	37·80
" " Iron,.....	5·95
	99·75

This occurrence of dolomite in a limestone destitute of magnesia, is evidently the result of a subsequent deposition in the the cavities of the shells, but the frequent replacement of small fragments of the shells, is not easily understood. In the pearl-spar which is found crystallized in the cavities of the Niagara limestone, we have an analogous instance of the deposition of a magnesian carbonate.

The silicified fossils which are so often found in the Lower Silurian limestones of the province, appear to be replaced by pure silica. A shell of *Orthis testudinaria*, which had been separated by the aid of dilute hydrochloric acid, and retained

perfectly its form, was found to consist of silica with but a trace of oxyd of iron.

Iron Ores from St. Maurice. You have remarked in page 46 of your last report, that the iron from these bog ores, attracted particular attention at the Great Exhibition at London in 1851, from the fact that a superior quality of metal is in this case, manufactured from a species of ore, which is supposed to yield only an inferior iron. The poor quality of the iron from bog ores has generally been ascribed to the presence of phosphates in the ore, phosphorus having been supposed to render the metal brittle when cold. It is however the opinion of Schafhautl and some other recent investigators, that this notion is erroneous, and the following examinations of specimens of the ore used at the St. Maurice forges, furnished me by yourself, go to confirm the opinion. The analyses were made by the process described in my report of last year. The first specimen was regarded as an ore of the best quality, and was a bright reddish colored limonite, with a brilliant black fracture; it gave for one hundred parts,

Peroxyd of Iron,.....	77·60
Sesqui-oxyd of Manganese,.....	·30
Phosphoric Acid,.....	1·81
Silica,.....	5·40
Loss on ignition, (water and vegetable matter),.....	17 25
	102·36

The second specimen was from a parcel supposed to be inferior in quality, and said by the workmen to be rotten, a change which they suppose to be produced by long exposure to the air. There was however nothing in the character of this specimen to support such a notion, and except in the larger amount of water and volatile organic matter, it did not differ from the last; it gave,

Peroxyd of Iron,.....	74·30
Sesqui-oxyd of Manganese,.....traces.....	
Phosphoric Acid,.....	1·80
Silica,.....	3·60
Water and organic matter,.....	22·20
	101·90

A portion of the iron in these ores appears to exist in the state of protoxyd, causing the apparent excess in the analyses. The amounts of peroxyd in the two specimens correspond to 54·3 and 52·0 per. cent of metallic iron. A third variety of the ore was dark colored, and evidently manganesian, dissolving in hydrochloric acid with an evolution of chlorine. A portion of the silica was chemically combined, and separated from the acid solution in a gelatinous state. This ore yielded,

Peroxyd of Iron,	64·80
Sesqui-oxyd of Manganese,	5·50
Water and organic matter,	23·65
Silica,	4.80
Phosphoric Acid and loss	1·25
	100·00

Iron Ochre. In connection with the above ores, which are hydrated oxyds of iron, combined with various proportions of an organic acid derived from the decomposition of vegetable matter, the results of some observations upon the composition of an iron ochre are not without interest. Beds of this material which are found at Pointe-du-Lac, Ste.-Anne-de-Montmorency and many other places, have already been described in your Reports. The extensive deposits at the last named locality afforded me the specimen which I have examined. It is here constantly forming, and is the deposit of a ferruginous water, which issues in a great number of places over the surface of the bed. The water is at first colorless, transparent and ferruginous to the taste, but by exposure to the air, soon lets fall a reddish-yellow flocculent precipitate, and becomes tasteless. The bed which is several feet in thickness, is yellowish-brown upon the surface, becoming reddish or purplish-brown in those parts which are most exposed to the air and light. Below the surface, the color becomes greenish, and at the depth of a few feet, it is a dirty pale green, from the partial de-oxydation of the iron, which appears to have been reduced either by the organic matter which is intimately combined with the oxyd, or by the gases evolved from the decaying trees and roots, which are abundant in the deposit. When exposed to the air, the greenish ochre grows yellowish as it dries, and the iron finally becomes again peroxydized.

The specimen examined was reddish-yellow in color; it was dried at a temperature of about 212°. F., gently crushed and sifted. When closely pressed into a crucible, covered to exclude the air, and heated to redness, it evolves inflammable gases, and leaves a mixture of metallic iron and charcoal, which even when cold, takes fire spontaneously if exposed to the air, and is changed into the red oxyd. When ignited in an open vessel, and carefully stirred to promote oxydation, it lost in three experiments 36·10, 36·15 and 36·20 per cent of its weight. By solution in hydrochloric acid, a residue of 3·6 per cent of silicious sand is obtained, and by evaporating the solution to dryness, a portion of silica separated in a gelatinous state; the whole amount equalled 4·75 per cent. The solution contained only traces of phosphates, and gave of peroxyd of iron, previously thrown down from a solution in tartrate of ammonia, as sulphuret, 59·10 per cent. We have then for 100 parts:

Peroxyd of Iron,	59·10
Silica,	4·75
Volatile matters,	36·10
	99·95

In order to ascertain the nature and proportion of the organic matter combined with the iron oxyd, a portion of the ochre was boiled with half its weight of hydrate of potash, and two or three parts of water, for half an hour in a platinum vessel; a great part of the organic matter was thus rendered soluble. After washing out the dark reddish-brown liquid by water, the residue was boiled with a second portion of potash solution, but gave only a slight color to the liquid. To the mixed filtrates, acetic acid was added in slight excess; the color became paler, but no precipitate was formed. A solution of acetate of copper now gave a dark brown precipitate, which after twenty-four hours was collected on a weighed filter, and dried at 280° F.; it was regarded as apocrenate of copper, and the amount of it from 10 grammes was ·388, corresponding to ·221 grammes, or 2·21 per cent of apocrenic acid. The filtrate mixed with a slight excess of carbonate of ammonia, gave no immediate precipitate; only after twenty-four hours, a few white flakes of crenate of copper separated. From these ex-

periments it appears that the great proportion of organic matter exists in some state distinct from either crenic or apocrenic acid.

To a solution obtained by treating five grammes of the ochre with a solution of potash as above, acetic acid was added, and then a solution of neutral acetate of lead, which gave a copious dark brown precipitate, weighing when dried at 212° F., 1·463 grammes. To the clear slightly colored filtrate, containing an excess of acetate of lead, ammonia was added until the reaction was feebly alkaline, when an additional precipitate weighing ·078 separated, leaving the liquid colorless. The mixed precipitates weighing 1·571 grammes, gave by solution in nitric acid, and determination as sulphate, ·468 of oxyd of lead, leaving for the matters combined, ·808 grammes, or16·16 per cent of the weight of the ochre. In another trial, where only the precipitate from the acid filtrate was collected, the organic matter obtained in combination with the oxyd of lead, was 14·11 per cent.

In one experiment, a weighed portion of the ochre, dried at 212° F. was exhausted by digestion with its own weight of hydrate of potash and two or three parts of water, washed and again dried at the same temperature; it lost 20·47 per cent of its weight. In another experiment a calculation from the loss of the dried ochre by ignition, compared with that of the residue from the action of potash, gave 20·8 per cent for the soluble matter. As there is about 1·15 per cent of silica in a condition soluble in potash, we have, subtracting this amount from 20·63, (the mean of the last two determinations,) 19·48; and as this dissolved silica would be precipitated with the lead salt, its weight must also be deducted from 16·16, leaving 15·01 for the organic acids obtained in connection with the oxyd of lead. As the organic matter is wholly precipitated by the acetate of lead, the difference would appear to indicate that it exists in the ochre in a higher state of hydratation than in the lead compound, so that the portion dissolved out by a solution of potash, consists of 15·01 of organic acids as they exist in the dried lead salt, and 4·47 of water, equalling 19·48, and giving for the whole amount of water 21·14. We have then for the composition of 100 parts of the ochre:

Peroxyd of Iron,	59·10
Organic Acids,	15·01
Water, by difference,	21·14
Soluble Silica,	1·15
Sand,	3·60
	100·00

For a farther determination of the nature of the organic acids, it will be necessary to submit the ochre and the lead precipitate to the ordinary process of organic analysis by combustion.

I have the honor to be,

Sir,

Your most obedient servant,

T. S. HUNT.