GEOLOGICAL SURVEY

OF

CANADA.

REPORT OF PROGRESS

FOR THE YEAR 1850–51.

Printed by order of the Legislative Assembly.

QUEBEC:
PRINTED BY JOHN LOVELL, 12 MOUNTAIN STREET.
1852.

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GEOLOGICAL SURVEY OF CANADA.

MONTREAL, 20*th August*, 1851.

SIR,

I have the honor to request you will do me the favor to place before his Excellency the Governor General, the accompanying Report of the Progress made in the Geological Survey of the Province, during the year 1850-51.

I have the honor to be,

Sir,

Your most obedient servant,

W. E. LOGAN,

Provincial Geologist.

To the Hon. J. Leslie,

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, NEW BRUNSWICK, AND THE ISLAND OF PRINCE EDWARD,

AND VICE-ADMIRAL OF THE SAME.

MONTREAL, *20th August*, 1851.

MAY IT PLEASE YOUR EXCELLENCY:

My absence from the Colony, under special leave from your Excellency, for the purpose of enabling me to superintend the arrangement of the collection of Economic Minerals, forwarded from Canada to the Exhibition of the Industry of all Nations in London, has prevented me from reporting at the usual time the progress made in the Geological Survey of the Province during the year 1850-51.

In now reporting to your Excellency on the subject, I have to state, that the Provincial Act of 1845, making provision for the Survey, having expired in March, 1850, the time which unavoidably elapsed before it could be renewed, considerably curtailed the season available for field exploration. On the renewal of the Act, the attention of my assistant, Mr. Murray, was devoted to an examination of the Peninsula lying between Lakes Huron and Erie; and I have the honor to transmit to your Excellency his Report on the district. It is accompanied by the Report of Mr. Hunt, on the analyses of various rocks, mine

rals and mineral waters, which have been the subject of his examination in the Laboratory.

The favorable opportunity afforded by the Industrial Exhibition to spread a knowledge of the mineral resources of the Colony, in so far as they are yet known, induced me to consider it a duty to aid in procuring as efficient a collection of materials to illustrate them as circumstances would permit, and nearly the whole of my own time was devoted to this end. The localities which were visited in making the collection were mainly such as have been geologically described in previous Reports, and I have therefore little to state on the subject of exploration.

A part of the materials thus brought together, with contributions from other sources, was displayed at the preliminary Provincial Exhibition in Montreal in October last, and these with many additions, procured later in the season up to the commencement of winter, having been transmitted to London, now constitute one class of the native objects occupying the Canadian division of the Exhibition building, where they attract considerable attention. Until the publication of the Jury Reports of the Exhibition, in which will, no doubt, be found an impartial review of the comparative merits of the collection, it would be premature to place any statement of results before your Excellency. These, therefore, will be reserved for some future communication.

In the Report of Progress preceding this, mention is made of a partial examination of the gold-bearing drift of the Chaudière. This examination was last season continued, and the facts resulting from it constitute the only additional topic to which I have to invite your Excellency's attention. The auriferous district was found to spread over an area probably comprising between 3000 and 4000 square miles. It appears to occupy nearly the whole of that part of the Province which lies on the south-east side of the prolongation of the Green Mountains into Canada, and extends to the boundary between the Colony and the United States. Two general lines of exploration were followed, one of them up the Chaudière and Rivière du Loup from the seigniory of St. Mary to the Province Line, and the other from Lake Etchemin to Sherbrooke on the St.

Francis. The former, running transverse to the rock ranges, measured about forty-five miles, and the latter with them about ninety miles. The transverse line was more closely examined than the other, and traces of the precious metal were met with at moderate intervals throughout the whole distance. They were not confined to the channels of the main streams merely, but those of various tributaries furnished indications sometimes for a considerable distance up.

The lowest point in the valley of the Chaudière, at which the drift yielded traces of gold, was on a small stream, falling in on the left side of the river, not far within the south-eastern boundary of the seigniory of St. Mary. They were found to occur on four tributaries, in the seigniory of St. Joseph, for distances of one and two miles from their mouths. One of these joins the main stream, on the left bank, about a quarter of a mile below the parish church, and the other three are on the right. The lowest of them is about two miles below the church, the next about the same distance above it, and the fourth is the Rivière des Plantes, about half a mile farther up and near the south-eastern boundary of the seigniory. In Vaudreuil Beauce they were discovered on the Guillaume, much farther up than previously stated, and on the Bras opposite to it; on this and some of its tributaries the metal was traced to the centre of the township of Tring, a distance of about twelve miles. Three other streams which yield it in Vaudreuil Beauce, have heretofore been mentioned; they are the Ruisseau Lessard, Ruisseau du Moulin and the Touffe des Pins, on which it was first discovered. In Aubert d'Isle it was found on the Famine and traced to Harbottles Settlement, and beyond the seigniory into Waterford, a distance altogether of about ten miles. Some particles were obtained on the Ruisseau d'Ardoise, about a mile above the Famine, and it was followed about three miles up the brook commonly called Pozer's Stream, in Aubert Gallion. On the Rivière du Loup, in addition to its occurrence in a multitude of spots, in fact almost continuously from its mouth across Jersey and Marlow, it was found in nearly all its tributary brooks, such as the Ladyfair, the Grande Coude, the Metgermet for four miles up, the Travellers Rest, the Portage, Kempt's Stream, Oliver's Stream for four miles up, and

another stream between it and the boundary of the Province. Above the Loup, on the Chaudière, it occurred at successive intervals in twenty places in sixteen miles, as far as the south-western boundary of Dorset Township.

The localities of its observed presence on the other line of exploration were on Lake Etchemin and along the Famine in Aubert d'Isle, and Pozer's Stream in Aubert Gallion, towards Tring, and again on the St. Francis, in Dudswell, in Westbury, and near the joint corners of Westbury, Stoke, Eaton and Ascott, as well as in this last township near Sherbrooke.

It is not supposed that the limits of the auriferous district have been ascertained, but that it very probably extends much farther to the north-east, and attains the valley of the river St. John, while to the south-west it is known to reach Vermont, and to be traceable at intervals through the United States, even, it is said, as far as Mexico. In its breadth, however, it does not appear to cross the range of mountains with which it runs parallel, and no traces of it have been met with on their north-western flank. The deposit in which the gold occurs is part of an ancient drift, probably marine, and supposed to be of higher antiquity than that which, from the extent to which it occupies the valley of the St. Lawrence and some of its tributaries, Mr. Désor, who has recently bestowed much attention on the detrital deposits of North America, is disposed to give the name of Lawrencian. In this, alluded to in various Reports as tertiary and post-tertiary, the remains of whales, seals, and two species of fish, the capeling and the lump-sucker, and many marine shells of those species still inhabiting the Gulf of St. Lawrence, are found. These shells on the Mountain of Montreal attain a height of about 470 feet above tide level in Lake St. Peter, which is the greatest altitude known to me; none of the remains have yet been found in the Canadian gold drift, and as this appears in its lowest undisturbed parts to be at a height of about 500 feet above the sea, it is probable what is now exposed of it, had emerged from the ocean before the Lawrencian drift was placed, while in lower levels it would be covered up by it.

In the localities in which the gold occurs, the coarser materials of the drift are made up in a large degree of the debris of

rocks similar to the clay slates and interstratified grey sandstones, on which it rests, but these are accompanied by fragments and pebbles of fine conglomerate, talcose slate, and serpentine, which with magnetic, specular, chromic, and titaniferous iron (none of them absent when the gold is present) are derived from the mountain range, bounding it on the north-west; pebbles and fragments of white quartz are abundant, which may be derived from veins of the mineral prevailing in the mountain range or from others on the south-east of it. With these materials there occasionally occur in the valley of the Chaudière and its tributaries, large boulders of limestone conglomerate, similar to the beds of St. Giles and St. Mary, and more rarely boulders of gneiss identical in character with known kinds of the rock on the north side of the St. Lawrence. Not only is the gold absent from the drift on the north-west flank of the mountain range, but so also are the chromic iron and the serpentine, notwithstanding that the two have been traced in association 135 miles, constituting a marked band accompanying the range from Potton to Cranbourne. On the north-west flank, however, boulders of northern gneiss are frequent, and a few of limestone have been met with even pretty high up on the hills, showing by their fossils their derivation from the Trenton limestone, the nearest exposures of which are on the north side of the St. Lawrence. In fact, in respect to the drift of the whole country, it may be said, that on southern formations are found resting the ruins of northern, but no northern rocks are met with overlaid to any extent by debris, derivable exclusively from southern. The auriferous drift shows no exception to this, and there is little doubt that causes connected with northern currents, when the rocks were beneath the surface of an ocean, have placed the whole. Ever since the surface, however, has risen from beneath this ocean, causes similar to those now in operation in the district have been working in a contrary course. The rivers of the district emptying into the St. Lawrence, flow north. In so far, therefore, as their forces modify the distribution of the drift, the materials of which it is composed are carried in that direction. This, no doubt, has some effect on the finer and lighter materials, and occasionally with the assistance of ice and great fresh-

ets, on some of the coarser and heavier, but the streams washing away the former in larger proportions than the latter, concentrate these in the valleys and channels. The gold being the heaviest substance is moved the least. It may occasionally be pushed along the bottom when this is smooth, but it seeks every hole and crevice in its course, and when it has once obtained shelter there, it remains protected. Where the edges of the slates come to the surface, the plates have all been moved by superficial forces, and they therefore lie more or less loosely on one another, and the fine particles of gold gradually work themselves down between them, reaching sometimes so deep as three feet.

Although it is probable the whole of the drift on the south-east of the mountain range, both that in high and that in low places, may be auriferous, it appears certain that the metal will be most concentrated in the valleys and the channels of streams, and the larger the stream, the more frequently it has broken down its banks, the oftener and more extensively it has changed its course, the more important the auriferous deposit is likely to be, and it is probably only in some such situations, if any where, that it will be worked to advantage. From the combination of the materials associated with the gold in the drift, there appears a strong probability that the metal is derived from quartz veins situated in the mountain range, through the agency of some southward-moving causes; and even if traces were found north of this range in the channels of the main streams, such as the Chaudière and the St. Francis, the circumstance would not militate against the supposition, as traces in such positions may be expected from the fluviatile remodification of the drift; but with the exception of one vein in talcose slate near Sherbrooke, no auriferous quartz veins have yet been discovered, and in this one there was merely a trace of the metal, so that the facts of this gold district as yet offer no contradiction to Sir Roderick I. Murchison's theory, 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, and that this part having been subsequently worn down by various destructive causes, the productive portion of the veins has been wholly or in a great degree removed, leaving

only their more quartzose continuation behind in situ, while the gold, the vein stone and the rock enclosing it have been carried away to form the drift. In this way it is his opinion that the drift will always be more productive than the veins; but whether this is to be borne out by the facts of California and Australia remains yet to be proved.

The object of this examination has not been so much to ascertain quantity as distribution, but an effective experiment being now in operation on the Rivière du Loup, under a letter of license from the Government, one condition of the lease being that a correct return shall be made of the quantity obtained, I am in hopes by the end of the present season to have a few such facts as will afford some criterion to determine whether there is reasonable ground for supposing the deposit in that vicinity can be worked advantageously.

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, 16*th December*, 1850.

SIR,—Agreeably to the instructions received from you in the beginning of August, after the renewal of the Act making provision for the Geological Survey of the Province, I proceeded without delay to continue the examination of the western portion of the Province, comprising the great Peninsula, bounded by Lakes Huron, St. Clair and Erie, for the purpose of more accurately determining the boundaries of the several formations, by which the country is underlaid, in their geographical distribution in the interior, and ascertaining the economic materials the various deposits might yield.

Repairing to Hamilton, and proceeding thence to Dundas, several days were occupied in making preparations for an exploration of the outcrop of the Niagara limestone group in the direction of Owen Sound, up to which place the same rocks had been followed from the opposite direction in the year 1848. In determining this as a base line for farther operations, little difficulty was experienced, a bold and sharp escarpment of the lower part of the formation running throughout the whole distance, which may be about 120 miles; but the higher rocks, which occupy the country west from the ridge formed by the previous group, are by no means so easily traced, being for the most part concealed by a thick deposit of drift, and only occasionally appearing in the channels of rivers and brooks, or on the shores of lakes, and at great distances apart.

For information regarding the route to be travelled through the northern townships, offering the greatest facility for the observation of the Niagara group, I am greatly indebted to the Rev. Andrew Bell, who has devoted much attention to the geological structure of this part of Canada, and to the collecting of fossils to illustrate it; and for a series of levels taken on the Survey of the Owen Sound Road, and other levels ascertained in the neighbourhood of Dundas, I take this opportunity of acknowledging my obligation to Robert Wells, Esq., C. E. In an expedition down the Saugeen, I was indebted to Mr. Jackson of Durham, on the Owen Sound Road, Crown Land Agent, for conducting me to the encampment of Mr. Brough's survey, at that time going on; and I have to acknowledge myself particularly obliged to Mr. Brough for kindly supplying me with a guide and assistant, while examining the district in which he was engaged.

As an agricultural country the whole of the Western Peninsula may be said to equal, if not surpass, in its capabilities of soil and climate, any other part of the British North American Provinces, as the rapidity with which it has been settled, the annual increase of its products and the growth of its numerous towns and villages, abundantly testify; and it may not perhaps be deemed out of place to remark here, that the exceeding fertility of portions still wild and unsettled, as shown by the size and kinds of their spontaneous growth of timber in the townships of Collingwood, Euphrasia, Artemisia, St. Vincent, Sydenham and others, destines them to become within a short time of great agricultural importance, a result which will be greatly facilitated by means of the road newly opened, connecting Toronto and Owen Sound.

Distribution of the rock formations.

The rock formations of the Western Peninsula, in ascending order, are as follows:—

Niagara group, including the Clinton rocks and the Grey band.
Gypsiferous strata and limestones.
Corniferous limestones.
Hamilton shales.

Niagara group.—A beautiful exhibition of this formation is displayed on the Sydenham Road, on the seventeenth and eighteenth lots of the first concession of Flamboro' West, near Dundas, where the following ascending section of the strata was carefully measured, previous to setting out to trace the boundary northward.

Section I.

	ft.	in.		
1. Whitish and grey sandstone with ferruginous spots, being part of the grey band	3	0		
2. Thin arenaceous beds, which weather yellowish, divided by blue or grey shales in thin partings	0	11		
3. Compact calcareous sandstone in two beds, with a thin pyritiferous parting; small nodules of iron pyrites, fucoids and other fossils, weather out on exposed surfaces.	1	9		
4. Bands of arenaceous dark grey or bluish limestone, sometimes slightly pink, and weathering to a pale red, with partings of dark grey or blue, and sometimes black or buff colored argillaceous and arenaceous shales, containing corals, shells, tentaculites and trilobites	7	0		
5. Bluish-grey argillaceous shales, with thin bands of impure calcareous rock with fossils (corals, shells, tentaculites, encrinites and trilobites,) and patches of greenish shale, the lower bands granular and marked with small green spots	8	0		
6. Buff colored shales with thin calcareous bands, with corals, bivalve shells and tentaculites	12	0		
			32	8
This is up to the top of the quarry on the seventeenth lot, and the following is in continuation from the last mentioned bed, where exposed on the travelled road on the eighteenth lot:—				
7. Concealed by debris	7	4		
8. Bluish-grey argillaceous and calcareous shale, with indurated argillaceous bands	11	0		
9. Green and grey argillaceous, calcareous, and arenaceous shale, with hard arenaceous and calcareous bands towards the top	10	8		
10. Thin hard red calcareous and arenaceous bands	1	0		
11. Green argillaceous and arenaceous shale	2	0		
12. Red marly shale	4	0		
13. Red calcareo-arenaceous rock, holding various fossils, mostly small corals and fucoids. This probably represents the iron ore bed of Rochester	7	0		

	ft.	in.
14. Red calcareo-arenaceous rock, of the same character as before, becoming brownish-red at the top, with partings of red marly shale holding numerous fossils, corals, bivalve shells and tentaculites	1	8
15. Red argillaceous shale with green stripes and patches, and three bands of red and green limestone	5	0
16. Pale green argillaceous shale, with three bands of limestone	5	0
17. Greenish calcareous, argillaceous and slightly arenaceous shale, with thin divisions of a greener shale	1	3
18. Pale green or bluish calcareous sandstone, with nodules of iron pyrites, ferruginous stains and stripes, and obscure fucoids, corals and shells	1	9
19. Bands of calcareous sandstone with partings of green or bluish argillaceous shale stained with iron, and holding nodules of pyrites ; encrinites, corals and broken shells prevail in great abundance at the top	3	10
20. Green or bluish argillaceous shale	1	3
21. Grey limestone with *Pentamerus* in abundance and a few other fossils ; joints and crevices are incrusted with orange-red calc-spar	1	0
22. Thin bedded blue limestone, with thin partings of bluish-grey shale, beautifully arranged in very regular beds from 16 to 18 inches thick ; the stone is used for building purposes	7	0
23. A massive bed of blue limestone used for building purposes, and known by masons and quarry-men as the *five feet band*	5	6
24. Bluish-grey, sometimes nearly black, argillaceous, arenaceous, and calcareous slaty rock, hard and solid in the bed, but decomposing and crumbling when exposed to the atmosphere	5	0
25. Massive solid beds of bluish-grey limestone, with great numbers of encrinites, the beds parted by very thin layers of buff colored argillaceous shale	19	3
26. Dark bluish-grey argillaceous shale ; this is a well marked band, traceable for a long distance	1	0
27. Blue and grey limestone, with bands of chert and disseminated chert nodules	20	0
	121	6

Resting on this cherty band in the channel of a small brook, on the property of Mr. Logie, seventeenth lot of the second concession of Flamboro' West, the ascending section continues as follows :—

28.	Dark brownish colored beds of bituminous and slightly silicious limestone, with obscure fossils, and small crystals and specks of galena	10	0	
29.	Dark grey bituminous limestone, in rough irregular beds.	5	0	
30.	Concealed by debris	5	0	
31.	Thin regular beds of black bituminous limestone	2	0	
32.	Black bituminous shale	1	0	
33.	Dark brown and blackish, very bituminous rock of a calcareous character, in thin beds with rough irregular surfaces	2	0	
34.	Dark brown and blackish bituminous, calcareous rock as before, with divisions of black shale, holding crystals of galena with *Leptena* and other fossils	5	0	
35.	Black slaty shale, with *Conularia*	2	0	
36.	Dark grey and blackish, very bituminous limestone, with black shale at the top; fossils abound, chiefly *Strophomena*	3	0	
37.	Compact dark brown and blackish bituminous limestone	2	0	
38.	Black bituminous shaly limestone	1	0	
39.	Concealed by debris	2	0	
40.	Black bituminous and partially silicious limestone beds with obscure fossils	5	0	
41.	Black bituminous silicious limestone as before	3	0	
42.	Slaty limestone, splitting into thin regular and even plates	2	0	
43.	Slaty limestone as before, with hard bands of 6 inches thick interstratified	2	6	
44.	Dark brown and blackish bituminous and arenaceous shale, with trilobite tails	0	6	
45.	Brownish, bituminous limestone beds, with partings and thin bands of dark brown bituminous shale	15	0	
				68 0
	Total thickness			222 2

The top of the grey band at the commencement of this section was found to be 204 feet above the level of the Desjardin Canal; and at Spenser's Mills, on the fourteenth lot of the first concession of the township, the bed measures about ten feet in thickness, and is there seen to rest upon the red marl of the Medina group.

A vertical section is likewise exhibited at the falls on Spencer Creek, in the twelfth lot of the second concession of the township, where an eye-sketch of its members in descending order was made as follows :—

Section II.

Bituminous limestones and shales (45 to 28 of Section I).....	55	0
Cherty limestones, (27).....	15	0
Thick bedded blue and grey limestones, (26 and 25).....	25	0
Argillaceous and arenaceous shales, (24).....	6	0
Massive limestones from the top of the five-feet band to the foot of the falls (23 and 22).....	12	0
	113	0

The rocks of these sections frequently form two separate and distinct terraces, the lower and more decidedly marked escarpment exposing more or less of the strata below the cherty limestone bands, which cap the precipices at Flamboro' West, and on the opposite side of the valley of the Desjardin, near Hamilton; while the upper escarpment, composed of the bituminous limestones and shales, rises more gradually in a succession of steps, terminating at the summit in a vast extent of table land.

The lower terrace was followed from Flamboro' West, in an easterly direction, through Flamboro' East into Nelson, in which township it takes a sweeping turn to the north, and thence maintaining a very straight course nearly due north, it passes through the south-east corner of Nassagaweya, the centre of Esquesing, the north-west corner of Chinguacousey, and reaches Caledon; here it shews a deep sinus to the westward, on the Credit, and sweeps round to the north-west corner of Albion, which it intersects, curving thence through the south-west corner of Ajala; from this it runs westward to the Nottawa, in Mono, and making a deep bay, occupied by the valley of the river, it again turns north, and passing up the middle of the township, on the third concession, it reaches Mulmer, makes another bay, which touches the town line of Melancthon, and runs up to Nottawasaga, crossing the town line on the Hurontario Road; running a little to the west of north in this township, it veers to the westward, and intersects the north-east corner of Osprey,

proceeding thence across the south-west corner of Collingwood, and reaching the Beaver River in Euphrasia. On this river it makes a deep, narrow, southerly sinus into Artemisia, and returns northward to St. Vincent, in which it holds a north-westerly course, and forming a conspicuous promontory on the town line between this and Sydenham, it turns westerly, and strikes the Owen Sound Road, about a mile and a quarter from the lake shore, near the village of Sydenham.

The sandstone or grey band was seen at intervals all the way from Flamboro' West to the township of Mono, varying in thickness from ten to twenty feet, but preserving a pretty uniform lithological character; and indications of its presence were observed in the township of Nottawasaga, while examining that part in 1843. It has not, however, come under my observation in any of the townships west of Nottawasaga, nor is its presence indicated by angular fragments as in that township. This sandstone, wherever it has been observed, is a whitish or pale grey, fine, granular rock, sometimes striped and spotted with ferruginous stains; it is always well adapted for building purposes, and, in many instances, is a very beautiful and easily worked material. It has long been exstensively quarried near Hamilton and at Waterdown, in the township of Flamboro' East, and is equally capable of being worked nearly all the way along its outcrop, to the township of Mono. In many places it is likewise of excellent quality for grindstones, for the manufacture of which it is used throughout the country in which it is known, and its applications thus render it a rock of considerable economic importance in its district.

The massive beds of encrinal limestone, which have been shown in Section, I. (25) to pass below the cherty band (27) hold the crest of the lower escarpment, north from Flamboro' East, and appear to attain a gradual increase in thickness, advancing to the northward. At Mr. McNaughton's farm, on the seventh lot of the seventh concession of Nassagaweya, there is a vertical precipice of limestone, varying from eighty to a hundred feet in height; and near Mr. Strange's mill, on the fourth lot of the fourth concession of Eramosa, a branch of the River Speed runs between vertical and solid calcareous cliffs of sixty to eighty feet, where divisional planes of stratification appear to be absent;

the Credit in Caledon is flanked by similar cliffs in many places, fully a hundred feet in height, which, ascending the valley, meet and form a crescent shaped precipice, over which the river is precipitated in a cascade; and in the valley of the Nottawa, in Mono, the same character prevails; similar cliffs were observed in the townships of Mulmer and Nottawasaga, and are mentioned in the Report of 1843; and in the valley of the Beaver River, in Euphrasia and Artemisia, the same limestone is at least 120 feet thick. These solid cliffs of limestone, however, probably contain all the strata between the pentamerus band and the top of the encrinal limestone (21 to 25 of Sec. 1) of Flamboro' West, and this band, holding abundance of its characteristic fossil, was observed at the foot of the cliff, on the thirteenth lot of the first concession north of what is called the Centre Road in the township of Sydenham, and traced for a considerable distance, while angular fragments, holding the fossil, were seen in several other places in nearly the same position as regards the escarpment.

Huge caverns are of frequent occurrence at the base of this limestone, among the most extensive of which that were visited, was one on the twelfth lot of the second concession, east of the Hurontario Road, in Mono, on a branch of the Nottawasaga River, and another near Mr. Strange's mill, already mentioned as in the fourth lot of the fourth concession of Eramosa, on a branch of the Speed. The latter cavern extends under the cliff for between thirty and forty yards, and is about the same in width at the mouth; the roof, which is about five or six feet high at the entrance, slopes towards the floor inwards, and at the termination of the distance specified, the space between is insufficient to permit a man's body to pass, so that the extent of the cavern beyond is unknown; the roof and floor are studded with small stalactitic incrustations.

The shales and thin bedded limestones (18 to 2 of Sec. 1,) which intervene between these limestones and the grey band, are generally concealed from view by a talus of debris, while the sandstone crops out from below, and forms a low terrace of its own.

The encrinal limestones are every where qualified to make a durable and handsome building stone, and in some parts, when

sufficiently removed from atmospheric influences, might be used as a marble for common ornamental purposes. Most of its beds are likewise of good quality for burning into lime.

The cherty strata which rest on the encrinal limestone in the Section (27) were not seen in contact with them to the north of Flamboro', any where along the outcrop of the latter, but they occur in this relation, where the strata are exposed on the banks of the north-east branch of the Speed, near Strange's mills in Eramosa. The chert in this place is much less abundant in quantity, however, than in the cliff of Flamboro' West, and the escarpment near Hamilton.

The bituminous limestones and shales which constitute the upper terrace, occupy a breadth of country, varying from eighteen to twenty or twenty-two miles. The upper beds were seen in the channel of the River Speed, at the bridge on the Brock Road, and other places in the immediate neighbourhood of the town of Guelph, and sections of the group were observed at several places between Guelph and Strange's mills, in Eramosa. The valley of the Eramosa branch of the Speed, below the town line of Puslinch, is bounded on either side by vertical cliffs of this part of the formation; they are from twenty to thirty feet high, and expose the following ascending section:—

	ft.	in.
Strongly bituminous black limestone without observed fossils,	12	0
Brown, very bituminous limestone,	7	0
Pale brown, very bituminous limestone to the top of the escarpment,	7	0
	26	0

Near McFarlane's tavern, in the second lot of the third concession of Guelph, on the Eramosa Road, there is another section, which is as follows in ascending order:—

	ft.	in.
Very dark brown, strongly bituminous limestone, in beds of about one foot each,	4	0
Dark brown bituminous limestone, brittle, hard and compact, in several beds,	2	0
Dark brown bituminous and slightly granular limestone,	2	6
Brown, very bituminous granular limestone,	4	0
Pale buff or whitish colored, slightly bituminous limestone with corals,	3	0
	15	6

A short distance from the place where this last section was measured, there occurred about six feet of black shale and thin bedded limestone, which probably pass below.

The upper beds of the bituminous part of the formation were struck on the Grand River, near the town line, between Garrafraxa and Nichol, and portions of the same rocks are exposed in the bed of that river, from that point to the highest part of it that was reached, which, according to the measurement made, was to the eighth concession of Luther, near the town line between it and Amaranth. These rocks are no where so bituminous on the Grand River as they are farther to the south, nor are the black shales observed on that river at all. The following ascending section was measured in a cliff on the fifteenth lot, between the eleventh and twelfth concessions of Garrafraxa, on the river bank :—

	ft.	in.
Compact buff colored limestone composing the bed of the river,	0	0
Drab-grey limestone, with fretted cellular surfaces, and cavities showing obscure impressions of shells,	0	2
Drab-grey limestone, stained and striped with oxide of iron,	0	3
Drab-grey limestone, slightly arenaceous,	0	3
Shale,	3	0
Pale grey, hard, compact, slightly bituminous limestone, with cavities supposed to have held fossils,	3	0
Very hard, whitish-grey limestone, slightly silicious, with obscure organic remains,	4	0
Drab and grey limestone, a few thin beds at the bottom,	2	6
Grey limestone, with obscure organic remains,	1	0
Bluish-grey, hard, compact limestone, with cavities and crystals of calc-spar,	2	0
Bluish-grey, hard, compact limestone, in irregular, rough surfaced beds to the top of the cliff,	4	0
	20	2

The upper part of the bituminous limestone crosses the Owen Sound Road, about six or seven miles from the village of Sydenham.

With the exception of building stone and limestone for the kiln, there is little of economic importance associated with this part of the formation, but good material for either of those purposes can be found in abundance, and stone from its beds is

used for such, wherever exposures of the rock approach a settled part.

Rumours are current through the country of the existence of lead ores, which, from the position usually indicated, would appear to belong to these rocks; but as there is in no instance, that has come under my observation, any evidence of the existence of mineral veins, or of disturbances in the strata to lead to the expectation of them, the probability is greatly against the discovery of the mineral in such quantity as to justify mining operations. That isolated crystals of galena are not unfrequently found in the rock, sometimes in considerable abundance, and that fossil shells are occasionally replaced by that mineral, is beyond doubt; mention was made of such instances in the Report of 1843, but it does not on that account by any means follow, that the quantity in any one place is sufficient to render its extraction profitable. While at Guelph, I was informed that lead had been found in large quantity at Mr. Strange's mill in Eramosa; upon enquiry of Mr. Strange himself, however, the report proved to be a gross exaggeration, founded upon the fact, that while quarrying out some rock for the construction of his mill buildings, he had struck a bed of limestone, about six or seven inches in thickness, in which there was an aggregation of crystals of galena, forming a sinuous string of fifteen or twenty feet in length, branching into a few similar smaller strings. This portion of the bed in question had been totally removed previous to the time of my visit, but the face of the bed below was distinctly exposed, without any appearance of a mineral *vein* of any kind, but still containing isolated crystals of galena; from all of which it may be inferred, that the aggregation of crystals was confined to one small bed, and the whole amount of lead, on removal, appears to have been insignificantly small. At this place, however, the rocks were observed to undulate slightly, showing a dip at one spot of rather over ten degrees to the south-west, and of about the same amount to the north-west and north at others, but the movements which have occasioned this variation from the usual nearly horizontal position, have probably been too slight to occasion any great amount of dislocation.

Gypsiferous group.—Succeeding the previously mentioned

deposits, are a set of limestones, which, in a former Report, were classed with the Niagara rocks, but have since been found by Mr. Hall, of New York, to contain certain fossils peculiar to the Onondaga salt group, and probably ought, in consequence, to be associated with the gypsiferous formation, of which they form the base. An undoubted difference exists in mineral as well as fossil character, between them and the beds upon which they repose ; they are usually of a pale yellowish or buff color, free from any bituminous substances, and some of the beds are granular. These limestones are extensively developed on the banks of the Grand River from about a mile above Middleton Bridge, which crosses on the twenty-first or twenty-second lot of the sixth concession of Dumfries, where they dip at a gentle angle about south-west, up to the junction of the Speed, above Preston, and they continue exposed up the Speed for a short distance. They again come out at Guelph, where they are displayed on the banks of the Speed, near the divisional line between the fourth and fifth concessions, and at several places in the immediate vicinity of the town. The same rocks appear next on the Grand River, about two miles below the junction of the Irvine, and continue exposed in bold vertical cliffs on each side of the river, nearly up to the town line between Garrafraxa and Nichol, where they come in contact with the lower formation. They are likewise exhibited on the banks of the Rocky Saugeen, on the twelfth lot of the third concession of Bentick, and up the stream as far as about one mile east of the Owen Sound Road. Finally, an outcrop was observed on the Owen Sound Road, on or about the fourth lot of the first concession of Sullivan. From the latter point they probably run in a north-west direction to the Rivière au Sable (north) and Chief's Point on Lake Huron, but that portion of their course has not yet been examined.

The remarkable bivalve shell so characteristic of these beds, to which my attention was drawn by the Rev. Mr. Bell, who had collected many specimens of it previous to my first visit to Galt, and to which Hall has since given the name of *Megalamus Canadensis*, was observed at all the places above enumerated, in some instances in immense numbers, and in a tolerable state of preservation, while in others it was scarce and obscure-

ly recognizable, but in almost all instances it exhibited only inside casts. This shell appears to belong exclusively to the upper portion of the limestones, none having been observed in any of the lower beds. It was seen in greatest abundance at Galt and at Elora, on the Grand River, associated with numerous other organic remains, chiefly corals and spiral univalves; two among the latter are considered recognizable, as *Loxonema Boydii* and *Euomphalus sulcatus*, figured by Hall as characteristic fossils of the Onondaga salt group; both of them are met with in all the beds of this part of the formation in Canada, and are very numerous in most. From the obscure condition in which the *Megalamus Canadensis* frequently occurs, it is not improbable that while examining the coast of Lake Huron, between Cape Hurd and the Rivière au Sable (north,) this fossil may have been overlooked, and the resemblance in mineral character between the rocks now known to contain it, and the limestones that exist on that part of the coast, rather favors the supposition, that farther examination may determine some points to belong to this group; in the meantime, however, farther evidence is requisite before a decided opinion can be given.

On the banks of the Irvine and Grand River, near their junction below Elora, perpendicular cliffs of these limestones occur, varying in height from seventy-five to eighty or eighty-two feet in the following ascending order:

	ft.	in.
Pale grey or drab colored massive beds of limestone, with fossils, among which are numerous univalves resembling *Loxonema Boydii* and *Euomphalus sulcatus*,.....	56	0
Buff colored coral limestone, with a stratum of about three feet, near the middle filled with *Megalamus Canadensis*,.....	14	0
Thin beds of compact drab colored limestone, with small cavities and cracks lined with calc-spar,.....	12	0
	82	0

In the former Report, the shales and limestones with which the workable gypsum is found associated, were described as occurring on the banks of the Grand River, nearly all the way from Dunnville, in the township of Moulton, to some distance above Paris, in the township of Dumfries. They cross the River below Middleton Bridge, and then disappear below a vast

thickness of drift, composed of clay, gravel and sand, and they have nowhere been seen in place in any of the townships passed through northward, between that place and the Saugeen River, in the townships of Brant and Carrick.

The following ascending section was measured on the banks of the Saugeen, on the thirtieth lot of the first concession, south of the Durham Road in the township of Brant:—

	ft.	in.
Thin-bedded, greenish colored limestone, slightly bituminous,...	2	0
Concealed, but holding a large accumulation of debris, chiefly fragments of red and green shale, and drab colored limestone, some of which was supposed to be water-lime,.....	25	0
Green shale with small quantities of red shale intermixed, holding one strong band of drab colored limestone about one foot in thickness,.....	25	0
Drab colored limestone and shale, alternating in thin, close bands, some of the limestone holding small lenticular crystals of calc-spar,.....	25	0
	77	0

At the summit of the bank was found a small slab of dark buff colored arenaceous limestone, showing numerous casts of a small bivalve shell, resembling casts found at the top of the formation near Haldimand, and suggesting a comparison with *Cytherina alta* of Conrad.

In the bed of the Saugeen, on the second lot of the seventh concession of Mr. Brough's recent survey of Brant, near the commencement of a great bend, called by the surveyors the Ox Bow, there are beds of pale drab colored bituminous limestone, holding small lenticular cavities, frequently before remarked as common in the limestone rocks of the gypsiferous formation. These are overlaid by a bed of black bituminous shale, which is surmounted by buff colored very bituminous limestone, varying in the thickness of the beds from three inches to nearly two feet. Small lenticular crystals of calc-spar occur in these beds, and the cracks and divisional planes are marked by a thin coating of black bituminous matter.

No gypsum was observed in the localities of any of the above sections, nor were there rumours of its having been found in any part of the country along the line of strike between the

Grand River, near Paris, and Lake Huron; nevertheless the character of the country, in many parts, is such as may be supposed to indicate its presence. Sharp conical hills and mounds, and large circular sinks or depressions, such as have been described in a former Report, as of frequent occurrence in the gypsiferous country, were observed between Bridgeport and Berlin, in the township of Waterloo, and in several parts along the course of the Saugeen; and it is extremely probable that as improvement advances, and the hills are cut into where roads happen to intersect them, this useful mineral will eventually be found in many places.

Most of the beds of fossiliferous limestone, at the base of this formation, are well adapted for building and lime-burning, and are largely quarried for both purposes at Galt, Guelph, Elora and Fergus. At Guelph one strong band, of three feet or upwards in thickness, being of a finer grain and less fossiliferous than the others, may be wrought into an exceedingly handsome material for facing buildings, and is capable of being dressed to a very smooth surface.

Beds of hydraulic lime are occasionally found associated with the shales and limestones of the upper part of the group; such beds were found at Point Douglas, on Lake Huron, in the previous year, and they are well known on the Grand River below Paris. Rock of apparently similar quality was observed among the shales of the Saugeen; but unfortunately the specimens collected at the latter place, which were to have been forwarded through the kindness of Mr. Jackson, have not arrived, and no opportunity of testing their quality, therefore, has yet offered. A bed of excellent water-lime, belonging to the formation, was found on the fourteenth lot of the second concession of Brantford, the property of Lieut. Col. Burrows, on the left bank of the Grand River, a sample of which was tested by Mr. Hunt; being burnt and pulverised, it set under water in the course of five minutes.

Corniferous limestone—Limestone holding fossils characteristic of the corniferous formation, was observed in two places near the Saugeen, both within a short distance of the town-line dividing Brant from Greenock. One of the localities was on the sixth lot of the first concession, south of the Durham Road

in Brant, the property of Mr. Johnson, where a well having been sunk by the proprietor, through eight or ten feet of soil and drift, a buff colored bituminous limestone was met with, highly charged with fossils, among which *Atrypa affinis* and other bivalve shells, several univalves, a trilobite and various corals occurred. The other locality was on the second lot on the line between the sixth and seventh concessions of the same township, in the bed of a small brook, which flows down the high bank of the Saugeen near the Ox Bow. Drab colored, thin bedded limestones were here met with, without fossils, and in mineral character resembling the upper portion of the Gypsiferous group, and they were overlaid by grey calcareous rocks, holding chert, and containing obscure fossils, chiefly corals.

A section of about twelve feet of the Corniferous limestone formation is displayed on the banks of the north branch of the Thames, at the village of St. Mary, between the seventeenth and eighteenth concessions of Blanchard. The rock is exposed for about a mile and a-half above, and about the same distance below the bridge, which crosses the river at St. Mary; its color is brownish-grey, occasionally weathering to a green tinge; it is very bituminous, and holds numerous fossils, principally a small species of *Leptena*, a shell resembling *Atrypa concentrica*, figured by Hall, and encrinites in smaller numbers.

Portions of the same formation have already been represented as occurring on the south branch of the Thames, near Woodstock, in the county of Oxford; but south from that place no exposures of any kind of rock have been met with or heard of in place, at any point nearer than Port Dover, on Lake Erie. From Port Dover the exposures occur at intervals along the coast, easterly to the termination of the lake at Fort Erie, and are usually very fossiliferous; among numerous other forms *Pterinea? cardiformis*, *Strophomena undulata* and *Hipparionyx* (*Atrypa*) *consimilaris* of Hall, are considered recognisable.

The rock exposures in the western part of the Peninsula are remarkably few, and only one of any importance, belonging to the formation, came under my notice during the time I was engaged in examining that part of the country. This was on

the Sydenham River, on the twenty-eighth lot of the fourth concession of Zone, according to the old survey, but in the Township of Euphemia by the new, at Smith's mills, where there are about four beds exhibited in the channel of the river, each from sixteen to eighteen inches in thickness; the rock here is a blue limestone, very fossiliferous, the prevailing species being a *Spirifer*, of which some portions of the rock appear to be almost entirely composed. The dip of the beds here is nearly north-west at a very small rate of inclination, probably about forty or forty-five feet in a mile, and they pass below the black shales of the Hamilton group, which crop out on the next southerly reach of the Sydenham, above the Zone Mills.

Limestone, I was informed by Mr. Parr, appears likewise on the twelfth lot of the first concession, east of the communication road near Blenheim, in the township of Harwich, and on the twentieth or twenty-first lot of the eighth concession of Raleigh, but the information was not obtained, unfortunately, until I had passed through that part of the country.

Hamilton shales.—A portion of this formation was observed in the bed of the River Sydenham, at the Zone Mills, on the town-line between Zone and Dawn, and at intervals on the same stream for between four and five miles above that point, in a reach running nearly on the town-line for about that distance. The rock in this locality is a black, very bituminous, brittle shale, holding numerous nodules and crystals of iron pyrites, but no species of organic remains could be discovered in it. I was informed, however, that a form (which, judging from the description given, was probably a trilobite) was occasionally found, while the rock was being quarried for the purpose of underpinning some of the buildings then in the course of their construction.

The formation was not seen in place in any other part visited during the season: neither did I hear of any other locality in which it is known, but the bituminous springs, which probably owe their origin to it, and are known to exist on the line of strike, in the townships of Enniskillen, Zone and Mosa, may be fairly supposed as indications of its presence beneath, in which case it would appear probable that a belt of the for-

mation stretches across the point of the Peninsula and extends from Kettle Point and the Rivière au Sable (south) to the Rondeau, and may possibly skirt the coast of Lake Erie for some distance down.

The rock found at Zone Mills has occasionally been applied in a rude manner for building the foundations of wooden houses, but the nature of the material is by no means such as to render it generally useful for such a purpose, as on exposure to the atmosphere, it soon decomposes and crumbles to pieces.

Drift.—It has already been remarked in the Report of 1843, that a great deposit of loose detrital material, consisting of clay, sand, gravel and boulders, deeply conceals the older strata in a great many parts of Western Canada; and this remark is peculiarly applicable to the Peninsula between the Niagara Ridge and the St. Clair River. The lower portion of the more recent deposits as exhibited on the shore of Lake Erie, where the cliffs are in many parts over 150 feet high, is a blue calcareous clay, frequently holding pebbles and small boulders of limestone, and small rounded fragments of granite or gneissoid rock. Clay of an ash-grey color when dried, but presenting a light brownish color in the bed, succeeds the blue clay, and this again is overlaid by pale buff and occasionally yellowish tinged clay. Back from the lake these clays are capped with a stratum of sand, and the more elevated parts present beds of calcareous gravel.

No organic remains of either marine or fresh-water origin have hitherto been observed among the superficial deposits of the Western Peninsula, with the exception of the shells which constitute the fresh-water shell marls, and the impressions of leaves and moss which are frequently preserved in the tufaceous deposits around calcareous springs, and on the banks of rivulets, both of which are evidently of very recent origin. The marls are only found immediately below the vegetable mould, and contain only shells common to almost all the lakes and rivers of the country at the present day; and in the accumulations of calcareous tufa the impressions are only of such plants as now grow in the immediate vicinity of the springs and brooks, to which the deposits owe their origin.

The materials of economic importance, connected with the

superficial deposits, are brick clays, bog iron ore, shell marl, calcareous tufa and peat.

All the clays are more or less calcareous, but some portions of the deposit are nevertheless admirably adapted for the manufacture of bricks, and are used for that purpose over a great part of the northern country. In the neighbourhood of London, white bricks of excellent quality are extensively manufactured, among the best samples of which are those made at the brick yard of Mr. Griffiths on the thirty-fifth lot of the first concession of Westminster, near the Commissioners Road. The clay used by Mr. Griffiths, is taken from a bed about twelve or fourteen feet thick, in which it is invariably found that the lower portion makes a compact solid white brick, sometimes assuming a pale green tinge, while the middle part yields a white brick without any shade of green, and the upper stratum burns into a bright red brick. The first of these varieties of bricks is usually esteemed the most durable and the handsomest, and it is said to be capable of withstanding a very strong heat, as an instance of which the bricks have been used at Mr. Labatt's brewery, in London, in the construction of furnace hearths with perfect success, one hearth having stood for upwards of four years without repair.

Bog iron ore is found in many parts of the country in greater or less abundance along the edges of marshes or on the marshy banks of streams. It usually occurs in rough irregular detached masses, and of all sizes under one foot diameter, generally deposited on clay, and concealed by vegetable mould and marsh grasses. At one time this ore was extensively used at the foundry of Normandale, on the shore of Lake Erie, by Mr. VanNorman, who informed me that it had been found in several places in the townships of Charlotteville, Middleton and Windham. Mr. VanNorman had found and used the ore in four different localities in Charlotteville, namely :—the fourth lot of the third concession, and the sixth, thirteenth and fourteenth lots of the sixth concession. In Middleton it is known on the seventeenth lot of the first concession, north of the Talbot Road, and in the third concession south of the same road on Venison Creek. In Windham the ore has been found on the twelfth lot

of the fourteenth concession. At Thamesville on the Long-woods Road, behind London and Chatham, indications of the ore were observed on the banks of a small stream called the Mill Creek, which falls into the Thames on the thirteenth lot of concession B., of Campden; the ore occurred at intervals for about a mile above its exit, and it seems probable that it is in sufficient abundance in the locality to be worth working.

Fresh-water shell marls were observed at several places in the new townships of Bentick and Brant. One bed extending over between two and three acres, with a thickness varying from three inches to one foot, occurs on the property of Mr. Jackson, on the nineteenth lot of the first concession, west of the Owen Sound Road, within a mile of the village of Durham. Another bed occurs on the fifty-ninth lot of the first concession south in Bentick, on the Durham Road, the extent of which was not exactly ascertained, but it shews a thickness in several places on the side of the road of not less than two feet. A third bed was seen on the seventieth or seventy-first lot of the first concession south of the Durham Road in Brant; this bed is exhibited in the banks and on the bottom of a small tributary of the Saugeen, near its junction with that river, and is in some parts fully three feet in thickness. Indications of the presence of the same substance were observed likewise near the junction of the Rocky Saugeen and the main stream, and it is probable that it will be found to exist in many other parts of the region, where its value as manure will doubtless be sufficiently appreciated as the settlement advances in improvement.

These marls, which are almost entirely composed of an aggregate of comminuted fresh-water shells, are usually concealed by a rich black vegetable mould or peat. The ground is usually swampy and sometimes assumes somewhat the character of prairie land. I was informed of some instances in which the peat is sufficiently thick and free from earthy matter to be available as a fuel, but none of these came within my observation.

In respect to the tufa, none of the deposits that came within my notice, were of sufficient importance to be deemed of economic value, but indications of it were met with on the banks

of many springs and streams, and in consequence of the calcareous nature of the soil and the subjacent rocks in so great an extent of the Western Peninsula, large deposits of it may be looked for. The material is applicable as a mineral manure, and may be resorted to for lime for mortar.

Springs of petroleum, commonly known in the country by the designation of *oil springs*, rise in the River Thames, near its right bank, on the twenty-eighth and twenty-ninth lots of the first range of Mosa, where the bituminous oil is frequently collected on cloths from off the surface of the water, and is very generally used in the neighbourhood as a remedy for cuts and cutaneous diseases in horses. Similar springs are known to exist in the township of Enniskillen, and a deposit of mineral pitch or mineral caoutchouc is said to extend over several acres on the seventeenth lot of the second concession of the township. A specimen of the latter was submitted to Mr. Hunt for analysis, and is described in his Report for 1849-50.

I have the honor to be,

Sir,

Your most obedient servant,

A. 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 COMMISSION,

MONTREAL, 1st *May*, 1851.

SIR,—Having been occupied with you during the principal part of the summer of 1850, I proceeded in the month of September to make some examinations on the north shore of the St. Lawrence below Quebec, and after my return thence, commenced my winter duties in the Laboratory, a Report of the results of which, I beg leave to present to you.

The older crystalline rocks of the northern shores of the St. Lawrence and of the Ottawa, afford a number of interesting mineral species, many of which have been made known to collectors through the researches of Drs. A. F. Holmes, of Montreal and Wilson, of Perth. Some of these minerals were sent by them to Dr. Thompson, of Glasgow, who, from his examinations, inferred the existence of several new species, which were accordingly described by him as such. Owing, however, to an unfortunate want of precision in his mineralogical descriptions, their identification has been difficult, and mineralogists have been unwilling to concede to them a rank among established species; and the more, as the chemical composition assigned to several of them, seemed but little accordant with their general physical characters. Having, through the kindness of the two gentlemen first named, been put in possession of well authenticated specimens of the minerals in question, I have

submitted them to careful examination and have obtained the results subjoined.

Felspar.—Among the species of this genus, which is very common among the granitic and gneissoid portions of the formation referred to, I shall first notice that one which has been described by Dr. Thompson under the name of *Perthite*. It is found in the township of Burgess, and, mixed with quartz, forms a *pegmatite* rock, in which large cleavable masses of the felspar are occasionally met with. Its cleavage form is apparently monoclinic, and its hardness is 6· upon the scale of Mohs;—specific gravity from 2·576 to 2·579, of a darker colored fragment 2·583; lustre vitreous inclining to pearly; color light flesh-red alternating with reddish or pinchbeck-brown, the two colors forming bands from half a line to a line in width, coincident with one of the planes T, often however, interrupted and mingling one with another. The darker bands exhibit on the cleavage surface T, when viewed perpendicularly, a golden reflexion like the variety known as *aventurine felspar*, and polished specimens of the mineral in the possession of Dr. Wilson show that it is available for ornamental purposes. The colors of this felspar become much darker by exposure to the action of the weather. The analytical results which follow were obtained from freshly broken light colored fragments, and the mineral reduced to a fine powder by elutriation, was dried in one analysis at 300° F., and in another at the ordinary temperature over a vessel of sulphuric acid. The earthy constituents were determined in the ordinary manner by fusion with carbonate of soda, and the alkalies by decomposing separate portions of the mineral with the aid of fluor-spar and sulphuric acid. One hundred parts of it gave:—

	I.	II.
Silica	66·44	66·50
Alumina	18·35	19·25
Peroxyd of iron	1·00	
Lime	·67	·56
Magnesia	·24	·24
Potash	6·37	6·18
Soda	5·56	5·56
Water, (loss on ignition).	·40	·44
	99·03	98·73

It is evident from these analyses, that the composition of this felspar is precisely that of *orthoclase*, to which species it had already been provisionally referred by Shepard, Dana and myself, (see my Report for 1847–48, p. 135.) The proportion of soda is larger than is generally met with in this species, but there are instances of orthoclase in which the greater portion of the alkali is soda. As it is, the quantity of potash present, and the extensive deposit of this felspar, are such as to make it worthy of attention as an economical source of this alkali, which in proportion as wood becomes scarce, is increasing in value, so much as to render its extraction from its mineral combinations a source of profit.

The second species to be noticed is that described by Dr Thompson under the name of *peristerite*, in allusion to the beautiful play of colors analogous to that of Labradorite, which it exhibits. The specimens from Bathurst furnished me by Dr. Wilson, as duplicates of those sent to Dr. Thompson, are composed of a mixture of quartz grains, readily distinguishable by their lustre, greater hardness and want of cleavage, disseminated through a felspar, which still so far predominates as to give distinct cleavages to the mass; such, from his analysis, also would appear to be the substance examined by Dr. Thompson. Specimens furnished me from the same locality exhibited the mineral in fine cleavable masses, free from quartz, and occasionally in consequence of an admixture of it, passing into the variety just described.

The crystalline form of the mineral shows it to belong to the triclinic system; the faces of cleavage give apparently the angles of albite, but do not admit of accurate measurement. The cleavage parallel with P and M is perfect, but less distinct with T. The surface P shows a fine play of colors like Labradorite, in which a delicate cerulean blue predominates, occasionally passing into light green and yellow; the face M is often marked with striae parallel to P. The same play of colors and striation on alternate surfaces are distinguishable in the quartzose masses. The hardness of the mineral is 6· and its specific gravity 2·625–2·627; lustre, vitreous inclining to pearly on P; color white, passing into pearl-gray, and reddish-white or flesh-red in the quartzose specimens; translucent, fracture uneven. Before the blow-pipe it fuses with difficulty,

and colors the flame strongly yellow; the analysis of a pure specimen gave:—

	I.	II.
Silica	66·80	67·25
Alumina	21·80	
Potash	0·58	
Soda	7·00	
Lime	2·52	2·03
Magnesia	·20	
Peroxyd of Iron	·30	
Loss on ignition	·60	·66
	99·80	

The results of this analysis, conjoined with its physical characters, show this mineral to be *albite*. The purity of the silica obtained was verified by subsequent examination, and it may be remarked, that in the first analysis the small portion of silica, which is always precipitated with the alumina, was not separated. Thompson, in his analysis of the peristerite, gives a much larger proportion of silica, but as has been before observed, the specimens examined by him were the quartzose mechanical aggregate.

Shepard and Dana have referred the mineral to orthoclase, and Dana, in the last edition of his Mineralogy, by a mistake says, that I have confirmed the opinion, whereas I had only in the Report for 1847–48, alluded to the oblique rhomboidal form of its cleavage, conjoined with its beautiful opalescence, (resembling the Fredericksvärn opalescent felspar, which has erroneously been referred to that species,) as leading to the supposition that it was Labradorite.

Another felspathic mineral, which was found as a boulder near Bytown, was described by Dr. Thompson as a new species under the name of *Bytownite*; it has been referred by other authors to a variety of species; Shepard includes it under pyroxene, and Dana at first classed it with scapolite, but in his last edition is inclined, from Thompson's analysis, to refer it to Barsowite, a species proposed by G. Rose. The specimen which Dr. Holmes kindly placed in my hands, had been pronounced by Dr. Thompson to be the mineral described by himself under the name of Bytownite. It is massive, granular, strongly co-

herent, and with the exception of occasional disseminated grains of black hornblende, is homogenous. Some of the larger and more distinct grains, exhibit one perfect cleavage, and indications of another oblique to it, which is less apparent. Its hardness is 6·5, and its specific gravity 2·732–2·733. The lustre is vitreous, approaching to pearly upon the cleavage faces; it is translucent and of a greenish or grayish-white. The analysis was performed upon carefully selected grains, and the pulverised mineral, first dried at 212° F., was afterwards exposed over the surface of sulphuric acid. It gave :—

	I.	II.
Silica	47·40	47·30
Alumina	30·45	
Lime	14·24	
Magnesia	·87	
Protoxyd of iron	·80	
Soda	2·82	
Potash	·38	
Water	2·00	1·80
	98·96	

The water in this mineral seems chemically combined. Thompson in his analyses gives the same amount of silica and water as above, but for the rest, differs greatly as to the proportions of lime and alkalies. It is identical in composition with the *thiorsauite* from Iceland, which Rammersberg regards as *anorthite*, and in general aspect can scarcely be distinguished from the *amphodelite* of Uton in Sweden, which is also regarded as belonging to the same species. We are then authorized in considering Bytownite to be *anorthite*, with which it agrees in hardness and specific gravity. A slight excess of silica, as in thiorsauite, is to be ascribed to a small admixture of quartz with the granular felspar.

The mineral from the vicinity of Perth, which has generally been distributed among mineralogical collectors as the Bytownite, is finely granular, almost compact, and has a smoky blue color, with a hardness of about 6·, and a specific gravity of 2·739. When viewed under a lens, it is seen to be a mixture of a light colored translucent granular mineral, apparently like the preceding, and exhibiting cleavages with a vitreous lustre,

intermixed with minute grains of what appears to be black hornblende. The specimens of it before me exhibit such a mixture that its analysis would be valueless.

The species of felspar, which was first discovered on the coast of Labrador, and has received the name of Labradorite, is common in boulders along the valley of the St. Lawrence from the Gulf to Canada West, but has not been found in place, except in a small island composed of Labradorite rock, observed by Dr. Bigsby, in Lake Huron, near Parry's Island. In the township of Drummond, C. W., large loose masses of the mineral are met with, (see report for 1847–48,) some portions of which exhibit a play of colors equal to the highly prized specimens from Labrador, and constitute a beautiful ornamental stone. A fragment from this locality was submitted to analysis; it had a hardness of 6· and a specific gravity of 2·697; its color was lavender-blue with pearly-gray iridescence. Analysis gave:—

Silica	54·70
Alumina	29·80
Lime	11·42
Peroxyd of iron	·36
Magnesia	a trace
Soda	2·44
Potash	·23
Loss by ignition	·40
	99·35

Raphilite.—This name was given to a species instituted upon specimens obtained by Dr. Wilson, in Lanark, C. W., and sent to Dr. Thompson by Dr. Holmes of Montreal; it is, according to Thompson's analysis, an anhydrous silicate of lime, magnesia, alumina and peroxyd of iron, with more than ten per cent. of potash. Dana, in the first edition of his Mineralogy, suggested that it might be a fibrous hornblende containing alkali, and analogous to the variety Arfvedsonite, to which species Shepard also refers it; while in his last edition, Dana, in conformity with a suggestion in my Report for 1847–48, regards it as tremolite. Being furnished with undoubted specimens of the mineral I have submitted it to a careful examination, the result of which confirms this opinion.

It occurs in delicate fibrous masses, slightly divergent, and often several inches in length; the fibres are readily separable, brittle, and somewhat elastic; hardness 5·5 on the scale of Mohs, or between apatite and felspar. Thompson gives 3·75, but the fibres scratch deeply the surface of a crystal of apatite; specific gravity in coarse powder 2·845, (2·850, Thompson). Lustre vitreous, silky; color grayish or greenish-white, becoming reddish on weathered surfaces; translucent. Analysis failed to detect more than very small portions of alkalies or alumina, and gave— :

					Ox. Ratio.
Silica	55·30	containing oxygen		28·7182 =	2
Lime	13·36	"	"	3·7991	
Magnesia	22·50	"	"	8·7162	
Protoxyd of Iron	6·30	"	"	1·3982	
Alumina	·40	"	"	·1869	
Manganese	traces				
Potash	·25	"	"	·0424	
Soda	·80	"	"	·2064	
Loss on ignition	·30				
	99·21			14·3492 =	1

The mineral has therefore an entirely different composition to that heretofore assigned to it, and from the ratio between the oxygen of the silica and the protoxyds, evidently pertains to the type of hornblende, of which tremolite is a variety.

Serpentine.—This species is known to be common in the crystalline limestones which belong to the older metamorphic rocks of the Province. Specimens of it from the vicinity of Grenville, sent by Dr. Holmes to Dr. Thompson some years since, were by the latter regarded as a new species, and named by him *retinalite.* The species was based upon the pretended chemical composition of the mineral, which, according to Dr. Thompson, is a hydrated silicate of magnesia and soda, containing—

Silica	40·550
Magnesia	18·856
Soda	18·832
Peroxyd of Iron, Alumina	·920
Water	20·000
	99·158

This composition in a mineral, having the external characters of serpentine, seemed anomalous, and I was therefore desirous of submitting it to a further examination. Dr. Holmes had still in his possession a portion broken from the specimen which he sent to Dr. Thompson, and kindly placed it in my hands. I have also specimens collected by myself at the original locality. It there fills seams, or is diffused through a white crystalline limestone in the vicinity of a dyke of trap, and is most abundant nearest the intrusive rock. The mineral is massive without any trace of crystallization, and has a hardness of about 3·5 (3·75, Thompson). Its specific gravity is 2·494—2·525 (2·493, Thompson); another fragment of an olive green color gave 2·476. The lustre of retinalite is resinous, shining; streak, white; color honey-yellow, passing into oil-green and olive-green; it is translucent and has a conchoidal fracture. The first analysis is upon the original specimen which was honey-yellow, the second upon another of an oil-green color. The pulverized mineral was dried over sulphuric acid—

	I.	II.
Silica	39·34	40·10
Magnesia	43·02	41·65
Peroxyd of iron	1·80	1·90
Soda	traces	·90
Water	15·09	15·00
	99·25	99·55

Another serpentine, closely resembling the retinalite, is found in nodular masses having a calcareous nucleus, at the Grand Calumet Island; it has a specific gravity of 2·362—2·381, and a pale wax-yellow color. Its analysis afforded me:

Silica	41·20
Magnesia	43·52
Peroxyd of iron	·80
Water	15·40
	100.92

The analytical results of Thompson, upon which the species was established, were entirely erroneous, and these specimens, although the latter differs somewhat from the others in specific gravity, are nearly identical in composition with each other,

and with the marmolite of Hermann, but are distinguished from it in not being foliated. The proportion of water is intermediate between that of ordinary serpentine and the Deweylite of Emmons, from which latter these specimens are separated by their greater specific gravity. Dana has, however, in consideration of the wide latitude presented in the composition of this class of minerals, united marmolite with serpentine, and it would not, in my opinion, be advisable to retain retinalite, which is only a compact marmolite, as a distinct species.

The presence of traces of alkalies has not hitherto generally been recognized in this class of minerals, but Ficinus has observed from ·50 to 1·33 per cent. of soda in the dermatine of Breithaupt, and Schmidt 1·98 per cent., in an asbestiform serpentine from Zoblitz.

Zircon.—The locality of this mineral at Grenville has been described in a previous Report (1847–48.) It is found associated with tabular spar, calcite, sphene, pyroxene, and plumbago, and forms crystals often half an inch in diameter, and an inch or more in length, with finely modified terminations. The specific gravity of these crystals is from 4·602–4·625; hardness 7·; their color is brownish-red, passing into flesh-red and cherry-red, they are sub-translucent to transparent; analysis gave me:

Silica,	33.7
Zirconia,	67.3
	101.0

The zirconia contained a trace of iron which was not separated.

New Mineral Species.—In a visit to the Grand Calumet on the Ottawa, in 1847, I observed, among the limestone exposed in constructing the timber slides, a mass containing pale green serpentine, a brown binaxial mica, pyrites, minute prisms of apatite, and a brown mineral somewhat resembling sphene, which I suggested in my Report for that year would probably prove to be a new species. The mica of this locality, which in larger crystals is found in the vicinity associated with crystallized pyroxene, has been optically examined by Professor B. Silliman, Jr.,

and determined to belong to the species *phlogopite*; the angle between the two optical axes is from 13° to 13° 12′.*

The unknown brown mineral has also been submitted to examination by myself, and its claim to be considered a distinct species established. Its crystalline form is indistinct, but it appears to form oblique rhombic prisms replaced on the acute and obtuse lateral edges, and on the acute solid angles. The edges are generally rounded, and the secondary planes not well defined. The cleavage with the sides and base of the prism is distinct, that with the longer diagonal imperfect. Hardness, 3·; specific gravity, 2·60–2·64. The lustre of the cleavages is vitreous, shining, the surfaces of the crystal are generally dull; the color is clove-brown to chocolate-brown, sometimes pale; streak and powder gray or grayish-white; sub-translucent, brittle, fracture uneven. The crystals, which are short and thick, are generally small, and so penetrated with the calcareous gangue, that great care was necessary in selecting specimens for analysis.

Before the blowpipe it loses color, and becomes grayish-white, but does not fuse; the powder heated in a tube gives off a large quantity of water with an empyreumatic odor; moistened with a solution of nitrate of cobalt, and ignited, it becomes deep blue. Acids take up magnesia, alumina, and protoxyd of iron, with a small but variable portion of lime, derived from the calcareous gangue, and leave pulverulent silica; the decomposition by this means is not, however, complete. Qualitative analysis showed the presence of no other ingredients than those already indicated, with the exception of a feeble trace of manganese. Regard was had in the examination to the detection of the rarer earths, the alkalies, and titanic and phosphoric acids.

The finely pulverized mineral was heated to whiteness, and the loss thus sustained regarded as water, with the carbonic

*These crystals of mica have been alluded to in a former Report, and described as associated with pyroxene, and large crystals of idocrase; an examination of the crystallization of the latter shows that these beautiful and highly modified crystals have the forms of tourmaline; the size, color and general appearance are, however, so much like idocrase, that several practised mineralogists have at first sight fallen into the same error as myself, with regard to their nature.

acid, which was too small to be determined directly upon the portions of the mineral which my specimens afforded me. The farther decomposition was effected by fusion with carbonate of soda, and the silica and bases were separated by the usual methods. In analyses upon three different specimens there were obtained :—

	I.	II.	III.
Silica,	32·84	32·14	33·17
Magnesia,	35·12	36·43	
Alumina	13·37	13·00	
Peroxyd of iron	2·00	2·28	
Water and carbonic acid.	17·02	16·83	16·50
Lime	·96	·93	
	101·31	101·61	

If we subtract from the loss by ignition, the amount of carbonic acid required to form a carbonate with the lime, we have respectively 16·36 of water and 1·70 of carbonate, and 16·12 water, and 1·64 of carbonate. Calculating the oxygen ratio between the silica and the bases, we have for the first analysis 17·515 : 34·990; and for the second, 17·140 : 35·198. As it appears from the third analysis that the amount of silica given in the second is rather too low, we may take the first as expressing more closely the ratio, which is just 1 : 2, and which makes it on the nomenclature of Gerhardt a protosilicate, of the type SiO^3M^4.

The composition is very closely expressed according to the Berzelian notation by $5SiO^3$, $12MgO$, $1\frac{1}{4}Al^2O^3$, $\frac{1}{4}Fe^2O^3$, $12HO$, which may be represented among others by the formula

$$2(Al^2O^3Fe^2O^3)SiO^3+4(3MgO,SiO^3)+12HO,$$

This affords by calculation the following numbers, which are compared with the first of the above analyses from which the carbonate of lime has been deducted.

	Calculated.	Found.
Silica	33·29	32·84
Magnesia	35·50	35·12
Alumina	13·31	13·37
Peroxyd of iron	1·92	2·00
Water	16·00	16·36
	100·02	99·69

The peroxyd of iron is to be regarded as replacing a portion of alumina, so that the mineral is essentially a hydrated silicate of magnesia and alumina, which, representing $Al\frac{2}{3}$ by al, will in the notation of Gerhardt be written,

$$SiO^3(al\frac{4}{5}Mg\frac{8}{5}H\frac{8}{5})$$

The only mineral hitherto described which nearly resembles this in constitution, is chlorite, which belongs to the same type, and is represented by $SiO^3(al\frac{8}{5}Mg\frac{5}{3}H\frac{4}{3})$, the principal difference in chemical composition being in the proportion of water. The hardness and other physical characters of this mineral are, however, such as completely distinguish it from chlorite, and constitute it a new and distinct species, for which, to connect your name with the science, I beg to propose the name of *Loganite.*

MINERAL WATERS.

The mineral springs of the Province have continued to engage my attention, and during the past season I have examined the waters of several different localities. Apart from the value which these waters may have in a medicinal point of view, I have been incited in my examinations by the hope that a careful study of their composition, taken in connection with the nature of the different strata through which they rise, may lead to some generalizations which shall be of use to geologists. This is a line of inquiry which has not as yet been carried on systematically over a large extent of country, embracing a great variety of rock-formations, and the numerous mineral waters of this Province, existing under such varied conditions present a favorable field for the investigation. With this end in view, it has not in all cases been considered necessary to submit the waters of the different springs to quantitative analysis, although this has been done in very many instances. The analytical results obtained during the last year are here presented, reserving any general conclusions for a future occasion.

Georgian Spring.

The water of this spring, which is in the township of Plantagenet, was noticed in the last Report, and a qualitative analysis of it given, in which, by a mistake, the presence of a por-

tion of sulphates, which had been detected in the qualitative examination, was not indicated. The specimen of the water furnished me at that time, contained 11·84 parts of solid matter in 1000. In March last, the proprietor of the spring, Capt. Kains, sent me through Mr. Bowman, druggist, of this city, a cask containing several gallons of the water, which has enabled me to make of it a quantitative analysis. This water, probably, from the season in which it was collected, was less concentrated than the other. It had a specific gravity of 1008·78 and contained 10·98 parts of solid matter in 1000. 1000 parts of it gave—

Chlorine,	6·18600
Bromine,	·00250
Iodine,	·00157
Sulphuric Acid, (SO^3),	·11333
Soda,	5·01580
Potash,	·06600
Lime,	·26880
Magnesia,	·48093
Oxyd of iron, traces,	
Silica,	·02050

These may be combined to give—

Chloride of Sodium,	9·46000
" of Potassium,	·10400
" of Calcium,	·04429
" of Magnesium,	·49426
Sulphate of Lime,	·19292
Bromid of Magnesium,	·00288
Iodid of Magnesium,	·00172
Carbonate of Lime,	·29800
" of Magnesia,	.36288
Silica (and traces of Carbonate of iron),	·02050
	10·98145

Mineral Spring of Lanoraie.

This spring is situated in the parish of St. Joseph of Lanoraie, on the Ruisseau St. Jean, a short distance to the west of the railway, and midway between the villages of Lanoraie and l'Industrie. The water rises through a bed of blue clay, and the supply is abundant; large quantities of carburetted hydrogen are evolved, and keep the fountain in constant agitation.

The water is transparent, and pleasantly but strongly saline to the taste; it contains, besides the alkaline chlorids, those of calcium and magnesium, with bromids and iodids, and salts of the rare bases baryta and strontia; these occur in part as chlorids, and in part as carbonates, which are thrown down on boiling together with a considerable amount of carbonates of lime and magnesia, and a trace of iron. These salts are held in solution as bicarbonates; but there is no excess of carbonic acid in the water.

I visited the spring on the 15th of March last, and collected the water for the subjoined analysis; the temperature of the water was then 42°, that of the air being 38° F. Its specific gravity was 1009·42.

1000 parts of it gave:

Chlorine	7·20940
Bromine	·02460
Iodine	·00472
Soda	5·90660
Potash	·09200
Lime	·37520
Magnesia	·33840
Baryta	·03023
Strontia	·02160
Silica, and a trace of iron	·05520

These ingredients may be combined so as to give the following salts for 1000 parts:

Chlorid of Sodium	11·1400
" of Potassium	·1460
" of Calcium	·2420
" of Magnesium	·2790
" of Barium	·0803
" of Strontium	·0185
Carbonate of Lime	·4520
" of Magnesia	·4622
" of Baryta	·0106
" of Strontia	·0137
Bromid of Magnesium	·0288
Iodid of Magnesium	·0052
Silica, and a trace of Carbonate of iron	·0552
	12·8839

The amount of solid matter thus calculated, amounts to 12·883 parts in 1000, while direct experiment gave of a residue dried at 300° F. 12·800 parts; the water collected in the month of January previous gave 13·025 parts. The processes employed in analyses have been detailed in preceding Reports; the proportions of baryta and strontia in the precipitate of carbonates obtained by boiling the water, and in the soluble salts of the concentrated liquid, were separately determined like the other earthy bases; the amount of the salts of baryta and strontia is more considerable than in any other mineral water that I have yet examined.

Gillan's Spring.

This interesting mineral spring is on the tenth lot of the second concession of Fitzroy upon the land of Mr. Francis Gillan. It rises through a stiff clay which here overlies the Trenton limestone. The spring discharges about 60 gallons in 24 hours. On the 24th of July the temperature of the water in the basin, which was seven feet deep and contained a large bulk of water, was 50° F. A cask of the water, which was brought to me by yourself, has been submitted to analysis.

The water of this spring is at once saline and alkaline to the taste; it has a specific gravity of 1006·24. By evaporation it deposits a considerable amount of earthy carbonates, and the liquid, which is strongly alkaline, yields prisms of carbonate of soda, mixed with cubes of common salt. It affords strong reactions of bromine and iodine, and when evaporated to dryness with the addition of acid, deposits a considerable amount of silica. A portion of silica is also thrown down in combination with the earthy bases, mixed with the carbonates, for on dissolving the matter precipitated by boiling, gelatinous silica separated, and when filtered from this and evaporated to dryness, a still farther amount of insoluble silica was obtained. A small portion of phosphates and traces of strontia, alumina, and iron were also detected in the precipitate, and a determinable quantity of phosphate of soda in the alkaline liquid. It was observed that a portion of the water evaporated to one-tenth, and filtered, became turbid when still farther concentrated, and deposited a flocculent precipitate,

which, by solution in hydrochloric acid, was found to consist of lime and magnesia, combined with a large proportion of silica; 1000 parts of the water gave:—

Chlorine,	4·0250
Bromine,	·0169
Iodine,	·0026
Soda,	3·7984
Potash,	·1160
Lime,	·0840
Magnesia,	·3806
Phosphoric Acid,	·0087
Alumina,	·0040
Silica,	·1330
Oxyd of iron and Strontia, traces,	

The phosphoric acid was determined by evaporating several litres of the water, with the addition of acid, precipitating the solution with a little perchlorid of iron and ammonia, and fusing the precipitate with silica and carbonate of soda in the usual manner. The amount of silica above given, was that obtained by directly evaporating the water to dryness with the addition of an acid, and the proportion of silica, combined with earthy bases, was determined by evaporating to a small bulk another portion of the water, and separating the silica of the insoluble portion; it was equal to ·088 in 1000 parts, the entire amount being ·133. To estimate the amount of soda existing as carbonate, a litre of the water was evaporated to a very small bulk, and the filtered solution was mixed with one of chlorid of barium; the precipitate of carbonate of baryta weighed 1·015 grammes; in a second determination, the liquid was evaporated to dryness, before separating the earthy carbonates and silicates, and the amount of carbonate of baryta was 1·019 grammes. The mean of the two is 1·017, which, neglecting the phosphate, corresponds to ·5466 grammes of carbonate of soda. As a control upon this, the quantity of soda necessary to form chlorid, iodid, and bromid, was deducted from the amount of soda obtained, and there remained a quantity equal to ·5885 of carbonate of soda.

In calculating the combinations of these ingredients as they may be supposed to exist in the water, there are difficulties arising first, from the fact that a portion of the lime and mag-

nesia are separated as silicates of an unknown composition, and secondly, from the probable existence of a similar silicate of soda. If, however, we represent the whole of these bases as carbonates, and give the silica as separate and uncombined, we have the following composition for 1000 parts :—

Chlorid of Sodium,	6·53250
" of Potassium,	·11600
Bromid of Sodium,	·02176
Iodid of Sodium,	·00323
Phosphate of Soda, (PO^5, $3NaO$),	·01244
Carbonate of Soda,	·58850
" of Lime,	·15000
" of Magnesia,	·78607
" of Iron and Strontia, traces,	
Alumina,	·00400
Silica,	·13300
	8·34750

The amount of solid matter, as directly determined by evaporation, was 8.200 ; the difference corresponds principally to the carbonic acid which is represented as combined with bases that really exist as silicates.

Mineral Water of Belœil.

I have not visited this spring, but a small quantity of its water, in carefully corked bottles, was furnished me by the late Mr. Brault, of this city. It is alkaline and saline, resembling that of Gillan's spring ; the concentrated water contains a large amount of carbonate of soda, with chlorid and small portions of bromid and iodid of sodium ; there is besides a little soluble silicate. The precipitate, which forms on boiling, consists principally of carbonates of lime and magnesia ; when dissolved in hydrochloric acid, gelatinous silica separates on evaporation. The solution of the earthy chlorids filtered from the silica separated by evaporation to dryness, is not immediately rendered turbid by a solution of gypsum, but yields after a few minutes a precipitate of sulphate of strontian ; a small amount of carbonate of iron is also present.

One litre of the water evaporated to a small bulk, contained ·064 grammes of silica in solution, and the earthy precipitate afforded ·050 grammes, equal to ·114 grammes in all. The amount of alkaline carbonate was determined as in the preceding analysis by evaporating a portion to dryness and precipitating the dissolved and filtered residue by a solution of chlorid of barium; one half-litre gave ·570 of carbonate of baryta. In a second experiment, the solution filtered from the earthy residue after complete evaporation and resolution, was digested with the addition of carbonate of ammonia to decompose any alkaline silicate which might be present, but there was no separation of silica, and the evaporated mass gave ·569 of carbonate of baryta. The two precipitates were mixed and converted into sulphate and gave 1·328, equal to ·872 of baryta; the same amount of pure carbonate should contain ·8856, and the mean of these is ·879, which corresponds to ·6082 of carbonate of soda. The amount of carbonate of soda calculated from the excess of sodium over the chlorine, was ·5780. The proportions of bromine and iodine and of potassium, were not determined in this analysis. There were obtained from 1000 parts of the water.

Chlorid of Sodium, with bromids and iodids	5·9662
Carbonate of Soda	·6082
Carbonate of Lime	·1440
" of Magnesia	·4756
" of Strontia	·0250
" of Iron	traces;
Silica	·1140
	7·3330

The amount of solid matter determined by direct experiment was 7·360 parts in 1000. It would seem probable from the experiments detailed, that on complete evaporation, the entire amount of the silica is deposited with the earthy bases. This question is one of interest, and I propose at another time to pursue the inquiry.

L'Orignal.

A saline water, furnished me by Mr. Edward Langlois, of L'Orignal, was found to contain 6·4 parts of solid matter in 1000. It was composed of alkaline and earthy chlorids, with portions of bromids and iodids, besides carbonates of lime and magnesia, and traces of iron. The water contains no sulphates, and neither baryta nor strontia were detected.

Bay St. Paul.

At the Bay St. Paul I visited a very strong bitter saline spring, which yields by evaporation 20·68 parts of solid residue for 1000 parts of water. It contains besides alkaline chlorids, large quantities of chlorids of calcium and magnesium, with portions of bromids and iodids of these bases. No sulphates were detected, and but a small quantity of earthy carbonates was deposited on boiling; the water afforded traces of iron, but neither baryta nor strontia salts.

There are several sulphurous springs at Bay St. Paul, but the amount of sulphuretted hydrogen which they contain is not very considerable, and they are feeble as to saline ingredients. One near the mill was found to contain small amounts of alkaline and earthy chlorids, with traces of sulphates, and an insignificant quantity of earthy carbonates; neither bromine nor iodine were detected. Others upon the land of Mr. Thos. Poitvin, and of Mr. Tremblay, on the east side of the Gouffre, are still weaker in saline ingredients and but slightly sulphurous; they deposit films of calcareous matter along their channels.

Les Eboulmens.

At the foot of the hill, a little above the Pointe aux Eboulis, there are several sulphurous springs, most of which are very weak, but one of them is much stronger than those at Bay St. Paul, and was selected for examination; 1000 parts of it gave ·70 of solid matter equal to 4·9 grains to the pound avoirdupois, consisting of earthy and alkaline chlorids, with traces of sulphates, and portions of carbonates of lime and magnesia; no bro-

mine or iodine was detected; 100 cubic inches of the recent water gave also ·42 of a cubic inch of sulphuretted hydrogen gas.

Reserving for a future occasion some observations upon the probable geological relations of these various mineral springs, this Report is respectfully submitted.

I have the honor to be,

Sir,

Your most obedient servant,

T. S. HUNT,