CANADA

DEPARTMENT OF MINES

GEOLOGICAL SURVEY BRANCH

Hon. W. TEMPLEMAN, MINISTER; A. P. LOW, DEPUTY MINISTER;
R. W. BROCK, DIRECTOR.

MEMOIR No. 7

GEOLOGY OF ST. BRUNO MOUNTAIN

PROVINCE OF QUEBEC

BY

JOHN A. DRESSER.

OTTAWA
GOVERNMENT PRINTING BUREAU
1910

No. 1077

Frontispiece.

PLATE I.

4076

St. Lawrence Plain from Mount Royal, showing St. Bruno and other Monteregian Hills.

CANADA

DEPARTMENT OF MINES

GEOLOGICAL SURVEY BRANCH

Hon. W. Templeman, Minister; A. P. Low, Deputy Minister;
R. W. Brock, Director.

MEMOIR No. 7

GEOLOGY OF ST. BRUNO MOUNTAIN

PROVINCE OF QUEBEC

BY

JOHN A. DRESSER.

OTTAWA
GOVERNMENT PRINTING BUREAU
1910

4076—1

No. 1077

To R. W. Brock, Esq.,
Director, Geological Survey,
Department of Mines.
Ottawa.

Sir,—I beg to submit a memoir on the geology of St. Bruno mountain, Quebec. The field work has been done at intervals during the past three years, chiefly during the season of 1905. In this work I had for one season the assistance of R. Harvie, jr., B.A., M.Sc. The determinations of fossils, as the appendices will show, have been made by Mr. J. F. Whiteaves, Palæontologist of this Survey, Dr. E. O. Ulrich, Palæontologist of the United States Geological Survey, and Dr. R. Ruedemann, Palæontologist of the Geological Survey of the State of New York.

I have the honour to be, sir,
Your obedient servant,

JOHN A. DRESSER.

January 27, 1910.

CONTENTS.

GEOLOGY

OF

ST. BRUNO MOUNTAIN, QUE.

BY

JOHN A. DRESSER.

ST. LAWRENCE PLAIN.

The valley of the St. Lawrence river, in the vicinity of Montreal, appears to the eye to be a level plain. It has, however, slight differences of elevation, varying from 100 feet above sea-level along the river, to 400 feet near the edge of the Appalachian highland some fifty miles to the east. It is thus a very broad, flat, valley, which extends for forty miles on either side of the St. Lawrence river near Montreal. The valley is bounded by the Laurentian highlands on the northwest, and the Appalachian hills on the southeast.

The Monteregian Hills.

The uniform surface and even skyline in the central part of the valley are broken only by the Monteregian hills. These do not form a continuous range or chain, but rise in separate hills at intervals of six to fourteen miles, in a somewhat irregular east and west line across the central and eastern part of the plain (Plate I). Their abrupt, sharply defined profiles make them conspicuous features of the landscape, and add to their apparent height. They are locally called mountains. Named in order from west to east they are as follows:—

(1) Mount Royal, at the foot of which the city of Montreal (Mount Royal) stands. It has an area of about two square miles and rises to 769 feet above mean sea-level, or 650 feet above the plain.

(2) St. Bruno, area 2·83 square miles, summit, 715 feet above the sea, or 618 feet above railway near the base.

(3) Belœil, or St. Hilaire, area about four square miles, height, 1,437 feet above the sea, or 1,350 feet above the plain.

(4) Rougemont, area about six square miles, height 1,400 feet above the sea, or 1,250 feet above the plain.

(5) Johnson, or Monnoir, area 0·422 of a square mile, height, 876 feet above the sea, or 720 feet above the plain.

(6) Yamaska, area five and a half square miles, height, 1,500 feet above the sea, or 1,300 feet above the plain.

(7) Shefford, area nine square miles, height, 1,600 feet above the sea, or 1,200 feet above the plain.

(8) Brome, area thirty square miles, height, 1,500 feet above the sea, 1,100 feet above the plain.

Johnson and Brome are out of alignment with the other hills of the series, the former being six miles south of Rougemont, and the latter two and a half miles south of Shefford. The distance from Mount Royal at the west to Shefford on the extreme east end of the series is fifty miles.

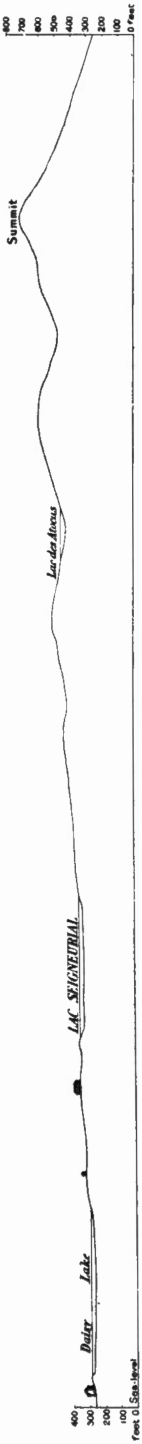
Several of these hills are now occupied as summer resorts, for which use their elevation, excellent natural water supply, generally wooded surface, and easy access from railway lines make them peculiarly suitable.

The Monteregian hills are quite uniform in the character of their relief. With the exception of Mount Johnson, which is much smaller than the others and forms a single conical hill, they consist of a crescent-shaped ridge, or succession of ridges, enclosing a central basin or group of lower hills on all sides, except at the southwest. Accordingly, when viewed in profile, they show abrupt cliff-like, faces on the northeast, and become gradually lower towards the southwest until they reach the level of the plain. This can be well seen in looking at any of the hills from a distance on the east or west sides, as Mount Royal from St. Bruno, or the latter from Mount Royal or Belœil.

This form of relief has been called crag-and-tail by Dr. Jas. Geikie,[1] to distinguish it from other forms given rock masses by ice movements which are generally designated as roches moutonnées. In the latter the surface rises gradually in proceeding along the direction of ice movements and the rock mass ends abruptly in

---

[1] 'Structural and Field Geology,' p. 310. By Jas. Geikie, LL.D. Van Nostrand Company, New York, 1905.



PROFILE OF ST. BRUNO MOUNTAIN
along a line Northeasterly from Daisy Lake

Scale, horizontal and vertical: 1200 feet to 1 inch

a cliff face on the lee side. The crag-and-tail structure as exhibited in these hills is, therefore, the reverse of the common roches moutonnées. The cause of this reversed form is not apparent. Geikie remarks that it occurs in the case of abrupt crags.

It was suggested by Sir William Dawson[1] that the steep faces on the northeast—the side against which the great glacial movement has taken place—was due to the action of floating ice, at a level below the present summits of the hills. This drifting ice was thought to have impinged heavily on the bases of the hills, thus producing erosion cliff faces. This, however, does not account for the slope of the surface to the southwest.

Mr. O. E. LeRoy, from investigations at Belœil and Mount Royal, suggests that this particular relief may be due to sheets given off the main mass of the mountain which have followed the stratification, gradually thinning out towards the southwest. This would seem to account for the condition at these two hills and also to apply to St. Bruno, where the dip of the sediments agrees with the southwesterly slope of the mountain. But, at the eastern end of the series, Shefford and Brome mountains pierce sediments which dip at high angles, 45° or more. Yet these hills show in profile the same gentle slope to the southwest as Belœil, St. Bruno, or Mount Royal.

The cliffs on the northeast side of these hills suggest fault scarps. But no evidence of a fault crossing the St. Lawrence plain in an east and west direction has been found except the linear arrangements of these intrusive hills. This, Sir William Logan thought to be due to transverse arching of the strata, which passed into a fault farther to the westward.

The hills, however, are not in a straight line, and if their position is due to faulting of the sediments, it seems quite as likely, as has been pointed out by Mr. R. W. Ells, after an areal examination of the district, that the hills are on a series of parallel faults running northeast and southwest.

The plain is heavily covered with drift, and faults may exist that have not been found. Yet, fossils collected at various points around St. Bruno mountain give no evidence of a fault, or any abrupt change in the surrounding strata.

---

[1] 'Candian Ice Age,' Montreal, 1893.

The fact that the resulting forms are much alike, however, indicates that, whether the surrounding sediments are highly folded or lie nearly horizontally, the relief is manifestly due to erosional rather than to structural causes.

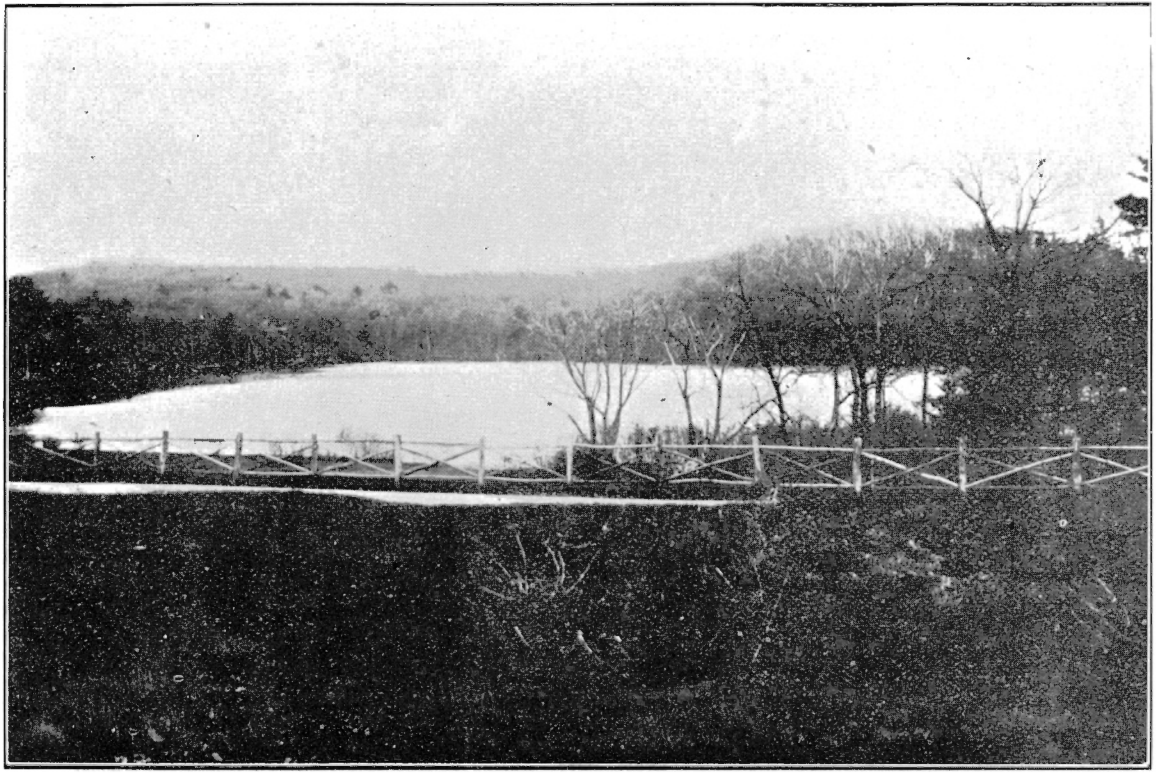
The hills are composed principally of igneous rocks formed by the solidification of molten material injected from below, which probably extended upward, and formed large bodies of igneous rock now removed by erosion. The plain is underlain by softer rocks, shales, limestones, etc., which have been eroded still more deeply. Around the igneous part of several of the hills the sediments have been baked and hardened by the heat of the intruded lavas, and so form a rim of altered rock. In the case of the shales or slates this is a hornstone which is harder and more resistant than the igneous rocks.

The entire district has been heavily eroded, probably a thousand feet or more, by sediments having been removed from the plain. The present elevation of the hills above the plain is due, therefore, not to the extrusion of lavas upon it, but to the greater resistance to erosion of the rocks of the hills than those of the plain. Hence, the Monteregians are residual hills or buttes.

The Monteregian hills also preserve a record, important in the physical history of the region, in the high level terraces which are often well displayed on their sides. These terraces are old sea beaches which were formed during the period of submergence which this part of the continent underwent near the close of the ice age. They can be found at corresponding heights on different hills and are the water level marks of different stages of the submergence, during which the hills were islands.

ST. BRUNO MOUNTAIN.

St. Bruno mountain, or as it is frequently called, Montarville, is the first of the Monteregian hills east of Mount Royal; that is, the second from the west end of the series. It is in the county of Chambly, fourteen miles from the city of Montreal. In its horizontal outline it is roughly elliptical, the extreme length from north to south being 1·9 miles, and its greatest breadth from east to west 1·6 miles.



Looking eastward from St. Bruno across Daisy Lake.

The summit is at the northeast part of the mountain, where it reaches an elevation of 715 feet above sea-level, or 618 feet above St. Bruno station on the Grand Trunk railway, three miles distant. (See profile.)

The area of the mountain, above the 300 ft. contour, is 2·83 square miles, of which the part occupied by igneous rock makes up 2·16 square miles.

The surface of St. Bruno mountain is uneven, giving it an imperfect drainage.

The coarse-grained igneous rocks disintegrate rapidly, and basins are thus formed which give rise to numerous small lakes. These add materially to the attractiveness of the mountain, which is now almost entirely reserved for private summer residences. Lac Seigneurial occupied 11·21 acres near the southern part of the mountain, Lac des Bouleaux, 3·4 acres in the northern part, and Daisy, or Mill lake, 3 acres near Lac Seigneurial. Daisy, or Mill lake is interesting as being the mill pond—partly artificial—the outlet of which supplied power to the seigniory mill in the early settlement of the country.

Lacs des Atocas, Lac des Ormnes, and Rond Eau are smaller bodies of water in the interior.

These are simple drainage lakes, though two of the larger, Lac Seigneurial and Lac des Bouleaux, seem to be in part fed directly by springs. The greatest depth found by sounding in any of these lakes was 17 feet 6 inches in the northwestern part of Lac Seigneurial.

The popular impression which obtains about the lakes of many of these hills that they are old volcanic craters is, therefore, incorrect. The great erosion which the district has suffered has been sufficient to remove all traces of the original surface of a volcano, if one ever existed. The present surface owes its inequalities to the eroding and denuding forces that have been at work since the intrusion of the igneous mass, of which the present mountain is probably a mere remnant.

Outline of Physical History.

After a great thickness of muds and silts had accumulated at the bottom of the sea in the Utica-Lorraine period, and these had become consolidated into the shales which form the principal rock in this part of the St. Lawrence plain, the rocks which compose the Monteregian hills were injected in a molten state from the heated interior of the earth, probably in Devonian time. Such intrusions imply that there has been a fracturing of the shales admitting of a release of the lava from below, or that the latter has more slowly eaten its way upward into the shales in places offering less resistance. The molten material may have reached the then surface, hundreds of feet above that of the present day, and so have formed active volcanoes, or it may have only filled subterranean cavities which it found or made, and so have formed laccoliths.

While all the Monteregian hills are of about the same geological age, they were not necessarily formed simultaneously, nor was a single mountain formed by one intrusion, in all cases. Thus, Mount Royal was formed at two periods of intrusion, Shefford, at three. St. Bruno, however, seems to have been formed by a single intrusion.

There was, besides these, a fracturing later than the formation of each of the hills, which gave rise to dikes cutting the igneous rocks as well as the surrounding sediments. Such dikes are very numerous at Shefford and at Mount Royal, but occur very sparingly in the other hills of the series.

At St. Bruno such dikes are occasionally met with, and indicate that some fracturing took place after the solidification of the molten materials which form the principal igneous rocks—essexite, and syenite (umptekite).

There is nothing to indicate whether the intrusion of the mountain took place while the land surface was still covered by the sea or not. But soon after, at least at the close of the Palæozoic period, if not earlier, the land must have been raised above sea-level, where it remained until geologically recent times. During this period of elevation, long erosion by the agencies of the atmosphere probably greatly altered and reduced the surface materials. Then followed the glacial period—or ice age—in which heavy glaciers from the northeast swept the debris from the surface, cut the tops of the volcanoes, if any existed, and uncovered and eroded laccoliths. Drift, or the debris brought by glaciers, forms the greater part of the present soil, in which boulders of granite from the Laurentian highlands north of the St. Lawrence river are abundant. Following the melting of the glacier, there was a comparatively short

Looking westward from summit of St. Bruno, across Lac des Bouleaux.

4076—p. 12.

period of submergence, when the waters of the sea rose nearly, or quite to the top of St. Bruno mountain, and again subsided in stages, leaving the terraces so well shown on the east side of the mountain opposite St. Bazile, and which extend several miles farther to the north.

The assorting of glacial debris by the water during this submergence has given the flat surface and the fertile soil of the plain.

Evidences and Character of Intrusion.

The strata in the vicinity of St. Bruno mountain dip towards the southeast at an angle of less than 10°. The slope of the mountain often coincides with the dip of the strata, if it has not been determined by it. The sediments, which are generally altered to hornstone, wrap around the igneous part of the mountain on all sides. On the southwest side of the mountain they extend all the way up to the summit, while on the northeast side, where the igneous rocks rise quite abruptly from the plain, fragments of the sediments may be found hanging upon them well up to the summit.

Near the contact with the irruptives, the sediments—Utica-Lorraine shales—become pyritiferous and rusty. Dikes strike off from the igneous rock into the sediments, and the evidence is perfectly clear that the igneous rock is intrusive. However, the intrusion does not seem to have been of the nature of a violent irruption. All the rock is of a plutonic or deep-seated character, and from evidences available it is not possible to say definitely whether St. Bruno mountain has ever been an active volcano, or whether it was originally a laccolith. The erosion of the district has been so great that the original surface material has been completely removed, and hence its character cannot be determined.

Sedimentary Rocks.

St. Bruno mountain is surrounded by shales of Utica or Lorraine age. They are fine, compact, argillaceous rocks of a dark iron-grey colour. Outside of the zone of contact metamorphism they are not greatly altered. They dip at an angle of less than 10° towards the west, in conformity with the general structure of the district. Within the contact zone they become more fissile, show a better cleavage, and are hardened to hornstone. Grains and nodules of pyrite become frequent, and shells and fossil remains are often coated with films of this mineral, making them rather easy to find in the dark coloured rock.

A collection of fossils was made around the base of the mountain at stations marked upon the map as (1), (2), etc. This work was done chiefly by Mr. R. Harvie, jr., B.A., M.Sc., who acted as assistant in the field season of 1905. During the course of this work Mr. Harvie also collected a few fossil specimens from a small rock exposure near St. Hilaire station. This is six miles from St. Bruno mountain, and is the first rock exposure found east of it.

All the fossils were submitted to Dr. J. F. Whiteaves, palæontologist of the Geological Survey, whose report on them is appended to this paper. The small suite of specimens from St. Hilaire, as well as some of those from St. Bruno, were handed over by Dr. Whiteaves to Dr. E. O. Ulrich, of the United States Geological Survey, Washington, D.C., and certain others to Dr. R. Ruedemann, Albany, N.Y. The evidence obtained from the determination of these fossils indicates that the sedimentary rocks surrounding St. Bruno mountain are of Utica rather than Lorraine age, or, that they are transition beds between these two formations.

Igneous Rocks.

Essexite.—By far the greater part of St. Bruno mountain is composed of a mass which ranges from essexite to peridotite. This rock was described by Sir William Logan[1], as follows:—

'The greater part of Montarville (St. Bruno mountain) is composed of a coarse-grained, granitoid, dolerite, in which black, cleavable mica predominates, sometimes almost to the exclusion of any other mineral. Small portions of white feldspar, and scales of brown mica, are sparsely scattered through this rock, with grains of carbonate of lime . . . . . In other portions the feldspathic element predominates, and the rock becomes porphyritic from the presence of large crystals of augite . . . . . Another and a remarkable variety of dolerite found at Montarville . . . . contains large proportions of olivine . . . . . The olivine varies in amount, but in some portions of the rock it is the predominant mineral.'

It is a dark greenish-grey rock, which weathers to a rusty brown colour. It is coarsely crystalline, and in the hand specimen there

---

[1] Geology of Canada, 1863, pp. 665 and 666.

can be seen augite, biotite, feldspar, and occasionally olivine. In the thin section the augite appears flesh-coloured, but it is not noticeably pleochroic. It seems to be identical with the augite which occurs in the essexite of Mount Royal.

An analysis of augite from St. Bruno by the late T. Sterry Hunt[1] is given below in column I. Column II is an analysis of augite from Shonkinite, Square Butte, Montana, described by Professor Pirsson:—

	I.	II.
SiO_2	49·40	49·42
Al_2O_3	6·70	4·28
Fe_2O_3 } FeO	7·88	8·33
MgO	13·06	13·58
CaO	21·88	22·35
Alkalis	0·74	Alkalis, etc., undet.
H_2O	0·50	
	100·16	

Biotite is an abundant constituent of the essexite from St. Bruno. It is very commonly intergrown with the augite. Hornblende occurs in about the same proportion as biotite. It shows pleochroism in shades of deep and yellowish brown. The scheme of absorption is $\mathfrak{c} > \mathfrak{b} > \mathfrak{a}$. The greatest extinction angle observed, $c \wedge \mathfrak{c}$, was 19° 30′.

The feldspar is a rather broadly striated plagioclase. Symmetrical extinction on the albite lamellæ was observed as high as 32°. An analysis of feldspar from this rock by Hunt[2], is given in column III. In column IV is given the theoretical composition of a lime-soda feldspar answering to the formula $Ab_2\,An_3$.

	III.	IV.
SiO_2	53·10	53·30
Al_2O_3	26·80	29·90
CaO	11·48	12·06
Na_2O	4·24	4·90
Fe_2O_3	1·35	....
H_2O	0·60	....
	97·57	100·16

The feldspar is, therefore, a somewhat basic labradorite.

[1] Geology of Canada, 1863, p. 468.
[2] Geology of Canada, 1863, p. 479.

Olivine is present in most parts of the essexite mass. It occurs in characteristic forms and is frequently serpentinized along cracks and partings. Its analysis, as given by Hunt[1], is as follows:—

	V.	VI.	VII.
SiO_2	37·15	41·39	38·46
FeO	22·56	7·71	23·07
MgO	39·52	50·90	38·46
	99·23	100·00	99·99

VI is the theoretical composition of olivine, having the general formula 2 (Fe, Mg)O, SiO_2; and VII the theoretical result of replacing a part of the magnesium with iron so as to give the proportion 2 (Fe$\frac{1}{4}$, Mg$\frac{3}{4}$)O, SiO_2.

The olivine occurs in places to an unusual amount, not infrequently forming from 10 to 25 per cent of the rock, as well as could be judged by the eye. In his calculation of the results of an analysis of a part of the rock extremely rich in olivine, which is given below, T. Sterry Hunt found olivine to make up 45·5 per cent of the specimen analysed by him.

Magnetite and apatite occur in this rock as accessory minerals.

The order of crystallization of the minerals seems to have been the normal one: (1) olivine and the accessory minerals; (2) augite; (3) hornblende and biotite, closely following the augite; and (4) feldspar.

The structure of the rock is granitic.

A specimen of this rock of medium composition (No. 1011) was analysed by Mr. M. F. Connor, B.A.Sc., at the laboratory of the Geological Survey, and the result is given in column VIII. VIIIa is the sum of two analyses, one of the soluble, and the other of the insoluble portions of an olivine-rich variety of the same rock given by Hunt[2] reduced to percentages of the whole rock.

IX. Palisadose (Peridotite), the Palisades, New Jersey.

X. Essexose (Essexite), Mount Johnson, Quebec; described by Dr. F. D. Adams; analysis by N. Norton-Evans, Journal of Geology, Vol. XI, No. 3.

[1] Geology of Canada, 1863, p. 464.
[2] Geology of Canada, 1863, p. 666.

XI. Yamaskose, Yamaska mountain, Quebec; described and analysed by Dr. G. A. Young, Annual Report, Geological Survey, Vol. XVI, part H.

XII. Akerose (Essexite), Shefford mountain, Quebec; described by J. A. Dresser; analysis by M. F. Connor, Annual Report, Geological Survey of Canada, Vol. XIII, part L, 1900.

XIII. Hessose (Essexite), Brome mountain, Quebec; described by J. A. Dresser; analysis by M. F. Connor, American Journal of Science, May, 1904.

	VIII.	VIIIa.	X.	XI.	XII.	XIII.
SiO_2	45·37	42·57	48·69	39·97	53·15	44·00
Al_2O_3	6·21	10·10	17·91	8·68	17·64	27·73
Fe_2O_3	2·40	16·42	3·09	8·63	3·10	2·36
FeO	8·09		6·41	7·99	4·65	3·90
MgO	18·67	21·26	3·06	10·32	2·94	2·30
CaO	14·47	8·20	7·30	15·18	5·66	13·94
Na_2O	0·85	1·11	5·95	1·19	5·00	2·36
K_2O	0·37		2·56	0·74	3·10	0·45
H_2O	0·88	0·30	0·95	0·57	1·10	0·80
TiO_2	1·50	...	2·71	4·05	1·152	1·90
P_2O_5	...	...	1·11	11·10	12·65	0·20
MnO	...	...	0·15	0·19	0·46	0·08
FeS_2	...	...	...	1·01	...	...
Cl	...	...	...	...	0·07	...
CO_2	0·62	...	...	1·15	...	...
	99·43	99·96	99·89	110·77	110·672	100·02

X, XI, XII, and XIII are the most basic types hitherto analysed from the Monteregian hills, from which they are taken. By the method of the quantitative classification the following norm is obtained from analysis VIII:—

o r	2·22	m t	3·48
a b	2·88	i l	2·89
a n	12·23	d i	47·24
n e	2·13	o l	25·05

Calcite, 1·40

This gives the rock the following classification:—

Class IV—Dofemane.

Order I—Hungarare.

Section 2—Quebeciare.

Rang I—Quebecase.

Section 2—Bruniase.

Sub-rang 2—Palisadose.

This rock is practically identical in chemical composition with the palisadose recently described from the Palisades on the Hudson by J. Volney Lewis[1]. The latter is a highly olivinitic phase of the diabase of that well-known locality. As the rock from St. Bruno is a type new to the Monteregian series, it is an important component of one or more of these remarkable hills, and as it is normative in its mineralogical composition, the section, rang, and subsection may suitably be named from this locality. Accordingly, after consultation with Professors Adams, Iddings, and Pirsson, the names used above have recently been proposed.[2]

Umptekite.—This is a light-grey or fawn-coloured rock, showing to the unaided eye only feldspar and specks of biotite. In the thin section the rock is found to consist of orthoclase, plagioclase, microperthite, biotite, and a colourless augite. It has a granitic structure and medium texture. An analysis, by Mr. Connor, of specimen No. 1047, is given below in column XIV.

XIV. Andose (Umptekite), St. Bruno mountain, Quebec.

XV. Andose, Mount Johnson, Quebec; described by Dr. F. D. Adams; analysis by N. Norton-Evans, op. cit.

XVI. Pulaskose, Mount Johnson, Quebec; described by Dr. F. D. Adams; analysis by N. Norton-Evans, op. cit.

XVII. Akerose, Yamaska mountain, Quebec; described and analysed by Dr. G. A. Young, op. cit.

XVIII. Laurdalose, Brome mountain, Quebec; described by J. A. Dresser; analysis by M. F. Connor, op. cit.

XIX. Pulaskose, Shefford mountain, Quebec; described by J. A. Dresser; analysis by M. F. Connor, op. cit.

	XIV.	XV.	XVI.	XVII.	XVIII.	XIX.
SiO_2	50·56	48·85	57·44	57·75	55·68	59·96
Al_2O_3	18·28	19·38	19·43	17·50	20·39	19·12
Fe_2O_3	3·57	4·29	1·69	2·92	2·10	1·85
FeO	4·62	4·94	2·70	2·94	1·95	1·73
MgO	3·38	2·00	1·16	1·70	0·80	0·65
CaO	7·10	7·98	2·66	3·86	1·92	2·34
Na_2O	4·30	5·44	6·48	5·08	9·18	6·98
K_2O	3·31	1·91	4·28	3·51	5·34	4·91
H_2O	1·40	0·68	1·03	0·37	1·50	1·10
CO_2	0·76	....	....	0·55	....	....
TiO_2	2·25	2·47	1·97	1·50	0·60	0·66
P_2O_5	....	0·23	....	....	....	....
MnO	0·13	0·19	0·25	0·19	0·31	0·49
BaO	....	....	....	0·07	....	....
FeS_2	....	....	....	0·21	0·06	0·14
	99·66	98·36	99·09	98·15	99·83	99·93

[1] J. Volney Lewis, Geological Survey of New Jersey, 1907, p. 124.
[2] J. A. Dresser, American Journal of Science, June, 1909.

XVI, XVII, XVIII, and XIX are analyses of specimens of the most acid type found in the mountains from which they have been selected. Applying the quantitative classification to analysis XIV, the following norm is obtained:—

o r	15·57	d i	15·93
a b	25·15	o l	9·95
a n	8·34	m t	10·21
n e	1·02	i l	8·51

Calcite, 3·20.

Considering the calcite as secondary the class of this rock becomes:—

Class II—Dosalane.
Order 5—Germanare.
Rang 3—Andase.
Sub-rang 4—Andose.

Dike Rocks.—Around the base of St. Bruno mountain the sedimentary rocks are somewhat frequently pierced by sills and dikes, most of which are fine-grained and dark coloured, and belong to the camptonite class. The sills are probably less numerous, but are generally larger than the dikes. At the southwest side of the mountain there is a sill having a horizontal position, which can be seen for about one hundred yards and probably has a much greater extent. It is 6 feet thick. Two feet from the top and bottom are made up of fine camptonite, while the central part of 2 feet is a coarse porphyritic rock containing large crystals of augite. This does not, however, differ from the finer portions so much in composition as in granularity or mode and degree of crystallization. It was first thought to be a case of sharp differentiation of the magma of the sill in horizontal layers. But some material from this dike was handed Dr. A. C. Lane, state geologist of Michigan, for study in connexion with an investigation of the fusion temperature of rocks, and in some large micro-sections which he had prepared, and kindly loaned the writer, a probable line of a closely fused contact could be discerned. The sill is, therefore, somewhat doubtfully regarded as a composite one in which the material of the coarser band has been injected into the central part of the original sill while the upper and lower portions of it were still hot, though solid, and perhaps before the central portion had become altogether rigid. While the magma of the central band did not differ materially from that of the walls, in composition, its conditions of solidification were much more favourable to the growth of large crystals in the later stages of cooling, and consequently to the forming of a porphyritic structure.

The rock of this sill consists of brown hornblende in idiomorphic crystals, green hornblende less well formed, colourless augite in large crystals and generally much decomposed, some feldspar, and kaolinized ground-mass. The feldspar seems to have been the last primary mineral formed. Some small dikes in the same vicinity have a similar composition. They may all be classed as camptonites.

In lot 239, rang des XII, there is a dike of porphyritic camptonite, as well as a number of others of the camptonite class, near the mill at the outlet of Daisy lake. In lot 311, rang des XLII, there is a 2 ft. dike of bostonite cutting hornstone. On the north side of the mountain a ridge extends towards Ste. Julie, at a slight though noticeable elevation above the surrounding plain. An attempt was made to find out by what kind of rock it is underlain, since a similar ridge on the northeast side of Mount Royal is known to be due to an underlying sill of trap. At St. Bruno, however, the ridge is wholly covered by clay, except for a few exposures of hornstone, and if any sill of importance exists there, it could not be found.

Structure of Igneous Rocks.

As is shown by the accompanying geological map, essexite forms by far the greater part of the igneous portion of St. Bruno mountain. In it flow structure is frequently observable, being indicated by differences of crystallization in adjacent band-like portions of the rock. This is often well shown on weathered surfaces, where the etching by atmospheric erosion has brought out more clearly the different aspects of the fine and the coarse-grained portions of the rock, as well as the tendency towards a parallel arrangement in the larger crystals of the latter.

The hornstone occurs not merely in close contact with the igneous rock, or where the sediments are nearly enclosed by it, as is sometimes the case, but also at places as far as thirty or forty rods distant from an exposure of the intrusive. This seems to indicate that the shape of the igneous rock underneath the sediments is irregular. The presence of altered sediments all the way from the base to the top of the mountain on the southwest side, and the fact that these agree in dip and strike with the unaltered sediments of the neighbouring district, indicate that the erosion that has taken place here since the intrusion of the mountain has been more than 600 feet, the extreme relief of the mountain. Similar evidence on the higher hills, as at Mount Royal, shows that it has been much greater. It is, therefore, evident that in the present study of St. Bruno we are only dealing with deep-seated rocks.

At the contact of the essexite with the sedimentary rock east of Lac Seigneurial, it was thought that an upward flow structure could be seen in the former rock such as would have resulted from an outpouring of the essexite magma at this place. The exposure, however, is a small one, and the phenomenon has not been elsewhere noted.

The umptekite occupies a small area 500 feet long and somewhat less in breadth—which affords little opportunity for investigation. The immediate locality is thickly wooded, and exposures are not plentiful. From as careful study as could be made, however, it seems quite safe to conclude that essexite gives place to this syenitic rock by a rather sharp transition, probably 100 feet around the umptekite being occupied by a rock of transitional character.

Since the strata surrounding the mountain are nearly horizontal, St. Bruno, as far as the present surface is concerned, must be regarded as a filled volcanic neck. But whether that neck ever reached the earlier surface as an actual vent, or merely led to a larger subterranean body or laccolith above, it is not easy to determine from present evidences. Remnants of hornstone are so numerous, even in the higher parts of the mountain, that the conclusion is difficult to avoid that the sediments once completely covered it. On the whole, perhaps, the most probable view is that the umptekite area represents the actual pipe, while the remaining igneous part of the mountain has been laccolith offshoots and outward magmatic stoping. This would seem to be corroborated by the occurrence of many sills of essexite which extend into the sediments, especially near the 300 ft. contour.

Comparison with the other Hills of the Monteregian Series.

Comparison of the chemical analyses already cited shows a general relation of the rocks in the Monteregian series. Evidences of consanguinity are, however, most conclusively shown in a comparative arrangement by the method of the quantitative classification. Accordingly, all of the rocks of this petrographic province that have yet been determined are given in the following tabular form. For convenience in comparison, the chemico-mineralogical characters for which the rock names stand are placed after each. The features which seem most noticeable in this table are the high alumina content, and the dominance of soda, which gives rise to the alkali-rich feldspathic rocks. The tabular comparison clearly shows the uniformity of these rocks in their general chemical and mineralogical composition, giving added evidence to that on which the petrographical province of the Monteregian hills was established.

Locality.	Rock Species.	Characters.
Johnson..........	Essexose...........	Dosodic—domalkalic—dofelic—dosalane.
	Andose....	Dosodic—alkalicalcic—perfelic—dosalane.
	Laurvikose	Dosodic—domalkalic—perfelic—persalane.
Shefford..........	Akerose.	Dosodic—domalkalic—perfelic—dosalane.
	Nordmarkose........	Dosodic—peralkalic—perfelic—persalane.
	Laurvikose	Dosodic—domalkalic—perfelic—persalane.
Brome...........	Hessose.	Presodic—docalcic—perfelic—dosalane.
	Nordmarkose	Dosodic—peralkalic—perfelic—persalane.
	Laurdalose..........	Dosodic—peralkalic—dofelic—dosalane.
Yamaska.........	Yamaskose........ .	Domagnesic—domiric—perpyric—dopolic —dofemane.
	Salemose	Dosodic—alkalicalcic—dofelic—dosalane.
	Akerose	Dosodic—domalkalic—perfelic—dosalane.
St. Bruno.	Palisadose..........	Domagnesic—domiric—permirlic—dopyric perpolic—dofemane.
	Andose............	Dosodic—domalkalic—dofelic—dosalane.

Age of Intrusion.

There seems to be no more definite limit to be assigned to the period within which this mountain was formed than that it was later than the deposition of the Lorraine or Hudson River formation. In the mountains farther to the east, especially Shefford and Brome, the volcanic rocks showed somewhat distinct foliation, due to their being situated within the range of the Appalachian uplift. Hence their age is known as between lower Ordovician and the Permian or late Carboniferous, since the latter formations in the eastern part of the continent lie within the Appalachian belt, but are unaffected by its folding. Therefore only the general view is warranted that if the intrusion of these hills occurred at about a common date, St. Bruno mountain was probably formed in later Devonian times: which was a period of well-known volcanic activity in eastern Canada and New England.

APPENDIX A.

Preliminary list of fossils from the supposed Utica or Lorraine shales at St. Bruno mountain, Chambly county, Que., collected by J. A. Dresser and R. Harvie, jr., in 1905.

BY

J. F. WHITEAVES.

HYDROZOA.

DENDROGRAPTUS TENUIRAMOSUS, Walcott.

Dendrograptus tenuiramosus, Walcott.—The Utica slate and related formations of the same geological horizon. Trans. Albany Inst., 1879, vol. x, p. 21, pl. 1, fig. 4.

Station 7; three specimens, which have been identified with this species by Dr. R. Ruedemann.

'Of this species we have here' (at Albany) 'a large collection from the Utica shale of Holland Patent, near Utica. Besides, I have a series of specimens collected by Dr. Ulrich in the Eden shale (lower third) of Covington, Kentucky. These are the only localities of the species previously known to me. Since the Ohio geologists consider the Eden shale as newer than the Utica shale (see Prosser's and Foerste's last papers), this species would not fix exactly the age of the rock. The associated forms are such as would point to a very late Utica, or rather Lorraine age.'—Ruedemann, in letter dated March 8, 1906.

On the evidence afforded by the brachiopoda and mollusca, Dr. Ulrich thinks that the fauna of these St. Bruno shales 'indicates early Cincinnatian—i.e., upper Utica or Eden.'

DICTYONEMA, sp. indet.

Station 7; two badly preserved specimens.

BRYOZOA.

BYTHOPORA ARCTIPORA, Nicholson.

Ptilodictya? arctipora, Nicholson. 1875. Ann. Mag. Nat. Hist., ser. iv, vol. xv, p. 180, pl. 14, figs, 4-4*b*; and Palæont. Ohio, vol. ii, p. 262, pl. 25, figs. 9-9*b*.

Bythopora arctipora, Miller and Dyer. 1878. Contr. to Palæont., No. 2, p. 6.

Bythopora arctipora, Nickles and Bassler. 1900. Synops. Amer. Foss. Bryozoa, Bull. U.S. Geol. Surv., No. 173, p. 184.

Station 5 (Quarry); one specimen. 'If this specimen came from Cincinnati, I would not hesitate to call it *Bythopora arctipora*. Externally it is certainly very much like one of the varieties of that Eden shale species.' E. O. Ulrich, in letter dated March 19, 1906.

BRACHIOPODA.

LEPTOBOLUS INSIGNIS, Hall.

Leptobolus insignis, Hall. 1871. Descr. N. Sp. Foss. fr. Hudson R. Gr., p. 3, pl. iii, fig. 17.

Leptobolus insignis, Hall. 1872. Twenty-fourth Rep. N. York St. Cab. Nat. Hist., p. 227, pl. vii, fig. 17.

Leptobolus insignis, Nicholson. 1875. Rep. Palæont. Prov. Ont., p. 85.

Leptobolus insignis, Hall and Clarke. 1892. Palæont. N. York, vol. viii, pt. i, p. 74, pl. iii, figs. 1-6.

Station 4, a few specimens; and Station 9, one specimen.

LINGULA, sp. indet.

Station 9; two specimens. One of these, which Dr. Ulrich has seen, he thinks is a 'distorted Lingula of the type of *L. Cobourgensis* and *L. Covingtonensis*.' 'So far as I can see,' he adds, 'it is indistinguishable from the Utica and Eden shale variety of the latter species at Cincinnati.'

PHOLIDOPS CINCINNATIENSIS? Hall.

Pholidops Cincinnatiensis, Hall. 1872. Twenty-fourth Rep. N. York St. Cab. Nat. Hist., pl. vii, fig. 10.

Pholidops Cincinnatiensis, Hall. 1873. Palæont. Ohio, vol. i, p. 130, pl. v, fig. 2.

Pholidops Cincinnatiensis, Miller, S. A. 1875. Cincinnati Quart. Journ. Sc., vol. ii, p. 14.

Pholidops Cincinnatiensis, Miller, S. A. 1878. Journ. Cincinn. Soc. Nat. Hist., vol. i, p. 87.

Pholidops Cincinnatiensis, Hall and Clarke. 1892. Palæont. N. York, vol. viii, pt. i, p. 157, pl. xli, fig. 18.

Station 10; two imperfect and badly preserved specimens. Of one of these Dr. Ulrich writes, that he cannot 'distinguish it from *P. Cincinnatiensis*.'

Dalmanella testudinaria multisecta (Meek).

Orthis emacerata, var. *multisecta* (James, M. S.), Meek. 1873. Palæont. Ohio, vol. i, p. 112, pl. viii, fig. 3; and Miller, S.A. (1875), Cincinnati Quart. Journ. Sc., vol. ii, p. 22.

Orthis multisecta, Sardeson. 1897. American Geol., vol. xix, p. 97, pl. iv, figs. 20-23.

Dalmanella multisecta, Hall and Clarke. 1892. Palæont. N. York, vol. viii, pt. i, pp. 207, 224.

Dalmanella testudinaria multisecta, Schuchert. 1897. Bull. U.S. Geol. Surv., No. 87, p. 205.

This stratigraphical variety of *Orthis testudinaria*, which was first recognized as occurring in these shales by Dr. Ulrich, is by far the most abundant fossil in the collections made at this locality by Mr. Dresser. It occurs abundantly at stations 1, 3, 4, 7, 8, 9, and 10. It is also the form of *O. testudinaria* that is so common in the unaltered, or comparatively unaltered, Utica shale at and near Ottawa.

MOLLUSCA.

Pelecypoda.

Ctenodonta, sp. nov.

Station 7; two specimens, of a very small and apparently undescribed species of this genus, apparently of the *C. levata* section, and most nearly related to *C. Calvini*, Ulrich, and *C. fecunda*, Hall.

CLEIDOPHORUS PLANULATUS? Conrad.

Cfr. Nuculites planulata, Conrad. 1841. Geol. Surv., State New York, Fifth Ann. Rep., p. 50.

Cfr. Nuculites scitula (Conrad, M.S.), Emmons. 1842. Geol. New York, pt. ii, Surv. Second Geol. Distr., p. 399, fig. 2.

Cfr. Cleidophorus planulatus, Hall. 1847. Palæont. New York, vol. i, p. 300, pl. lxxxii, figs. 9, *a-e*.

Station 2, a cast of the interior of a left valve; and station 9, casts of the interior of three right valves.

WHITELLA, sp. nov.

Station 10; a cast of the interior of a left valve, with the beak broken off.

In regard to this specimen, Dr. Ulrich writes as follows, in a letter dated March 19, 1907: 'I have no doubt concerning the generic position of this shell, but its specific relations are not so easily determined. It has been slightly distorted by pressure, causing the post-dorsal slope to be more gentle, and the antero-ventral more abrupt than normal. It is a pity also that the beak has been broken away. Judging from what we have, I think it closely related to only *W. umbonata*, Ulrich, (of described species). This is a Richmond species, differing from your specimen in such comparatively minor points as the broader anterior end, stronger umbonal ridge, and more abrupt post-cardinal slope. I am, however, inclined to believe that the escutcheon, or ligamental area, in your shell, will prove to be much narrower in a dorsal view, and shorter than in *W. umbonata*; and this would be a good specific character.'

RHYTIMYA, sp. nov.

Station 9; one specimen, in two pieces.

'Two small slabs showing, besides other things, the convex and concave impressions of a typical species of *Rhytimya*. I believe it is an undescribed species, with alliances to *R. producta* on the one hand, and *R. radiata* on the other. It agrees with the former in having a rather well defined umbonal sinus, but differs in the more truncate posterior end and slightly stronger surface wrinkles. From the latter it differs in having a much better defined sinus, and in wanting surface radii, otherwise your shell is very much like *R. radiata*.'—Ulrich, in letter previously quoted.

Gasteropoda.

Cyrtolites ornatus, Conrad.

Station 10; one imperfect but well preserved and characteristic specimen.

CRUSTACEA.

Trinucleus concentricus, Eaton.

Station 9; a cast of the under surface of a small cephalon.

APPENDIX B.

List of fossils from St. Hilaire, Quebec, as provisionally determined June 30, 1907, by Dr. E. O. Ulrich. Collected by R. Harvie, jr.

BRYOZOA.

Paleschara beani (James).

BRACHIOPODA.

Pholidops cincinnatiensis, Hall.
Rafinesquina (?) sp. nov.

MOLLUSCA.

Pelecypoda.

Byssonychia, cfr. *B. suberecta,* Ulrich.
Ctenodonta, sp. nov. Near *C. pectunculoides,* and *C. cingulata.*
Ctenodonta, sp. indet. Small, of the *C. levata* group.
Clidophorus, sp. nov. Near *C. planulatus* (Conrad).
Psiloconcha sinuata, Ulrich.
Psiloconcha, sp. nov., var. 1.
Psiloconcha, sp. nov., var. 2.
Whiteavesia pholadiformis? (Hall). A fragment.
Whitella, sp. nov. (Near *W. quadrangularis.*)
Whitella, sp. nov. (Near *W. sterlingensis.*)

CRUSTACEA.

Ctenobolbina ciliata (Emmons) var.
Isotelus, cfr. *I. gigas* (pygidium).

'The St. Hilaire fauna, as represented in the small collection before me, is not decisively Richmond, but, so far as it goes, it indicates lower Richmond rather than Lorraine. The matter is so important that it seems worth while to recommend the making of a full collection.

'The most significant fossil in the lot is the fragment provisionally referred to *Whiteavesia pholadiformis.* So far we know this type of shell only in Richmond faunas. Pointing in the same direction is the presence of two species of *Whitella,* a genus so far unknown in Lorraine faunas. This evidence is further corroborated by the *Paleschara beani,* but the specimen is small and not in sufficiently good preservation to permit positive identification.

'The *Clidophorus* I have in both Lorraine and lower Richmond. Likewise *Psiloconcha sinuata, Pholidops cincinnatiensis,* and *Ctenobolbina ciliata.* The remaining things being either new or not definitely determinable, may be disregarded. I will say, however, that I see nothing about them that might be used in rebuttal of the general trend of testimony afforded by the species mentioned.'

INDEX.

A

B

C

D

E

F

G

H

I

J

L

M

N

O

P

R

S

U

V

W

Y

CANADA

DEPARTMENT OF MINES

GEOLOGICAL SURVEY BRANCH.

HON. W. TEMPLEMAN, MINISTER; A. P. LOW, DEPUTY MINISTER;
R. W. BROCK, DIRECTOR.

SELECTED LIST OF REPORTS AND MAPS

(SINCE 1885)

OF SPECIAL ECONOMIC INTEREST

PUBLISHED BY

THE GEOLOGICAL SURVEY.

Reports of the Mines Section:—

No. 245.	Report of Mines Section,	1886.	No. 662.	Report of Mines Section,	1897.
272	" "	1887.	698	" "	1898.
300	" "	1888.	718	" "	1899.
301	" "	1889.	744	" "	1900.
334	" "	1890.	800	" "	1901.
335	" "	1891.	835	" "	1902.
360	" "	1892.	893	" "	1903.
572	" "	1893-4.	928	" "	1904.
602	" "	1895.	971	" "	1905.
625	" "	1896.			

Mineral Production of Canada:—

No. 414.	Year 1886.	No. 422.	Year 1893.	No. 719.	Year 1900.
415	" 1887.	555	" 1894.	719a	" 1901.
416	" 1888.	577	" 1895.	813	" 1902.
417	" 1889.	612	" 1896.	861	" 1903.
418	" 1890.	623	" 1886-96.	896	" 1904.
419	" 1891.	640	" 1897.	924	" 1905.
420	" 1886-91.	671	" 1898.	981	" 1906.
421	" 1892.	686	" 1899.		

Mineral Resources Bulletins:—

No. *818. Platinum.	No. 860. Zinc.	No. 881. Phosphate.
851. Coal.	869. Mica.	882. Copper.
*854. Asbestos.	872. Molybdenum and Tungsten.	913. Mineral Pigments.
857. Infusorial Earth.	877. Graphite.	953. Barytes.
858. Manganese.	880. Peat.	984. Mineral Pigments. (French).
859. Salt.		

Reports of the Section of Chemistry and Mineralogy:—

No. *102.	Year 1874-5.	No. 169.	Year 1882-3-4.	No. 580.	Year 1894.
*110	" 1875-6.	222	" 1885.	616	" 1895.
*119	" 1876-7.	246	" 1886.	651	" 1896.
126	" 1877-8.	273	" 1887-8.	695	" 1898.
138	" 1878-9.	299	" 1888-9.	724	" 1899.
148	" 1879-80.	333	" 1890-1.	821	" 1900.
156	" 1880-1-2.	359	" 1892-3.	*958	" 1906.

* Publications marked thus are out of print.

REPORTS.

GENERAL.

745. Altitudes of Canada, by J. White. 1899.
*972. Descriptive Catalogue of Minerals and Rocks, by R. A. A. Johnston and G. A. Young.

YUKON.

*260. Yukon district, by G. M. Dawson. 1887. Maps Nos. 274, scale 60 m. = 1 in.; 275–277, scale 8 m. = 1 in.
295. Yukon and Mackenzie basins, by R. G. McConnell. 1889. Map No. 304, scale 48 m. = 1 in.
687. Klondike gold fields (preliminary), by R. G. McConnell. 1900. Map No. 688, scale 2 m. = 1 in.
884. Klondike gold fields, by R. G. McConnell. 1901. Map No. 772, scale 2 m. = 1 in.
*909. Windy Arm, Tagish lake, by R. G. McConnell. 1906. Map No. 916, scale 2 m. = 1 in.
943. Upper Stewart river, by J. Keele. Map No. 938, scale 8 m. = 1 in. } Bound together.
951. Peel and Wind rivers, by Chas. Camsell. Map No. 942, scale 8 m. = 1 in. } Bound together.
979. Klondike gravels, by R. G. McConnell. Map No. 1011, scale 40 ch. = 1 in.
982. Conrad and Whitehorse mining districts, by D. D. Cairnes. 1901. Map No. 990, scale 2 m. = 1 in.
1016. Klondike Creek and Hill gravels, by R. G. McConnell. (French). Map No. 1011, scale 40 ch. = 1 in.
1050. Whitehorse Copper Belt, by R. G. McConnell. Maps Nos. 1,026, 1,041, 1,044-1,049.

BRITISH COLUMBIA.

212. The Rocky mountains (between latitudes 49° and 51° 30°), by G. M. Dawson. 1885. Map No. 223, scale 6 m. = 1 in. Map No. 224, scale 1½ m. = 1 in.
*235. Vancouver island, by G. M. Dawson. 1886. Map No. 247, scale 8 m. = 1 in.
236. The Rocky mountains, geological structure, by R. G. McConnell. 1886. Map No. 248, scale 2 m. = 1 in.
263. Cariboo mining district, by A. Bowman. 1887. Maps Nos. 278-281.
*271. Mineral wealth, by G. M. Dawson.
*294. West Kootenay district, by G. M. Dawson. 1888-9. Map No. 303, scale 8 m. = 1 in.
*573. Kamloops district, by G. M. Dawson. 1894. Maps Nos. 556-7, scale 4 m. = 1 in.
574. Finlay and Omineca rivers, by R. G. McConnell. 1894. Map No. 567, scale 8 m. = 1 in.
743. Atlin Lake mining division, by J. C. Gwillim. 1899. Map No. 742, scale 4 m. = 1 in.
939. Rossland district, by R. W. Brock. Map No. 941, scale 1,600 ft. = 1 in.
940. Graham island, by R. W. Ells. 1905. Map No. 921, scale 4 m. = 1 in., and Map No. 922, scale 1 m. = 1 in.
986. Similkameen district, by Chas. Camsell. Map No. 987, scale 400 ch. = 1 in.
988. Telkwa river and vicinity, by W. W. Leach. Map No. 989, scale 2 m. = 1 in.
996. Nanaimo and New Westminster districts, by O. E. LeRoy. 1907. Map No. 997, scale 4 m. = 1 in.
1035. Coal-fields of Manitoba, Saskatchewan, Alberta, and Eastern British Columbia, by D. B. Dowling.

ALBERTA.

*237. Central portion, by J. B. Tyrrell. 1886. Maps Nos. 249 and 250, scale 8 m. = 1 in.
324. Peace and Athabaska Rivers district, by R. G. McConnell. 1890-1. Map No. 336, scale 48 m. = 1 in.

703. Yellowhead Pass route, by J. McEvoy. 1898. Map No. 676, scale 8 m. = 1 in.
949. Cascade coal-fields, by D. B. Dowling. Maps (8 sheets) Nos. 929-936, scale 1 m. = 1 in.
968. Moose Mountain district, by D. D. Cairnes. Maps No. 963, scale 2 m. = 1 in.; No. 966, scale 1 m. = 1 in.
1035. Coal-fields of Manitoba, Saskatchewan, Alberta, and Eastern British Columbia, by D. B. Dowling. Map No. 1,010, scale 35 m. = 1 in.

SASKATCHEWAN.

213. Cypress hills and Wood mountain, by R. G. McConnell. 1885. Maps Nos. 225 and 226, scale 8 m. = 1 in.
601. Country between Athabaska lake and Churchill river, by J. B. Tyrrell and D. B. Dowling. 1895. Map No. 957, scale 25 m. = 1 in.
868. Souris River coal-field, by D. B. Dowling. 1902.
1035. Coal-fields of Manitoba, Saskatchewan, Alberta, and Eastern British Columbia, by D. B. Dowling. Map No. 1,010, scale 35 m. = 1 in.

MANITOBA.

264. Duck and Riding mountains, by J. B. Tyrrell. 1887-8. Map No. 282, scale 8 m. = 1 in.
296. Glacial Lake Agassiz, by W. Upham. 1889. Maps Nos. 314, 315, 316.
325. Northwestern portion, by J. B. Tyrrell. 1890-1. Maps Nos. 339 and 350, scale 8 m. = 1 in.
704. Lake Winnipeg (west shore), by D. B. Dowling. 1898. Map No. 664, scale 8 m. = 1 in.
705. Lake Winnipeg (east shore), by J. B. Tyrrell. 1898. Map No. 664, scale 8 m = 1 in.
Bound together.
1035. Coal-fields of Manitoba, Saskatchewan, Alberta, and Eastern British Columbia, by D. B. Dowling. Map No. 1010, scale 35 m = 1 in.

NORTH WEST TERRITORIES.

217. Hudson bay and strait, by R. Bell. 1885. Map No. 229, scale 4 m. = 1 in.
238. Hudson bay, south of, by A. P. Low. 1886.
239. Attawapiskat and Albany rivers, by R. Bell. 1886.
244. Northern portion of the Dominion, by G. M. Dawson. 1886. Map No. 255, scale 200 m. = 1 in.
267. James bay and country east of Hudson bay, by A. P. Low.
578. Red lake and part of Berens river, by D. B. Dowling. 1894. Map No. 576, scale 8 m. = 1 in.
*584. Labrador peninsula, by A. P. Low. 1895. Maps Nos. 585-588, scale 25 m. = 1 in.
618. Dubawnt, Kazan, and Ferguson rivers, by J. B. Tyrrell. 1896. Map No. 603, scale 25 m. = 1 in.
657. Northern portion of the Labrador peninsula, by A. P. Low.
680. South Shore Hudson strait and Ungava bay, by A. P. Low. Map No. 699, scale 25 m. = 1 in.
713. North Shore Hudson strait and Ungava bay, by R. Bell. Map No. 699, scale 25 m. = 1 in.
Bound together.
725. Great Bear lake to Great Slave lake, by J. M. Bell. 1900.
778. East Coast Hudson bay, by A. P. Low. 1900. Maps Nos. 779, 780, 781, scale 8 m. = 1 in.
786-787. Grass River region, by J. B. Tyrrell and D. B. Dowling. 1900.
815. Ekwan river and Sutton lakes, by D. B. Dowling. 1901. Map No. 751, scale 50 m. = 1 in.
819. Nastapoka islands, Hudson bay, by A. P. Low. 1900.
905. The Cruise of the *Neptune*, by A. P. Low. 1905.

ONTARIO.

215. Lake of the Woods region, by A. C. Lawson. 1885. Map No. 227, scale 2 m. = 1 in.
*265. Rainy Lake region, by A. C. Lawson. 1887. Map No. 283, scale 4 m. = 1 in.
266. Lake Superior, mines and mining, by E. D. Ingall. 1888. Maps Nos. 285, scale 4 m. = 1 in.; No. 286, scale 20 ch. = 1 in.

326. Sudbury mining district, by R. Bell. 1890-1. Map No. 343, scale 4 m. = 1 in.
327. Hunter island, by W. H. C. Smith. 1890-1. Map No. 342, scale 4 m. = 1 in.
332. Natural Gas and Petroleum, by H. P. H. Brumell. 1890-1. Maps Nos. 344-349.
357. Victoria, Peterborough, and Hastings counties, by F. D. Adams. 1892-3.
627. On the French River sheet, by R. Bell. 1896. Map No. 570, scale 4 m. = 1 in.
678. Seine river and Lake Shebandowan map-sheets, by W. McInnes. 1897. Maps Nos. 589 and 560, scale 4 m. = 1 in.
723. Iron deposits along the Kingston and Pembroke railway, by E. D. Ingall. 1900. Map No. 626, scale 2 m. = 1 in.; and plans of 13 mines.
739. Carleton, Russell, and Prescott counties, by R. W. Ells. 1899. (*See* No. 739, Quebec.)
741. Ottawa and vicinity, by R. W. Ells. 1900.
790. Perth sheet, by R. W. Ells. 1900. Map No. 789, scale 4 m. = 1 in.
961. Sudbury Nickel and Copper deposits, by A. E. Barlow (Reprint). Maps Nos. 775, 820, scale 1 m. = 1 in.; 824, 825, 864, scale 400 ft. = 1 in.
962. Nipissing and Timiskaming map-sheets, by A. E. Barlow. (Reprint). Maps Nos. 599, 606, scale 4 m. = 1 in.; No. 944, scale 1 m. = 1 in.
965. Sudbury Nickel and Copper deposits, by A. E. Barlow. (French).
970. Report on Niagara Falls, by J. W. Spencer. Maps Nos. 926, 967.
977. Report on Pembroke sheet, by R. W. Ells. Map No. 660, scale 4 m. = 1 in.
992. Report on Northwestern Ontario, traversed by National Transcontinental railway, between Lake Nipigon and Sturgeon lake, by W. H. Collins. Map No. 993, scale 4 m. = 1 in.
998. Report on Pembroke sheet, by R. W. Ells. (French). Map No. 660, scale 4 m. = 1 in.
1075. Gowganda Mining Division, by W. H. Collins. Map No. 1,076, scale 1 m. = 1 in.

QUEBEC.

216. Mistassini expedition, by A. P. Low. 1884-5. Map No. 228, scale 8 m. = 1 in.
240. Compton, Stanstead, Beauce, Richmond, and Wolfe counties, by R. W. Ells. 1886. Map No. 251 (Sherbrooke sheet), scale 4 m. = 1 in.
268. Megantic, Beauce, Dorchester, Levis, Bellechasse, and Montmagny counties, by R. W. Ells. 1887-8. Map No. 287, scale 40 ch. = 1 in.
297. Mineral resources, by R. W. Ells. 1889.
328. Portneuf, Quebec, and Montmagny counties, by A. P. Low. 1890-1.
579. Eastern Townships, Montreal sheet, by R. W. Ells and F. D. Adams. 1894. Map No. 571, scale 4 m. = 1 in.
591. Laurentian area north of the Island of Montreal, by F. D. Adams. 1895. Map No. 590, scale 4 m. = 1 in.
670. Auriferous deposits, southeastern portion, by R. Chalmers. 1895. Map No. 667, scale 8 m. = 1 in.
707. Eastern Townships, Three Rivers sheet, by R. W. Ells. 1898.
739. Argenteuil, Ottawa, and Pontiac counties, by R. W. Ells. 1899. (*See* No. 739, Ontario).
788. Nottaway basin, by R. Bell. 1900. *Map No. 702, scale 10 m. = 1 in.
863. Wells on Island of Montreal, by F. D. Adams. 1901. Maps Nos. 874, 875, 876.
923. Chibougamau region, by A. P. Low. 1905.
962. Timiskaming map-sheet, by A. E. Barlow. (Reprint). Maps Nos. 599, 606, scale 4 m. = 1 in.; 944, scale 1 m. = 1 in.
974. Report on Copper-bearing rocks of Eastern Townships, by J. A. Dresser. Map No. 976, scale 8 m. = 1 in.
975. Report on Copper-bearing rocks of Eastern Townships, by J. A. Dresser. (French).
998. Report on the Pembroke sheet, by R. W. Ells. (French).
1028. Report on a Recent Discovery of Gold near Lake Megantic, Que., by J. A. Dresser. Map No. 1029, scale 2 m. = 1 in.
1032. Report on a Recent Discovery of Gold near Lake Megantic, Que., by J. A. Dresser. (French). Map No. 1029, scale 2 m. = 1 in.

NEW BRUNSWICK.

218. Western New Brunswick and Eastern Nova Scotia, by R. W. Ells. 1885. Map No. 230, scale 4 m. = 1 in.
219. Carleton and Victoria counties, by L. W. Bailey. 1885. Map No. 231, scale 4 m. = 1 in.

242. Victoria, Restigouche, and Northumberland counties, N.B., by L. W. Bailey and W. McInnes. 1886. Map No. 254, scale 4 m.=1 in.
269. Northern portion and adjacent areas, by L. W. Bailey and W. McInnes. 1887-8. Map No. 290, scale 4 m.=1 in.
330. Temiscouata and Rimouski counties, by L. W. Bailey and W. McInnes. 1890-1. Map No. 350, scale 4 m.=1 in.
661. Mineral resources, by L. W. Bailey. 1897. Map No. 675, scale 10 m.=1 in.
New Brunswick geology, by R. W. Ells. 1887.
799. Carboniferous system, by L. W. Bailey. 1900. }
803. Coal prospects in, by H. S. Poole. 1900. } Bound together.
983. Mineral resources, by R. W. Ells. Map No. 969, scale 16 m.=1 in.
1034. Mineral resources, by R. W. Ells. (French). Map No. 969, scale 16 m.=1 in.

NOVA SCOTIA.

243. Guysborough, Antigonish, Pictou, Colchester, and Halifax counties, by Hugh Fletcher and E. R. Faribault. 1886.
331. Pictou and Colchester counties, by H. Fletcher. 1890-1.
358. Southwestern Nova Scotia (preliminary), by L. W. Bailey. 1892-3. Map No. 362, scale 8 m.=1 in.
628. Southwestern Nova Scotia, by L. W. Bailey. 1896. Map No. 641, scale 8 m.=1 in.
685. Sydney coal-field, by H. Fletcher. Maps Nos. 652, 653, 654, scale 1 m.=1 in.
797. Cambrian rocks of Cape Breton, by G. F. Matthew. 1900.
871. Pictou coal-field, by H. S. Poole. 1902. Map No. 833, scale 25 ch.=1 in.

MAPS.

1042. Dominion of Canada. Minerals. Scale 100 m.=1 in.

YUKON.

805. Explorations on Macmillan, Upper Pelly, and Stewart rivers, scale 8 m.=1 in.
891. Portion of Duncan Creek Mining district, scale 6 m.=1 in.
894. Sketch Map Kluane Mining district, scale 6 m.=1 in.
916. Windy Arm Mining district, Sketch Geological Map, scale 2 m.=1 in.
990. Conrad and Whitehorse Mining districts, scale 2 m.=1 in.
991. Tantalus and Five Fingers coal mines, scale 1 m.=1 in.
1011. Bonanza and Hunker creeks. Auriferous gravels. Scale 40 chains=1 in.
1033. Lower Lake Laberge and vicinity, scale 1 m.=1 in.
1041. Whitehorse Copper belt, scale 1 m.=1 in.
1026. 1044-1049. Whitehorse Copper belt. Details.

BRITISH COLUMBIA.

278. Cariboo Mining district, scale 2 m.=1 in.
604. Shuswap Geological sheet, scale 4 m.=1 in.
771. Preliminary Edition, East Kootenay, scale 4 m.=1 in.
767. Geological Map of Crowsnest coal-fields, scale 2 m.=1 in.
791. West Kootenay Minerals and Striæ, scale 4 m.=1 in.
792. West Kootenay Geological sheet, scale 4 m.=1 in.
828. Boundary Creek Mining district, scale 1 m.=1 in.
890. Nicola coal basin, scale 1 m.=1 in.
941. Preliminary Geological Map of Rossland and vicinity, scale 1,600 ft.=1 in.
987. Princeton coal basin and Copper Mountain Mining camp, scale 40 ch.=1 in.
989. Telkwa river and vicinity, scale 2 m.=1 in.
997. Nanaimo and New Westminster Mining division, scale 4 m.=1 in.
1001. Special Map of Rossland. Topographical sheet. Scale 400 ft.=1 in.
1002. Special Map of Rossland. Geological sheet. Scale 400 ft.=1 in.
1003. Rossland Mining camp. Topographical sheet. Scale 1,200 ft.=1 in.
1004. Rossland Mining camp. Geological sheet. Scale 1,200 ft.=1 in.
1068. Sheep Creek Mining camp. Geological sheet. Scale 1 m.=1 in.
1074. Sheep Creek Mining camp. Topographical sheet. Scale 1 m.=1 in.

ALBERTA.

594-596. Peace and Athabaska rivers, scale 10 m. = 1 in.
808. Blairmore-Frank coal-fields, scale 180 ch. = 1 in.
892. Costigan coal basin, scale 40 ch = 1 in.
929-936. Cascade coal basin. Scale 1 m. = 1 in.
963-966. Moose Mountain region. Coal Areas. Scale 2 m. = 1 in.
1010. Alberta, Saskatchewan, and Manitoba. Coal Areas. Scale 35 m. = 1 in.

SASKATCHEWAN.

1010. Alberta, Saskatchewan, and Manitoba. Coal Areas. Scale 35 m. = 1 in.

MANITOBA.

804. Part of Turtle mountain showing coal areas, scale 1½ m. = 1 in.
1010. Alberta, Saskatchewan, and Manitoba. Coal Areas. Scale 35 m. = 1 in.

ONTARIO.

227. Lake of the Woods sheet, scale 2 m. = 1 in.
*283. Rainy Lake sheet, scale 4 m. = 1 in.
*342. Hunter Island sheet, scale 4 m. = 1 in.
343. Sudbury sheet, scale 4 m. = 1 in.
373. Rainy River sheet, scale 2 m. = 1 in.
560. Seine River sheet, scale 4 m. = 1 in.
570. French River sheet, scale 4 m. = 1 in.
589. Lake Shebandowan sheet, scale 4 m. = 1 in.
599. Timiskaming sheet, scale 4 m. = 1 in. (New Edition 1907).
605. Manitoulin Island sheet, scale 4 m. = 1 in.
606. Nipissing sheet, scale 4 m. = 1 in. (New Edition 1907).
660. Pembroke sheet, scale 4 m. = 1 in.
663. Ignace sheet, scale 4 m. = 1 in.
708. Haliburton sheet, scale 4 m. = 1 in.
720. Manitou Lake sheet, scale 4 m. = 1 in.
*750. Grenville sheet, scale 4 m. = 1 in.
770. Bancroft sheet, scale 2 m. = 1 in.
775. Sudbury district, Victoria mines, scale 1 m. = 1 in.
789. Perth sheet, scale 4 m. = 1 in.
820. Sudbury district, Sudbury, scale 1 m. = 1 in.
824-825. Sudbury district, Copper Cliff mines, scale 400 ft. = 1 in.
852. Northeast Arm of Vermilion Iron ranges, Timagami, scale 40 ch. = 1 in.
864. Sudbury district, Elsie and Murray mines, scale 400 ft. = 1 in.
903. Ottawa and Cornwall sheet, scale 4 m. = 1 in.
944. Preliminary Map of Timagami and Rabbit lakes, scale 1 m. = 1 in.
964. Geological Map of parts of Algoma and Thunder bay, scale 8 m. = 1 in.
1023. Corundum Bearing Rocks. Central Ontario. Scale 17½ m. = 1 in.
1076. Gowganda Mining Division, scale 1 m. = 1 in.

QUEBEC.

251. Sherbrooke sheet, Eastern Townships Map, scale 4 m. = 1 in.
287. Thetford and Coleraine Asbestos district, scale 40 ch. = 1 in.
375. Quebec sheet, Eastern Townships Map, scale 4 m. = 1 in.
571. Montreal sheet, Eastern Townships sheet, scale 4 m. = 1 in.
665. Three Rivers sheet, Eastern Townships Map, scale 4 m. = 1 in.
667. Gold Areas in southeastern part, scale 8 m. = 1 in.
668. Graphite district in Labelle county, scale 40 ch. = 1 in.
918. Chibougamau region, scale 4 m. = 1 in.
976. The Older Copper-bearing Rocks of the Eastern Townships, scale 8 m. = 1 in.
1007. Lake Timiskaming region, scale 2 m. = 1 in.
1029. Lake Megantic and vicinity, scale 2 m. = 1 in.

NEW BRUNSWICK.

675. Map of Principal Mineral Occurrences. Scale 10 m. = 1 in.
969. Map of Principal Mineral Localities. Scale 16 m. = 1 in.

NOVA SCOTIA.

812. Preliminary Map of Springhill coal-field, scale 50 ch. = 1 in.
833. Pictou coal-field, scale 25 ch. = 1 in.
897. Preliminary Geological Plan of Nictaux and Torbrook Iron district, scale 25 ch. = 1 in.
927. General Map of Province showing gold districts, scale 12 m. = 1 in.
937. Leipsigate Gold district, scale 500 ft. = 1 in.
945. Harrigan Gold district, scale 400 ft. = 1 in.
995. Malaga Gold district, scale 250 ft. = 1 in.
1012. Brookfield Gold district, scale 250 ft. = 1 in.
1019. Halifax Geological sheet. No. 68. Scale 1 m. = 1 in.
1025. Waverley Geological sheet. No. 67. Scale 1 m. = 1 in.
1036. St. Margaret Bay Geological sheet. No. 71. Scale 1 m. = 1 in.
1037. Windsor Geological sheet. No. 73. Scale 1 m. = 1 in.
1043. Aspotogan Geological sheet. No. 70. Scale 1 m. = 1 in.

NOTE.—Individual Maps or Reports will be furnished free to *bona fide* Canadian applicants.

Reports and Maps may be ordered by the numbers prefixed to titles.

Applications should be addressed to The Director, Geological Survey, Department of Mines, Ottawa.

Canada
Department of Mines
GEOLOGICAL SURVEY

HON. W. TEMPLEMAN, MINISTER, A. P. LOW, DEPUTY MINISTER.
R. W. BROCK, DIRECTOR.

AREAL GEOLOGY | 1910 | QUEBEC

Legend

Sedimentary

Utica-Lorraine

Igneous

Essexite

Umptekite

Geological boundary

Geological boundary, assumed (Zone of mingled igneous and sedimentary rocks)

Geological boundary, inferred (Drift covered)

Dip and strike

Fossils

Legend

Roads and buildings

Bridges

Lakes and streams

Dams

Marshes

Contours, interval 20 feet.

Depression contours

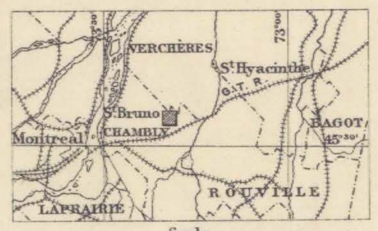
Bench marks

Elevations in feet above sea-level, based on a line of levels from St. Bruno station, Grand Trunk Ry.

C. O. Senécal, Geographer and Chief Draughtsman.
H. Lefebvre, Draughtsman.

Nº 1079

St. BRUNO MOUNTAIN
CHAMBLY COUNTY
QUEBEC



Scale:- 800 feet to 1 inch.

Feet 1000 500 0 1000 2000 Feet
Metres 100 0 100 200 300 400 500 600 700 800 Metres

GEOLOGY
J. A. DRESSER, 1907, 1909.

TOPOGRAPHY
W. H. BOYD, (IN CHARGE) 1908.
W. H. BOYD, COMPILER.

Accompanying Reports Nos 1077 and 1087.

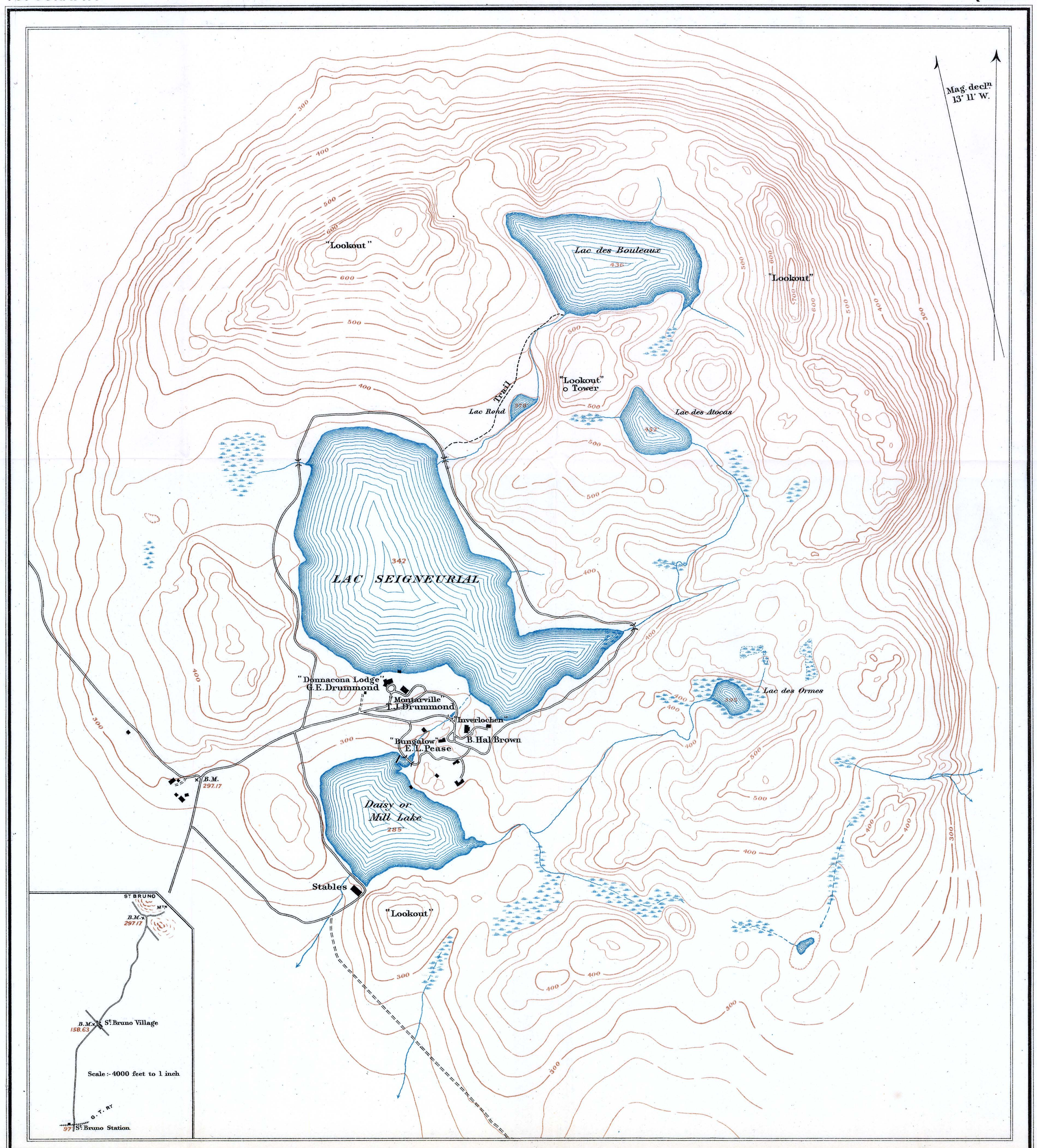
St. Bruno
5.1.9
A, Geol.

1079

Canada
Department of Mines
GEOLOGICAL SURVEY

HON. W. TEMPLEMAN, MINISTER; A. P. LOW, DEPUTY MINISTER.
R. W. BROCK, DIRECTOR.

TOPOGRAPHY | 1910 | QUEBEC

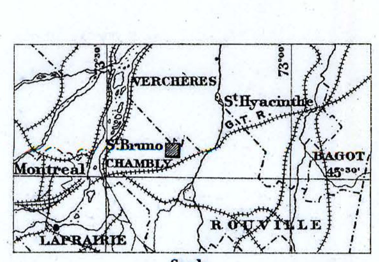


Legend

- Roads and buildings
- Bridges
- Lakes and streams
- Dams
- Marshes
- Contours, interval 20 feet.
- Depression contours
- Bench marks (297.17 ×)
- Elevations in feet above sea-level, based on a line of levels from St. Bruno station, Grand Trunk Ry. (342)

C. O. Senécal, *Geographer and Chief Draughtsman.*
H. Lefebvre, *Draughtsman.*

No 1078



ST BRUNO MOUNTAIN
CHAMBLY COUNTY
QUEBEC

Scale:- 800 feet to 1 inch - 1/9,600

Feet 1000 500 0 1000 2000 Feet
Metres 300 0 100 200 300 400 500 600 700 800 Metres

TOPOGRAPHY
W. H. BOYD, (IN CHARGE) 1908.
W. H. BOYD, COMPILER.

Accompanying Reports Nos 1077 and 1087.