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MARSOUI MAP-AREA, GASPE PENINSULA, PART D

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PROVINCE OF QUEBEC, CANADA

BUREAU OF MINES

Honourable J. E. PERRAULT, Minister of Mines

J. L. BOULANGER, Deputy-Minister A. O. DUFRESNE, Director

ANNUAL REPORT

OF THE

QUEBEC BUREAU OF MINES

FOR THE CALENDAR YEAR

1933

JOHN A. DRESSER, Directing Geologist

PART D

QUEBEC

PRINTED BY R. PARADIS

PRINTER TO HIS MAJESTY THE KING

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THE MARSOUI MAP-AREA
GASPÉ PENINSULA

by I. W. Jones

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THE MARSOUI MAP-AREA, GASPÉ PENINSULA

by I. W. Jones

INTRODUCTION

General Statement and Summary

The investigation described in this report completes the study of a section from the central to the northern part of Gaspé peninsula, which was begun by the Quebec Bureau of Mines five years ago. Although more work can and should be done in extending these studies in adjacent regions, the information that has been obtained is sufficient to give a fairly comprehensive knowledge of a section across central and northern Gaspé, and it is believed that an appropriate stage has been reached in the investigations when a general summary of this information may be presented. Such a description is given in the pages immediately following this report on the Marsoui map-area.

Besides the fact that it completes the section as described above, a primary reason for examining the Marsoui map-area was to investigate its economic possibilities. The presence on Marsoui river of lead and zinc deposits has been known for several years and, more recently, it has been learned that they carry values in gold and silver. It was desirable to obtain more knowledge of these occurrences and of the adjacent country in order to determine the chances of the known deposits being of economic value and of finding other ore-bodies ①.

It was found that most of the map-area is underlain by sedimentary rocks, some, and probably all, of which are of Ordovician age. There are rocks of igneous origin in the southern part of the area: granite of Devonian age, forming the northern end of the extensive intrusive mass of the Tabletop mountains; some narrow diabase dykes, also possibly of Devonian age; and an area underlain by Ordovician basic volcanics. In many places, these various rocks

① A preliminary examination of the Marsoui deposits was made in 1932. See Que. Bur. Mines, Ann. Rept., Pt. D, 1932, pp. 44-51.

are cut by veins of quartz and calcite. The lead-zinc deposits on Marsoui river are associated with quartz veins, and elsewhere in the region metallic minerals, in small amount, were observed under similar conditions. Sufficient indications were observed that warrant continued search for ore-deposits of economic value.

Location and Area

The Marsoui map-area is situated about midway along the northern side of Gaspé peninsula, with the gulf of St. Lawrence forming its northern boundary. The southern boundary is governed by the limits of previously published map-sheets. In the southwestern part, where the area borders the Mount Albert map-sheet ①, the boundary follows latitude 49°00′ for about 3½ miles. Farther east, the southern boundary swings northerly and follows the limits of the adjoining Tabletop map-sheet ②. The physiographic conditions and the desire to cover as much territory as possible prevented the limiting of the area to definite rectangular borders. Along the west side, the boundary follows Martre river, while the eastern border runs along Pierre river. The lighthouse at Sainte-Marthe-de-Gaspé, at the northwest corner of the map-area, is at latitude 49° 12′ 23.553″ and longitude 66° 10′ 18.779″ ③.

Included in the area are about one-half of Christie township, a large part of Duchesnay, and portions of Mont-Louis Seigniory and of the townships of Lapotardière and Boisbuisson. The northern boundary extends along the St. Lawrence for 18½ miles, and the area explored reaches as far as 15 miles from the shore in its most southerly part. The total area is approximately 210 square miles.

Means of Communication

An excellent motor-highway follows the St. Lawrence shore. It is part of the Perron boulevard, which encircles Gaspé peninsula and connects with the other major highway systems of Quebec and New Brunswick. For part of its length within this area, the highway

① Geol. Surv. Can., Map No. 2060, accompanying Mem. 144, 1926.

② Que. Bur. Mines, Map No. 250, accompanying Ann. Rept., Pt. D, 1932.

③ Canadian Hydrographic Service, communication, April, 1934.

follows the shore or on terraces not much above the water level, but in some places it passes over high hills where passage along the lower level is obstructed by steep cliffs that reach and almost overhang the water's edge. A view over the water is seldom lost, however, and from some of the high points on the road, such as two miles east of Marsoui, where a height of 800 feet above sea-level is attained, one may observe a sweeping panorama of many miles of sea, shore, cliffs, and tree-covered slopes that, for scenic beauty, is difficult to surpass. The part of the highway which passes through the Marsoui map-area, with its rugged and majestic character, is one of the finest sections of the Perron boulevard which, as a whole, is famed for the variety and splendour of its scenery.

The nearest railway points are Matane and Gaspé Basin, which, by the motor highway, are respectively 74 miles west and 97 miles east of the limits of the map-area. Matane is the terminus of the Canada Gulf and Terminal railway, which connects with the main line of the Canadian National railway at Mont-Joli. Gaspé Basin is the terminus of the Canadian National Railways branch line that leaves the main line at Matapédia and follows the north shore of the Baie des Chaleurs. A motor-bus service operates between Matane and Gaspé Basin.

The area may also be reached by the water route. Mont-Louis, only six miles east of the map-area, is a port of call in a regular steamship service operating between Montreal, Gaspé, and Newfoundland.

There are telegraph offices at Sainte-Marthe-de-Gaspé and at Mont-Louis. This part of Gaspé is not connected by telephone with the remainder of the Province, and there is only a short private telephone line between Marsoui and Sainte-Marthe.

Within the area, as shown on the accompanying map, there are a few waggon roads, which begin at the St. Lawrence shore and extend up the main valleys. They are all short, however, continuing only for two to four miles, or not much beyond the cultivated areas, which are of limited extent. From these roads, trails lead to more southerly points, but only one of them, that passing by Claude lake, reaches as far as the southern limit of the map-area. This trail also continues to the Tabletop mountains, connecting with other trails and eventually with roads that lead to the southern side of the peninsula. From

Claude lake, another trail goes southeasterly to join one that connects Mont-Louis with Madeleine-Nord river and the Tabletop mountains. These trails to and from Claude lake were made some years ago for the use of hunting clubs in the region, but in recent years they have not been kept in good repair. A 'jumper' ① may be used for transportation as far as Claude lake. There are 'jumper' trails, formerly winter roads used in lumbering operations, following Marsoui-Est and Marsoui rivers. That following Marsoui-Est river reaches a point about 8½ miles from the St. Lawrence; it is now in need of repair. The trail along Marsoui river is in good condition; it goes as far as the mining claims, 13 miles from the shore. A fairly good trail follows Martre river to the lake at its head and thence continues down the valley of Duchesne creek to join the trail on Marsoui river.

The writer has drawn attention in previous reports to the urgent need of establishing better means of communication in interior Gaspé. It is desired to emphasize again this necessity. Immediate advantages would accrue from such a step, whether in the form of 'jumper' trails or roads, from the viewpoint of tourist traffic, forest protection, and especially the aid that would be given to those searching for minerals. The question has at times been discussed of constructing a road across the peninsula from the St. Lawrence to the Baie des Chaleurs. An excellent beginning has been made by the Provincial Government in building a gravelled road for 45 miles from the south shore of the peninsula as far as the mining camps in Lemieux township, and one suitable for waggons easterly from that point and passing about eleven miles south of the Marsoui map-area. Should the decision be made to connect this road with the north coast, the writer offers the following suggestion: A road could be constructed with little difficulty from the village of Marsoui following Marsoui-Est river, passing Les Quatre Lacs and crossing Sainte-Anne-Nord-Est river a short distance above the mouth of Cascades brook. The road could then ascend the northern spur of Tabletop mountains and, crossing that high region, eventually reach the road already built on the other side. It is believed that this route would be among the shortest available and no serious difficulties should be encountered in establishing suitable

① A 'jumper' is a low wooden sleigh, sometimes with sheet-iron runners, that may be drawn over the ground by one horse. A load of 200 to 400 pounds may be transported in this way. The trail is necessarily wider than a foot-path.

grades. In addition to offering greater attraction from the viewpoint of the tourist than any other route across the peninsula, such a road would pass through a country where geological conditions are sufficiently favourable to indicate the possible presence of metallic minerals. Plate III-A shows the view at Les Quatre Lacs, where fishing and hunting are also attractions. A description of the Tabletop mountains and the numerous lakes there has been given in a previous report ①; the waggon-road and the motor-road already built farther south also pass through a region with scenic and other attractions.

Field Work and Acknowledgments

The field work in preparation for this report and the accompanying map was carried on during a period of four months in 1933. A closed survey was made with telemeter and stadia to establish a control for location and elevation. This survey, beginning at the St. Lawrence shore, followed the trail up Claude river to Claude lake, thence westerly along the township line to Marsoui river, northerly along the trail following that stream to the St. Lawrence, and finally along the shore to the starting point. Additional stadia surveys were made for control and also to tie with the surveys which had been made in previous years and which had been begun in the central part of the peninsula. A very satisfactory agreement with this previous work was obtained. From the control surveys, side traverses were made by pacing with compass and aneroid. An aneroid was kept in camp and read every hour in order to check and correct the elevations indicated by the aneroids used in the field work.

During the field season, blueprints supplied by the Quebec Department of Lands and Forests were available, showing the first two range lines of Christie and Duchesnay townships and most of the principal streams. Additional surveys of the township lines and other range lines, as shown on the accompanying map, were made for that Department during the summer of 1933; but the resulting plans were available only after the writer's departure from the field.

To Dr. E. M. Kindle and Dr. Alice E. Wilson, of the Geological Survey of Canada, deep appreciation is expressed for examining the fossils collected during this investigation. Special acknowledgment

① Jones, I. W., *The Tabletop Map-area;* Que. Bur. Mines, Ann. Report Pt. D, 1932.

is made to Dr. Rudolf Ruedemann, State Palæontologist, New York State Museum, who classified the graptolites and most kindly aided by correspondence in the problem of correlating the formations of this map-area with those in New York and elsewhere.

Assistance in the field was rendered by A. E. Miller, H. S. Bérubé, L. Lavigne, and P. Normandeau.

General Topography

The rugged topography characteristic of the whole of Gaspé is perhaps more pronounced in this map-area than elsewhere in the peninsula. The elevations range from sea-level along the St. Lawrence shore to 3,800 feet at the southern border of the area, and to still higher levels a few miles farther south. The rise is rapid from the shore to elevations of 1,200 to 1,700 feet, with almost no low ground bordering the coast excepting at the mouths of the principal valleys that enter from the south. The region is dissected by deep valleys, the steep sides of which rise 1,200 to more than 2,000 feet above the valley bottoms.

A more detailed account of these physiographic features is given in later pages.

Inhabitants

The villages in the map-area—Mont-Saint-Pierre (Rivière-à-Pierre) ①, Rivière-à-Claude, Ruisseau-à-Rebours (Ruisseau Arbour), Marsoui (Marsouins), and Sainte-Marthe-de-Gaspé (Rivière-à-la-Martre)—are all at the coast, at the mouths of the streams bearing the same names. Most of the population is confined to these places. There are some families living on the terrace between Ruisseau-à-Rebours and Rivière-à-Claude, and at Sainte-Marthe there are some farm-houses on the hillside east of the village proper. Very few inhabitants dwell away from the coast, and then only a mile or so distant. At the claims on Marsoui river, 13 miles from the coast, two cabins have been built recently, but elsewhere in the interior, cabins are few and mostly abandoned or little used.

The total population is in the neighbourhood of 900 to 1,000. Agriculture and fishing are the main industries, though lumbering,

① Names in brackets are others by which these villages are known.

frequently in operations outside this map-area, employs some of the people. Others are occupied in the maintenance of the highway, in various functions for the marine service, and as fire-rangers for the lumber companies and the government. The tourist traffic, which has developed considerably since construction of the highway in 1929, and hunting parties, also, directly or indirectly, afford employment for some of the inhabitants.

Agricultural Possibilities

As the accompanying map illustrates, the areas available for agricultural purposes, being defined by topographic conditions, are of limited extent. Flat stretches with suitable soil are to be found on terraces and bordering the streams in the lower parts of the principal valleys. For the most part, available ground so situated is already occupied, but there still remain some narrow tracts extending up the valley bottoms to distances of about three to five miles from the coast, especially in the valleys of Pierre and Martre rivers. On Marsoui river, there are narrow flats as far as six miles from the shore, but in range V, the valley sides are so high that direct sunlight is shut-off from the bottom of the valley during much of the day.

Only in one part of the coast—excepting at the mouths of the valleys—is there any extensive tract available for agricultural purposes. This is between Ruisseau-à-Rebours and Rivière-à-Claude, where a series of marine terraces extend for about a quarter of a mile back from the shore. There are a few small patches of flat ground bordering the highway between Marsoui and Sainte-Marthe, and in some parts of that section farming operations may be undertaken on the hillside where the slope is not too steep.

The remaining ground available for agricultural purposes is situated on the top of the high interfluvial regions, at elevations of 1,000 to 1,700 feet above sea. There are some fairly extensive areas of this type, extending to about five miles from the shore, the largest and probably the most suitable area being that between Marsoui and Martre rivers. A few small farms, said to be meeting with success, have been begun on this upland region near Sainte-Marthe (*see* Plate I-B) but these clearings comprise only a small percentage of similar ground that is available. It is believed that the soil, resulting mostly from the decay of the underlying slate, limestone, and sandstone, would

be favourable. The question of water-supply would have to be considered in some of the flat-topped higher areas; where there are no streams it would be necessary to investigate the possibility of obtaining water from wells. It would be essential, moreover, if farms are to be made on these higher lands, to connect them to the coastal section by means of good roads with an easy grade. While the writer believes these upland regions, as far as about five miles from the shore, to be suitable for farming, it is recommended that an agricultural expert, more familiar with the problems involved, should examine the territory from this special viewpoint.

There is not sufficient ground suitable for agricultural purposes to warrant an extensive scheme of colonization by bringing in settlers from elsewhere. Indeed, there is probably not much more than enough to interest those local inhabitants who are not now farming and to meet the needs resulting from expansion of the present population.

Timber

A dense growth of timber covers the region, with the exception of the higher slopes and summits of the Tabletop mountains. Over most of this wooded area the timber is of commercial value. A small quantity of timber has been destroyed by forest fires in a few places between Marsoui-Est and Marsoui rivers, and in the southwest corner of the map-area considerable damage has been caused by strong winds. Some timber has been cut for lumber and for the pulp and paper industry, but most of the forest wealth is yet available for exploitation.

Balsam and spruce are the most abundant trees, though there is a good scattering of birch throughout the area. Maple trees, from the sap of which the inhabitants manufacture syrup and sugar, are to be found in groves along the valley bottoms for a distance as far as six miles from the shore. Cedar trees, in less abundance, are found in the lower levels.

Water-Power Possibilities

The streams in this area, although not deep during most of the year, are usually from 15 to more than 25 feet in width, and, flowing in narrow, steep-sided valleys, they descend from considerable heights

in relatively short distances. Their sources, in many cases, are lakes sufficiently large to act as reservoirs for possible water-power developments. Although there may not be sufficient volume of water for large enterprises, the possibilities of small-scale developments, should the need arise, are worthy of investigation. Among other sites that may be favourable for such operations is one on Claude river, which descends 2,000 feet in a distance of four miles below Claude lake.

Previous Geological Work

Geological and physiographic studies in which this region was involved have been made at various times, but mainly in connection with investigations of a wider scope and necessarily of a reconnaissance nature.

Sir William Logan ①, in 1844, continued his studies of the Gaspé coast, which he had begun the previous year, and explored the north shore of the peninsula from Cap-des-Rosiers as far as Cap-Chat. From the latter place he crossed the peninsula by way of the Cap-Chat and Cascapédia rivers, and then examined the shores at the head of the Baie des Chaleurs and ascended the Matapédia valley.

In 1858, J. Richardson ②, in the course of his work in Gaspé peninsula, examined the coast from Rivière-du-Loup to a point seven miles east of Marsoui river, and then went to the Tabletop mountains, going by way of Marsoui river and returning to the coast by way of Marsoui-Est river, or Henley's brook as it was called by Richardson.

Robert Bell, after various expeditions to Gaspé, in some of which he accompanied Richardson, published a paper ③ in 1863 dealing with the superficial geology of the peninsula.

In 1882, the work of R. W. Ells ④ included an investigation of the coast from Cap-des-Rosiers to Métis.

R. Chalmers ⑤ visited this part of the peninsula in 1904, during a study of its surface geology.

① Geol. Surv. Can., Rept. of Prog., 1844.
② Geol. Surv. Can., Rept. of Prog., 1858.
③ Can. Nat. and Geol., Vol. VIII, 1863, pp. 175-183.
④ Geol. Surv. Can., Rept. of Prog., 1880-81-82, Pt. DD.
⑤ Geol. Surv. Can., Summ. Rept., 1904, pp. 252-56, 258.

The physiography and glacial geology of Gaspé peninsula was investigated by A. P. Coleman ① in 1918 and 1919, and during the course of this examination parts of the present map-area were visited.

The region adjoining the southern boundary of the Marsoui map-area has been mapped and described in reports by F. J. Alcock ② and the present writer ③.

PHYSIOGRAPHY AND GLACIATION

Topography

Inland Region:

There is a difference of 3,800 feet in elevation between the highest part of the map-area, on Northwest mountain, and the lowest, at sea-level along the St. Lawrence shore. Even though there is this difference, the topography of the map-area is essentially of the one type—an elevated region, cut by narrow, deep steep-sided valleys. This condition is characteristic of the whole map-area, even of the region immediately bordering the shore. For the most part, there is no transitional phase between the coast-line and the high land, which quickly attains an elevation of more than 1,200 feet above the sea, and in one part even reaches 1,700 feet at a distance of only one mile from the shore. This elevated character is typical of the mountainous coast that extends for a length of 50 miles, from Tourelle on the west to Madeleine river on the east. It is a region in which the Shickshock mountains broaden and extend sufficiently far northward that their foothills or outer summits actually reach, and abruptly drop to, the shore.

Southward from the shore, after the short distance in which the land rises to an elevation of usually about 1,200 feet above sea-level, but to as much as 1,700 feet near Pierre river, the ridges of variable width between the north-trending river valleys present an almost flat appearance, in places sufficiently so to form plateau-like areas of limited extent. There is a general, gentle southward rise in the elevation of this dissected plateau until, at three to five miles from the coast, it is

① Geol. Surv. Can., Mus. Bull. 34.

② Geol. Surv. Can., Mem. 144, 1926.

③ Que. Bur. Mines, Ann. Rept., 1932, Pt. D.

about 1,700 feet above sea-level. The interfluvial areas then rise rapidly towards the south until elevations of 2,500 to 2,700 feet are attained, after which, while continuous flat areas are not abundant, there is another region with rather accordant summits, rising gently until, near the Sainte-Anne River valley, they are 3,000 to 3,400 feet above sea-level. On the south side of this valley are the still higher summits of Tabletop mountains, as much as 3,800 feet above the sea in this map-area, but rising to 4,160 feet at Mount Jacques Cartier, a few miles farther south.

The Coast:

The coast presents a uniform, almost smooth line with indentations only at the mouths of rivers. Excepting in one locality, it is only where streams enter the gulf that any flat ground borders the shore above high-tide level, and even then only to a limited extent. The one exception is at that part of the coast between Ruisseau-à-Rebours and Rivière-à-Claude, where there are a series of terraces from 45 to 245 feet above sea-level permitting farming operations to extend for about one-quarter of a mile from the shore. Former marine beaches are a characteristic feature of this part, as of all the coast, of Gaspé, though none of them continue unbroken for any considerable distance. Along the shore, wave-action has destroyed much of the evidence of the former existence of such beaches, but in the lower parts of the valleys, the terraces, usually occupied by small farms, are well exposed, rising in step-like fashion one above the other (*see* Plate II-A). At least ten of such former marine beaches may be recognized in this map-area, and probably more if sufficient search were made. Coleman ① measured fourteen terraces at Sainte-Anne-des-Monts, ranging from 19 to 270 feet above the sea.

Drainage

All the streams of the map-area drain into the gulf of St. Lawrence. The drainage pattern for the most part is one of parallel, north-trending valleys, the side branches of which are short, as the trunk valleys are only three to five miles apart and frequently are separated by plateau-like areas. These principal streams—Pierre river, Claude

① *Loc. cit.*, p. 17.

river, Rebours brook, Marsoui river, and Martre river—head nine to thirteen miles from the shore at altitudes of 1,800 to 2,400 feet above sea-level. As indicated on the accompanying map, the grades of these streams to within a few miles of the shore are strong; Claude river, for example, descends 2,000 feet below Claude lake in a distance of four miles. Chutes and falls are common, the water in places falling as much as fifty feet in a very short distance. The streams seldom exceed a width of 30 feet, and they scarcely deserve the designation of 'river' that is given to them. During the spring-floods and after continued heavy rains, the water rises rapidly and the swollen streams may become waist deep and swiftly flowing, but during much of the summer season they are easily fordable on foot.

While most of the streams flow almost directly northward, some in the southern part reach the St. Lawrence only after traversing circuitous routes. Sainte-Anne-Nord-Est river is one of these streams, flowing westerly at first and eventually reaching the shore at Sainte-Anne-des-Monts, 17 miles west of this map-area. In the southeast corner there are brooks that lead to Madeleine river and reach the place of that name on the St. Lawrence shore, 25 miles east of the map-area, only after having flowed through a distance of more than 50 miles.

The valleys, usually narrow and steep-sided, are deeply entrenched, being from 1,200 to more than 2,000 feet below the adjacent summits. Only in the lower parts of the valleys, near the St. Lawrence shore, are the streams bordered by any extensive river flats.

The names applied in this report, and on the accompanying map, to the streams in the area have all been employed previously, either on other maps or by local usage. There are, however, some differences in the spelling of these names. Rebours brook is also known as Arbour brook. Marsoui river has been called Marsouis, Marsouin, and Marsouins. *Marsoui* is the correct designation, as it is the name originally given by the Indians; it is a word of Micmac, not of French, origin, meaning *fire-stone*. There is a possibility that the name was applied to this river from the fact that, at its mouth and along the neighbouring shore, there are beds of hard chert which may once have been used for striking fire.

Nearly all the streams have lakes at their headwaters. The largest of these is Claude lake, which has a length of about $1\frac{1}{4}$ miles. It is interesting to note that these lakes are in a zone, roughly paralleling the coast and extending almost to the eastern end of the peninsula, in which lakes and ponds are abundant. Further work may verify the possibility that is here suggested, namely, that this zone follows near the broad crest of an anticlinal structure, on which, however, there may be superimposed subsidiary folds. Some of these lakes may prove of value as reservoirs in possible small-scale developments of hydro-electric power.

There are examples in this map-area of the interesting physiographic feature of stream-capture, involving changes in direction of drainage, in some places of south-flowing streams diverted to flow north, but also, in others, of northward flowing streams diverted to other directions. Alcock① has discussed this subject in detail with reference to contiguous areas. An example of such a changed course is to be seen at the headwaters of Marsoui river. The most southerly part of this stream, where it comes from the west, about two miles south of the township line, at one time flowed south to the Sainte-Anne river. Where the stream now turns sharply to the north, the ground is low and swampy, with land only a few feet higher preventing the water from flowing south. Without entering into details, other instances may be cited where the Sainte-Anne river has captured waters that at one time drained directly north: Cascades brook once flowed to the St. Lawrence by way of the valley of Les Quatre Lacs and Marsoui-Est river; and the brook in the north-trending valley one mile east of Cascades brook in all probability used to flow by way of the Claude valley before the Sainte-Anne valley was eroded eastwards to capture it.

Glaciation

As noted by previous investigators, with whom the present writer agrees, the Labrador ice-sheet did not cover this region. It may have impinged on the northern coast, where rock boulders, transported

① *Loc. cit.*, pp. 18-21; also Bull. Geol. Soc. Amer., Vol. 39, No. 2, 1928, pp. 403-420.

from the region north of the St. Lawrence, are to be found along the beach and part of the way up the neighbouring slopes. It seems probable, however, that these boulders and blocks were carried by floating ice and deposited on the present beach, and on the former (now raised) beaches when they were at sea-level. Coleman ① is of opinion that the Labrador ice-sheet actually reached the north shore of Gaspé, though not rising upon the higher land. He observed typical blue boulder-clay with striated stones, some of which must have come from the Labrador or Quebec region. None of this boulder clay, however, was found more than a mile or so inland, and never more than 100 feet above sea-level.

While continental glaciation played a negligible rôle in this region, there nevertheless was glaciation of a local character, with the snow and ice accumulating in the higher interior parts of the peninsula. Chalmers ② found no evidence of ice action along the north coast between Rivière-au-Renard and Sainte-Anne-des-Monts, even on the higher hills and summits, the ice-sheets having moved, according to him, from the interior towards the east, south, and west. Coleman ③ however, on the upland surface near the north shore, found granite boulders that have been transported from Tabletop mountains, 12 miles or so to the south. The present writer, in similar conditions, noted a few boulders, more than six feet in diameter, which could have reached their present position only by glacial transportation. The effects of this local glaciation, however, were relatively slight. Most of the soil and rock débris above the valley bottoms is of residual nature, resulting from the weathering of the immediately underlying bed-rock or having moved only a short distance down the hillside slopes.

The valleys for the most part are *V*-shaped and do not present the aspect of having been glaciated. In some places, however, such as in the broad valley containing Les Quatre Lacs, and in other valleys at about the same distance from the shore, it was observed that, higher than an elevation of about 2,000 feet above sea-level, the valley sides are less steep in contrast to the sharp drop below that level. From this altitude upwards, the valley-sides present a broad *U*-shaped

① *Loc. cit.*, p. 12.

② *Loc. cit.*, p. 253.

③ *Loc. cit.*, p. 18.

appearance and there is frequently more glacial débris than elsewhere. It is possible that these higher parts represent valleys that were occupied by glaciers, and that the narrow, steep-sided lower portions represent the parts eroded subsequent to any glacial action.

DESCRIPTIVE GEOLOGY

General Statement

The bed-rocks in the Marsoui map-area are of sedimentary, volcanic, and intrusive origin. They are all of Palæozoic age. Outcrops are abundant along the shore of the St. Lawrence in the zone between the high and low tide levels, and, of course, the rocks are well exposed in the cliffs, which are in places more than 300 feet high. Usually, rock exposures are lacking in the embayments at the mouths of the principal streams, where sandy beaches occupy the shore. Inland, outcrops are fairly numerous along the water courses, excepting in some of their lower parts, where they flow through low ground underlain by alluvial deposits. In places, there are bare escarpments of rock on the steep sides of the valleys, but exposures are lacking on the summits, except in the higher region of the Tabletop mountains, where there are extensive bare patches of rock, broken by weathering into blocks and fragments of variable size.

Although exposures are relatively abundant, the information thus far obtained is insufficient for purposes of classifying the rocks with respect to their age, except in a rather broad way. It is believed that further work, especially east and west of this map-area, would make possible a more detailed age classification, particularly of the sedimentary formations, and would aid in correlating them with the somewhat similar rocks that extend along the St. Lawrence valley as far west as, and beyond, the city of Quebec.

The types and possible succession of the rocks met with in the area are as follows:

TABLE OF FORMATIONS

MIDDLE (?) DEVONIAN	Diabase dykes; may possibly be of Ordovician age Granite, granodiorite, diorite and related rock types
MIDDLE, or in part LOWER, ORDOVICIAN.	Conglomerate, slate, limestone Basic volcanics Shale, slate, limestone, chert, and sandstone
LOWER (?) ORDOVICIAN.	Shale, slate, limestone, sandstone, and quartzite

LOWER (?) ORDOVICIAN

The rocks classified as Lower (?) Ordovician include all the sedimentary rocks of the map-area with the exception of those in the southwest corner, south of the belt of basic volcanics, and those occupying a narrow belt along the coast that begins at Marsoui and extends westward to and beyond Rivière-à-la-Martre. The upper limit of this Lower (?) Ordovician is placed at the top of a massive sandstone horizon which is exposed along the shore east of Marsoui river. At that point it leaves the shore, but continues with a westerly trend along the slopes facing the St. Lawrence and crosses Martre river $1\frac{1}{4}$ miles from its mouth. The rocks north of the boundary thus defined are of younger age than this sandstone, as is indicated in exposures on the shore at the eastern entrance to the cove of Marsoui river. At this point the sandstone forms the crest of an anticline that plunges westward beneath other sedimentary rocks, which are thus higher in the stratigraphic sequence. The sandstone of this horizon does not appear at all along the coast between Marsoui and Sainte-Marthe; instead, strata successively higher in the series are encountered as the western boundary of the area is approached.

The lithological contrast between the beds overlying this sandstone and the beds lower in the series is so sharp that, on this basis alone, there are grounds for marking a major division of the strata at the top of these massive sandstones. Whether this horizon also marks a major chronological division is difficult to establish, with our

present knowledge. A few fossils were found in the sandstones along the shore and in the underlying beds of slate and limestone along Marsoui river and Martre river in the interior part of the map-area. These fossils—mainly small brachiopods, with some graptolites, crinoid stems, and a species of bryozoa—are too fragmentary, however, to be specifically named, and, consequently, are of little value in establishing the age of the rocks concerned. In reporting on the graptolite forms in a collection submitted to him by the writer, Dr. Rudolf Ruedemann suggested a Middle or Upper Ordovician age for them, but emphasized the insecurity of the evidence. For the brachiopods and other fossils of this collection, Dr. Alice E. Wilson, of the Geological Survey of Canada, suggested a possible Middle Ordovician age, but again strong emphasis was given to the inadequateness of the material. This meagre evidence seems to indicate that the chances are in favour of the rocks being of Ordovician age. The beds overlying the massive sandstones at Marsoui, as will be discussed further in later pages, contain fossils definitely known to belong to formations near the base of the Middle Ordovician, and some that Dr. Ruedemann believes to be of Lower Ordovician age. It seems permissible, then, to deduce that the beds below the top of the sandstones belong to the Lower Ordovician, and provisionally, they are so classified. But until a better knowledge is obtained, the element of doubt should always be indicated. Other possibilities would be that these rocks belong to the lowest part of the Middle Ordovician; and, less probable, that part of the series in the interior of the map-area may be as early as Cambrian in age.

The massive sandstones are in beds up to ten feet thick, and some zones forty feet in thickness are made up entirely of this type of rock. They are calcareous in character, and grey in colour on a freshly broken surface. They contain angular fragments, up to half an inch in size, of slate, limestone, chert, and dark quartz. On the weathered surface, greenish-yellow in colour, the rock presents a coarse, rough appearance, almost that of a conglomerate, but on the freshly broken surface this character is lacking and the rock is seen, in general, to be of medium grain with the coarser particles scattered through it. Some slates and arenaceous limestones are interbedded with the sandstones. This zone of massive beds is exposed along the shore of the St. Lawrence for a distance of about three-quarters of a mile east of Marsoui. For a distance of about two miles farther towards the

east, beds exposed are lower in the stratigraphic sequence, and consist mostly of alternating grey slate and limestone, with several beds, up to ten feet in thickness, of medium- to coarse-grained calcareous sandstone. Following this series farther east along the shore, and still stratigraphically lower, the rocks for about 1¼ miles are again predominantly massive, calcareous, medium- to coarse-grained sandstones, resembling those near Marsoui but in general not as coarse or not as massive in appearance. From this point, which is 1½ miles west of Ruisseau-à-Rebours, to Mont-Saint-Pierre, the rocks, grey to dark grey in colour, are mostly interbedded slates, arenaceous slate, limestone, arenaceous limestone, and fine-grained calcareous sandstone. The harder beds are usually about one foot thick, but in places the thickness is as little as one inch and as much as three feet. In some places the calcareous types predominate, in others the slate is more abundant. The typical appearance of these beds along the beach is shown in Plate II-B. Sandstone in massive beds such as are exposed 1¼ miles west of Ruisseau-à-Rebours is found again, overlying the interstratified slate-limestone series, at Pointe de Chasse and Petit-Cap. Approaching Mont-Saint-Pierre from the west, although some beds are repeated by folding, the strata met with are successively older, and those at Mont-Saint-Pierre are the lowermost rocks exposed along that part of the coast which lies within the limits of the map-area.

Beds similar to those exposed along the beach between Mont-Saint-Pierre and the point 1½ miles west of Ruisseau-à-Rebours outcrop along the lower parts of the streams flowing to the St. Lawrence from the south. It is possible that beds of similar appearance as far south as nine miles from the coast may also be of the same general horizon, but too great a reliance must not be placed on lithological resemblance for purposes of correlation.

Slates are the most abundant rock type encountered in the interior; they are dark grey and platy in some places, but in others are almost black in colour and with a splintery fracture. Some of the slates, especially in the upper part of Claude river, contain abundant fine pyrite, and some springs issuing from them are strongly sulphurous. One thin bed, observed in different places, is composed of soft, black, carbonaceous shale that readily soils the fingers or leaves a mark on paper. Some of the black, splintery slates are also

carbonaceous, but to a lesser degree. Red slates from beds that seem to be only a few feet thick were observed as loose débris well up the valley sides near the claims on Marsoui river and at a few other localities. Similar red slates, probably of the same stratigraphical horizon, were found in place on the river about half a mile below Duchesne creek, where they dip northerly. They were not seen again in the interval between this point and the coast. They are probably relatively near the base of the Lower (?) Ordovician section exposed in this map-area, and at a considerably lower horizon than the red beds, to be mentioned later, that outcrop along the shore west of Marsoui.

In addition to limestones similar to those found along and adjacent to the coast, more massive beds of this rock appear about five miles inland and are frequently met with throughout the area farther towards the south, being repeated several times owing to folding. Some of these limestone beds have a thickness of more than twelve feet. They are argillaceous, dolomitic, and in places finely arenaceous. It is possible, although evidence is lacking to support this suggestion, that these massive limestones may represent highly calcareous phases of some of the massive sandstone beds of the coast. Beds of dark, almost black, limestone, weathering brown, are to be seen in various places; they are one to two feet thick usually and are traversed by veinlets of calcite and sometimes of quartz. Hard, light-grey, calcareous sandstone beds up to one foot thick are also found, often at the base of, and grading up into, massive beds of argillaceous limestone. The dark limestones and the calcareous sandstones strongly resemble some of the beds along the shore west of Mont-Saint-Pierre.

The oldest part of this series in the map-area is believed to be represented by the rocks underlying the zone extending through the headwaters of Marsoui and Claude rivers. To the north of this zone, the beds are repeated in a series of folds, but, as well as can be determined, the higher horizons are to be found towards the coast. Southerly from this zone of supposedly oldest Lower (?) Ordovician rocks, the beds dip more regularly, and generally towards the south. Younger horizons are encountered as the southern boundary of the map-area is approached, until the beds are cut by the Tabletop granite near Petit Lac Sainte-Anne and until they are overlain by the still younger series of basic volcanics on the high ridge that extends westerly from

Northwest mountain. In this section, the rocks are of much the same type as those found in the northern part of the area, but there is a tendency for the beds to be harder and to present a more massive appearance, probably due to their proximity to the large intrusive masses of Tabletop mountains and mount Albert. In addition to slates and limestones, some beds of quartzite are found, probably representing the arenaceous beds of the more northerly part of the area.

There is such a general similarity of the sedimentary rock types throughout the map-area as a whole, with the exception of the narrow belt bordering the shore between Marsoui and Sainte-Marthe, that one cannot help but gain the impression that these rocks are all part of the same major formation. The beds are considerably disturbed and much repeated by folding, and with the data at hand it is not possible to compute the thickness of the section represented; but it is quite probable that the total thickness is not as great as the width of territory underlain by these rocks might suggest.

Middle, or in part Lower, Ordovician

Sedimentary Rocks:

The sedimentary rocks that are here classified as Middle Ordovician—with the possibility that some of them may be of Lower Ordovician age—are exposed in a belt which borders the shore from Marsoui to and beyond Martre river. There are some sedimentary rocks of uncertain age in the southwest corner of the map-area that are also being provisionally placed in this division. The base of this series, in the belt bordering the shore, is placed at the top of the massive sandstones already described, which appear on the eastern side of the cove at the mouth of Marsoui river and at other places farther eastward. The structural proof that the rocks west of this point are stratigraphically younger than these sandstones has already been given. The younger beds are well exposed along the shore between Marsoui and Sainte-Marthe, and may be seen in some places along the highway between these two points. There are a few outcrops of these rocks in escarpments on the west side of Marsoui river, near its mouth, but only occasional exposures along the slopes facing the coast. The beds also outcrop at several places along

Martre river, for a distance of about $1\frac{1}{4}$ miles from the shore. South of this point, the rocks met with all belong to the underlying, Lower (?) Ordovician series.

The outcrops along the shore expose a section of this series that is believed to be predominantly Middle Ordovician in age. The massive sandstones on the coast at the east side of Marsoui river are overlain by dark grey to black fissile slate, grey calcareous slate, black chert, beds grading from argillaceous chert to cherty slate, and occasional beds of dark grey limestone. These rock types are exposed along the beach and in the cliff for a distance of about three-quarters of a mile westward from Marsoui. The dark-coloured slates are most abundant, but the cherts are also prominent. Beds of the latter are as much as ten feet thick, and possibly more, but crumpling of the strata prevents the making of accurate determinations. In places, the rock contains pyrite in the form of nodular aggregates up to one inch in diameter and also as thin films on the bedding planes. Graptolites are abundant at some horizons in the dark slates and argillaceous cherts. Species found here and at other localities along the shore are listed on page 26.

From the point three-quarters of a mile west of Marsoui to Sainte-Marthe, the strata are green, red, and grey shales and slates, green and light grey chert, and light grey siliceous and dolomitic limestones. Graptolites were found in the grey slates at the localities indicated on the accompanying map. The greenish slates predominate, with the red varieties forming irregular zones and patches. The light grey, dolomitic limestones, sometimes hard and siliceous, are interbedded with the slates at various horizons, in beds from a few inches to three feet in thickness. At one place on the east side of the mouth of Portage brook, these dolomitic beds predominate throughout a zone 100 feet thick. A partial analysis of the rock gave the following result ①: CaO, 22.56%; MgO, 15.82%; Fe_2O_3, 3.44%; Al_2O_3, 3.48%; Insol., 23.41%.

The shales and slates of this series, including the dark grey as well as the green and red types, are characteristically soft, with smooth texture and conchoidal fracture. These characters serve to distinguish them from the grey slates of the lower formation. The cherts and cherty slates also have a conchoidal fracture. Their fine texture and conchoidal fracture are suggestive of deposits precipitated in part

① Analysis by M. Archambault, Que. Bur. Mines Laboratory.

at least from solutions of colloidal character. Many of these beds were probably deposited under shallow water, or were exposed to the air shortly after deposition of the sediment, as is shown by the red and green colours, which usually result from such conditions. Moreover, some of the beds have short markings on their surface that probably represent furrows made by water running over them—as might happen on a beach—at a time when the sediment was not yet consolidated.

Fossils were collected from the dark grey slates and argillaceous cherts at several places along the shore between Marsoui and Sainte-Marthe. They are abundant in the horizons from which these collections were made, and probably a greater variety could be found with further search. Dr. Rudolf Ruedemann, State Palæontologist, New York State Museum, very kindly examined these fossils and reported as follows:

"*Lot 10.*—On shore, 1,000 feet west of mouth of Marsoui river:
Climacograptus cf. *antiquus* Lapworth
Climacograptus modestus Ruedemann
Diplograptus (*Glyptograptus*) *euglyphus* Lapworth
Diplograptus incisus Lapworth
Dicranograptus sp. (branch)

Age.—Upper Normanskill

"*Lot 11.*—On shore, at a point three-quarters of a mile west of mouth of Marsoui river:
Dicellograptus sextans Hall
Dicellograptus sextans perexilis Ruedemann
Dicranograptus furcatus Hall
Climacograptus modestus Ruedemann

Age.—Lower Normanskill (Chazy)

"*Lot 9.*—In cliff, 250 feet west and 180 feet south of lot 11:
Didyomograptus bifidus Hall
Didyomograptus cf. *nitidus* Hall
Didyomograptus patulus Hall
Tetragraptus similis (*bigsbyi*) Hall
Phyllograptus fragment

Age.—Deepkill (Levis shale), Lower Ordovician (Canadian)

"*Lot 12.*—In cliff, at small brook or spring 1,300 feet westerly along the shore from Portage brook:
Dicranograptus furcatus Hall
Diplograptus (*Glyptograptus*) *euglyphus* Lapworth
Climacograptus modestus Ruedemann
Climacograptus cf. *parvus* Hall
Glossopteris ciliatus Emmons

Age.—Lower Normanskill (Chazy)"

Thus, the fossils of lots 10, 11, and 12 show clearly that most of these rocks are of Middle Ordovician age; the possibility that some of them are Lower Ordovician is indicated by the fossils of lot 9.

The interpretations of the ages of the formations so far described differ widely from those made by Ells① in 1882. Because of their similarity to the Sillery and Levis beds (Lower Ordovician) in the vicinity of Quebec, Ells considered the red and green slates west of Marsoui to be of that general horizon and postulated a fault by which these beds had been overthrust on to what he considered the younger rocks of Utica age. Much of this interpretation is due to the confusion existing at that time regarding the stratigraphical position of the 'Hudson River group', to which Ells ascribed the rocks along the coast easterly from a point about a mile above Marsoui. This group was considered by some investigators to be of Chazy-Trenton age, while others regarded it as being equivalent to the considerably younger Utica-Lorraine series. Ells favoured the latter view. Later work has shown that the so-called Hudson River group actually comprises rocks of all these ages.

In another respect, the present writer disagrees with an interpretation of Ells, who states that the cherty slates at the mouth of Marsoui river underlie the massive sandstones. The present opinion is that the evidence clearly shows the sandstones to be underneath the cherty beds. This may be well seen on the east side of the cove at Marsoui, as already described. This new interpretation has an important bearing on the relative ages of the formations in the map-area, and, according to the present view, places all the sedimentary rocks (except perhaps those in the southwest corner of the area) in a lower stratigraphical position than the belt bordering the coast from Marsoui to Sainte-Marthe. The sedimentary belt in the southwest consists of grey slates, limestones, and conglomerates, whose age can be inferred only with considerable uncertainty. These rocks overlie the basic volcanics that are to be described below and are thought to be of Middle or Upper Ordovician age.

① *Loc. cit.*, pp. 22-24.

BASIC VOLCANICS:

A belt of basic volcanics, indicated on the accompanying map, forms a high ridge south of Sainte-Anne-Nord-Est river. These rocks are of the same type, and form part of the same series, as the volcanics a few miles east of this map-area, which were mapped and described by the writer in 1932. The continuity of the belt is broken by the granite mass of Tabletop mountains. The volcanics are dark, greenish to mauve-grey, in colour, and are dense and massive. Very fine-grained varieties predominate, but in places—particularly in the area to the east—there are amygdular, scoriaceous, and brecciated types. While the term 'greenstone' is most convenient as a field designation, they are essentially basalts. In thin section, they are seen to consist of plagioclase, augite, chlorite, epidote, green hornblende, and magnetite; the plagioclase forms small phenocrysts in some of the sections examined. Where there are amygdules, the fillings are quartz, epidote, or calcite, and the same minerals sometimes occur in narrow veinlets. The content of magnetite is sufficiently great to cause a marked deflection of the needle of a compass when in the vicinity of the rock.

The thickness of this volcanic series appears to vary. In places, also, as on Northwest mountain—where the volcanics are but thinly developed—there are interbedded sedimentaries. It is difficult to mark the contact between the volcanics and the intruding granite, but that they extend to the granites and were cut by them is certain, since the granite may be seen enclosing angular pieces of the basic volcanics.

The flow origin of these rocks is evident from the occurrence of amygdaloidal and pillow structures, of volcanic breccias, and of scoriaceous types. The gradations of texture suggest a succession of flows, one over the other. Similar volcanics in related regions have been ascribed to the late Middle Ordovician ①.

MIDDLE (?) DEVONIAN

There are no sedimentary rocks younger than Ordovician in this map-area, but strata of Silurian and Devonian ages are to be found eight to ten miles farther south. There are intrusive rocks, however,

① Schuchert, C., *Orogenic Times of the Northern Appalachians*; Bull. Geol. Soc. Am., Vol. 41, 1930, p. 712.

which, although they cut only Ordovician beds in this area, have been shown in adjacent areas to intrude the lower Devonian and to have been introduced probably during Middle Devonian time.

GRANITE AND RELATED ROCKS:

Granite and related rocks, of red to grey colour and fine to coarse texture, are to be found in the southern part of the area. They form the northern end of an igneous mass that extends for ten miles in a north-south direction and that has a width of as much as four to five miles. This mass forms the Tabletop mountains. Granite is the main rock type, but with it, and probably derived from the same magmatic source, are granodiorite, syenite, diorite, felsite, and pegmatite. A detailed description of these rocks has been given in a report ① on the area to the south, and the reader is referred to that account for further information.

Exposures are numerous, usually as patches of broken rock, on the summits and valley-sides south of Petit Lac Sainte-Anne and bordering Cascades brook and the other brooks in this vicinity. To a great extent, however, the boundaries of the igneous mass can be only approximately located in the densely wooded lower parts of the valleys. A few outcrops of granite were observed on the slope north of Petit Lac Sainte-Anne, and, as no exposures of sedimentary rocks were observed in the valley bottom, it is believed that the intrusive mass crosses this valley and terminates approximately at the point indicated on the map. Above this point, loose sedimentary rocks were found in sufficient abundance to warrant the inference that they form the underlying bed-rock.

As described in the report for 1932, there are, associated with the border phases of the igneous mass, patches of rocks, sedimentary in origin, that were assimilated by the intruding magma. The resulting rocks approach the composition and texture of granodiorite, and as, in appearance, they resemble igneous rather than sedimentary rocks, they are mapped with the intrusive body.

① Jones, I. W., Que. Bur. Mines, Ann. Rept., Pt. D, 1932.

DIABASE DYKES:

There are diabase dykes at various localities: near the head of Claude river, on Les Quatre Lacs brook, and on Sainte-Anne-Nord-Est river. Most of these dykes are narrow, from six inches to four feet wide, but some in the southwest corner of the area have a width of as much as eighteen feet. The rock in the narrow dykes is fine-grained and light grey, and in the wide ones coarse and greenish-grey to dark green. In one, the colour is pinkish-grey due to the presence of orthoclase. Under the microscope, these rocks are seen to have the typical structure of diabase and to consist principally of lath-shaped plagioclase with interstitial augite. Phenocrysts of these minerals are sometimes present in the coarser varieties. Chlorite, magnetite, and calcite are also present in varying amount. Most of the dykes trend northwest and are vertical or dip steeply northeast.

In this map-area, the dykes cut through only Ordovician strata, but in the neighbouring regions similar rocks have been seen cutting the granite and the Silurian and Devonian strata. Probably all these dykes are of the same age, but the possibility must also be considered that those in the present area are of Ordovician age and that they fill channels through which the Ordovician lavas reached the surface.

STRUCTURE

The sedimentary rocks of the region are considerably folded, as a result, for the most part if not entirely, of the mountain-building forces exerted at the close of the Ordovician and again during Middle Devonian time. Only a general description, however, of the structural relations obtaining in the map-area can be given in this report.

It is believed that the axis of a major structure, of the nature of an anticlinorium, passes in an easterly direction about two miles south of the northern boundary of Boisbuisson township. North of this axis, the beds are continuously folded in a series of subsidiary anticlines, synclines, and monoclines. Although subsidiary to the major regional structure, some of these folds are of considerable magnitude. In general, the north-dipping limbs of the folds are longer than those dipping south, and, as a result of this type of structure, any particular horizon at the shore would be found at higher altitudes as the axis of the presumed major structure is approached. By the

same reasoning, although the ground at this major axis is at a considerable elevation above the coast, the rocks in that higher region are the oldest in the map-area. Frequently, the beds are overturned and contorted in numerous drag-folds, especially in the less competent slaty zones, and at many places the rocks have been fractured and displaced near the axes of different folds. Whether there are any major faults with considerable displacement is difficult to ascertain; most of the displacements that were observed do not seem to be of great magnitude.

Southerly from the major axis mentioned above, the rocks, including the volcanic series, dip towards the south in a more or less regular manner, as well as could be observed, with only a few subsidiary folds. By this structure, horizons continually higher in the stratigraphic sequence are encountered as the southern border of the map-area is approached.

Slaty cleavage is strongly developed in the strata north of the presumed major anticlinal axis. Wherever observed, the cleavage planes dip steeply north. Frequently, bedding planes cannot be distinguished in the slates, and the direction of the bedding can be ascertained in such cases only where beds of different composition, colour, or texture are present in the same exposure.

Another prominent structural feature is the plunging of the folds. The general trend of the bedding and of the structural axes ranges between true and magnetic east-west, but along the plunging crests of many of the folds the bedding strikes in a general north-south direction and dips at angles ranging from four to twenty-five degrees. It was observed that, in the eastern part of the map-area, this plunge is towards the east, while in the western part it is towards the west. This change is visible along the shore, between points 2,000 and 3,300 feet west of Ruisseau-à-Rebours. It is possible that this plunging of the folds results from upheaval along a north-south belt continuous with the similarly trending belt of intrusive rocks forming the Tabletop mountains, and this upheaval may have taken place at the time of the intrusion of the Tabletop mass. There is also a possibility that it may be due in part to the warping nature of the later regional movements.

ECONOMIC GEOLOGY

General Statement

The presence of two large bodies of intrusive igneous rocks—in the Tabletop mountains and mount Albert—offers geological conditions which warrant the hope that ore-deposits of economic value may exist in this region. Part of the Tabletop mass, mostly of granite and related types of rock, extends into the southern part of the map-area. Mount Albert, which is composed of amphibolite and peridotite, is only six miles southwest of this area.

Although very little prospecting has been done in the Marsoui map-area, deposits of metallic minerals have been found at two localities, namely, on Marsoui and Pierre rivers. During the present investigation, outcrops with a sparing content of metallic minerals were observed at other places. These discoveries and the favourable geological conditions are sufficiently encouraging to warrant a further search for ore-deposits in the district. The most promising section is believed to be the zone including, and extending southward from, the presently known deposits.

Claims of Marsouins Mines, Limited

Introductory Statement:

A report on the mineral deposits on Marsoui river was made by the writer in 1932 ①. Much of the information given in that description is being repeated here for the sake of making more complete the report on the area as a whole. Some additional information is given as a result of observations made during the season of 1933, but not much is added to the knowledge of the mineral deposits, as little further work had been done on them since the visit made in 1932.

History and Location:

Discoveries of lead and zinc sulphides were made at this locality as far back as 1916 and claims have been held intermittently since that date. The discovery in 1932 that these deposits carry gold and silver values has given renewed interest to this locality. The claims are at present owned by a Company known as Marsouins Mines, Limited.

① *Loc. cit.*, pp. 44-51.

Twelve claims have been added to the three held in 1932. The property is situated on Marsoui river, thirteen miles along the trail from the shore. The boundary between the townships of Christie and Boisbuisson crosses the northern part of the group of claims, and a very small part of one of the claims, for a width of 20 feet only, extends into Duchesnay township.

General Geology:

The rocks at the claims and in their vicinity are of Ordovician age, and consist mostly of arenaceous and argillaceous limestones, and grey and black slates. The beds strike nearly true east-west and, for the most part, they dip 20° to 60° north. In some places, however, the beds are folded and slightly fractured. Joints trending in various directions are well developed, and veins and lenses of quartz and, less commonly, of calcite are numerous in some places, usually in the folded and fractured zones Further information on these structures in their relation to the mineral deposits is given below.

No igneous rocks were observed in the immediate vicinity of the claims. As mentioned above, however, it is only a few miles to the extensive igneous masses of Tabletop mountains and mount Albert. There are some diabase dykes on Sainte-Anne-Nord-Est river, two miles south of the claims, and also on Les Quatre Lacs brook and Claude river, two and five miles southeast and east, respectively. It is not known what relation the deposits may have to these known intrusives.

Description of Deposits:

Occurrence No. 1.—This prospect is in claim Q-13493 (formerly 12533) on a small brook, 1,550 feet west and 850 feet north of the point where the Christie-Boisbuisson line crosses Marsoui river. The rocks here, thin-bedded calcareous slates and one $\frac{1}{8}$-inch bed of calcareous sandstone, contain quartz veins and lenses of variable width. The beds strike N.25°E. and dip 17°N.W. ①. The veins and lenses occupy joint planes that trend E.-W., N.25°W., and N.10°W., and

① The directions refer to astronomic north.

their dip is vertical or very steep. The more persistent veins are along the east-west trending planes. They vary in thickness from one inch to one foot, and, in the aggregate, make up possibly one-half of the 8½-foot-wide exposure at this point. The zone outcrops for a length of 25 feet.

The metallic minerals are erratically distributed, and some of the quartz is barren. Near the centre of the zone, a two-inch vein is fairly well mineralized with galena, and a ten-inch band at the north side of the zone has veins four inches thick carrying a little galena and some sphalerite in half-inch streaks and in lumps up to a size of three inches. The sphalerite is the light yellow variety. Pyrite occurs in separate bands and disseminated.

A loose lump, weighing one pound, of quartz carrying sphalerite and galena, representing the material at the north side of this zone, was assayed for the writer in 1932 at the Provincial Assay Laboratory, Montreal. It is interesting to note that the assay showed the presence of both gold and silver, even though not in important quantities, as follows: gold, 0.05 oz. per ton; and silver, 0.35 oz. per ton.

Occurrence No. 2.—This prospect is in claim Q-3628, at the point where the Christie-Boisbuisson township line crosses the river. A quartz vein is exposed in the face of the cliff, which is of limestone and slate, on the west side of the river. The vein has been further uncovered by stripping for a distance of 15 feet from the river's edge, and in addition it has been opened-up by a twenty-foot excavation in the solid rock of the cliff. In the face of this cutting, from the base to a height of five feet, the quartz vein has a width of fifteen to twenty inches. Above this height it splits and becomes narrow, until, at the top of the twenty-foot escarpment, there are only two narrow veinlets following minor fractures separated by five feet of partially brecciated limestone. The wall-rocks strike east-west, with dip of 20°N. on the footwall and 40°N. on the hanging-wall of the vein. There has been some movement of the beds along the fracture-zone. The vein at its lower, wider part, strikes S.85°W. and dips 80°N.

Sphalerite, galena, pyrite, and a little chalcopyrite, are present in small lenses and veinlets in this narrow vein. On both sides of the vein, the wall-rocks are strongly jointed, and pyrite is abundantly disseminated along the joint planes and bedding planes over a width of six feet in the footwall rock and two feet in the hanging-wall.

Five samples for assaying were collected from this zone during the investigation of 1932, and another sample (No. A15) was taken in 1933. Those of 1932 were assayed at the Provincial Assay Laboratory, Montreal, and that of 1933 at the Provincial Assay Laboratory, Quebec. Descriptions of the samples, and assay results, are as follows:

No. 2.—Channel-sample weighing ¾ lb., taken across the vein where 20 inches wide.

No. 3.—Piece of hanging-wall slate, weighing ¾ lb., containing pyrite.

No. 4.—Piece of footwall slate, weighing ¾ lb., containing pyrite.

No. 5.—Lump of quartz, weighing 1¼ lb., containing pyrite, taken from loose material on dump.

No. 6.—Lump of quartz, weighing 1½ lb., containing pyrite, taken from loose material on dump.

No. A15.—Channel-sample taken across the same vein as No. 2 where 15 inches wide, and five feet farther west along strike than No. 2.

Sample No.	Gold oz./ton	Silver oz./ton	Lead per cent	Zinc per cent
2.....	0.12	1.51	0.20	7.10
3.....	0.04	n.d	n.d	n.d
4.....	trace	n.d	n.d	n.d
5.....	0.15	6.05	n.d	n.d
6.....	0.36	0.50	n.d	n.d
A 15.....	0.069	10.330	trace	5.53

There are small, irregular quartz veins of no economic importance at points in the west bank of the river, 88 and 141 feet south of the vein just described. A lump of quartz containing pyrite taken from the first of these small zones was assayed and showed 0.03 oz. gold per ton. A similar lump from the more southerly zone showed no values.

Occurrence No. 3.—This occurrence, exposed on the river and in some pits on the west bank, is 2,200 feet south of the Boisbuisson-Christie township line. The country rocks here are the same as at

the other occurrences, that is, slates and limestones. At this place, a series of minor folds are exposed in the river and the quartz veins appear to follow the fractures and jointing that were caused by this folding of the beds.

On both sides and in the bed of the river there is a quartz vein, about three feet wide, striking E.-W. and dipping 30°S. Southerly along the brook from this vein there are several small, irregular veins of quartz, up to three inches wide, but individually they lack continuity and are of only short length. For the most part, they occupy fractures and joint planes trending N.40°E. to N.40°W. and dip steeply N.E. and N.W., but some follow cleavage planes that parallel the bedding and dip steeply north. These small veins form networks, apparently at positions where the strata have been fractured at the crests of minor folds. There are two such groups of vein networks within a distance of 50 feet south of the three-foot quartz vein. Some pyrite occurs as clusters and in short streaks in the larger vein and also, in smaller quantities, in the irregular networks of small veins. Assay of a lump of quartz, carrying pyrite, from here showed: gold, none; silver, 1.10 oz. per ton.

A short trench has been dug thirty feet from the west side of the river, but it is now filled-in with débris. It is said that nothing of value was found in this trench, but it is possible that it did not go sufficiently deep.

Thirty feet still farther west, that is, 60 feet from the river, there is another trench, a description of which was given in the report for 1932, but which since that date has been deepened to form a pit. More information is now revealed than was available during the earlier visit. In this pit there are several small metal-bearing veins and lenses in fractured slates. The pit is 22 feet deep, 19 feet long, and 6 feet wide. Five feet from the bottom, the same south-dipping quartz vein as was noted at the river is exposed, but in the hole it is only from six to ten inches thick. As at the river, this vein is rather barren of economic minerals. It follows a fault with a downthrow, apparently of only a few feet displacement, on the hanging-wall side. The vein and the fault-plane here strike E.-W. and dip 17° to 30°S. There are several small quartz veins and lenses following joint and bedding planes. These smaller veins are cut by the low-angle fault and the thicker vein. There are more and better

mineralized veins below the south-dipping vein than above it. The joints that these smaller veins and lenses tend to follow strike N.35°E., N.20°W., and N.40°W. Those trending northeasterly dip at angles of 45° and less to the northwest, while the others are vertical or dip at steep angles towards the east. The best mineralized veins and lenses follow the planes trending N.40°W. The following section, measured from east to west across the strike of the more favourable-looking zone at the north end of the pit, shows the nature of the deposit:

12	inches	Slate and quartz with pyrite and galena
4	"	Pyrite, galena, quartz, sphalerite
5	"	Slate, quartz, pyrite, and specks of galena
4	"	Quartz, pyrite, galena, and a little sphalerite
3.5	"	Slate, little pyrite
1	"	Quartz and pyrite
5.5	"	Slate, small quartz seams with pyrite
1	"	Quartz, pyrite, little sphalerite
4.5	"	Slate with a little quartz and pyrite
1.5	"	Pyrite, quartz, specks of galena
13	"	Slate, little quartz and pyrite
2	"	Galena, pyrite, quartz
7.5	"	Quartz, slate, little pyrite
6.5	"	Quartz, calcite, pyrite, galena, slate
		Total width measured, 5 ft. 11 in.

A channel-sample across this zone, assayed at the Provincial Assay Laboratory, Quebec, gave the following results: gold, 0.006 oz. per ton; silver, 4.833 oz. per ton; lead, 8.99 per cent; zinc, 7.19 per cent; copper, 0.16 per cent.

A channel-sample, taken over a length of four feet in a similar zone at the south end of the pit, showed the following when assayed: gold, 0.051 oz. per ton; silver, 12.661 oz. per ton; lead, 16.32 per cent; zinc, 5.11 per cent; copper, 0.02 per cent.

Lump samples were taken at various places from the sections that were channelled, and assays of them showed: gold, from 0.007 oz. to 0.179 oz. per ton; and silver, from 0.101 oz. to 61.673 oz. per ton. The higher gold assays were obtained from quartz carrying pyrite, while the better silver values come from some of the narrow galena veins or lenses. This does not imply, however, that higher values are always found with pyrite or with galena, as the case may be; some samples of galena show very little silver, and some pyrite-rich rocks

have no gold. A sample from a vein of solid galena, 1½ inches wide, showing above the south-dipping quartz vein and mentioned in the report for 1932, gave: gold, none; silver, 83.20 oz. per ton; lead, 75.06 per cent.

Another pit, 33 feet west of the one described above, was dug to a depth of 20 feet during the summer of 1933. Only a few small lenses of quartz carrying galena and sphalerite were found, the remainder of the rock being contorted slate. It is possible that it should have been dug slightly farther to the north in order to encounter the zone exposed in the other pit.

Further prospecting is required to determine the direction in which this mineralized zone extends. The possibilities that may be first considered are that it may trend in the same direction as the better mineralized veins in the pit, that is, N.W.; or that, even though individual veins trend N.W., the zone in general may follow the strike of the folds and faults in the sedimentary beds, that is, east-west.

Other Occurrences.—There is a small exposure on the east side of the valley, about 300 feet south and 800 feet west of the corner-post marking the junction of Duchesnay, Christie, and Boisbuisson townships. The beds here are slightly crumpled, and over a width of one foot there are narrow stringers of quartz that follow joint planes. The stringers are up to half an inch wide and ten inches long, and they contain small quantities of galena, sphalerite, and pyrite. A few pieces, of better appearance than the average, were assayed and showed: gold, none; silver, 0.50 oz. per ton. Very little prospecting has been done at this locality.

Quartz veins were observed at other places in the district, among these being Duchesne creek, Marsoui river 400 feet above the mouth of Duchesne creek, and that fork of the river which comes from the west and joins the fork from the south, three-quarters of a mile upstream from where the township line crosses the river. Pyrite in small quantity was the only metallic mineral observed in these veins. Assays showed no more than traces of gold and silver.

Rivière-à-Pierre Prospect

A discovery has recently been made by Yvon Auclair and Albert Ouellet on a tributary of Pierre-Est river. While small, it offers encouragement to further prospecting. One claim has been staked here, part of it being in Mont-Louis Seigniory and part in the township of Duchesnay. The northern boundary of the claim crosses the township line 1,800 feet southeast of Mile-post 2 of a survey made of this line in 1932 by D. M. Croteau, or about seven miles along the township boundary from the St. Lawrence. The prospect is exposed over a width of five feet in the bed of a small brook that flows northeasterly and is near the centre of the claim. The veins occur in beds of bluish-grey limestone, slaty limestone, and calcareous slates, which are folded in an anticline trending N.60°E. The north limb of this fold dips 35°N. and the south limb 60° to 70°S. The veins are of quartz, with a little calcite, and they contain galena, sphalerite, pyrite, and a small quantity of chalcopyrite. These veins are a quarter of an inch to three inches wide and are separated by barren zones two to four feet wide. They follow joint planes and bedding planes near the crest of the fold. When along the bedding, they dip both north and south. The joint planes trend N.45°W. and E.-W., and dip 45° to 70°N. and N.E. The veins trending northwest are the better mineralized. Assay of one sample of quartz with pyrite showed: gold, 0.020 oz. per ton; silver, 1.188 oz. per ton. Another sample, taken only to show the tenor of some of the lumps and not of the vein-zone as a whole, gave: gold, 0.024 oz. per ton; silver, 0.738 oz. per ton; lead, 10.13 per cent; zinc, 10.76 per cent; copper, 0.05 per cent.

Other Localities

Small quartz and calcite veins carrying minor amounts of metallic minerals were observed on Les Quatre Lacs brook, and on the brook that enters the largest of Les Quatre Lacs from the east at a point about 1,200 feet north of the Duchesnay-Boisbuisson township line. Galena, sphalerite, chalcopyrite, and pyrite were found at these places, but in quite negligible quantities. Pyrite was observed in small quartz veins at the north end of Claude lake and near the diabase dykes along Claude river. Several samples from these localities were assayed, but most of them gave negative results and in none was there found better than a trace of gold and silver.

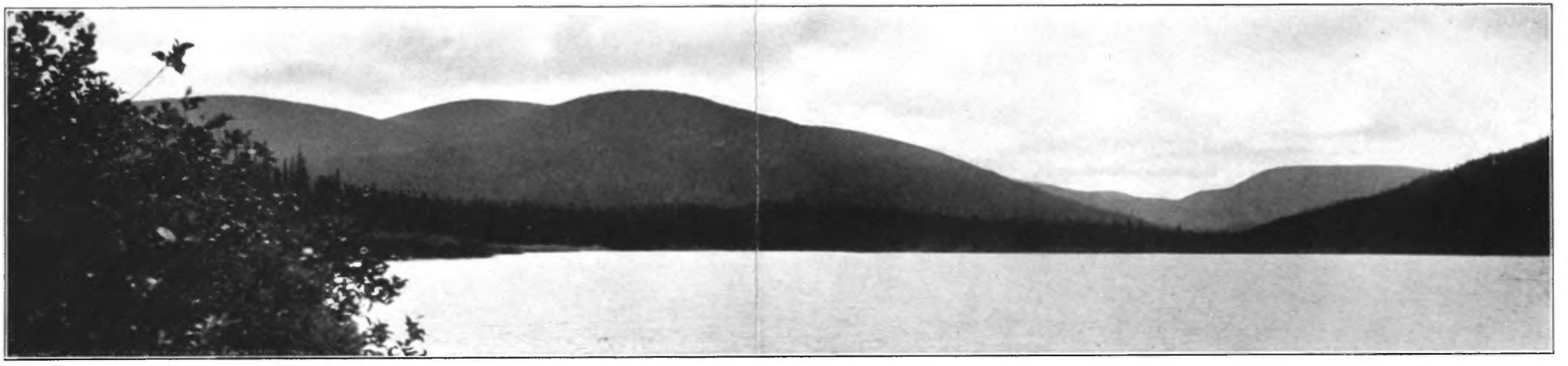
A.—Looking east along shore, Ruisseau-à-Rebours in foreground.

B.—Summit of table-land (1200 feet elevation) between Sainte-Marthe and Marsoui, with other peneplain surface in distant background.

(*Photograph by Compagnie Aérienne Franco-Canadienne*)

A.—Marsoui, showing terraces at different elevations.

B.—Mont-Saint-Pierre.



A.—Looking south across largest of Les Quatre Lacs towards Northwest mountain.

B.—Panorama from Northwest mountain, looking east and north. Tabletop mountains on right. Petit lac Sainte-Anne, centre. Les Quatre Lacs and Marsoui valleys at left.

Lower part of Claude River valley, looking towards shore; farm-lands at bottom of valley; flat-topped summits.