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VILLEBON-DENAIN AREA, ABITIBI, TEMISCAMINGUE AND PONTIAC COUNTIES, PART C

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Department of Mines and Fisheries

Honourable ONESIME GAGNON, Minister L.-A. RICHARD, Deputy-Minister

BUREAU OF MINES

A.-O. DUFRESNE, Director

ANNUAL REPORT

of the

QUEBEC BUREAU OF MINES

for the calendar year

1935

JOHN A. DRESSER, *Directing Geologist*

PART C

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PRINTED BY R. PARADIS

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VILLEBON-DENAIN MAP-AREA

ABITIBI, TÉMISCAMINGUE, AND PONTIAC COUNTIES

by G. K. Lowther

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MAP

VILLEBON-DENAIN MAP-AREA

ABITIBI, TÉMISCAMINGUE, AND PONTIAC COUNTIES

by G. K. Lowther

INTRODUCTION

General Statement

The metamorphosed sedimentary and volcanic rocks of the Abitibi mineral belt are intruded on the south and east by granite and granite gneisses, which are part of a vast complex of these rocks that extend from Georgian bay to the gulf of St. Lawrence. For several seasons, officers of the Quebec Bureau of Mines have been mapping the contact of the metamorphosed sedimentary and volcanic rocks with the granite gneisses, since this contact marks the limit of the recognized Abitibi mineral belt.

L. V. Bell (1) and A. M. Bell (2), in 1932, showed that the belt does not continue east of Jurie and Haig townships, and they mapped the eastern limit of the belt southward as far as the southern boundary of Pershing township. In 1934, B.-T. Denis (3) traced the southern limit of the belt through Laubanie, Sabourin, and Marrias townships. The writer completed the mapping in this locality by tracing the contact through the area lying between those mapped by Denis and A. M. Bell.

Location and Access

The area represented on the accompanying map No. 345 totals approximately 400 square miles. It includes most of Villebon and Denain townships, and extends for ten miles south of them to take in the north part of Lake Victoria on the west and lake Gladu and the Canimitti river on the east.

Lake Villebon, in the northwestern part of the area, and lake Matchi-Manitou, in the northeast, are both conveniently reached by canoe routes from Senneterre. Two motor roads connect the town of Senneterre with lake Tiblemont. The one on the west side of the Bell river extends south to the large bay on the west side of Tiblemont lake, and the water route from here to lake Villebon has only two short portages, the first at the south end of lake Tiblemont, and the second to avoid rapids in the small river between lake Simon and lake Villebon.

(1) Bell, L. V., *Granitic Gneisses in the Foch Area, Abitibi*, Que. Bur. Mines, Ann. Rept., 1932, Part *B*, pp. 94-103.

(2) Bell, A. M., *Assup River Map-Area*, Que. Bur. Mines, Ann. Rept., 1932, Part *B*, pp. 61-92.

(3) Denis, Bertrand T., *Sabourin Map-Area, Témiscamingue County*, Que. Bur. Mines, Ann. Rept., 1934, Part *C*, pp. 3-18.

Within the area itself, travel is difficult. Rapids are quite numerous along the rivers in the more rugged parts of the region, and practically all the rivers are small, due to their proximity to the height-of-land, which passes through the area. It is possible to travel from the east end of lake Villebon to lake Matchi-Manitou by way of the Shamus river. However, between lake Villebon and the Shamus river, there are two portages, each 1½ miles long. The first, near lake Villebon, is very swampy. In addition, there are three short portages along the Shamus river between lake Shamus and lake Matchi-Manitou.

Lake Victoria, south of the height-of-land, can be reached either from lake Villebon or from lake Matchi-Manitou. The Villebon route is the shorter from Senneterre. Between the Lowther (Nottaway) river and lake Victoria, it has four portages, the longest of which is 1½ miles. However, these are kept in excellent condition by fire-rangers of the Canadian International Paper Company, who use the route to transport provisions from Senneterre to their post on lake Victoria.

From lake Matchi-Manitou, lake Victoria may be reached by two routes: one is by way of lake Shamus and the Shamus river; the other by lake Denain, lake Gladu, and the Canimitti river. Both involve numerous portages, and enter lake Victoria at Seven Mile bay. The Shamus route is not to be recommended at low water, because the Shamus river is shallow and flows very rapidly in its upper reaches.

With the completion of the Senneterre-Mont-Laurier highway, now under construction, the region will be accessible by motor car from both Montreal and Senneterre.

Method of Work and Scope of Report

The area was surveyed by pace-and-compass methods. The western part, underlain by metamorphosed sedimentary and volcanic rocks, was traversed at intervals of about half a mile. Traverses were modified, however, in order to avoid evident swamps and to include possible outcrops, insofar as these were indicated from stereoscopic study of aerial photographs. The eastern and southern part of the area, underlain by granite and gneiss, and, therefore, considered less favourable for metallic mineralization than the belt of metamorphosed sedimentaries and volcanics, was examined in much less detail. Exposures along the canoe routes were mapped, but land traverses were made only at sufficient intervals to demonstrate the non-existence of any large inclusions of metamorphic sedimentaries or volcanics. The section immediately west of lake Matchi-Manitou was not examined, because it is shown in considerable detail on the map accompanying the report on the Bell River Headwaters area (1).

The Department of Lands and Forests of Quebec furnished an accurate and detailed base-map of Marrias, Villebon, and Denain townships, based on aerial photographs taken by Canadian Airways, Limited.

(1) Bell, L. V., and Bell, A. M., *Bell River Headwaters Area*, Que. Bur. Mines, Ann. Rept., 1931, Part *B*, pp. 59-123.

This map does not extend south to include the area between lake Victoria on the west, and lake Gladu and the Canimitti river on the east, an area which has not yet been photographed. The base-map in this part of the area is less accurate, having been prepared from township plans and surveys of the Department of Lands and Forests, and from a cruise-map kindly made available by the engineering staff of the Canadian International Paper Company. Outlines of the main water-routes were taken from the township plans and surveys, the intervening areas being filled-in from the Canadian International Paper Company's map, which is based on cruise lines spaced at intervals of half a mile.

Acknowledgments

The writer was ably assisted in the field by the following student assistants: J. C. Lyons, P. Lesage, C. Poirier, and R. Martineau. E. Marchand and A. Tremblay efficiently performed their duties as cook and canoeman, respectively. The writer is deeply indebted to the Canadian International Paper Company's fire-rangers on lake Victoria, and to the Provincial fire-rangers on lake Matchi-Manitou, for hospitality and many courtesies extended the party during the course of the field-work.

Previous Work

The earliest geological work in the area was by Robert Bell and his assistant, A. S. Cochrane. In 1887 (1), and again in 1895 (2) and 1896 (3), parties under the direction of Robert Bell crossed the height-of-land north of lake Victoria and descended the Bell river, continuing their explorations to the north. More detailed reconnaissance work was done by M. E. Wilson in 1912 (4), and his map of Témiscamingue county, published in 1918 (5), includes the present area. In 1931, L. V. Bell and A. M. Bell (6) mapped the northern part of Villebon township and the northwestern part of Denain, but in somewhat less detail than they mapped the remainder of the Bell River Headwaters area.

GENERAL CHARACTER OF THE AREA

Topography

The eastern and southern part of the area, although having the low general relief characteristic of Precambrian terrain, is quite rough in detail. Many hills and ridges rise more than 300 feet above the adjacent valleys. East of the Shamus river, the ridges trend in a northeast direction, their western side characterized by steep scarps and cliffs

(1) Geol. Surv. Can., Ann. Rept., Vol. III, Part *I.A*, 1887-88, pp. 22-27.
(2) Geol. Surv. Can., Ann. Rept., Vol. VIII, Part *A*, 1895, pp. 75-81.
(3) Geol. Surv. Can., Ann. Rept., Vol. IX, Part *A*, 1896, pp. 66-67.
(4) *A Geological Reconnaissance from Lake Kipawa* via *Grand Lake Victoria to Kanikawinika Island, Bell River, Quebec*, Geol. Surv. Can., Summ. Rept., 1912, pp. 315-336.
(5) *Timiskaming County, Quebec*, Geol. Surv. Can., Mem. 103, 1918, and Map 145A.
(6) *Op. cit.*

but with gentler eastern slopes. These forms have been produced by erosion of the underlying gneiss, which strikes in a northeasterly direction and dips at relatively low angles to the southeast. The hills are not so regular in trend in the southern part of the area, where the strike and dip of the rocks is less uniform. The higher ridges are from 1,600 to 1,800 feet above sea-level, their flat tops being, presumably, remnants of an old peneplain. West of the Shamus river, most of the hills are composed of hornblende gneiss, but sedimentary rocks make up a few of them. The hills rapidly diminish in height toward the west, the rugged, hilly country extending on an average only about two miles west of the Shamus river.

In the northern and western part of the map-sheet, the relief is much less rugged. This part of the area lies near the eastern boundary of the 'clay belt' and, as a result, is covered by thick deposits of sand and gravel. The land surface, in general, has the appearance of a flat or gently rolling plain, the irregularities in which are due to projections of bedrock above the plain surface and to glacial deposits in the form of northerly-trending boulder and gravel ridges. The average level of the lowland surface is slightly in excess of 1,100 feet. M. E. Wilson (1) gives the elevation of lake Victoria as 1,103 feet, and that of lake Villebon (Christopherson) as 1,099 feet.

Drainage

The height-of-land divides the area into two drainage basins: the northern, draining into James bay by the Nottaway River system; and the southern, drained by the tributaries of the Ottawa and thus into the St. Lawrence. The rocky hill-country in the eastern part of the map-area is characterized by innumerable lakes, and by waterfalls in the small rivers, which commonly flow over bedrock. The linear arrangement of the lakes and rivers in this part of the area clearly reflects the northeasterly strike of the underlying rocks. In contrast to this, the relatively flat area to the northwest is poorly drained, with the result that there are many swamps in Marrias township and the western half of Villebon. The rivers here are in general slow and sluggish, flowing over glacial drift in wide, meandering channels and only rarely reaching bedrock.

Timber

There is a considerable variety of timber in the area. The particular variety to be found in any locality depends on the topography and drainage. Black spruce and jack pine are the most common types. Jack pine flourishes wherever there are sand plains or sand and gravel ridges. The better stands of black spruce occur in the low, poorly drained parts of Marrias and Villebon townships. In swampy areas, the spruce in places is accompanied by small tamarack. In the rugged hill-country, spruce, poplar, birch, balm-of-Gilead, and scrub maple are the predominant types.

(1) *Op. cit.*, Memoir 103, pp. 25 and 31.

GENERAL GEOLOGY

Marrias, Villebon, and the northwestern part of Denain township are underlain principally by metamorphosed sedimentary and volcanic rocks. These are the continuation to the east and south of bands of similar rocks that have been mapped as Temiscamian and Keewatin, and these names have been retained for them in the present area. Granite and pegmatite intrude these older rocks in the southern and eastern part of the area, and a stock of oligoclase granite, about 5 miles in diameter, intrudes Keewatin rocks northeast of lake Victoria, immediately north of the main granite-Keewatin contact.

Table of Formations

Quaternary	Pleistocene	Sand, gravel, boulders, boulder clay, lake clays
Precambrian	Pre-Cobalt Intrusives	Quartz gabbro Pegmatite and associated muscovite granite Quartz porphyry, feldspar porphyry Albite granite Oligoclase-hornblende granite Gneiss
	Temiscamian	Conglomerate, greywacke, mica schist
	Keewatin	Iron formation Amphibolite — believed to have resulted from the metamorphism of basic to intermediate flows and tuffs — with possibly some intrusive hornblendite Basalt, andesite, trachyte, rhyolite; tuffaceous sediments

Keewatin

Definitely volcanic rocks were observed only in the northern half of Villebon township and in the northwestern part of Denain. They range from acidic to basic in composition, with intermediate types predominating, and in most places they are much altered. This is especially true of the intermediate and basic varieties, in which, commonly, the constituent minerals are almost completely replaced by chlorite, carbonate, epidote, and zoisite. Metasomatic alteration, with introduction of carbonate, chiefly ankerite, is very pronounced in the volcanics south of lake Villebon. Elsewhere, intense metamorphism has converted lavas of intermediate and basic composition into amphibolite. The more

acidic volcanics are not altered to the same extent, but even these, in places, have been changed into quartz-sericite schists.

Hornblende rocks, or amphibolites, occur in the southern half of Villebon township and extend four miles farther south. They differ in composition from band to band, but contain, on an average, about 75 per cent hornblende, the balance being plagioclase feldspar, with small amounts of quartz and ilmenite. In texture, also, they present a wide range, from dense, massive types so fine-grained that the individual minerals are not distinguishable in the hand specimen, to much coarser varieties with crystals of secondary hornblende an inch in length. The original nature of such rocks is difficult to ascertain. Theoretically, they may be derived by the metamorphism of lavas, tuffs, or intrusive rocks of intermediate to basic composition, or of a greywacke type of sediment, which, however, would have to be more basic than the Temiscamian greywacke as typically developed in this region. Immediately north of the present map-sheet, in the Assup River area (1) and in the Bell River Headwaters area (2), such rocks have been tentatively assigned to the Keewatin and are believed to be, in part, altered basic volcanics, and, in part, hornblendic intrusives. To the west, in Marrias township, Denis (3) has included similar amphibolitic rocks in the Temiscamian, and considers that they have resulted from the metamorphism of sills, or of volcanic flows interbedded in the Temiscamian. M. E. Wilson (4) concluded that the amphibolites in the present area are volcanic in origin, and on his map shows a band of 'Abitibi' volcanics extending south from lake Villebon to the main granite-Keewatin contact. Following Wilson, the present writer has provisionally assigned them to the Keewatin. Recrystallization has destroyed almost completely the original textures and structures. In some places, however, a suggestion of bedding was noted, indicating that at least some of the amphibolite may be of sedimentary origin. This 'bedding' was observed most commonly within a comparatively small vertical range below the normal Temiscamian sediments, so that the beds, if such they are, would probably correspond to the tuffs which, farther north, occur near the top of the Keewatin. The fact that the amphibolites are considerably more basic than the normal Temiscamian sediments, and are in places interbedded with well-preserved rhyolites (5), further supports a volcanic, rather than a sedimentary, origin for these rocks.

Temiscamian Sediments

A belt of Temiscamian sediments, with an average width of more than ten miles, extends eastward from the vicinity of the Quebec-Ontario boundary to the greenstone belt in Villebon township. Lithologically similar sediments occur east of the greenstone belt and continue eastward

(1) Bell, A. M., *Op. cit.*, p. 68.
(2) Bell, L. V. and Bell, A. M., *Op. cit.*, pp. 72-73.
(3) Denis, B.-T., *Op. cit.*, p. 12.
(4) Wilson, M. E., *Op. cit.*, Summ. Rept., 1912, pp. 315-336.
(5) Only two occurrences of this type were observed in the map-area and they may possibly be intrusive.

a short distance past lake Matchi-Manitou. This second occurrence of sediments appears to be connected to the main belt by a narrow band of micaceous schists that extends west to lake Victoria, following the southern margin of the amphibolites. From here northward, a thick mantle of drift covers bedrock in the vicinity of lake Victoria and along the western boundary of Villebon township. The structure strongly suggests, however, that the narrow (eastern) band of sediments continues northward to join the main belt in Marrias township. The sediments overlie, and are younger than, the amphibolites, forming the outer margin of a dome-like structure, which exposes the older amphibolites toward the centre. A core of oligoclase granite forms the central part of the dome. Inclusions of sedimentary rock in the gneiss for many miles to the east and south indicate a once greater areal extent of these sediments.

The predominant rock in the sedimentary series is a rusty-weathering biotite schist or greywacke, but associated with it locally are thin beds of chert and conglomerate. The biotite schist consists essentially of biotite, quartz, and plagioclase feldspar. Hornblende, orthoclase, garnet, apatite, and magnetite occur as minor constituents. The foliation is parallel to the bedding. Two small lenses of conglomerate were observed northeast of lake Villebon, with deformed pebbles and boulders from a few inches to over a foot in length. The matrix of this conglomerate resembles the normal biotite schist, but the boulders include greenstone, quartzite, and various types of intrusive rock.

Toward the south and east, due to the contact action of the southern granite, the sedimentaries become coarser in grain, contain much deep-red garnet, and pass gradually into gneiss under the influence of deep burial and many *lit-par-lit* injections of granite and pegmatite.

Pre-Cobalt Intrusives

A variety of intrusive rocks have been noted in the area. Masses of oligoclase-hornblende granite, albite granite, quartz porphyry, and feldspar porphyry occur within the Keewatin, and the Temiscamian is intruded by quartz-gabbro ('later gabbro') dykes, as well as by large masses of granite and pegmatite, these latter being marginal outliers of an immense body of granitic rock that extends to the south and east beyond the map-area. The quartz-gabbro dykes are believed to be the youngest intrusive rocks in the area, but the age relationships of the other intrusions are for the most part unknown. For purposes of description, the intrusive rocks are here divided into three groups, as follows:

(1) Stocks and dykes, mostly within the Keewatin belt, and including albite granite, oligoclase granite, quartz porphyry, and feldspar porphyry.

(2) Gneiss, granite, and pegmatite lying south and east of the sedimentary-volcanic belt.

(3) Quartz-gabbro dykes.

Oligoclase Granite, Albite Granite, Quartz Porphyry, and Feldspar Porphyry:

The largest stock within the sedimentary-volcanic belt occurs in the southwest quarter of Villebon township and extends in a southwesterly

direction almost to lake Victoria. It is elliptical in outcrop, with its major and minor axes respectively about 7 miles and 3½ miles in length. Structurally, this stock appears to occur near the summit of a dome, which is slightly overturned to the west. The foliation of the intruded amphibolites, and the bedding, where observed, strike parallel to the margin of the intrusive. On the east and southeast, the amphibolites dip away from the stock, but on the west and northwest they dip beneath it.

The rock is a massive, pink to grey oligoclase-granite, remarkably uniform in appearance and composition throughout the entire mass. It consists essentially of oligoclase (An20), orthoclase, quartz, hornblende, and a little biotite. The grain size normally is from 1/8 inch to 1/4 inch, with the feldspar tending to be rounded and slightly larger than the other constituents, giving the rock a somewhat porphyritic appearance.

A second, smaller intrusion of granite occurs east of the one just described and extends along the west side of the Shamus river for more than three miles with an average width of slightly more than half a mile. In composition and texture, the rock resembles more closely many of the larger concordant intrusives in the gneiss to the east than the oligoclase granite just described. It is a pink, gneissoid granite, consisting essentially of orthoclase, albite, quartz, and biotite, the individual crystals ranging normally from 1/4 inch to ½ inch in size.

Gneissoid acidic rocks, some of which are intrusive into the Keewatin, occur east of the southwest arm of lake Villebon. The intruded and intrusive rocks in this locality are extensively sheared and metasomatized, and their relationships are often obscure, especially as acidic volcanics occur in the vicinity. In many places, the intrusive is altered to a quartz-sericite schist. A few sheared masses of quartz porphyry, with quartz 'eyes' 1 to 2 mm. in diameter, were observed, which appear to be related to the intrusive. Both the intruded and intrusive rocks contain numerous fine needles of tourmaline, and in places both are heavily mineralized with pyrrhotite and pyrite.

A small mass of feldspar porphyry was observed near the north end of lot 49, range VI, Villebon township. The rock is dark-coloured, with white to pink phenocrysts of andesine as much as half an inch long, in a black, highly-altered, groundmass containing feldspar, epidote, calcite, leucoxene, pyrite, and relatively large crystals (porphyroblasts) of hornblende.

GNEISS, GRANITE AND PEGMATITE:

A complex of igneous and sedimentary gneisses occur east and south of the sedimentary-volcanic belt. They form part of an extensive series of similar rocks that extend from Georgian bay to the gulf of St. Lawrence between the Grenville Precambrian sub-province on the south and the Temiscamian sub-province on the north.

It is the general belief that intrusive rocks of more than one age may be present in this complex. In the region to the south, the igneous gneisses are intrusive into rocks of the Grenville series. In the north, from the Quebec-Ontario boundary eastward, the gneisses are intrusive

into the Temiscamian, wherever the contact has been observed. However, the presence of granite boulders in Temiscamian conglomerate is evidence of the existence of an earlier granite, and it is possible that some of the granite exposed in this complex may be pre-Temiscamian. In the present area, the igneous gneisses have intimately intruded and thoroughly metamorphosed the Temiscamian greywackes, and zones of garnetiferous biotite schist within the gneisses are interpreted as Temiscamian inclusions. There is thus no doubt that most of the gneisses in this area are post-Temiscamian. Their uniformly banded character, and the extent of their folding, suggest, however, that they belong to the basement complex, so it is probable that they are pre-Huronian in age.

East of the Shamus river and lake Matchi-Manitou, the gneisses consist largely of recrystallized sedimentary rocks, with many *lit-par-lit* injections of granite and pegmatite. The meta-sedimentary parts are chiefly garnetiferous-biotite schists and gneisses consisting principally of quartz, acidic plagioclase, orthoclase, biotite, and garnet. These rocks appear to be the metamorphosed equivalents of the Temiscamian rocks to the west. In fact, there is a gradation eastward from the normal Temiscamian greywackes to a coarse-grained garnetiferous gneiss.

The size and number of *lit-par-lit* injections varies from place to place. They form from 20 to 80 per cent of the exposures and range in thickness from less than an inch to several hundred feet. In addition, much larger, lenticular, concordant intrusions of granite gneiss occur in the sedimentary gneiss, with their longer dimensions parallel to the direction of foliation in the containing gneiss. Probably more than 95 per cent of the injections observed in the area are either granite or pegmatite, but, in addition, syenite, granodiorite, diorite, and aplite occur. The granites consist essentially of orthoclase, microcline, albite or oligoclase, quartz, and biotite. Hornblende, apatite, titanite, garnet, and magnetite are the most common accessory minerals. The rocks are coarse-grained, and, even in the narrower injections, the constituent minerals in most places are more than a quarter of an inch in diameter. The pegmatitic injections, as a general rule, are richer than the granitic in orthoclase (or microcline), and contain muscovite as well as biotite. Foliation is not pronounced, and some of the thicker injections are entirely massive.

In the southwestern part of the area, the rocks of the granitic complex are somewhat different in character from those in the east. Pegmatite is much more abundant, and thin lenses of biotite granite are less common. West of lake Victoria, the hills are composed of massive, coarse-grained pegmatite, with associated muscovite granite. Both the granite and the pegmatite consist almost entirely of white feldspar, quartz, and muscovite, with, rarely, a minor amount of tourmaline. Graphic granite is common. The more typical, banded, garnetiferous gneisses occur south of the pegmatitic zone.

Quartz Gabbro:

Two dykes of quartz gabbro were observed in the northern part of the area. Both intrude Temiscamian sediments. The larger, in

range X immediately west of lake Villebon, strikes N.50°E. and has an average width of 150 feet. Only one outcrop of the other was found, in range IX, northeast of the same lake; it, also, appears to strike northeast.

In both dykes, the rock is similar in all respects to the 'later gabbro' of the Rouyn-Harricana region (1). It is a mottled grey-and-black rock consisting essentially of augite and basic andesine. The grain size is normally from 1/8 inch to 1/4 inch, except in the margins of the dykes, where the rock is fine-grained, dense, and massive, with small laths of feldspar the only mineral recognizable in hand specimen. Quartz, hornblende, epidote, zoisite, carbonate, and magnetite occur as accessory and secondary minerals.

Quaternary

Unconsolidated deposits of Glacial and post-Glacial age cover bedrock over most of the area. The drift consists largely of sand, gravel, boulders, and boulder clay, except in Marrias township and the northwestern part of Villebon, where the glacial deposits are overlain by the lacustrine clays of the 'clay belt'. Sand hills and ridges of fluvioglacial origin are numerous and in many places rise more than 75 feet above the surrounding country. Most of these trend slightly east of north. Extensive sand deposits occur west of the Lowther river in Villebon township, along the headwaters of the Shamus river in Villebon township and in the area to the south, and about half way between Denain and Shamus lakes in Denain township.

STRUCTURE

In the Abitibi region of Quebec, no evidence for a pronounced angular unconformity between the Temiscamian and Keewatin has been brought forward, and, in most areas, any angular discordance between the two series is considered to be the result of faulting along the contact. The present area is no exception; no evidence for a discordance between the two series was found, except in the northern part of Villebon township along the western contact of the volcanics with the sedimentaries, where intense shearing may indicate a fault. The major folding is thus post-Temiscamian, and the folds in the Temiscamian and Keewatin will be discussed together.

As has been pointed out previously, the areal distribution of the metamorphosed sedimentary and volcanic rocks indicates a dome structure. Keewatin volcanics and their metamorphosed equivalents occurring in, and a short distance south of, Villebon township occupy the central part of the dome and are almost completely surrounded by the younger Temiscamian sediments. The oligoclase-granite mass in the southwestern part of Villebon township is near the summit of the dome, its position apparently having been determined by the regional structure

(1) Cooke, James and Mawdsley, *Geology and Ore Deposits of Rouyn-Harricanaw Region, Quebec*, Geol. Surv. Can., Mem. 166, 1931, pp. 141-144.

in a manner similar to that of the granitic intrusives in the Rouyn-Harricana region (1), the majority of which occur near the crests of anticlines. Possible minor folds within the major structure are difficult to determine. It is practically impossible to trace individual beds in the greywackes and amphibolites, and recrystallization has destroyed any textures and structures which might be of use in determining the tops and bottoms of beds. In addition, the foliation in the sedimentaries is invariably parallel to the relics of bedding; and drag folds are only rarely developed.

The foliation in the gneisses of the eastern part of the area strikes northeast and dips at 30° to 70° southeast. In the southern gneisses, the strike is more irregular, but in general it conforms to the dome structure for some distance south of the contact of sedimentary rocks and gneisses.

Owing to lack of exposures along the western limb of the dome, the structure in that vicinity cannot be determined with certainty. The angular discordance between the Temiscamian and Keewatin, and intense shearing along the western contact of the volcanics with the sedimentaries, suggest a fault. It has also been suggested that lake Victoria lies on a northeasterly-trending fault (2). It is thus possible that a fault-zone extends along the western limb of the dome in a direction slightly east of north. Such a fault might account for the apparent displacement in the main granite contact to the south. It would also help to explain the abrupt change in strike of the structure from almost east-west in the sedimentaries in Marrias township to north-south in the Villebon greenstone belt.

Reference has already been made to the linear nature of the topography in the rugged hill-country in the eastern part of the map-area. Intense shearing along many of the almost vertical cliff faces may indicate that many of the northeasterly-trending valleys are due to erosion along fault-zones. The presence of such faults is difficult to prove, because the foliation in the gneisses and amphibolites also strikes, as would the faults, in a northeasterly direction. Farther west, however, in the vicinity of Cooper lake, the hills continue to have a northeasterly trend, although the amphibolites strike in an east-west direction. This suggests at least the possibility of faulting in the vicinity.

ECONOMIC GEOLOGY

The volcanic and sedimentary rocks of the area have for the most part undergone intense metamorphism, due to their proximity to the large granite batholiths to the south and east. Inasmuch as the mineral deposits that have been found in this general region are believed to be genetically related to granitic intrusions, any that are found in the present area are likely to be of the same high-temperature, deep-seated type. Under these conditions, aside from the rarer minerals sometimes

(1) Cooke, James and Mawdsley, *Op. cit.*, p. 104.

(2) Wilson, M. E., *Op. cit.*, Mem. 103, pp. 37-38.

associated with pegmatites, the ores of copper, zinc, and gold are the most likely to occur. Development work on claims southeast of lake Simon, less than two miles north of the present map-area, has revealed the presence of gold and chalcopyrite in Keewatin rocks. There is no apparent reason why similar rocks within the map-area should not contain deposits of metallic minerals.

The greenstones and small acidic intrusions are considered to be the most favourable rocks in the area for commercial mineralization. Unfortunately, prospecting in the areas underlain by these rocks is hindered by the scarcity of outcrops, due to a thick mantle of drift and the many large swamps. Outcrops are numerous only in the rocky hill-country to the south and east, which is largely underlain by granite and gneiss, rocks not considered favourable to metallic mineralization. Exploration work carried on in areas north of the present map-area has indicated that stocks appear to have afforded a controlling structure along which mineral-bearing solutions might ascend, so that many of the deposits are found in the smaller intrusive masses. Economic mineralization also occurs in the marginal parts of the larger intrusive masses, and in volcanics near their contact with the granites and granodiorites. In traversing the present area, the writer encountered three bodies of pyrrhotite, all of which are in the vicinity of granitic intrusions. One occurs in an acidic intrusive east of the southwest arm of lake Villebon. The rocks in this area are intensely sheared and metasomatized, and contain tourmaline and much carbonate material. There are also mineralized quartz porphyries in the vicinity. Another zone of sulphide mineralization occurs in amphibolites in range III of Villebon township, immediately west of the Shamus river and north of the long granitic intrusive that parallels the river. Iron-sulphide mineralization was also observed about a mile east of lake Victoria in amphibolites, near their contact with the granodiorite to the north. In each occurrence, the mineralization is chiefly pyrrhotite with a small amount of pyrite.

Metallic mineralization was nowhere seen in the granite and gneisses in the southern and eastern part of the area. Similarly, the sedimentary rocks are not considered favourable for prospecting, either well within their outcrop or at their contact with the gneiss, where they are highly metamorphosed. Although they contain many narrow quartz veins, usually parallel to the bedding, these are invariably barren looking, and no metallic mineralization was observed in them.

There is a possibility of finding deposits of some of the less common minerals in the pegmatite dykes, which are particularly abundant west of lake Victoria. Beryl has been noted in three localities in the Sabourin area (1), and molybdenite has been found in and near pegmatite dykes in Preissac and LaCorne townships (2). In the present area, however, the pegmatite dykes consist almost entirely of quartz, feldspar, and muscovite, and occasional crystals of tourmaline and garnet are the only other minerals observed in them.

(1) Denis, B.-T., *Op. cit.*, p. 14.
(2) Cooke, James and Mawdsley, *Op. cit.*, pp. 173-174.