# RG 002(A)

Lower Laflamme river area, Abitibi district

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Énergie et Ressources naturelles Québec

PROVINCE OF QUEBEC, CANADA
Department of Mines
Honourable EDGAR ROCHETTE, *Minister* L. A. RICHARD, *Deputy-Minister*

BUREAU OF MINES
A.-O. DUFRESNE, *Director*

GEOLOGICAL DIVISION
JOHN A. DRESSER, *Directing Geologist*

## GEOLOGICAL REPORT No. 2

# LOWER LAFLAMME RIVER AREA
## ABITIBI DISTRICT

I—WESTERN SECTION, by P.-E. Auger
II—EASTERN SECTION, by W. W. Longley

QUEBEC
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1939

# LOWER LAFLAMME RIVER AREA

## ABITIBI DISTRICT

## I—WESTERN SECTION

*by P.-E. Auger*

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TABLE OF CONTENTS


| | Page |
|---|---|
| INTRODUCTION | 5 |
| Location of area | 5 |
| Means of access | 5 |
| Relief and drainage | 6 |
| Soil, timber and game | 7 |
| Previous work and bibliography | 7 |
| Purpose and method of work | 8 |
| Acknowledgments | 9 |
| GENERAL GEOLOGY | 9 |
| Table of formations | 10 |
| Keewatin | 10 |
| Volcanic rocks | 10 |
| Sedimentary (?) rocks | 13 |
| Intrusive rocks | 13 |
| Post-Keewatin | 13 |
| Algoman (?) | 13 |
| Younger dykes and sills | 14 |
| Pleistocene and Recent | 14 |
| STRUCTURAL GEOLOGY | 15 |
| ECONOMIC GEOLOGY | 16 |


MAP AND ILLUSTRATIONS


Map No. 457.—Lower Laflamme River Area ..... (in pocket)


PLATES

(After page 17)


Plate I.—A.—Pillow structure in lavas, southeastern section of township 109.

B.—Brecciated lava flow, southern part of township 109.

Plate II.—A.—Varved clay, three miles west of Laflamme river, along survey line north of 49° parallel.

B.—Drag fold in a rhyolite sill along a fault, southern section of township 109.


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# LOWER LAFLAMME RIVER AREA
## ABITIBI DISTRICT
### I—WESTERN SECTION

*by P.-E. Auger*

## INTRODUCTION

### Location of Area

The region explored by the writer during the summer season of 1937 is situated in the Abitibi district, about fifty miles north of Barraute, on the Canadian National railway. The northern and southern limits are respectively 49° 15′ and 49° 00′ latitude. The Laflamme river forms the eastern boundary, and the watershed between the Bigniba and Daniels rivers that on the west. The area thus outlined includes the entire Bigniba valley and part of the Laflamme and Bernetz River basins. Townships within this area are: the western part of Fraser, the northwestern corner of No. *111*, most of *110*, *210*, and *109*, and a small part of *209* and *108* (1).

In order to tie-in with the area farther south, which was examined by Faessler in 1934 (2), our work was continued southward from the 49th parallel to the Castagnier river, a tributary of the Laflamme.

### Means of Access

The region is easily accessible by canoe along two different routes. The longer of these follows the Bell river from Senneterre, on the Canadian National railway, down to Canica island, which is immediately north of the map-area. From this point one can ascend the Laflamme, Bigniba, or Daniels rivers, which drain into the west branch of the Bell. These rivers cross the area in a general northeast direction and give access to most of the country included in the map.

The other route is shorter and much easier to follow because of its fewer portages and longer stretches of quiet water. Starting at Barraute, a good automobile road, about 23 miles long, leads to the village of Rochebeaucourt, in ranges VII and VIII of Rochebeaucourt township. From here, one can descend the Tourville river to the easily navigable Laflamme river.

The region is not easy of access by air, since there are no large lakes or rivers suitable for aeroplane landings. The only possible landing places are on the Bell river, and perhaps at the mouth of the Bigniba. There are some dangerous shallows at this latter point during the dry season.

Travel is very difficult in the interior of the map-area, away from the main rivers, because of the small amount of water in the tributary streams. Also, the small water courses are choked with débris and few portages have

(1) Numbers are assigned tentatively by the Bureau of Mines to un-named townships in unsurveyed Crown lands.

(2) Que. Bur. Mines, Ann. Rept., Part *C*, 1934.

been cut. In the spring, and even in the summer during high water, the land adjacent to the streams is flooded, making travel through the woods almost impossible. However, there is usually a dry embankment along the shore upon which tents can be pitched.

The Bernetz river is navigable for about 15 miles from its mouth. About half way up stream an intersecting outcrop dams the river and raises the water level, thus providing enough water for canoe travel. Above the point where the river crosses the boundary between Bernetz and *109* townships, its channel is blocked and the water is very low. However, it is not impossible that there may be another such dam farther up-stream, and another stretch of navigable water.

Where the Bernetz becomes impassable, one can cross over to the Bigniba river, northwestward, by a three and a half mile portage, opened and used by trappers. This river is navigable for 35 miles from its mouth, but there is a series of four rapids in a distance of four miles, commencing at about 12 miles above the mouth. The third of these is really a fall and must be portaged; the others can be run with a canoe at high water. The highest is about a mile long and must be descended with care, as the current is strong and the channel is obstructed by many large boulders.

## Relief and Drainage

The area studied lies just within the northern limit of the 'clay belt', which extends eastward and also far to the west, beyond the Ontario-Quebec boundary. It is a region covered with a thick mantle of partially stratified unconsolidated sediments, which probably represent glacial material deposited in post-glacial lake Ojibway. Numerous eskers, moraines, and drumlins are distributed over the area and form obstructions to the streams.

Because of this mantle of glacial deposits, the map-area has low relief, and, in the few hills encountered, elevations of 200 feet are rare. For the same reason, there are relatively few lakes and only two have a width of as much as half a mile. These larger lakes are Bigniba and à-la-Femelle, both of which drain into the Bigniba river. In general, the terrain is very swampy and is traversed by a great number of small, shallow streams.

Toward the south and southwest, the ground is higher than in the north and rock exposures are more abundant. Near the survey line between *109* and Bernetz townships, there is an east-west line of hills rising abruptly above the surrounding plain. From the tops of some of these hills one can overlook most of the territory included in the map-sheet. The nature of these hills and the reason for their resistance to glacial erosion will be discussed on a later page.

The whole area, with the exception of a small section in the southwest, is within the drainage system of the Bell river. The Bell feeds into the Nottaway river, which empties into James bay. Because of the low relief of the area, the streams are remarkably affected by rainfall. It is not unusual to see the water-level raised six or seven feet within a couple of days after a heavy rain. This is due to the slow run-off caused by the meanders and obstructions in the streams.

## Soil, Timber and Game

Some of the territory between the Laflamme and Bigniba rivers, as well as to the south between the Castagnier river and the northern boundary of Hurault township, is covered by a sandy clay soil which would be suitable for cultivation. Unfortunately, the area covered by such soil is small, at most 15 to 20 square miles. The rest of the region is too swampy to be cultivated.

The principal trees are white and black spruce, which in places attain a diameter of twelve inches. There are some growths dense enough to form important stands of timber. Fir and tamarack grow in great numbers around the edges of the swamps but they never attain any great size. Grey pine and scrub spruce were observed from place to place. Considerable areas of evergreens have been destroyed by forest fires. An old brulé, about 52 square miles in area, covers the central part of the region. Birch and poplar are common on the higher ground, and there are extensive growths of alder on the flats and along the small streams.

Several times we sought to collect specimens of the larvae of the spruce saw-fly for the Entomological Service of the Dominion Government, but the spruce in this region seems to be free from attack, as none of the larvae could be found. It was observed, however, that the tamarack was affected, probably by a larva which was found in great numbers on the trees and in the moss nearby.

Game is moderately abundant in the region. Moose were frequently seen, but no caribou or deer. Bear, fox, and beaver are fairly common, but we saw few signs of trapping. There are sturgeon, pike, pickerel, and whitefish in the larger rivers, but the small streams are always muddy and apparently contain very few fish.

## Previous Work and Bibliography

Largely because of its inaccessibility, the area has never been studied in detail. A certain amount of reconnaissance exploration has been carried out, but in the main it has been restricted to tributaries of the Laflamme river.

In 1887, A. S. Cochrane (1) descended the Bell river to James bay. In 1895 and 1896, Robert Bell (2), and in 1906 and 1910, W. J. Wilson (3), visited the Mégiscane river and the tributaries of the Bell. Some years later, in 1912, J. A. Bancroft (4) made a geological survey of the Laflamme river from its mouth to a point somewhat south of the present map-area, this work being carried out for the Quebec Bureau of Mines. In the same year, M. E. Wilson (5), of the Geological Survey of Canada, studied the same region in the course of a geological reconnaissance of the Bell river. H. C. Cooke (6), also of the Geological Survey, made a complete survey of the Laflamme river in 1914; and in 1924 he did some geological work along the Castagnier river, which forms the southern limit of the present map-area. In 1915, T. L. Tanton (7) explored the Harricana river, west of our area. From 1922 to 1930, Cooke, James, and Mawdsley (8), carried

(1) Numbers within brackets refer to reports cited at end of paragraph.

out surveys in the Rouyn-Harricana region and a compilation of the results of their work was published in Memoir 166 of the Geological Survey of Canada. The country immediately south of our area was examined in 1934 by Carl Faessler for the Quebec Bureau of Mines (9), and in 1936 B. C. Freeman (10), of the Geological Survey, made a reconnaissance survey of the territory included within the present map-sheet.

### Bibliography

(1) Cochrane, A. S. (Reference to work by), Geol. Surv. Can., Ann. Rept., Vol. 3, Pt. 1, 1887-8, pp. 24-25A.

(2) Bell, Robert (Summ. rept. by), Geol. Surv. Can., Ann. Rept., Vol. 8, 1895, pp. 75-85A, and Vol. 9, 1896, pp. 64-74A.

(3) Wilson, W. J., *On Explorations along the Proposed Line of the Transcontinental Railway from Lake Abitibi Eastward*; Geol. Surv. Can., Summ. Rept., 1906, p. 119; also *Geological Reconnaissance along the Line of the National Transcontinental Railway in Western Quebec*; Geol. Surv. Can., Mem. No. 4, 1910.

(4) Bancroft, J. A., *Report on the Geology and Natural Resources of Certain Portions of the Drainage Basins of the Harricanaw and Nottaway Rivers to the North of the National Transcontinental Railway in Northwestern Quebec*; Que. Bur. Mines, Ann. Rept., 1912, pp. 131-198.

(5) Wilson, M. E., *A Geological Reconnaissance from Lake Kipawa* via *Grand Lake Victoria to Kanikawinika Island, Bell River, Quebec*; Geol. Surv. Can., Summ. Rept., 1912, p. 315.

(6) Cooke, H. C., *An Exploration of the Headwaters of the Broadback or Little Nottaway River, Northwestern Quebec*; Geol. Surv. Can., Summ. Rept., 1912, p. 337.

(7) Tanton, T. L., *The Harricanaw-Turgeon Basin, Northern Quebec*; Geol. Surv. Can., Mem. 109, 1919.

(8) Cooke, H. C., James, W. F., Mawdsley, J. B., *Geology and Ore Deposits of Rouyn-Harricanaw Region, Quebec*; Geol. Surv. Can., Mem. 166, 1931.

(9) Faessler, Carl., *Geological Exploration along the Laflamme River, Abitibi County*; Que. Bur. Mines, Ann. Rept., 1934, Pt. *C*, pp. 35-44.

(10) Norman, G. W. H., *West Half Waswanipi Map-Area, Quebec* (with map); Geol. Surv. Can., Paper 37-8, 1937. (Includes Freeman's work).

(11) Douglas, G. Vibert, *Bruneau Township and Surrounding Area, Abitibi District*; Que. Bur. Mines, Ann. Rept., 1936, Pt. *B*, pp. 37-60.

(12) Longley, W. W., *Grevet (Kamshigama Lake) Map-Area, Abitibi District*; Que. Bur. Mines, Ann. Rept., 1936, Pt. *B*, pp. 61-77.

## Purpose and Method of Work

The principal purpose of the present examination was to study the various geological formations in the area, to locate as accurately as possible the formational contacts, to examine any mining prospects, and to correct and complete the topographic map.

The ground was systematically covered by parallel traverses at half-mile intervals. The water courses served generally as a base for the traverses, except in the southwest corner of the map-area, which could not be reached by canoe. In this section, side camps had to be established in order to explore the region completely.

The principal rivers had been previously surveyed, and in Fraser, *210*, and *111* townships there were stations marked from place to place along the main water-routes. These served as traverse bases and for the location of rock outcrops along the streams.

ACKNOWLEDGMENTS

Aerial photographs of the region were available and were found of great use for locating hills and rock outcrops. Our base-maps were prepared from these photographs by the Topographic Survey of Canada. Freeman's reconnaissance map, made in 1936, was found very useful for locating outcrops and contacts along the rivers. The township plans of the Quebec Bureau of Mines and the Laflamme River survey of the Department of Lands and Forests of the Province of Quebec were also used.

I am particularly indebted to Dr. W. H. Newhouse, of the Massachusetts Institute of Technology, who assisted in the microscopic study of thin sections and offered constructive suggestions concerning the general problems of the region. Thanks are due also to Dr. W. W. Longley for his kindness and advice during the course of the summer, when he was engaged in field work for the Bureau of Mines. Efficient and conscientious service was rendered by J. Claveau, of Queen's University, as assistant, by A. Plourde and P. Blondin, canoemen, and by J. Roberge, the cook of the party.

## GENERAL GEOLOGY

All the rock outcrops observed in the map-area have been plotted on the accompanying map. As will be noted, they are in the main relatively small, and they are widely scattered, particularly in the northern part of the area. The contacts shown are necessarily only approximate, except at one or two points.

The rocks exposed are all of Precambrian age. They comprise Keewatin volcanics, with some slaty schists that may be of sedimentary origin, and later intrusive rocks. The latter are chiefly granitic—diorite in one locality—but types ranging from basic to acidic occur as dykes or sills.

In a broad way, the distribution of the rocks is as follows: The northwestern portion of the area is occupied by granite, representing the tip of a southerly-trending lobe of the Bell River-Harricana River batholith, which is known to extend far to the north. The northern margin of another granite batholith crosses Hurault township, immediately south of the present map-sheet, in an east-west direction, turning northwesterly in the adjoining Bernetz township. The whole of the area between these batholiths is occupied by Keewatin greenstone, except at two points along the Laflamme river, where, as shown on the map, a small body of granite, and another still smaller of diorite, are intrusive into the Keewatin. Another small granitic body intrudes the Keewatin on the eastern side of the Laflamme river but does not outcrop within the present map-area. In the north part of the area, also, a small outlier of Keewatin is enclosed within the granite. The Keewatin rocks extend to east and west far beyond the limits of the present map-area.

Dykes, ranging from basic to acidic, cut the Keewatin, and also the granite, in many places.

TABLE OF FORMATIONS

| | |
|---|---|
| PLEISTOCENE AND RECENT | Sand, gravel, stratified clay, swamp |
| *Great unconformity* | |
| POST-KEEWATIN ALGOMAN (?) | *Batholiths:* Granite, granodiorite<br>*Dykes or sills (later):* Granite, aplite, pegmatite, rhyolite, feldspar porphyry, diorite, diabase |
| *Intrusive contact* | |
| KEEWATIN | *Volcanic:* Basalt, andesite, rhyolite, trachyte and their schistose derivatives; gabbro, diorite, amphibolite<br>*Sedimentary* (?): Slaty schist, banded slate<br>*Intrusive:* Diorite |

## KEEWATIN

### *Volcanic Rocks*

The Keewatin rocks are exposed at many points along and in the vicinity of the Laflamme, Bernetz, and Bigniba rivers. In the northern part of the map-area, the country between these rivers is mostly flat and swampy and there are practically no rock outcrops, but in the south and southwest, where the ground is higher, outcrops are fairly numerous, as for example along the line of hills at the south of townships *109* and *110*.

Judging by the exposures seen, the Keewatin rocks of the area are mainly well foliated, fine grained, chlorite schists and sericite schists, but in some localities, particularly toward and along the southern boundary, coarser grained, massive, and porphyritic types are interbanded with the schists.

Certain slaty schists occurring in the extreme south of the area may be altered sedimentaries. Apart from these, the Keewatin rocks, both schistose and massive, are believed to represent highly metamorphosed volcanic flows, dominantly andesites and basalts, in which the original ferromagnesian constituents have been more or less completely altered to chlorite, accompanied by sericite, talc, and serpentine. More acidic types, representing trachytes and rhyolites, are found in a number of localities, but they are comparatively rare.

It was noted that, in a general way, the Keewatin rocks in the southern part of the area show more typical volcanic structures than do those in the north. Thus, in exposures seen along the Laflamme river in the northeastern corner of the area, the characteristic feature of the schists is their extreme foliation. Such volcanic structures as vesicular cavities, flow lines, and ellipsoids are rarely seen. These features are much more common in the rocks exposed farther up the Laflamme, at the first portage, and in the southern part of townships *109* and *110*. In these localities, the Keewatin rocks are, in part, coarsely porphyritic and in many places they contain amygdules filled with carbonate, quartz, and epidote. Also, a well developed pillow structure is seen in many of the exposures (see Plate I-A). In some, there is pronounced brecciation of the rock (Plate I-B).

A good example of the massive type of Keewatin volcanics is seen in the ridge, or line of hills, that rises abruptly in the southern part of *109* and *110* townships. The rock exposed along this ridge is mainly coarse grained gabbro or diorite and the ridge owes its elevation to the relatively greater resistance of these rocks to erosion as compared with the softer schists that flank it. It has a width of half a mile and strikes east-west, parallel to the adjacent schists, extending to and beyond the map boundary. While this occurrence might represent a dyke or sill intrusive into the Keewatin, it is believed much more likely that the gabbro-diorite is the slowly cooled, and hence coarsely crystalline, central portion of a thick lava flow, or series of flows.

As supporting this view, we have the fact that careful search failed to reveal a single instance of the gabbro-diorite cutting across the schists. Also, where the two types of rock are in contact, or closely adjacent, the schists present their normal character and show no high-temperature effects such as would be expected at an intrusive contact. In this connection, it should be mentioned that, in the northern part of the area, where the Keewatin is intruded by granite, the schists show important effects of contact metamorphism. As one approaches such a contact, a progressive change is observable in the schists, the hydrous silicates giving place first to hornblende and finally, at the immediate contact, to pyroxene. There has also been some albitization of the rock, and development of quartz stringers, along these contacts. It is true that the contact effects of basic intrusives are generally less pronounced than those of acidic intrusives, but we would expect to find some evidence, at least, of elevated temperature in the rocks adjacent to them if the contact between the two were an intrusive one.

An excellent cross-section of the lavas is exposed on the north-facing escarpment of the largest of these hills. The beds are dipping at 15° to 20° to the south, and the section shows typical ellipsoidal Keewatin schist at the base, followed by a porphyritic band and, at the top, massive gabbro-diorite.

The porphyritic rock consists of phenocrysts of feldspar, now completely altered to a fine grained aggregate of quartz, kaolin, sericite, and zoisite, in a fine to medium grained groundmass which is similar in composition to the adjacent schists. The phenocrysts range from a fraction of an inch to two inches in length, and they are oriented with their long dimension east-west, parallel to the general strike of the flows. They are most abundant above the central portion of the band, becoming gradually more widely spaced and finally disappearing at the upper and lower margins.

The occurrence of porphyritic bands in otherwise even grained lava flows is not altogether rare. Broderick has described occurrences similar to the above in the upper parts of the Keweenawan flows of Wisconsin (1). He concluded they are to be explained as the result of gaseous emanations rising through the cooling lava and carrying upward with them the earlier formed crystals. It is possible, also, that feldspar crystals might rise and accumulate beneath the already solidified crust of a flow because of their

(1) Bull., Geol. Soc. Am., Vol. 46, pp. 503-558.

low specific gravity relative to that of the more basic, and hence heavier, lava from which they crystallized. Either of these explanations might well apply in the case of the porphyritic band in the section described above.

The massive lavas are apparently less intensely metamorphosed than the schistose types. This may be explained by their coarser grain and greater resistance to foliation. They are, however, cut by numerous faults or joints, as a result of which exposures have a 'blocky' appearance. These breaks may be due to the same regional stresses which caused the general foliation of the finer grained lavas.

In the southeast corner of township *209*, a patch of the volcanics, having an area of about two square miles, is enclosed within the granite batholith that occupies the whole of the area to the northwest. For the most part, the rocks are typical Keewatin schists, but associated with them are coarse grained gabbro and diorite similar to that described in the foregoing paragraphs and unquestionably forming part of the flows. The rocks here strike N.30°W., and a traverse across the strike of the individual flows shows a textural gradation from bottom to top. Thus, in one flow, having a measured thickness of 65 feet, specimens taken at 5-foot intervals show, at the base, a fine grained fragmental rock, above which there is an abrupt change to coarse gabbro. Gradually the grain becomes medium, ellipsoidal structure begins to make its appearance, and at the top of the flow, which is brecciated, the rock is a fine grained, ellipsoidal and amygdaloidal 'greenstone'.

Examination of a number of the flows at this locality showed an exact repetition of the variations noted above. Microscopic examination of these rocks shows them to contain fresh amphibole and a pyroxene, commonly augite. The presence of these minerals is undoubtedly due to the contact action of the granite. At the extreme south of the patch, close to the contact with the granite, the Keewatin rocks are completely altered to coarse grained amphibolite. Toward the western side, they are cut by a number of granite and aplite dykes.

Similar fine grained and gabbroid lavas are exposed in a low line of hills about two miles south and southeast of Bigniba lake, but there the alternation of the fine and coarse flows is not so regular and they are interrupted by sills or flows of brecciated feldspar porphyry. The porphyry consists of phenocrysts of orthoclase and albite-oligoclase in a fine grained matrix of feldspar, quartz, and chlorite. The phenocrysts are relatively fresh but they are much fractured and secondary quartz, with some sericite and talc, has developed around them. They have a tendency to be oriented with their length parallel to the strike of the sills and to the foliation of the enclosing schists.

In several places in the area, the lavas have a pronounced ophitic texture, with idiomorphic laths of feldspar, fairly fresh and having the composition of oligoclase (Ab 80), completely or partially enclosed by the ferromagnesian minerals.

Rocks of this type are most abundantly developed on the northern side of the gabbro-diorite band south of townships *108* and *109*.

### *Sedimentary (?) Rocks*

Besides the chlorite and sericite schists and rocks of more massive habit that are of undoubted volcanic origin, there are, in the extreme south of the area, certain slaty schists which may be altered sedimentary rocks. Such schists, resembling sediments of Temiscamian type, occur south of the boundary line between *110* and Hurault townships, and they appear again along the Castagnier river and farther up the Laflamme. Unfortunately, these rocks are so highly altered that it is not possible to be certain of their original nature. Slaty schists which exhibit variously coloured bands at an angle of 20° to the schistosity outcrop also along the north boundary of Hurault township, three miles west of the Laflamme river. In thin section, the rock is seen to be composed of quartz, feldspar, and finely crystalline sericite in shreds oriented parallel to the schistosity. Traversing the rock are numerous minute veinlets of fine granular quartz.

### *Intrusive Rocks*

Extending along the Laflamme river, from 4½ to 7 miles above the lowest rapid, there is a series of outcrops (marked *K2* on map) of more or less highly altered diorite. No outcrops were observed away from the river. This dioritic body is believed to be intrusive because it does not resemble the common volcanic gabbro-diorite of the area. The mass has also too great a north to south extension to be considered as a lava flow.

In the most southerly outcrops, near the contact with the Keewatin volcanics, the diorite has been converted to a schist composed of quartz, chlorite, serpentine, and biotite, with stringers of magnetite between the planes of foliation. The rock over a width of about ten feet contains sufficient magnetite to cause a compass deviation of 45°.

In the central outcrops, the rock is massive and porphyritic, but even here it is too highly altered to permit determination of the feldspar it contains.

These various outcrops doubtless represent a continuous underlying body of diorite intruding the Keewatin volcanics here. Because of the extreme alteration of the rock, its age is tentatively placed as pre-Algoman.

## Post-Keewatin

### *Algoman (?)*

Granite, or rock of granitic type, intrusive into the Keewatin, is believed to underlie the whole of the northwestern portion of the map-area (see accompanying map). The scattered outcrops observed mark approximately the southern margin of the southerly-extending lobe of the Bell River-Harricana River granite batholith which is known to extend far to the north. The rock presents a variety of facies, from granodiorite, through normal granite, to aplitic and pegmatitic types. Typically, however, it is a pink to grey, medium grained, massive granite containing about 50 per cent quartz, with varying proportions of orthoclase, albite, and hornblende. The rock is usually quite fresh, but at and near contacts with the Keewatin it may contain minor amounts of epidote.

On the west side of the Laflamme river, about seven miles from its mouth, granite, intrusive into the Keewatin, outcrops over an area of four square miles. These outcrops represent the western nose of a granite stock that has been traced, by other observers, for some ten miles eastward, beyond the Laflamme. The granite contains 20 to 30 per cent quartz, together with orthoclase, albite, and minor hornblende, which usually shows some alteration to chlorite and epidote.

### *Younger Dykes and Sills*

In many places, the granite and the Keewatin rocks are cut by dykes, some of considerable width, of aplite, pegmatite, and younger granite. Thus, about eight miles from the mouth of the Laflamme, the granite stock referred to in the last paragraph is cut by a dyke of pale grey granite, finer grained than the rock it intrudes. The dyke itself is somewhat coarser at the centre than at the margins. A single outcrop of a similar dyke was seen at the foot of the fourth rapid on the Bigniba river. The adjacent rocks here are Keewatin, but the actual contact is not exposed.

Quartz veins are fairly numerous cutting the Keewatin rocks, but so far as observed they are generally barren of metallic minerals and of no economic interest. A group of such veins cut the Keewatin in the southeast corner of township *209*, where, as mentioned on an earlier page, a patch of these rocks is included within the granite. The veins are doubtless genetically related to the granite. They are mostly irregular lenses, but some are up to 8 feet wide and can be traced for a length of 100 feet. The common strike is N.9°E., and the dip 44° west. The quartz is bluish-white. Although iron stained in places, it contains practically no metallic minerals. It is of interest to note, however, that the greenstone adjacent to the veins carries sulphides in appreciable amount.

Some mineralized quartz veins were observed about six miles south of Canica island, as noted in the section on Economic Geology.

Diabase dykes were seen cutting Keewatin schists south of the Bigniba river, about three miles from the lowest rapid. Although the diabase is evidently highly altered, consisting now of hornblende (40 per cent), labradorite (40 per cent), and quartz (20 per cent), with a minor content of epidote, the rock presents a very fresh appearance in hand specimen. Quartz veins traverse the dykes, and possibly the alteration of the latter is closely connected with this veining. The cross-cutting relationship of the dykes to the Keewatin schist is well seen in this locality. Similar dykes were seen at a number of other points.

Sills of rhyolite have been intruded along two prominent faults in the massive gabbroid flow-rocks exposed in the line of hills at the south of townships *109* and *110*; and a number of brecciated sills or flows of feldspar porphyry are interbanded with the Keewatin lavas in the low hills two miles south and southeast of Bigniba lake.

## Pleistocene and Recent

By far the greater part of the map-area is covered by poorly consolidated Pleistocene and Recent deposits. Glacial-lake clays are very

widespread. Along the Bigniba river, about seven miles below Bigniba lake, and along the 49th parallel at three miles west of the Laflamme river, the clays show typical varved structure (Plate II-A).

There are numerous glacial moraines, particularly on the southern side of hills. Morainal material contains granite boulders up to four feet in diameter. Drumlins, eskers, and extensive gravel deposits are fairly abundant. These are characteristically elongated in a northeast direction and have lengths from a few hundred feet to a mile and a half. Gravel deposits are particularly in evidence near the second, third, and fourth rapids of the Bigniba river. At these points, the river is turned from its natural course by the glacial dumps, and the glacial débris causes the rapids.

The direction of the final ice advance, as indicated by numerous striae, was N.6°W.

## STRUCTURAL GEOLOGY

For the most part, the Keewatin rocks of the area show pronounced foliation, but gneissoid structure in the granite is rarely seen. In the extreme north of the area, however, between the Laflamme and Bigniba rivers, the granite exposed in some places is faintly gneissoid in an east-west direction.

Away from the granite masses, the foliation in the Keewatin schists has a fairly constant trend, averaging N.75°W., with dip vertical or at a high angle (usually steeper than 80°) to the north. Locally, however, there are variations from this general attitude, as along the Laflamme river, where the strike of the schistosity ranges from N.40°E. to N.75°E., and the dip in some places is as low as 60° north. In one outcrop near the river, a dip to the south was observed.

Adjacent to the margin of the granite batholith, however, and also to the small granite mass on the Laflamme river, the strike of the foliation in the Keewatin schists is much more variable. In a general way, it tends to parallel the contact, and there can be no doubt that it has been controlled by the contour of the granite bodies.

As mentioned on an earlier page, the Keewatin rocks, particularly in the northern part of the area, are so highly deformed that the actual attitude of the flows has been entirely obscured. In three places, however, it was possible to determine their strike and dip. In the escarpment on the northern side of the line of hills in the southern part of townships *109* and *110* (see p. 10), the finer-grained flows below the massive gabbro-diorite strike N.86°W. and dip 15° to 20° to the south; the strike of the flows exposed a short distance east of Bigniba lake is N.80°W.; and in the patch of Keewatin enclosed within the granite in the southeast corner of township *209*, the flows strike N.30°W. and dip approximately 60° to the northeast. In the last named occurrence, observation of grain-size variation indicates that the tops of the flows face to the northeast, and this is confirmed by the attitude of the ellipsoids.

The banded slaty schists, possibly of sedimentary origin, along the survey line north of the 49th parallel (near the south limit of the map-

sheet) strike N.86°W., but the slaty cleavage strikes N.74°E. The dip in each case is vertical.

In many places, shear-zones have developed in the schistose Keewatin rocks. Those seen range in width from a few inches to four feet, and some of them can be traced for distances up to 400 feet. They commonly strike N.76°W. and dip at 77° to the north, that is, they have the same strike and attitude as the regional foliation.

The massive flow-rocks show little or no foliation or shearing, but in many places they are much jointed. Thus, in the massive gabbro-diorite ridge in the southern part of townships *109* and *110*, the rock is traversed by two systems of joints, regularly spaced at intervals of 15 feet to 20 feet, and striking, respectively, N.86°W. (*i.e.*, in the direction of the regional foliation of the schists), and N.19°E. Both sets dip southward at about 75°. That there has been appreciable movement, or faulting, along the joint planes is evident from striations to be seen on the surface of some of the joint blocks. On one such surface, measurements gave the direction of these striations as 52° and 18° from the horizontal, indicating two distinct periods of movement along the same fault plane in different directions.

The joints striking N.86°W. are unquestionably related to two pronounced faults which cut the gabbro ridge longitudinally and along which there has been considerable displacement. Along each of these faults a sill of rhyolite has been intruded, which in turn is traversed by quartz veinlets paralleling the rhyolite banding. The sills are in many places contorted and drag-folded, indicating a recurrence of the fault movement following their intrusion (see Plate II-B.).

The granite, as already stated, is for the most part massive. It presents no regular jointing, and fracturing of any kind is rare. Dykes cutting the granite have random orientation, but quartz veins traversing the rock commonly strike north and south.

Generally speaking, the topography of the area is but slightly influenced by the nature of the underlying rock or the structure, because of the considerable mantle of unconsolidated material.

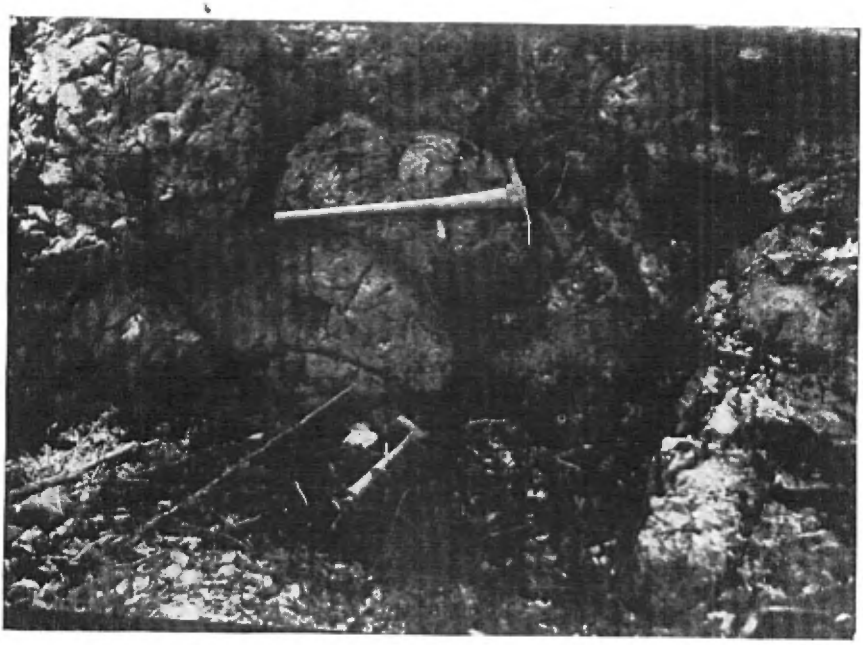
## ECONOMIC GEOLOGY

There has been very little prospecting in the area, which, owing to sparsity of rock outcrops and relative inaccessibility, offers little encouragement to one searching for mineral deposits. Only one group of claims was seen, and these had been abandoned following a very limited amount of surface work. These claims, twelve in number, are at the lower falls on the Laflamme river, about ten miles from its mouth. Here, a 3-foot fracture zone in the Keewatin volcanics contains a little quartz and pyrite, but the occurrence does not appear to be of economic importance.

Although quartz veins are fairly numerous and widespread in the area, they appear, in general, to be barren of sulphide minerals. Some mineralization was observed in a series of such veins in Keewatin schists, near their contact with the granite, at a point west of the Laflamme river and about six miles south of Canica island. Here, a group of parallel veins,

individually from a few inches up to two feet in width and occurring over a total width of ten feet, are exposed for a length of fifty feet. The granular vein-quartz contains small amounts of disseminated pyrite, chalcopyrite, and pyrrhotite, and the wall-rocks are mineralized to about the same extent as the veins.

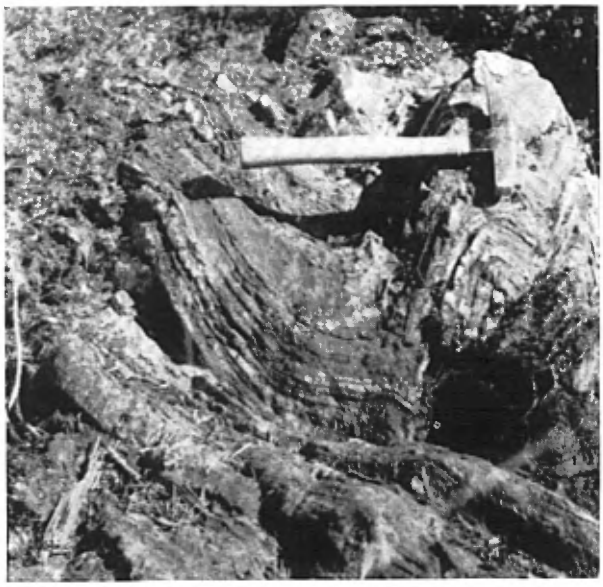
Similar mineralized quartz veins, or groups of veins, were seen in the Keewatin in other places, particularly near granite contacts, but in all of them the sulphides are disseminated and in small amount only.



A.—Pillow structure in lavas, in southeastern section of township 109.

B.—Brecciated lava flow, in southern part of township 109.

A.—Varved clay, three miles west of Laflamme River, along survey line north of 49° parallel.



B.—Drag fold in a rhyolite sill along a fault, in a southern section of township 109.

# LOWER LAFLAMME RIVER AREA

## ABITIBI DISTRICT

## II—EASTERN SECTION

*by W. Warren Longley*

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TABLE OF CONTENTS


| | PAGE |
|---|---|
| INTRODUCTION | 21 |
| General statement | 21 |
| Related publications | 22 |
| Location and access | 22 |
| Topography and drainage | 23 |
| Timber, fish, and game | 23 |
| Agriculture | 24 |
| Acknowledgments | 24 |
| GENERAL GEOLOGY | 24 |
| Table of formations | 24 |
| Keewatin | 25 |
| Post-Keewatin intrusives | 27 |
| Olivine gabbro | 27 |
| Granite | 27 |
| Dykes | 28 |
| Pleistocene and Recent | 29 |
| STRUCTURAL GEOLOGY | 29 |
| ECONOMIC GEOLOGY | 30 |
| Léo Bomia claims | 30 |
| Kiask Falls Mining Company, Limited | 31 |
| G. R. Blais claims | 31 |
| Other mineralized zones | 32 |
| General considerations | 33 |


MAP AND ILLUSTRATIONS


Map No. 457.—Lower Laflamme River area, Abitibi territory ..... (in pocket)

PLATE
(After page 33)

Plate I.—Fraser chute, Laflamme river.


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# LOWER LAFLAMME RIVER AREA
## ABITIBI DISTRICT

## II—EASTERN SECTION

*by W. Warren Longley*

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## INTRODUCTION

### General Statement

The writer spent the field season of 1937 making a geological survey of an area along the Bell river, extending from the Kiask falls north to the Florence river, and from longitude 77° westward beyond the Bell to the Laflamme river. This work was a continuation of that carried out by the writer in the summer of 1936 (1). Westward from the Laflamme river, the mapping was carried forward by P.-E. Auger, whose report appears on pages 3-17 of this volume. The area to the north of the present map-sheet was mapped by G. Vibert Douglas during the summer of 1936 (2), and that to the southwest by Carl Faessler in 1934 (3).

Work of the preceding year in the area adjoining to the east, and observations along the Bell river, indicated that the area to be mapped was largely underlain by Keewatin greenstone. Although traversed by geological parties on several occasions in the past, little detailed mapping had been done previous to the writer's work.

The first surveying and geological mapping in this area was done by Robert Bell, of the Geological Survey of Canada, in 1895 and 1896 (4). No information regarding the geology is included in his reports, but his observations are recorded on a map published in 1900 (5). In 1912, M. E. Wilson, of the Geological Survey, passed through the area in the course of a geological reconnaissance along the Bell river, and his report and accompanying map contain information relating to the present area (6). The Nottaway Sheet (7), compiled by H. C. Cooke in 1927, includes the geology shown on the maps of Bell and Wilson and also some additional data. G. W. H. Norman gives further information on the geology of the area in two preliminary reports (8).

The work done by the writer was of reconnaissance nature. Land traverses were run by pace-and-compass, for the greater part at half-mile intervals. Many traverses were modified to avoid obvious muskegs and to include possible outcrops where these were indicated on aerial photographs. These photographs were a great help in locating small, isolated hills. Dry weather and low water made traversing the swamps and muskegs easier than it would otherwise have been, and exposed outcrops along the streams that would be covered during summers of high water.

The base-map upon which the geology has been plotted was supplied by the Quebec Bureau of Mines. It is a compilation made from aerial

(1) Numbers within brackets refer to publications cited on page 22.

photographs, and from township surveys by the Department of Lands and Forests. A few alterations and additions in the base-map were made as a result of surveys by the writer.

## Related Publications

For details of the earlier work in this and adjoining areas, reference may be made to the following reports:

(1) Longley, W. W.
*Grevet Map-Area, Abitibi District;* Que. Bur. Mines, Ann. Rept., Part *B*, 1936.

(2) Douglas, G. Vibert
*Bruneau Township and Surrounding Area;* Que. Bur. Mines, Ann. Rept., Part *B*, 1936.

(3) Faessler, Carl
*Geological Exploration along the Laflamme River, Abitibi County;* Que. Bur. Mines, Ann. Rept., Part *C*, 1934.

(4) Bell, Robert
Geol. Surv. Can., Ann. Rept., Vol. VIII, Part *A*, 1895; Vol. IX, Part *A*, 1896.

(5) Bell, Robert
*Geology of the Basin of the Nottaway River;* Geol. Surv. Can., Ann. Rept., Vol. XIII, Part *K*, 1900 (map accompanying report).

(6) Wilson, M. E.
*A Geological Reconnaissance from Lake Kipawa* via *Grand Lake Victoria, to Kanikwanika Island, Bell River, Quebec;* Geol. Surv. Can., Summ. Rept., 1912, p. 315-336.

(7) Cooke, H. C.
*The Nottaway Sheet;* Geol. Surv. Can., Map No. 190A, 1927.

(8) Norman, G. W. H.
*Waswanipi Map-Area, Northern Quebec,* Geol. Surv. Can., Paper 36-3, 1936; and *West Half, Waswanipi Map-Area,* Geol. Sur. Can., Paper 37-8, 1937.

(9) MacKenzie, G. S.
*Currie Township Map-Area, Abitibi District;* Que. Bur. Mines, Ann. Rept., Part *B*, 1935.

(10) MacKenzie, G. S.
*Pusticamica Lake Map-Area, Abitibi District;* Que. Bur. Mines, Ann. Rept., Part *C*, 1934.

(11) Bannerman, H. M.
*Josselin-Delestre Map-Area, Abitibi County;* Que. Bur. Mines, Ann. Rept., Part *C*, 1935.

## Location and Access

The Lower Laflamme River map-area, eastern part, is about fifty miles north of Senneterre, Abitibi district (see the accompanying map). The map-sheet extends northward from about latitude 48°55′N. to 49°15′N., and westward from longitude 77°W. to the Laflamme river. It includes a large portion of Fraser, Franquet, Quévillon, *111* (1), and Laas townships, and small corners of Hurault and *110* townships, comprising an area of approximately 300 square miles.

The easiest route to the area is from Barraute by way of the Laflamme river. The first twenty miles or so of the trip can be made by truck, following the La Morandière road north, thence east to a point near the mouth of Rochebaucourt creek. Along the water route from here to the Bell river

(1) Numbers are assigned tentatively by the Bureau of Mines to un-named townships in unsurveyed Crown lands.

there are five portages, four of them short and the other slightly over half a mile long. These portages are kept in good condition by the fire rangers.

The Bell river offers an optional route from Senneterre. On this route there is a long stretch of open water in crossing Parent lake, but the portages along the river are somewhat difficult. There are five of these to the central part of the area, one of three miles, one of half a mile, and three short ones. Five short portages may be made instead of the long one. At times, Mr. Kelly of Senneterre operates an auto across the three-mile portage at a very reasonable rate. When the water is not too low, he also operates a lake boat from Senneterre to the head of the three-mile portage.

The portages are all well cleared and in good condition, with the exception of one about half a mile long at the head of the Kiask falls. At present, this portage follows an old tram-line, constructed some years ago as part of a fisheries project, but the planking and trestles are in such a state of decay that either they will have to be repaired or the route abandoned in the near future.

## Topography and Drainage

The area lies along the eastern edge of the clay belt of northern Ontario and Quebec. It is low and flat, with extensive sandy clay plains, many large swamps and muskegs, and scattered, small rounded ridges and knolls. Franquet hill is by far the largest and highest in the area, and most of the other large hills are near it. Although, on some of the hills, rock exposures were not seen, it is probable that bed-rock forms the core of the majority of them, but is obscured by heavy drift.

The area is drained by the Bell and Laflamme rivers and their tributaries. In spite of its low, flat nature, the major portion is well drained. The western end of Quévillon lake projects into the area on its eastern side. Apart from this, there are no lakes within the map-sheet.

## Timber, Fish, and Game

The greater part of the area east of the Bell river has been burned over by recent forest fires and there have also been local fires in the southwest. Timber covers practically all of the country between the Bell and Laflamme rivers, and there are several small stands east of the Bell. For the most part, the timber is jackpine with a sprinkling of spruce and local heavy undergrowths of alder. There are scattered stands of spruce and fir, some of which are good, and also a few small patches of spruce with white birch and poplar. In some places, the trees are large, with butts up to about eighteen inches in diameter; but in general they are small, especially the spruce.

There are pickerel, pike, and sturgeon in the rivers and their larger tributaries, but they are not plentiful.

Moose and bear are numerous, but lynx, fox, and rabbits are scarce. A few ruffed grouse and spruce partridge were seen. Trapping is carried on in the area during the winter months.

### Agriculture

The greater part of the area between the Bell and Laflamme rivers is flat and well drained. The soil is a light, sandy clay and in many places should be excellent for agricultural purposes. The soil along the Quévillon and Wedding rivers is similar. Many good patches of wild raspberries were observed, and the best growth of wild gooseberries the writer has ever seen was found in a small stream-valley in Franquet township.

Precipitation and temperature range are about the same as at Senneterre.

### Acknowledgments

The writer wishes to express his appreciation of the courtesies and assistance extended him by Mr. René Dallaire, engineer for the Consolidated Mining and Smelting Company; Mr. René Lévesque, game warden, of Senneterre; and Messrs. Trouchon and Marcotte, of the Forest Ranger service.

Information regarding the area between Quévillon lake and the Bell river was supplied by G. S. MacKenzie, of the Quebec Bureau of Mines.

P. D. Normandeau, of l'École Polytechnique, Montreal, discharged his duties as assistant in a very satisfactory manner.

## GENERAL GEOLOGY

Almost everywhere, the area is blanketed by glacial tills and clays. Exposures of bed-rock are few and in general are confined to small hills, ridges, and the channels of the larger streams. The scarcity of outcrops makes the interpretation of the geology problematical in places and is a great hindrance to prospecting.

The rocks are all of Precambrian age. Probably about two-thirds of the area is occupied by Keewatin volcanics, and the remainder by granites and related rocks. The latter form several stock-like bodies, the largest of which is in the southwestern part of Franquet and extends into the adjoining townships. There are many feldspar-porphyry and quartz-porphyry dykes in the vicinity of the granite bodies, and also some basic dykes.

### Table of Formations

| | | |
|---|---|---|
| Quaternary | Pleistocene and Recent | Varved clays and glacial-lake silts, till, sand and gravel |
| | *Great unconformity* | |
| Precambrian | Post-Keewatin Intrusives | Aplite, rhyolite porphyry, soda-feldspar porphyry, granite, granite gneiss, syenite, diorite, gabbro |
| | *Intrusive contact* | |
| | Keewatin | Acidic to basic lava flows with associated tuffs, agglomerates, and intrusives; diorite (?) |

## Keewatin

Keewatin rocks underlie about two-thirds of the area. They are bounded to the north and to the south by rather extensive bodies of granitic rocks, and through the area are interrupted by five other bodies of intrusive rock. Three of these are completely within the area, the largest occupying about twenty-five square miles.

The Keewatin rocks are usually well foliated, and bedding or banding structures are prominent in many of the exposures. In places, however, the rocks are quite massive. The general trend of both the foliation and the bedding is slightly north of east. There is some variation from this, especially in the vicinity of igneous contacts.

A large proportion of the outcrops studied consist in part or entirely of ellipsoidal and amygdaloidal lavas. In many places, the pillows are well preserved, but as a rule they are more or less sheared. Where shearing has been extreme, the rock has been converted into a fissile, chlorite schist, and identification of its original nature is difficult. The pillows observed range in diameter from a few inches to several feet, and in general they are somewhat elongated. Where they are well preserved, an amygdaloidal texture is quite prominent, with the amygdules largest and most abundant near the margins of the pillows. The matrix of the pillows has been extensively carbonatized, and in places there are pockets of white to pinkish carbonate. In some of the pillows, there has been local replacement by carbonate. The filling of the amygdules is usually quartz, with occasional carbonate. The pillows are composed largely of chlorite, epidote, and carbonate.

There are several bands of the ellipsoidal lava extending across the area in an east-west direction. These may represent the upturned and eroded edges of a single stratigraphic horizon, but it is probable that more than one horizon of pillow lava is represented.

Pillow lavas are well exposed at the Kiask falls. Similar rocks occur at Laas chute along the same line of strike and probably belong to the same belt. To the west of Quévillon lake, at the Little Kiask falls and on the Laflamme river immediately west of them, there are good exposures of pillow lava, which probably form another belt; and occurrences at Fraser chute may be the continuation of still another belt that extends through the eastern part of Franquet township between the Wedding river and the southern boundary of the township. Good exposures of pillow lava also occur on the Bell river slightly north of the mouth of the Florence, and on the Laflamme river immediately west of the mouth of the Florence.

A wide belt of fragmental rock and acidic flows crosses the Bell river near the Greenstone narrows and extends nearly to the Little Kiask falls. This belt is exposed in several large outcrops a short distance north of the west end of Quévillon lake, but was not definitely picked up on the Laflamme river. Similar rock is exposed at Laas chute, Kiask falls, and Rain lake.

These rocks were nowhere observed to hold large angular fragments, but an outcrop on a small island just below the Greenstone narrows contains numerous small ones. In places, the rock appears amygdaloidal, and in many localities it is strongly porphyritic, with conspicuous phenocrysts of feldspar. Such a rock occurs a short distance below the Little Kiask

falls, and in places it is made up of small elongated 'blebs' of a trachytic feldspar porphyry in a matrix of a similar rock. One very large outcrop northwest of Quévillon lake is composed almost entirely of blebs of feldspar porphyry in a finer matrix that may be partly fragmental. These blebs vary in size from an inch or so to about three feet. They are elongated so that their thickness is only one-fourth of their length. They are much more symmetrical than the pillows of the ellipsoidal lavas. The feldspar phenocrysts in the blebs are largely albite, and they are embedded in a fine-grained matrix that is chiefly feldspar and quartz. Some feldspar-porphyry dykes of a similar composition cut the outcrop.

Several outcrops of amphibolite were observed. These do not appear to have any definite stratigraphic relationship, but rather are related to the intrusive igneous masses. They occur near the margins of the latter and are no doubt a product of contact metamorphism. In the southeastern corner of Fraser township, there are several exposures of a very coarse-grained amphibolite that is somewhat mineralized with pyrite and pyrrhotite.

Along the Laflamme river, in the northwest corner of township *111*, there are many exposures of a rock that has a surface appearance suggesting diorite. In places, this rock is quite massive and medium to coarse grained, and it appears to be composed of plagioclase feldspar and hornblende with some quartz. Usually, however, it has been sheared to a chlorite schist and in such outcrops can be identified as a facies of the better-preserved massive rock only by the presence of occasional coarse grains of hornblende and quartz. No continuation of this body of dioritic rock was definitely picked up to the east, although there is an outcrop of a rock of similar appearance on the Bell river near the northern boundary of the township. A microscopic examination of several thin sections showed that the feldspar has been completely altered to epidote, zoisite, and related minerals, and the hornblende to uralite and chlorite. The degree of alteration in this rock is much more intense than in nearby bodies of granitic rock. In view of this, the writer is of the opinion that the rock represents either recrystallized Keewatin 'greenstone', or an intrusive rock essentially contemporaneous with the greenstone and injected into it as a laccolith or sill. On the other hand, it is of course possible that it represents an early phase of the granitic intrusion of the area, as diorite was found near, and at the margins of, some of the granite bodies. Such diorite, however, is not as intensely altered as the rock exposed along the Laflamme river.

Several outcrops of greenstone of medium to basic composition were observed in which no amygdules could be found. The absence of amygdules may be due to their having been destroyed by dynamic action. Quite possibly, however, the rock was originally massive and represents sills that were formed at the same time as the pillow lavas and the amygdaloidal flows.

Much of the presumably Keewatin rock seen in the area could not be classed definitely as belonging to any of the types discussed above, due to its having been extremely altered or sheared. Such rock is indicated on the map as 'chlorite schist'. It varies in composition from acidic to basic, and in some places has been extensively carbonatized, especially where it has been very highly sheared.

## Post-Keewatin Intrusives

The chief intrusive rocks of the area are granites or closely related types. Large granitic masses occur along both the north and south boundaries, and, in addition, there are two large stocks and parts of three smaller bodies within the area. The largest stock is in the southwest corner of Franquet township, beyond which it projects for a short distance into Quévillon and Fraser townships. The next in order of size is in the southwest corner of Quévillon township and adjoining parts of Laas and *111* townships. Of the other bodies, one is in the north-central part of township *111* and extends into Fraser township; another in the central part of the latter township; and a third in the north-central part of Quévillon.

Many dykes occur in the area. The largest seen is an olivine-gabbro dyke that is exposed just north of the northwestern part of Quévillon lake. Rhyolite and feldspar-porphyry dykes are numerous in the vicinity of the large intrusive masses. Some basalt and diabase dykes were also observed.

### Olivine Gabbro:

The only exposures of olivine gabbro observed within the area occur immediately north of the northwestern part of Quévillon lake. The rock is coarse grained and is characterized by large plagioclase laths and pronounced diabasic texture. The pyroxene also is in coarse grains which include a considerable amount of magnetite (probably titaniferous) and, less commonly, pyrite. The weathered surface of the dyke has a rusty-brown appearance.

This dyke continues northeastward beyond the limits of the map-area as a series of offset ridges, and in places it is as much as 300 feet wide. At one place outside of the area it was found to be cut by a granite dyke, showing that the olivine-gabbro dyke is older than some at least of the granite.

### Granite:

The several granite masses within the area are sufficiently similar in composition to suggest that they are closely related. The stock in the southwestern corner of Franquet township is typically a medium to coarse grained biotite granite. In many places it is very coarse grained and strongly porphyritic, with feldspar crystals nearly an inch across. This granite is usually grey in colour, less commonly reddish-pink. For the greater part, it is quite massive, but locally it has a well developed foliation.

It is composed chiefly of sodic plagioclase and orthoclase, together with about 20 to 25 per cent quartz, 3 to 5 per cent biotite, and a small amount of microcline that is probably secondary. The feldspars are zoned and have been considerably altered to sericite. Titanite, often in large euhedral grains, is a common accessory. Zircon, apatite, and magnetite are also present.

The margins of the stock appear to be more basic than the central part. Specimens taken from two localities near the margin were found to be quartz monzonite. They differ little from the rock of other parts of the stock, except in the composition of the feldspar. Quartz diorite was found

at two points within the stock. It is extensively cut by the granite and probably represents a marginal phase of the original magma of the stock.

The stock at the central part of the north boundary of Laas township has the same mineral composition as that described above. The same is true of the stock in the central part of Fraser township, except for the presence of more epidote. It is quite possible that the latter stock is an extension of the one in Franquet township.

These stocks have been mapped as two separate bodies on the evidence of the foliation in the greenstone along their margins, which tends to bend around the adjacent ends of the two bodies. The writer has found that, in general, where the foliation of the greenstones diverges from its normal east-west trend, it is in conformity to some igneous contact, and it is inferred that the intrusive bodies are the controlling factor in the divergence of the foliation here.

The stock in the northern part of township *111* and the southern part of Fraser township occupies an area of about eight square miles. The rock is porphyritic in texture and is much less acidic in composition than the other granite bodies, containing but 10 per cent or less of quartz. In places, the quartz content is so low that the rock may be considered a syenite. Also, it contains about 40 per cent microcline, as contrasted with about 3 per cent in the other granites, and the biotite content is lower. The phenocrysts are microcline and they hold numerous small inclusions of other feldspars, usually plagioclase. In one thin section examined, these inclusions show a definite orientation parallel to the crystal-face directions of the microcline.

On the east side of the map-area, near the northern boundary of Quévillon township, there is a small body of rhyolite porphyry that has been very highly sheared, so that much of the rock is quite fissile. The feldspar has been largely altered to sericite. The quartz, of bluish opalescent appearance, is in euhedral grains, but many of them are much corroded. The foliation trends slightly north of east and is vertical.

In Laas township, just above Laas chute, there is a small body of coarse-grained hornblende syenite. This rock is composed of about 70 per cent sodic-plagioclase and orthoclase, and 25 per cent hornblende and biotite, with the hornblende predominating. In this vicinity there are also numerous small dykes of a similar composition. In view of the fact that the large body of intrusive rock extending near the southern margin of the map-area is rich in hornblende, it is assumed that this small body is related to it.

DYKES:

There are numerous rhyolite and feldspar-porphyry dykes in the area. They are most abundant in the vicinity of the granite intrusives. In general, these dykes trend parallel to the foliation structures but some cut across the foliation, and one was seen that appeared to be following joint planes. The dykes are quite massive, although some show a flow structure. In many of them, the constituent mineral grains are considerably crushed.

A few fine-grained basic dykes occur within the granite masses. The largest observed is along the east side of the Bell river, a short distance

south of Rain lake. In many places here, these dykes follow the jointing of the granite, forming a zig-zag pattern.

### Pleistocene and Recent

Nearly all of the bed-rock of the area is covered by glacial deposits. In general, rock exposures occur only on the few scattered hills and ridges, and at some places in the channels of the larger streams. The hills and ridges are almost everywhere covered with boulder clay. This deposit appears to be thickest on the south side of the hills, and rock exposures are more common on the northern side. On some hills and ridges, no rock exposures could be found. It is probable, however, that these have rock cores which are completely covered by glacial débris.

A few small, scattered ridges were seen that are probably composed of glacial gravels. The largest, and the best example, of these is in the north-eastern part of Fraser township. Others are situated in the north-central part of Quévillon and the central part of Franquet.

The greater part of the area is covered by extensive plains of glacial-lake silts, which, in some localities, are at least twenty-five feet thick. In general, they are very fine grained clays that in some places show well developed varves. Frequently, the fine clay grades upward into a very fine grained sandy soil. It is on this type of soil that the extensive growths of jackpine occur.

For the greater part, these sand plains have been much dissected by recent stream erosion, so that the silt plains, which were originally flat, are now gently rolling and cut by innumerable, narrow steep-sided valleys.

Glacial striæ were observed at numerous points throughout the area. They indicate that the general direction of ice movement was slightly west of south.

## STRUCTURAL GEOLOGY

Both the foliation and stratification of the greenstone have an east-west trend, with, however, some variation, especially in the vicinity of the intrusive bodies. In general, the dips are vertical or steep to the north.

Several belts of pillow lavas extend entirely across the area, and one belt of fragmental material was traced for the greater part of the distance. These belts probably represent the upturned and eroded edges of isoclinally folded lavas and interbedded fragmental material. The axes of these folds trend about east-west and probably dip slightly to the north.

The tops of the pillow lavas were interpreted by the writer as facing to the south at the Kiask falls and Fraser chute, and to the north along the southern shore of Quévillon lake. If these interpretations are correct, a synclinal axis is indicated extending east-west through the central part of Quévillon township, and a parallel anticlinal axis near the south boundary of the township.

Many of the tributary streams and certain sections of the rivers, as well as many of the other topographic depressions, have a northeast trend. Since such glacial striæ as were seen do not indicate an ice movement in this direction, it is probable that these linear expressions reflect some structural

condition. Several escarpments in this general direction were observed and there is also some shearing in this direction, although most of the strong shear-zones have an east-west trend.

All of the chutes and falls in the area appear to have a structural control. In most places, shearing, probably associated with faulting, appears to be a large factor. The heaviest shear-zone seen is at Laas chute. This zone, striking east-west, is very fissile over a width of about fifty feet, and there are many other shear-zones in the vicinity which are probably subsidiary to it. At the Kiask falls, also, there has been considerable shearing. The writer is of the opinion that the shearing here and at Laas chute is closely related.

At the Cedar rapids there has probably been considerable displacement in planes with a general trend slightly west of north and in subsidiary planes having nearly the same direction. As a further indication of this displacement, there is an outcrop of fairly well preserved pillow lava a short distance below the falls, on the west side of the river, in which the bedding trends approximately east-west; while on the eastern side of the channel there is some rhyolite in which the banding has a north-south trend. However, the rhyolite may have been intruded along a zone of shearing and the banding may be a flow structure.

## ECONOMIC GEOLOGY

Prospecting has been carried on in some parts of the area during the past few years. Many claims have been staked, but the majority of them have been abandoned because of discouraging results. The heavy overburden that covers practically all of the area makes prospecting unusually difficult.

### Léo Bomia Claims

The most extensive exploration has been on the Léo Bomia claims, in Laas township, by the Consolidated Mining and Smelting Company of Canada, Limited. The property consists of fifteen claims, Nos. A.67934 to 67948 inclusive, on Laas creek, in the northern part of the township.

The main showing is on claims 67941 and 67942, where a mineralized zone crosses Laas creek at a small rapid and has been exposed at a number of points in a series of trenches on each side of the creek, over a total length of about 400 feet. The country rock in the immediate vicinity of the zone is a highly sheared, banded, siliceous rock that is probably a tuff. It is interbedded with a basic rock, probably amygdaloidal lava. The general trend of both the banding and the shearing is east-west. This sheared rock is cut by several feldspar porphyry and pink rhyolite dykes that are up to four feet wide. Pyrite is disseminated through the latter dykes and the country rock in their immediate vicinity is mineralized with pyrite, and is also cut by numerous quartz-tourmaline stringers which occur for a distance of about a hundred feet across strike. In the central part of the zone there is a series of irregular quartz-tourmaline lenses. These pinch and swell sharply, varying in width from a few inches up to about three feet. The tourmaline is usually massive, in bands or seams, but in many places it is enclosed in the quartz as long, slender diverging needles. In one place, a

band of massive tourmaline about six inches wide was observed. The veins are slightly mineralized with pyrite and in places the mineralization is heavy.

In claim 67948 there is a zone of shearing in interbedded tuffs and flows that has been cut by a few narrow rhyolite dykes. These contain a small amount of disseminated pyrite and the sheared greenstone in their vicinity has been replaced by pyrite to a minor extent. Occasional narrow quartz-tourmaline veins also occur in the shear-zone.

The Company reports that samples from the mineralized zones yielded only negligible values in gold and silver.

There is a block of claims to the east of this group and another to the west. The writer could find no evidence of prospecting work having been done on either group. Such corner posts as were observed bore no claim tags.

### Kiask Falls Mining Company, Limited

The Kiask Falls Mining Company, Limited, owns a group of claims at and near the Kiask falls, on the Bell river. Twenty-one of these (Nos. A.58761 to 58781 inclusive) are in Laas township or border the river. The country rock consists of basic lava flows with some interbedded fragmental material. At the northern boundary of the property there is a rather wide band of fragmental material. Much of the lava is of the pillow variety, and it is probable that the tops of the flows face to the south. The strike is approximately east-west, and the dip 75° to the north. If the interpretation regarding the attitude of the tops is correct, the rocks in this vicinity are in the overturned limb of a fold.

There are two sets of rather strong shearing which appear to have controlled the configuration of the river channel and the falls. One of these is in a direction slightly south of east, and the other, which appears to be the stronger, is slightly north of east. Many quartz-carbonate lenses and stringers occur along these zones of shearing. In places they are slightly mineralized with pyrite.

Some surface stripping has been done on the property, but no extensive exploration work was carried out during the field season of 1937.

### G. R. Blais Claims

G. R. Blais, of Senneterre, owns five claims (Nos. A.62977 to 62981 inclusive) in the southeast corner of Fraser township. The rock exposed here is massive, basic greenstone and amphibolite. Local zones of the amphibolite are pegmatitic, with hornblende crystals from one-fourth of an inch to three inches in length making up from 25 to 90 per cent of the rock. The massive amphibolite consists almost entirely of hornblende, with some magnetite and scattered grains of pyrite and pyrrhotite. Some stripping has been done in the vicinity of the pegmatite and also along two local zones of shearing. One of these zones trends southeast and the other slightly east of south. Both are slightly iron-stained and sparsely mineralized with pyrite and pyrrhotite. No extensive work was done on these claims during the field season of 1937.

## Other Mineralized Zones

During the course of the summer's work, several occurrences of possible economic interest were observed by the writer. These included shear-zones, veins, and carbonate zones, and most of them showed evidence of having been visited by prospectors. Samples taken from the better looking of these showings were assayed, but the values obtained are not promising. Following are descriptions of the occurrences from which samples were taken.

At Laas chute there is a zone about fifty feet wide that is extensively sheared, and cut by rhyolite-porphyry dykes and quartz-tourmaline veins. The dykes, the veins, and the shear-zone itself are all slightly mineralized with pyrite. The trend of this shear-zone is east-west and it may be related to the shearing in the vicinity of the Kiask falls and Cedar rapids. An assay of a sample of well mineralized material from this locality yielded neither gold nor silver.

On the west side of the Bell river, about one mile north of the mouth of the Florence river, a zone of massive carbonatized greenstone is cut by quartz veins. The surface of the greenstone is soft, porous, and iron-stained due to weathering and alteration. The carbonate has a slight pinkish tint, which, together with the iron stain, suggests an iron-manganese variety. The texture of the rock is such as to suggest that it may originally have been a basic dyke which has undergone extensive carbonatization. Both the greenstone and the veins are mineralized with pyrite. A sample of well mineralized rock from this locality yielded 'trace' of both gold and silver. A carbonatized rock of similar appearance occurs on the Laflamme river slightly north of the Laas township-line.

About two miles northwest of the northwest extremity of Quévillon lake there are several small quartz veins cutting banded silicic rocks. One of these veins is considerably brecciated and contains numerous inclusions of chlorite, in the vicinity of which it is mineralized with pyrite. An assay of a sample made up from several mineralized pieces of this vein yielded neither gold nor silver.

At the lower end of the fast water below the Cedar rapids there are several rhyolite-porphyry dykes that contain some disseminated pyrite. In general, these trend parallel to the structure of the greenstone. In places, the greenstone is extensively sheared, carbonatized, and somewhat mineralized with pyrite. It also appears that there is a fault here trending in a general southeasterly direction. Associated with one of the dykes on the east shore of the river there is a quartz vein at least two hundred feet long and as much as six feet wide in places. During times of low water, parts of this vein are exposed. Local pockets in the vein are well mineralized with pyrite. An assay of the mineralized portion of the vein yielded neither gold nor silver.

At the Cedar rapids there has been considerable shearing and many local pockets and zones have been mineralized with pyrite. One particularly strong shear-zone, trending about north-south, has been silicified over a width of some twenty feet, and locally the silicified rock is well mineralized with pyrite. A sample of the mineralized portion yielded 'trace' of gold, and 0.042 ounces of silver per ton.

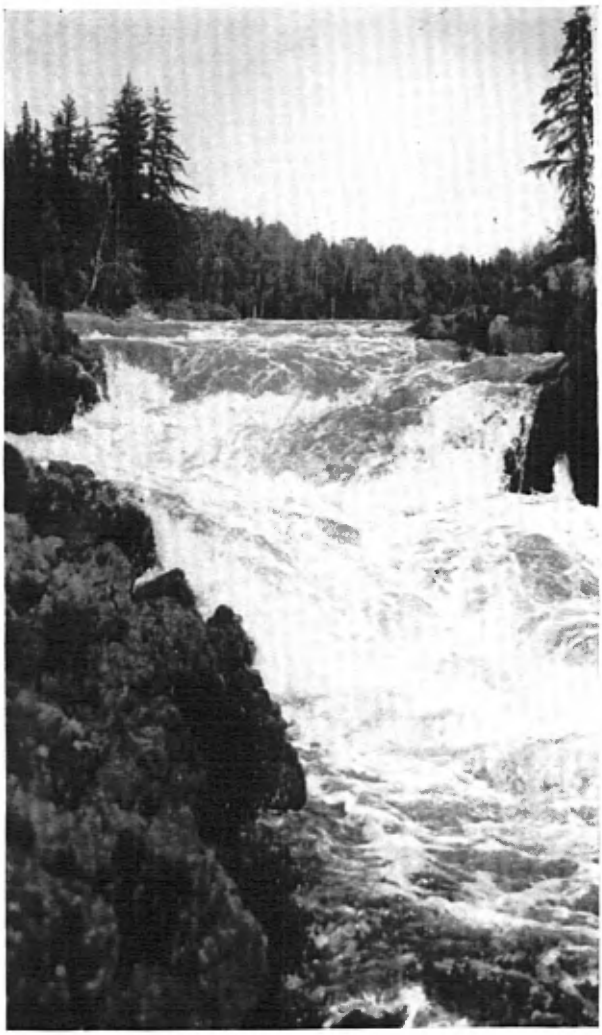
A sample from a quartz-tourmaline vein about three miles southwest of Cedar rapids yielded neither gold nor silver.

## General Considerations

Few places in the map-area can be considered favourable for prospecting, because of the heavy overburden and scarcity of outcrops. However, the ground immediately around the granite intrusives is worthy of attention. Since the general structures of the area are east-west, the ground to the east and west of the granite bodies should be more favourable than that to the north and south, unless there are small satellitic granite masses in these latter directions which were not found.

The rocks in the area southwest of the stock in the southwestern part of Franquet township show evidence of much recrystallization, hydrothermal action, and some mineralization. This area probably merits further prospecting. Zones of mineralization occur on the west side of the Bell river about one mile north of the mouth of the Florence river, at Fraser chute, Cedar rapids, Kiask falls, and Laas chute. The shearing at Laas chute is very heavy and may be closely related to that in the vicinity of Kiask falls.

Doubtless there are in the area many other mineralized zones that were not observed. Although nothing that can be considered of real economic importance was seen, it is quite possible that some of the zones referred to in the foregoing paragraphs may be closely related to zones that elsewhere do carry mineralization in economic concentrations. In view of this, prospectors intending to work in the area might do well to give particular attention to the vicinity of the localities mentioned.



Fraser Chute, Laflamme River.

# ALPHABETICAL INDEX


PAGE

Algoman (?) intrusives—
Lower Laflamme R. area ..... 13
Amphibolite—
Lower Laflamme R. area ..... 26
Andesite—
Lower Laflamme R. area ..... 10
Aplite dykes—
Lower Laflamme R. area ..... 14
Auger, P. E.—
Rep't, W'rn section, Lower Laflamme R. area ..... 3-17

Basalt—
Lower Laflamme R. area ..... 10, 27
Bernetz river ..... 6
Keewatin rocks along ..... 10
Bigniba river ..... 6
Keewatin rocks along ..... 10
Blais claims, Fraser tp ..... 31
Blondin, P. ..... 9

Claveau, J. ..... 9
Consolidated M. & S Co.—
Work by, Léo Bomia cl. ..... 30

Dallaire, René, ack's ..... 24
Diabase dykes—
Lower Laflamme R. area ..... 14, 27
Diorite—
Lower Laflamme R. area .. 11, 13, 26

Franquet tp. ..... 22
Granite in ..... 27
Fraser chute—
Pillow lava at ..... 25, 29
Fraser tp. ..... 5, 22
Blais claims in ..... 31
Granite in ..... 27, 28

Gabbro—
Lower Laflamme R. area ..... 11, 27
Glacial deposits—
Lower Laflamme R. area ..... 14, 29
Granite—
Lower Laflamme R. area ..... 13, 27

Hureault tp., Abitibi ..... 22

Keewatin rocks—
Lower Laflamme R. area ..... 10, 25
Kiask falls—
Pillow lava at ..... 25, 29
Kiask Falls Mining Co. ..... 31

Laas chute—
Pillow lava at ..... 25
Shear-zone at ..... 32
Laas tp., Abitibi ..... 22
Granite in ..... 28
Léo Bomia claims in ..... 30
Syenite in ..... 28

PAGE

Laflamme river—
Claims on ..... 16
Laflamme R. area, lower—
Eastern section ..... 19-33
Western section ..... 3-17
Access to ..... 5, 22
Geology, economic ..... 16, 30
Geology, general ..... 9, 24
Geology, structural ..... 15, 29
Relief and drainage ..... 6, 23
Soil, timber, game ..... 7, 23
Léo Bomia claims ..... 30
Levesque, René, ack's ..... 24
Little Kiask falls—
Pillow lava at ..... 25
Longley, W. W.—
Rep't, E'rn section, Lower Laflamme R. area ..... 19-33
Lower Laflamme R. area—
Eastern section ..... 19-33
Western section ..... 3-17
*See* under Laflamme R.

Newhouse, W. H., ack's ..... 9
Normandeau, P. D. ..... 24

One hundred and eleven tp ..... 5, 22
One hundred and nine tp ..... 5
One hundred and ten tp ..... 5, 22

Pegmatite dykes—
Lower Laflamme R. area ..... 14
Pleistocene and Recent—
Lower Laflamme R. area ..... 14, 29
Plourde, A. ..... 9
Post-Keewatin intrusives—
Lower Laflamme R. area ..... 13, 27

Quartz veins—
Lower Laflamme R. area ..... 14
Quévillon lake—
Olivine gabbro near ..... 27
Quévillon tp ..... 22
Granite in ..... 27
Rhyolite prophyry in ..... 28

Rhyolite—
Lower Laflamme R. area 10, 14, 27, 28
Roberge, J. ..... 9

Temiscamian-type rocks—
Lower Laflamme R. area ..... 13
Trachyte—
Lower Laflamme R. area ..... 10
Two hundred and nine tp ..... 5
Two hundred and ten tp ..... 5