DPV 370

LA TUQUE AREA: WEST HALF (COMTE DE LAVIOLETTE)

EXPLORATION GÉOLOGIQUE

MINISTÈRE
DES RICHESSES
NATURELLES

DIRECTION GÉNÉRALE
DES MINES

LA TUQUE AREA (west half)

by

M. A. KLUGMAN

DOCUMENT DÉPOSÉ AU SERVICE DE LA DOCUMENTATION LE 3 août 1976
Distribution sur demande seulement

DOCUMENT FILED WITH THE DOCUMENTATION SERVICE ON Aougust 3 1976
Distribution on request only

DPV-370

LA TUQUE AREA (WEST HALF)

LAVIOLETTE COUNTY

by M.A. KLUGMAN

Reproduit tel que présenté par l'auteur en 1956.
Printed as presented by the auther in 1956.

TABLE OF CONTENTS

TABLE OF CONTENTS (Con'd.)

LA TUQUE AREA (WEST HALF)

LAVIOLETTE COUNTY

by

M. A. Klugman

INTRODUCTION

General Statement

The La Tuque area (west half) was mapped by the writer during the summer of 1955. The area was mapped under the programme being carried out by the Geological Surveys Branch of the Quebec Department of Mines.

The map-area is located within the Laurentian uplands, and has a maximum elevation of approximately 950 feet with a local relief of 500 feet.

The map-area lies within the Grenville sub-province of the Precambrian shield. All of the consolidated rocks of the map-area are of Precambrian age. Listed in order of abundance they are: paragneisses (which underlie more than two-thirds of the map-area), granitic rocks, syenitic rocks, and gabbroic and anorthositic rocks, and various minor intrusives. The paragneisses strike roughly northwest and dip towards the east. In places they have been distorted and displaced by later intrusives. A major fault which strikes N. 5°E. and dips 45° E. runs through the area. It is possible that the structures in this area represent the western limb of a major syncline.

No economic deposits of any interest were observed.

Location

The map-area is bounded by longitudes 72° 45' and 73° 00', and by latitudes 47° 15' and 47° 30'. The map-area, which includes nearly all of Turcotte and Vallieres, and parts of Dumoulin, Harper, Baril, Malhiot, and Carignan townships of the County of Laviolette, has an area of about 200 square miles. The town of La Tuque, which is in the northeast corner of the map-area, is 131 miles from Quebec City, 176 miles from Montreal, and 105 miles north of Three Rivers.

Access

The transcontinental line of the Canadian National Railways passes through La Tuque. It enters the map-area in the east-centre and leaves the area in the northeast. The newly paved route 19, which was opened by Prime Minister M. Duplessis of Quebec during the summer of 1955, joins La Tuque to Three Rivers, 105 miles to the south. Route 19 follows the east bank of St. Maurice River in the eastern section of the map-area and crosses the map-area from its southern boundary to its northern limit. There are several gravel roads on the east side of St. Maurice river but only two on the west side. One follows rivière aux Rats across the southwestern corner of the map-area and is a well maintained bush road. The other follows the west bank of St. Maurice river as far as the power line crossing and then runs westward for six miles towards Lac Turcotte. A very poor road runs westward from La Tuque to Parker lake and from there northward along the power line towards Vermillion river. An excellent portage connects St. Maurice river and Lac La Tuque in the northwestern corner of the map-area, and another is along Deverich creek to the head of Lac Turcotte in the centre of the map-area. A portage links Lac Turcotte to Lac La Tuque in the northwest.

A paved and maintained emergency landing strip was completed for the R.C.A.F. on the second terrace, just south of the town of La Tuque, in 1954. This strip is also used by private and commercial aircraft for regular landings. A sea-plane base, which is used by all types of waterborn aircraft, is located on Lac à Beauce, ten miles south-southeast of La Tuque. just inside the eastern boundary of the map-area.

The only two rivers which are large enough for transport by canoe are St. Maurice river and rivière aux Rats.

Field Work and Acknowledgments

The base-map employed was a 1 inch to half a mile blow-up of the La Tuque Sheet (31 P7 W) of the National Topographic Series which is published by the Department of Mines and Resources (Ottawa), 1948, on a scale of 1 inch to 2 miles. The mapping was carried out on a scale of 1 inch to half a mile and traverses were spaced at half mile intervals. Traverses were run by pace and compass, aided by aerial photographs, which were supplied by the R.C.A.F. Outcrops are not plentiful in the map-area, but sufficient exposures were observed to get a clear picture of the geology.

C. N. Savage rendered valuable service as senior assistant and contributed much in the way of discussion carried on during the summer. Able services were also rendered by the two junior assistants, J. Simard and C. Hubert. The writer is also grateful to Dr. F. F. Osborne for many valuable suggestions. The writer is indebted to the manager of the C.I.P. mill at La Tuque for allowing him access to the company's maps and for other assistance during the course of the summer. The writer is also indebted to the people of La Tuque for many courtesies during the field season.

Previous Work

A. P. Low (1891) was the first man to carry out any geological work in the region. He travelled west, through the two Wayagamack lakes, to St. Maurice river and then turned south down the river. O'Sullivan (1908) mapped the geology along the transcontinental railway from La Tuque northwestward. J. A. Bancroft (1916) ran a reconnaissance survey along the transcontinental railway from Hervey Junction, in the southeast, to Doucet in the northwest. I. B. Crosby (1932) studied the physiography and drainage of the St. Maurice valley with special emphasis on the glacial geology. M. Tiphane (1954) mapped an area immediately east of that dealt with in the present report.

DESCRIPTION OF THE AREA

Settlement and Resources

Inhabitants

La Tuque, in the northeast corner of the map-area, is the largest town in the region. It has a population of approximately 12,000, and is situated on the second terrace on the east side of the St. Maurice river valley. The only other settlements in the map-area are the villages of Carignan and Lac à Beauce, nine miles south of La Tuque, and on the west shore of Lac à Beauce, respectively. Carignan is an all year round settlement while Lac à Beauce is mainly a summer resort. Numerous farms line the east bank of St. Maurice river, and there are a number of farms down the west bank as far south as the power line crossing just north of Carignan.

Industry

The main indsutry of the area is the C.I.P. pulp and paper mill at La Tuque. During the summer of 1955 a large addition to the mill was being built. It is planned that the new mill will be in operation early in 1956. With the new mill in operation La Tuque will be the largest kraft paper producer in Canada. There is a large railway yard in operation at Fitzpatrick, three miles north of La Tuque.

Agriculture

Farming is confined to the valleys of St. Maurice river, Bostonais river, and rivière Croche. The soil is very sandy as all of the farms are located on river terraces. The main products are hay and dairy products. Other sections of the map-area are too hilly and the soil is too rocky for farming.

Timber Resources

The area is heavily wooded with black spruce the dominant growth. Maple is also plentiful. There are balsam fir, white birch, poplar, plain, jackpine and tamarack in subordinate amounts. Lumbering operations are being carried out by the C.I.P. The pulp wood cut in this area is not for use in the local C.I.P. mill. It is shipped downstream to another of the company's mills at Three Rivers. A number of independent "jobbers" are also lumbering wood in the area. Hardwood is also being lumbered in the area, but it is purely for local consumption and is used mainly for building.

Fish and Game

Fish and game are plentiful in the area. There are several fishing and hunting clubs which have been granted the fishing and hunting rights on certain lakes and in certain designated areas. Brook-trout, lake-trout and pike are the most common varieties caught. Moose and deer are also plentiful, and partridge are abundant.

Water Power

The dam at La Tuque was built and is maintained by the Shawinigan Power Company. It has a head of 114 feet and is used to supply power to La Tuque, the C.I.P. mill at La Tuque and the Shawinigan System.

Climate

Weather observations have been made at La Tuque since 1911. The mean annual temperature at La Tuque is 38.23° F. The hottest months are June, July and August with means of 61° F., 62° F., and 61° F. respectively. August and September are the rainy months with average rainfalls of about three and a half and five and a half inches respectively.

TOPOGRAPHY

The whole area is drained by St. Maurice river either directly or through Lac Turcotte, La Tuque river, and rivière aux Rats. Most of the smaller rivers have steep gradients while the two major rivers, St. Maurice river and rivère aux Rats, are in a mature stage of the river cycle. The map-area lies within the Laurentian uplands and is extremely hilly. The maximum altitude is approximately 950 feet with an available relief of about 500 feet.

The map-area is a dissected peneplain modified locally by lithologic and structural controls. The local relief of the area is controlled by three factors; joint patterns, the structure of the underlying bedrock and, to a minor extent, glacial deposits. In the paragneisses the joints are usually parallel to the bedding of the gneisses. The area is moderately rugged with most of the hills having steep south-facing slopes and gentle north-facing slopes. An exception is the valley of St. Maurice river which has steep west-facing slopes. High scarps border the north bank of rivière aux Rats. The relief is modified by moraine, which mantles much of the map-area, particularly the northwest part.

Above the scarps, which border the west bank of St. Maurice river and the north bank of rivière aux Rats, the local relief is never more than 300 feet. The drainage in this part of the area is controlled by the gneissic layering of the paragneisses and the jointing which is parallel and at right angles to it. These two factors have produced a sub-parallel drainage pattern, which in places becomes a sub-rectangular drainage pattern. The strike of the major valleys in this region is northwest in the south, north-northwest in the centre, and northwest in the north. Most of the minor valleys strike northeast and east-west. In many places the drainage is modified by glacial drift.

East of St. Maurice river and south of rivière aux Rats the local relief is about 500 feet. The drainage patterns in these areas are controlled by the same factors as those that control the drainage patterns west of St. Maurice river. The drainage on the massive rocks is controlled by the outline of the bodies and by the jointing. The strike of the major valleys in the areas underlain by massive rocks is roughly north-south and east-west. Other valleys strike northwest.

Most of the major topographic features of the map-area are pre-last glacial, and the valleys are now partially filled with gravel, sand, and clay, into which the present rivers are now cutting. The St. Maurice river valley as far south as the bend south of Carignan followsa fault zone. The fault is exposed on the east side of the Shawinigan Power dam at La Tuque. The St. Maurice river valley above La Tuque and at La Tuque is over a mile wide. It narrows down towards the south and at the second bend below Carignan is less than a quarter of a mile wide. The falls on the west side of the valley at La Tuque, on which the dam has been built, are produced by a rock ridge which allowed erosion below them and retarded it above them, (Crosby, 1932). Above the dam at La Tuque, St. Maurice river is 500 feet above sea-level, while below the dam it is 385 feet above sea-level. Rivière aux Rats valley follows a joint. The width of the valley in the map-area is about a mile wide. The river is in a late mature stage of erosion, with numerous ox-bow lakes and cut-offs along its course. Terraces indicate that at one time the river meandered across the whole width of the valley.

A well preserved crevasse filling forms a point near the southern end of Lac Turcotte. Much glacial drift mantles this section of the area, and it is probable that the lake originally drained south and southeast.

GENERAL GEOLOGY

General Statement

The consolidated rocks of the map-area are all of Precambrian age. Listed in order of abundance they are: well layered paragneisses, which have some orthogneisses in them (these rocks underlie more than three-quarters of the map-area), granite, gabbro and meta-gabbro, syenite, anorthosite and various minor intrusives.

Although contact between layers in the gneisses are well defined, the tracing of the individual layers is almost impossible because of the thinness of the layers and the small size and wide spacing of the exposures. In places where individual layers have been outlined the contacts are shown as dotted lines on the accompanying map. Nearly all of the layered gneisses in the map-area have been injected to diverse extent by granitic material. In places the lit-par-lit injection of the granite into the gneisses is obvious in the field, elsewhere it can be seen only under the microscope. The writer attempted to separate the "lit-par-lit gneisses" from the other gneisses of the map-area, but this proved impossible as the lit-par-lit gneisses occur in local areas rather than as continuous lithologic units.

Most of the gneisses strike northwesterly and dip east. In the southern part of the map-area, the strike is northwest, changing in the central part to north-northwest, and then swinging back to northwest in the northern section of the map-area. These strikes are not those reported by O'Sullivan (1908) and Bancroft (1916) who mapped areas to the north and through the map-area respectively. M. Tiphane (1954) who mapped the area immediately to the east of the present map-area, found that the strikes of the layered gneisses are northwest.

The contacts between the syenite bodies and the layered gneisses are in most places difficult to determine. The only marked difference between the gneissic syenite and the adjacent gneisses is the grain-size and this criterion has been used to outline the body. The contacts of the gabbro, granite, and anorthosite are easily seen, and little difficulty was encountered in outlining these bodies. Age relationships between the intrusive bodies, where they are in contact, are also clear.

Large stretches of the map-area are mantled by moraine, through which the underlying bedrock protrudes in many places.

Table of Formations

CENOZOIC	Pleistocene and Recent	Sand, gravel, clay, till, boulder moraine
		Pegmatite and mylonite dykes (not shown on map)
		Pink granite
		Pink hornblende granite.
	Intrusives	Syenite and gneissic syenite
		Gabbro and metagabbro
		Anorthosite
PRECAMBRIAN		Injection gneiss and composite gneiss
	Grenville Series?	Hornblende andesine gneiss, hornblende hypersthene andesine gneiss, hornblende, biotite andesine gneiss, quartzo-feldspathic actinolite gneiss, quartzo-feldspathic biotite gneiss, quartzo-feldspathic hornblende gneiss, felspathic gneiss, quartzo-feldspathic gneiss, garnetiferous quartzite, impure quartzite.

PRECAMBRIAN

Grenville Series?

The paragneisses of the La Tuque area (west half) do not bear much resemblance to rocks of the Grenville Series described by Logan (1863) in the "type area" of Grenville township, Quebec. Quartzite is not abundant, but it occurs at several places throughout the map-area. One layer of quartzite was traced for more than two and a half miles. No limestone was observed in place, but many boulders were found particularly in the northwest corner of the map-area. These boulders showed little evidence of having travelled far, and it is therefore probable that a body of limestone may lie nearly somewhere to the north of the map-area. A thin layer of crystalline limestone was reported by Bancroft (1916) along the railroad two miles south of the present map-area. It is possible that limestone may occur within the map-area, but because it weathers easily, it probably underlies local depressions or small valleys and is now concealed.

Because of the dissimilarity between the metasedimentary rocks of the present map-area and those of the type area, it is unwise to blindly accept these rocks as part of the Grenville series. It is possible however that these rocks are a part of the Grenville series that is neither present nor exposed in the type locality.

Gneisses, which crop out in 90 per cent of the map-area, contain abundant dark minerals with feldspar and with or without quartz. The gneisses are predominantly fine- to medium-grained, and are from light grey to grey-green. Gneissic structure is distinct, and lineation can be observed in all hand specimens. The layers are well defined, with light and dark layers alternating.

The minerals, which are used in naming the rocks are feldspar, quartz, hornblende, hypersthene, biotite and garnet. In some rocks in which feldspar is abundant the varietal name for the feldspar is used in compunding the rock name.

Much of the quartz shows undulose extinction, and many of the plagioclase grains are bent and have part of their twinning obliterated. Andesine and microcline are the most abundant feldspars.

Hornblende Andesine Gneiss

Hornblende andesine gneiss underlies about 70 per cent of the map-area. The thickness of the individual layers is diverse. Most of them are about one to two inches thick, but, layers as much as three feet and as little as a fraction of an inch thick are not uncommon. The layers are commonly well defined and are produced by alternating layers rich in light or dark minerals.

The weathered surface is from light yellow-grey to a deep red-brown, but the rock is easily identified despite variation in texture and colour. The fresh surface is from light grey to grey-green. Where the gneiss is bordered by a syenite mass, the contact between the rocks is gradational and, therefore, difficult to place.

The rock has a granoblastic and commonly equigranular texture. The average grain-size is medium. The tenor of hornblende is diverse, with a maximum of 40 per cent. The essential minerals are; hornblende, plagioclase, and biotite. Quartz, apatite and magnetite are always present. Accessory minerals are; hypersthene, augite, diopside, actinolite, alkali feldspar, garnet, sphene and zircon.

The plagioclase is from An_{33} to An_{54} with an average composition of An_{36}. It is twinned according to the albite law, and pericline twinning is also commonly present. A number of grains also show carlsbad twinning. Some of the grains of plagioclase have been granulated and recrystallized. Alteration to sericite is not extensive. Several of the plagioclase grains are bent and have partially lost their twinning. Myrmekitic textures around the margins of some of the grains was obversed in some thinsections. The plagioclase makes up from 44 to 65 per cent of the rock.

The hornblende is strongly pleochroic in pale yellow-green or pale green to dark green. Replacement of some of the hornblende by biotite and magnetite was observed in some of the thin-sections. Hornblende makes up from 14 to 40 per cent of the rock. Two varieties of biotite occur, one pleochroic in green and the other in brown. In some rocks the two occur in the same rock. The brown variety is pleochroic from honey-yellow to brown and very dark brown, and the green variety is pleochroic from pale green to dark green.

Quartz, apatite, and magnetite are present. Quartz never makes up more than five per cent of the rock and appears to be of secondary origin, either introduced at a later date or as an alteration product. The grains commonly have a wavy extinction and small grains are sometimes poikioblastically enclosed in the feldspar and hornblende.

Apatite commonly makes up to five per cent of the rock. In some thin-sections it occurs in or close to the dark minerals whereas in others it is a randomly distributed throughout the rock.

Magnetite is present up to seven per cent in some thin-sections. It occurs both as a primary and as an alteration mineral. In those rocks where magnetite is abundant, many of the light minerals are stained yellow.

Hypersthene, augite, and diopside occur near gabbroic bodies. Hypersthene and augite occur together in on thin-section, hypersthene in another, and diopside in another. The hypersthene and augite together make up less than five per cent of the rock, hypersthene makes up less than one per cent of the rock, and diopside makes up six per cent of the rock, respectively. The diopside-rich rock is probably an altered gabbro, whereas the other two appear to be the result of metasomatism. Schiller structure was observed in a number of the hypersthene grains. Alteration of the pyroxene to hornblende, biotite and magnetite is common. A relic pyroxene cleavage in the hornblende was observed in one thin section. In the rock containing diopside the accessory minerals, sphene, magnetite and apatite have a strong affinity for the dark minerals.

A small percentage of actinolite was observed in one of the thin-sections examined.

Garnet is present in amounts of up to three per cent in several of the thin-sections. Sphene is present in all thin-sections.

A few grains of zircon were observed in some of the thin-sections.

Amphibolites are for the purpose of this report considered a variety of the hornblende andesine gneiss which contains more hornblende than most of the gneiss. They form layers or lenses in the hornblende andesine gneiss and are also found around the margins of the gabbro bodies and in places grade into them. The accessory minerals apatite, sphene and magnetite are associated with the dark minerals (Patchett , 1954, Klugman, 1956). The other amphibolites, which are conformally interbedded with the other metasedimentary rocks are assumed to be of sedimentary origin.

Lit-par-lit injection of granitic material into the hornblende andesine gneiss has taken place to diverse extent. Where the lit-par-lit injection is obvious in the thin-section, the minerals so introduced have not been included in describing the overall composition of the rock. Alkali feldspar is present in a very minor amount in one of the thin-sections, and it does not appear to be related to granitic injection. It is quite possible however that it is the result of metasomatism.

Where lit-par-lit injection has been great, porphyroblasts of alkali feldspar (microcline) are numerous. Accessory minerals in the granite of the injection include garnet, magnetite, zircon, and in one case graphite.

Hornblende Hypersthene Andesine Gneiss

Hornblende hypersthene andesine gneiss which occurs as layers within, and is not megascopically separable from, the hornblende andesine gneiss, has more hypersthene than the hornblende andesine gneiss, and no quartz. It is medium-grained, strongly gneissic, dark green on the fresh surface and red-brown on the weathered surface.

Under the microscope the rock is seen to be prominantly gneissic with the dark minerals oriented with their long axes parallel to and in the plane of the gneissic layering. The essential minerals are plagioclase, An_{45}, hornblende and hypersthene. Accessory minerals include biotite, apatite and magnetite. The plagioclase makes up 50 per cent of the rock and shows very little alteration.

Hornblende makes up 21 per cent of the rock and is strongly pleochroic from pale green to dark green. Around the margins of many grains the hornblende is altered to biotite and in places magnetite.

Hypersthene which makes up 15 per cent of the rock, is pleochroic from very pale green to very pale pink, and often shows schiller structure. It alters to hornblende, biotite, and magnetite.

Biotite which only occurs as an alteration mineral makes up five percent of the rock. It is strongly pleochroic from pale brown to dark brown.

Apatite and magnetite are the accessory minerals and they make up four per cent and five per cent of the rock respectively.

Hornblende Biotite Andesine Gneiss

Hornblende biotite andesine gneiss was classified in the field as an amphibolite. It greatly resembles the hornblende andesine gneiss in the hand specimen but is darker because of a greater amount of dark minerals. It occurs interbedded with the other gneisses and does not appear to be related to any of the more basic igneous rocks.

Examination under the microscope shows it is medium-grained, equigranular and gneissic. The essential minerals are plagioclase, hornblende and biotite. Alteration minerals are chlorite, sericite and muscovite, epidote, magnetite and spinel. The accessory minerals are apatite, ilmenite, and magnetite. In one of the thin-sections examined orthoclase makes 13 per cent of the rock and quartz made up 5 per cent. These percentages were included in the overall composition of the rock in this case, but both were introduced either by lit-par-lit injection, which can easily be seen, or by metasomatism. This particular specimen was taken near the fault zone, along St. Maurice river, along which there has been much granitic injection.

The average composition of the plagioclase is $An_{4}2$. It is extensively altered to sericite and muscovite. Both twinned and untwinned plagioclase are present, and some grains have numerous inclusions. Some of the orthoclase is perthitic, and shows alteration to epidote. Plagioclase makes up to forty per cent of the rock.

Hornblende, which is present in amounts of as much as 34 per cent, is strongly pleochroic from light green to green. It is altered around its margins to biotite, chlorite (clinochlore), and magnetite.

Biotite, which occurs both as a primary mineral and as an alteration product, makes up from 15 to 20 per cent of the rock. It is pleochroic from honey-brown to dark brown and is altered to chlorite (clinochlore) and magnetite. Several of the biotite flakes are bent.

There are two varieties of chlorite in the rock. Clinochlore, which occurs as an alteration product after hornblende and biotite, and pennine, which was probably introduced along with the injected granitic material. All of the injected granite, which occurs along the fault zone, contains diverse amounts of pennine.

Apatite makes from one to seven per cent of the rock. It occurs in subrounded grains which have a random distribution in the rock.

Magnetite and ilmenite make up from one to eight per cent of the rock. One grain of spinel was observed enclosed in a grain of ilmenite. The spinel is pleonast.

Quartzofeldspathic Actinolite Gneiss

Quartzofeldspathic actinolite gneiss is a well layered gneiss which occurs interbedded with hornblende andesine gneiss and is found throughout the whole map-area. In the field it appears to be a quartzose variety of hornblende andesine gneiss. It is medium-grained, grey to green and weathers to a red-brown. In all occurrences lit-par-lit injection of granitic material has been extensive.

Under the microscope it is medium-grained, and has a clearly discernable gneissic layering. The essential minerals are plagioclase, quartz orthoclase perthite, actinolite and biotite. Hornblende is common but is not always present. Accessory and alteration minerals include hypersthene, apatite, zircon, epidote, chlorite, sphene, sericite, allanite and magnetite.

The composition of the plagioclase is difficult to determine due to the high degree of alteration to sericite and a felted alteration aggregate. The only result obtained was An_{33}. Many of the plagioclase grains are bent and a few grains of antiperthite were observed.

Most of the quartz and orthoclase was introduced by lit-par-lit injection of granitic material. However a high percentage of the quartz is also found in the body of the gneiss. Scattered grains of orthoclase lie within the gneiss itself but these grains are always adjacent to the injected layers. Myrmekitic textures are prominently developed around several of the quartz and orthoclase grains, and much of the quartz has a wavy extinction.

Actinolite is very pale green to colourless, with a few of the coloured grains showing a very weak pleochroism. The extinction is from nearly parallel to 12°, and some grains have very poorly developed polysynthetic twinning. Some of the actinolite is altered to biotite and magnetite.

Two varieties of biotite are present, a green, which is pleochroic from green to dark green, and a brown, which is pleochroic from light brown to dark brown. Nearly all of the biotite appears to be the result of alteration from tremolite, hornblende and hypersthene.

Hornblende was not found in all of the thin-sections examined, and when present forms only a small percentage of the rock. It is strongly pleochroic from green to dark green and is easily confused with the green biotite.

The hypersthene is pleochroic from pale pink to pale green, and in places it has schiller structure. It makes up a very small part of the rock and is most abundant in a specimen taken adjacent to a syenite body. It alters to hornblende, biotite, chlorite (clinochlore), sphene, and magnetite.

Epidote occurs as an alteration mineral after potash feldspar. A few widely scattered grains of allanite were observed in two of the thin-sections. A few of the grains have poorly developed destruction halos around them. Numerous subrounded and lath-shaped grains of apatite are found in all thin-sections. They have a random distribution and have no obvious relation to any of the dark minerals.

Magnetite is common and occurs both as a primary and a secondary mineral. Two of the thin-sections examined have wide-spread iron stain on the light minerals. Zircon and sphene are in very minor amounts.

An accurate determination of the percentage composition of the rock is difficult because of extensive lit-par-lit injection of granitic material. The approximate persentages of the essential minerals are; plgioclase, fifty per cent; orthoclase perthite, seventeen per cent; quartz, fifteen per cent; tremolite, six per cent; and, biotite, four per cent.

Quartzofeldspathic Biotite Gneiss

Quartzofeldspathic biotite gneiss, which is not abundant in this map-area, is probably the result of much lit-par-lit injection of granite into the country rock. It is medium- to coarse-grained, pink to white, and varies from very gneissic to faintly gneissic. It occurs as conformable layers, up to four feet thick, interbedded with the other layered gneisses of the map-area. It is found throughout the map-area.

Under the microscope it is medium- to coarse-grained, equigranular and granoblastic. The essential minerals are quartz, orthoclase, plagioclase, biotite, and hornblende. Accessory and alteration minerals include apatite, magnetite, zircon, sericite and epidote.

Quartz makes up from 27 to 30 per cent of the rock, and is of both primary and secondary origin. It shows very little effect of stress and seldom has a wavy extinction.

Orthoclase makes from 40 to 46 per cent of the rock. It is sometimes perthitic and is highly altered to epidote.

The plagioclase, whose composition is indeterminable, forms from ten to 17 per cent of the rock. Alteration to sericite and a fine-grained alteration aggregate is extensive.

Biotite, which is pleochroisc from pale brown to dark brown, makes up from four to six per cent of the rock. It occurs both as a primary mineral and as an alteration product after hornblende.

Hornblende is present in amounts of up to three per cent. It is strongly pleochroic from green to dark green, and alters to biotite and magnetite.

Apatite and magnetite are widespread and make up as much as five and seven per cent of the rock respectively. A few scattered grains of zircon were also observed.

It is believed by the writer that this rock is mixed rock formed by the introduction of granitic material into hornblende andesine gneiss.

Quartzofeldspathic Hornblende Gneiss

Quartzofeldspathic hornblende gneiss is fairly common in the map-area. It occurs as well defined layers interbedded with the hornblende andesine gneiss. In composition it appears to be a quartzose variety of hornblende andesine gneiss. The rock is medium-grained, grey to green, and has a prominant gneissic structure.

Under the microsscope the rock is seen to be highly sheared with much of the quartz and plagioclase granulated. The dark minerals have a preferred orientation with their along axes parallel to and in the plane of the gneissic layering. Lit-par-lit injection of quartz has taken place with the injected quartz having a coarser grain than the primary quartz. Quartz also appears to be replacing feldspar.

The rock is composed of quartz, 37 to 40 per cent; plagioclase, 35 per cent; hornblende, ten to 30 per cent; biotite, one to ten per cent; apatite, one to five per cent; epidote, one to five per cent; and magnetite, two to five per cent. Other minerals present include zircon, chlorite (clinochlore), diopside, and sericite.

The composition of the plagioclase is An_{35}. It is altered to sericite and a fine-grained alteration aggregate. Some of the unaltered grains contain inclusions and minute needles of magnetite.

The hornblende is strongly pleochroic from green to dark green, and alters to biotite, clinochlore, and magnetite.

Biotite occurs both as a primary mineral and as an alteration product, and is pleochroic from yellow-brown to brown. It alters to clinochlore and magnetite.

Diopside, when present, is very pale green, length slow and alters to hornblende, biotite, clinochlore and magnetite.

Quartzofeldspathic Gneiss

Quartzofeldspathic gneiss might also be called lit-par-lit gneiss in that it appears to be either entirely or predominantly the result of lit-par-lit injection of granitic material. In some cases it forms a mixed rock with the country rock it has intruded, and in others it is entirely made up of the injected material. Furthermore it has itself been injected by a later granite. The only three minerals which are present in all of the thin-sections examined are quartz, fifteen to forty per cent; perthite, thirty eight to seventy-seven per cent; and, magnetite, one to five per cent.

Under the microscope the rock has a highly granular texture, is very gneissic, and often has alternating finer- and coarser-grained layers. This is the result of later lit-par-lit injection of granitic material. Myrmekitic textures occur around many of the perthite grains. The quartz commonly has a wavy extinction and the feldspar is usually altered to a fine-grained aggregate of alteration products, including among others, sericite, muscovite and epidote. Some of the quartz grains contain liquid inclusions. Recrystallization textures were observed in some of the thin-sections.

The most common dark mineral present is biotite. In all occurrences it makes up a very small per cent of the rock. The most abundant mineral in any one of the thin-sections examined, not including those already mentioned, is plagioclase. It forms up to nineteen per cent of the rock, but its composition could not be determined because of the high degree of alteration.

Other minerals include actinolite, apatite, zircon, garnet, chlorite (pennine), allanite, pyrite, and limonite.

Garnetiferous Quartzofeldspathic Gneiss

Garnetiferous quartzofeldspathic gneiss differs from quartzofeldspathic gneiss only in that it contains about ten per cent garnet (spessartite). It is not so widely distributed as the quartzofeldspathic gneiss and may merely represent a local phase of that gneiss. It is also has injections of granitic material giving it lit-par-lit structure. The specimens containing abundant garnet all border the fault zone which is along St. Maurice River valley.

Feldspathic Gneiss

The feldspathic gneiss could be called a syenite gneiss. However it does not appear to be related to any of the syenite masses in the map-area and it occurs in the field as a well layered rock interbedded with hornblende andesine gneiss and the other layered gneisses. The possibility that it may be the result of lit-par-lit injection of syenitic material must not be overlooked.

The rock is composed of microcline perthite (ninety-five per cent) and quartz (five per cent). Magnetite is the only accessory mineral present. The microcline is altered to a fine-grained alteration aggregate which includes epidote.

Quartzite

As previously stated quartzite is not abundant in the map-area. However, in one place it was possible to trace a layer of quartzite for over two miles. When present it can easily be seen in the field because of its white weathered surface and the small ridges it forms. These ridges are purely a local phenomena as it is sometimes found cropping out along the bottom of a valley. Megascopically, it is medium- to coarse-grained, crystalline, white, and is sometimes gneissic.

Under the microscope it is seen to be medium-grained, with most of the grains having sutured margins. The gneissic structure is produced by narrow lenses and lenticles of finer grained quartz, which are commonly iron stained. Quartz accounts for 96 per cent of the rock, this includes the finer grained, iron stained quartz. Other minerals present are; muscovite (three per cent), biotite (one per cent), and zircon, allanite, and graphite. A few grains of perthite are present in the quartzite which crops out in the fault zone along St. Maurice river valley. The perthite occurs as large porphyroblasts which are surrounded by a rim of fine-grained quartz.

Impure Quartzite

Impure quartzite greatly resembles the pure quartzite in the field, but has its gneissic structure accentuated by the brown flecks and flakes of biotite, graphite, and magnetite which it contains. Quartz makes up 73 per cent of the rock. The impurities are; plagioclase, perthite, biotite, phlogopite, sillimanite, epidote, graphite, and magnetite. In one of the thin-sections examined sillimanite makes up as much as ten per cent of the rock. It occurs as long thin needles which are oriented with their long dimensions parallel to and in the plane of the gneissic layering. Biotite, which occurs in the other thin-sections, has a similar orientation in the rock. Plagioclase and perthite are present in the same thin-section as the sillimanite and they make up eight per cent and seven per cent of the rock respectively, Biotite is usually present in amounts of up to 12 per cent.

Injection Gneiss and Composite Gneiss

Four areas in which injection gneisses and composite gneisses predominate have been outlined on the accompanying map. Injection gneisses and composite gneisses were observed in other parts of the map-area, but because they are minor in these areas they have not been outlined as separate units. They are commonly associated with nearby intrusive masses, but are also found far from any exposure of intrusive rock. They represent all stages of transition from paragneisses to a rock which there has been complete admixture through assimilation of gneiss and interchange of material with the magma.

The normally well layered paragneisses are commonly highly contorted and deformed by the repeated intrusion of granitic or gabbroic material. In some places two distinct periods of injection have taken place. The paragneiss was first intruded by gabbroic material and both were then intruded by granitic material.

Anorthosite

Anorthosite is found only at one locality in the map-area. It crops out in an area of about one square mile on the west bank of St. Maurice river, on the northern boundary of the map-area, and extends northwards beyond the limit of the area. In the field it is fine- to medium-grained, white, and highly granulated in some places. It intrudes the surrounding paragneisses and is itself intruded by pegmatite dykes and stringers.

Under the microscope it is seen to be medium-grained, and hypidiomorphic granular. The rock is highly sheared with many of the plagioclase grains granulated, fractured and bent. The dark minerals are drawn out into lense-shaped pods which are oriented in the direction of the gneissic layering.

The rock is composed of plagioclase (96 per cent), pyroxene, hornblende, biotite, chlorite, muscovite, sericite, epidote, calcite and ilmenite. The plagioclase has the composition of An_{56}. Some of the grains have very faint twinning but they are more commonly well twinned. Pericline twinning is also present in some of the grains. Alteration to sericite and muscovite is not common. In one of the thin-sections examined the pyroxene is altered to an aggregate of hornblende, biotite, magnetite, and quartz. The pyroxene and its alteration products make up four per cent of the rock. It is in this thin-section that the dark minerals occur in lense-shaped pods.

In one thin-section muscovite makes up two per cent of the rock. It occurs as flakes between the grains of plagioclase and is definitely not an alteration product of the plagioclase. Chlorite and epidote each make up about one per cent of the rock. Biotite, calcite, and ilmenite are all present in very minor amounts.

Gabbro and Metagabbro

A body of gabbro intrudes the paragneisses in the central part of the map-area between Lac Turcotte and St. Maurice river and is itself intruded by granite. It covers an area of approximately three square miles. A small satelite of this body lies to the south of it and another lies to the west. In the field the rock is medium-grained, grey to green-brown and weathers to a crumbly rusty rubble.

Under the microscope the rock is seen to be medium- to coarse-grained, seriate, and granular. The rock appears to have undergone a great amount of stress as the plagioclase grains are bent, fractured and the twinning is partially obliterated in many thin-sections. Many of the biotite flakes are also bent, as are some of the pyroxene grains. Poorly developed kelyphitic rims are found in two of the thin-sections examined. The rims are the result of the replacement of olivine by hypersthene and magnetite, and of hypersthene by amphibole, biotite and sometimes chlorite after these last two minerals. Augite forms one of the rims around hypersthene in one of the thin-sections. The rock is composed of plagioclase (60 to 70 per cent), hypersthene (three to 17 per cent), augite (five to 11 per cent), hornblende (nine to 16 per cent), biotite (six to eight per cent), and olivine (less than one per cent). Accessory and alteration minerals include clinochlore (up to four per cent), apatite, magnetite, ilmenite, sphene, and epidote.

The composition of the plagioclse is from An_{47} to An_{65}, with an average of An_{60}. Many of the grains have partially lost their twinning, and some show pericline as well as polysynthetic twinning. The grains are commonly clear, but alteration is present in some.

The hypersthene is clearly pleochroic from pale pink to pale green. It is highly altered to hornblende, biotite, chlorite, and magnetite. Schiller structure was noted in a few grains and in one thin-section exsolution lamellae of clinopyroxene were seen. Augite alters to hornblende, biotite, and magnetite. In places the augite appears to be after hypersthene.

Hornblende is present both as a primary mineral and as an alteration product after pyroxene and olivine. It is strongly pleochroic from green to dark green, and alters to biotite, chlorite and magnetite. It is often found replacing pyroxene around the margins and along the cleavages of the grains. Biotite is also present both as a primary mineral and as an alteration product. It is strongly pleochroic from light brown to very dark brown. It is most common as an alteration product.

Sphene is primarily an alteration product but it is possible that primary sphene is also present. Ilmenite is an alteration product as is some of the magnetite. Apatite and epidote are the other minerals present.

Numerous metagabbro sills and dykes are found throughout the area. Not all of the metagabbro bodies in the map-area are indicated on the accompaning map, as many of them are too small. Some of the contacts outline zones of much intrusion rather than discrete bodies of metagabbro. The metagabbro is finer grained than the gabbro, and commonly contains much hornblende. Most bodies show shearing, and many are deformed. The composition is diverse because of the introduction of granitic minerals. The average composition is plagioclase An_{65} (50 per cent), hypersthene (two per cent), hornblende (30 per cent), biotite (12 per cent), augite (two per cent) and apatite (two per cent). Other minerals are sphene, magnetite, epidote, sericite, and zircon. The introduced minerals include quartz and potash feldspar.

Syenite and Gneissic syenite

One small body of syenite was outlined in the field. It lies in the southern part of the map-area, west of St. Maurice river. Other small occurrences of gneissic syenite were observed but no contacts could be drawn because the syenite appears to grade into the hornblende andesine gneiss. Under the microscope the rock is seen to be medium-grained, hypidiomorphic granular. Recrystallization and granulation was observed in one of the thin-sections examined. It is composed of plagioclase An_{26} (15 per cent), microperthite (70 to 73 per cent), quartz (nine per cent), diopside (three per cent), hornblende (one per cent), and biotite (one per cent). Other minerals include clinochlore, epidote, garnet (spessartite and almandine), apatite, sphene, zircon, and magnetite.

Pink Hornblende Granite

A small body of pink hornblende granite, which underlies about two square miles, is located in the north central part of the map-area. Another small mass, which is less than one square mile in extent, is located at the northern end of La Tuque lake in the northwestern corner of the map-area. The writer believes that the hornblende granite represents an intermediate rock between the syenite and the biotite granite. Several of the features common to both of these rocks were observed in the hornblende granite.

The hornblende granite is medium- to coarse-grained, pink, and massive. Under the microscope the rock is seen to be hypidiomorphic granular, with much granulation and secondary crystallisation of quartz along fractures and along the margins of some of the grains.

The essential minerals are quartz, orthoclase perthite, microcline, plagioclase, hornblende, biotite, and pyroxene. Alteration minerals include sericite, which in one thin-section makes up about 40 per cent of the total feldspar percentage, muscovite, epidote, and magnetite. Accessory minerals are apatite, sphene, zircon, allanite, magnetite and pyrite.

Quartz makes up from 27 to 30 per cent of the rock. In places it appears to be replacing both orthoclase and plagioclase. The plagioclase has the composition of An_{28}, is well twinned according to the albite law and some grains also show pericline twinning. In one of the thin-sections examined it is extensively altered to sericite, muscovite and an indeterminable felted alteration aggregate. Perthite and microcline make up from 25 to 45 per cent of the rock. The host mineral of the perthite appears to be orthoclase but it is possible that much of it might be untwinned microcline. Well developed myrmekitic textures are developed around some of the perthite grains. Poikiolitic inclusions of feldspar in quartz were observed in one of the thin-sections examined.

Hornblende forms up to ten per ~~cent of~~ the rock. It is pleochroic from pale green to dark green, and alters to biotite and magnetite. Pyroxene makes up less than two per cent of the rock and is usually altered to hornblende, biotite and magnetite. It is impossible to determine the composition of the pyroxene because of the high degree of alteration.

Biotite is present in amounts of up to six per cent. It occurs both as a primary mineral and as an alteration product after pyroxene and hornblende. Poikiolitic inclusions of magnetite are to be found in some of the biotite grains. In one thin-section magnetite and pyrite together make up three per cent. Apatite is always present as disseminated grains throughout the rock. It makes up as much as two per cent in one of the thin-sections examined. A number of scattered grains of sphene and allanite were also observed.

Pink Biotite Granite

Medium- to coarse-grained pink biotite granite is the most common intrusive rock in the map-area. It intrudes all other rocks of the area, either as irregular masses, transgressive layers, or as lit-par-lit injections in the layered rocks. Three areas were outlined in the field. Two of them are west of St. Maurice river, in the central and southern parts of the map-area, and the third is east of the river, about two and a half miles south-east of La Tuque. There has also been much injection of granitic material along the fault zone, which follows St. Maurice valley. The four bodies in the central part of the map-area together underlie about three square miles, the three bodies in the southern part together underlie about six square miles. The body east of St. Maurice river is a narrow lenticular shaped mass which is about three quarters of a mile long and a quarter of a mile wide at its widest point.

Under the microscope the biotite granite is seen to be hypidiomorphic granular, with quartz, perthite, microcline, plagioclase and biotite the most abundant minerals. Accessory and alteration minerals include sphene, zircon, apatite, magnetite, clinochlore, sericite and epidote.

Quartz makes up to 17 per cent to 28 per cent of the rock and shows little effect of stress. All of the feldspars are highly altered to sericite, epidote, and a felted alteration aggregate. Most of the perthite grains do not show microcline twinning, but it is probable that the host mineral is untwinned microcline. Microcline, microline perthite, and untwinned perthite together make up from 55 to 71 per cent of the rock. The plagioclase has the composition of An_{28} and makes up to eight per cent of the rock. Biotite is pleochroic from pale brown to dark brown and makes up six per cent the rock. It alters to clinochlore and magnetite, with the magnetite occurring as specks within the clinochlore and the partly altered biotite. Sphene is the most abundant accessory mineral and is present in amounts of up to two per cent in some of the thin-sections examined. Scattered grains of apatite and zircon are present in all of the thin-sections examined.

Pegmatite and Mylonite Dykes

Pegmatite dykes cut all the previously described rock types. The The pegmatite varies from coarse- to very coarse-grained with some of the potash feldspar crystals reaching a diameter of 18 inches. The pegmatite dykes are more abundant near the fault zone which follows St. Maurice river valley. The width, length, and shape of the pegmatite dykes is diverse. The width of some can be measured in inches, while others are more than 30 feet wide. Some dykes are only one or two feet long whereas others are tens of feet long. The longest pegmatite dyke observed can be traced for over 100 feet before it disappears underneath the overburden. The term dyke does not accurately describe the form of the pegmatite bodies. They can have any shape. Dykes, sills, lens-shaped bodies, and irregular masses of pegmatite were all observed in the field.

The principal minerals in the pegmatite are: pink potash feldspar, quartz, plagioclase, biotite and/or hornblende or augite. Garnet, magnetite, epidote, allanite, pyrite, chalcopyrite, and bornite are present in places. One occurrence of fluorite in a pegmatite dyke was observed in a road-cut along route 19.

The mylonite dykes are almost entirely confined to the fault zone along St. Maurice river valley. They have the same composition as the pegmatite but are fine-grained. They are probably the result of mylonitization of granite or pegmatite.

Pleistocene and Recent

Large stretches of the map-area are mantled by moraine, through which the underlying bedrock protrudes in many places. Drumlin-like hills are found in many parts of the map-area, particularly in the south-eastern, northeastern and west central parts. These drumlins, together with glacial striae, indicate that the ice-sheet moved in a south-south-easterly direction across the map-area.

The unconsolidated material is composed of clay, sand, gravel, and boulders of all sizes. On the northern sides of many of the hills in the map-area accumulations of unsorted and unstratified sand, gravel and boulders occur. In the flatter areas where the glacial material has been reworked by water, sorting and layering of the material has taken place to varying degrees. Along most of the valleys and around many of the lakes in the map-area the unconsolidated material is well stratified. Clay, sand, boulder and pebble beds are often found alternating with one another. More commonly however, there appears to be a regional sorting, with well stratified sand occurring in on area, varved clays in another, and well bedded coarser material in another.

The valleys of St. Maurice river, rivière aux Rats, and Bostonais river are all pre-last glacial, and are now partially filled with gravel, sand, and clay into which the present rivers are now cutting. At one locality, along the east side of St. Maurice river valley, an old stream bed was observed. This stream flowed roughly parallel to St. Maurice river, and was cut half in the well stratified unconsolidated deposits and half in consolidated rock. The contact between the rock and the unconsolidated material runs roughly down the middle of the stream bed. Excellently bedded varved clays are exposed on the west side of St. Maurice river valley just south of the Shawinigan Power dam near La Tuque. The thickness of the exposed beds is over 40 feet, with the individual beds having an average thickness of one inch.

The depth of unconsolidated deposits in the St. Maurice river valley at La Tuque is known to be more than 230 feet. Several well defined terraces in these deposits can be traced along St. Maurice river and rivière aux Rats. The elevation of four terraces at La Tuque were measured. The lowest terrace, just downstream from the Shawinigan Power dam, is 425 feet above sea-level and about 40 feet above the high water mark of the river. The second terrace, on which the town of La Tuque is situated, is 585 feet above sea-level and 200 feet above the level of the river. The third terrace is 615 feet above sea-level and 230 feet above the level of the river, and the fourth, which is the highest and smallest, is 675 feet and 290 feet above sea-level and the river; respectively.

There are several terraces along the rivière aux Rats valley, but only the two main terraces could be traced for any appreciable distance along the valley sides. The lower of these two terraces is 420 feet above sea-level, and the higher is 580 feet above sea-level.

Glacial erratics, some of which are ten feet in diameter, occur on many of the hill tops and at scattered localities far from any other glacial material.

STRUCTURAL GEOLOGY

The overall structure of the map-area is relatively simple. Over three-quarters of the rock-types are paragneisses and related layered igneous rocks, which cannot on the present scale of mapping be separated into lithologic units. There are exceptions to this however, In the regions where interpretation has been possible the contacts are shown as dotted lines on the accompanying map.

Apart from a few exceptions, all the gneissic structures strike in a roughly uniform direction and dip east. In the southern part of the map-area the strike is northwest, changing in the central part to north-northwest and then swinging back to northwest in the northern part. In the central part of the map-area the granite and gabbro intrusives have disrupted the regional trend and caused much distortion of the paragneisses. Around the southern margin of the intrusives the strike of the layering has been changed from north-northwest to roughly east-west, on the east and west it is roughly north-south. In places around the margins of these intrusives, where intrusion has been greatest, the paragneisses have been so highly deformed that there is no uniform strike. These highly distorted and deformed areas have been outlined on the accompanying map and classified as injection gneisses and composite gneisses. Other areas of injection gneisses are; the southern end of Lac La Tuque, the northern end of Lac Turcotte, and along the fault zone in St. Maurice river valley.

The overall structure of the map-area is a northwesterly striking foliation, dipping towards the northeast, that has been displaced and distorted by later intrusiions, and cut by a fault which strikes N. 5°E. It is possible that this structure represents the western limb of a major syncline which strikes roughly northwest. Several minor drag folds were observed in the map-area. The axial lines of all these drag folds strike northwest and the dip towards the northwest. These minor folds seem to confirm the foregoing structure.

Faults

Only one major fault was observed in the map-area. This fault is exposed in a cliff face on the east side of the Shawinigan Power dam on St. Maurice river at La Tuque. The strike of the fault is N. 5°E. and the dip is 45°E. It cuts the paragneisses, which are exposed at this locality, at a low angle. The strike of the paragneisses is N.10°W. and they dip 30°E. The hanging-wall of the fault is highly brecciated, deformed, and mineralized, and forms a zone about 200 feet wide. The hanging-wall is composed of highly deformed paragneisses which have been injected by mylonitized pink granitic material and a very fine-grained black material. The black material was probably partially derived from the paragneisses and partially from mineralization which took place at the time of the faulting. Along the fault plane is a narrow zone, from two to four inches wide, of chlorite. The foot-wall, immediately adjacent to the fault, is composed of chlorite schist, which in places is garnetiferous. The chlorite schist is cut by numerous narrow, up to one inch wide, hematite stringers. Below the chlorite schist the foot-wall has the same composition as the hanging wall. The fault zone can be traced for ten miles south along the east side of the St. Maurice river valley.

No other faults were observed in the field, but it is probable that other faults do exist in the map-area.

Joints

Jointing is common throughout the map-area, particularly in the igneous rocks. In these bodies the strike of the joints is about north-south, and the dips are steep either east or west. In the paragneisses and their related igneous rocks the jointing is parallel to the layering and at right angles to it.

ECONOMIC GEOLOGY

Sulphides

Disseminated pyrite occurs in many of the rocks of the map-area, particularly in the rocks of granitic composition, but their amounts were too insignificant to warrant further investigation.

Specks of chalcopyrite and bornite were seen in some of the pegmatites. These occurrences are also too small for further investigation.

Oxides

Disseminated magnetite is a common constituent of most of the rocks of the map-area. Only one occurrence was of any interest to warrant further investigation. It is located at the foot of a cliff on the east bank of St. Maurice river, where the river turns west nine miles south of La Tuque. Upon more detailed study it was found that there was insufficient tonnage and that the magnetite was not of ore grade.

Narrow stringers of hematite are exposed in the foot-wall of the fault on the east side of the Shawinigan Power dam at La Tuque. This occurrence is of no economic interest.

Radioactivity

Nearly all pegmatites in the map-area show very slight radioactivity. Three exposures on the east bank of St. Maurice river show readings higher than normal with the Geiger counter. Upon closer examination only one showed any reason for this higher radioactivity. It has scattered crystals of allanite, whose removal reduced the reading to normal for the pegmatite. In the other two exposures it is assumed that the radioactivity is the result of potassium K_{40} in the feldspar. The body of pink hornblende granite at the northern end of Lac La Tuque and the body of syenite in the southern part of the map-area, are both very slightly radioactive.

Fluorite

A very small showing of fluorite is exposed in a pegmatite dyke in a road cut along route 19, south of La Tuque.

Sand and Gravel

Sand and gravel deposits are numerous along the valleys of St. Maurice river and rivière aux Rats. Many of them, on the east side of St. Maurice river valley, are being or have been worked.

BIBLIOGRAPHY

Bancroft, J. A. (1916) Geology and Mineral Resources along the National Transcontinental Railway in the Province of Quebec. Rept. on Mining Operations for 1916, Dept. of Colonization, Quebec, pp. 128-168.

Crosby, I. B. (1932) Drainage Changes and their Causes in the St. Maurice Valley. Jour. of Geol., Vol. 40, pp. 140-153.

Klugman, M. A. (1956) The Geology of an Area between Pigou and Sheldrake Rivers, Saguenay County, Quebec, with a detailed study of the Anorthosite. Ph.D. Thesis, McGill Univ., Montreal.

Logan, W. E. (1863) Geology of Canada, G.S.C.

Low, A. P. (1891) Summary Report for the Year 1891. G.S.C., Vol. V, pt. 1, pp. 46-47.

O'Sullivan, O. (1908) Summary Report for the Year 1907. G.S.C., pp. 67-68.

Patchett, J. E. (1954) The Distribution of Accessory Minerals as a Criterion of the Origin of Gneisses. M.A. Thesis, Univ. of Toronto, Toronto.

Tiphane, M. (1954) Geology of Wayagamack Lake Area, Laviolette County, Quebec. Unpublished Report of the Quebec Dept. of Mines.

Fig. 1 Looking north up Lac La Tuque in the northwestern corner of the map-area. The surrounding topography is underlain by paragneisses.

Fig. 2 Looking southeast down St. Maurice river from the top of the scarp on the east bank.

Fig. 3 One of the meanders in riviere aux Rats. The valley at this point is about a mile and a half wide.

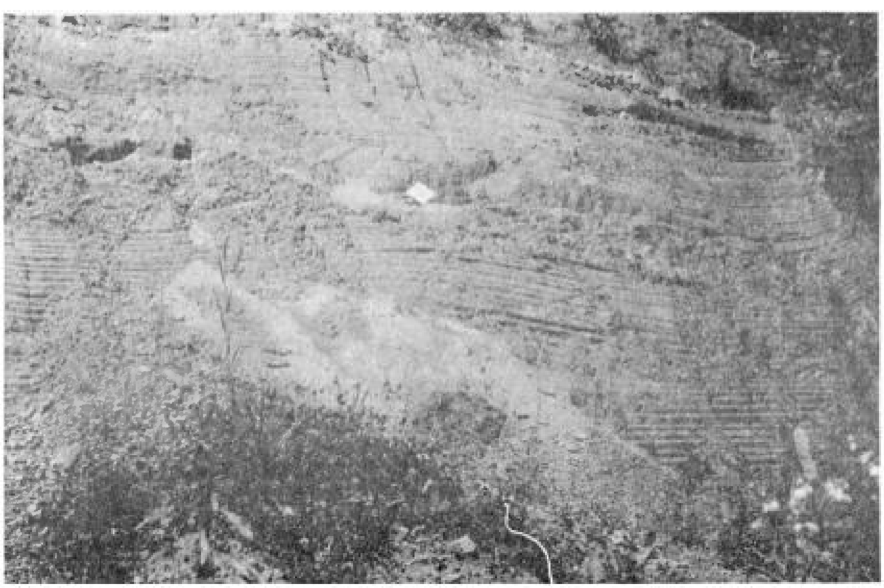

Fig. 4 Varved clays on east bank of the St. Maurice river near La Tuque.

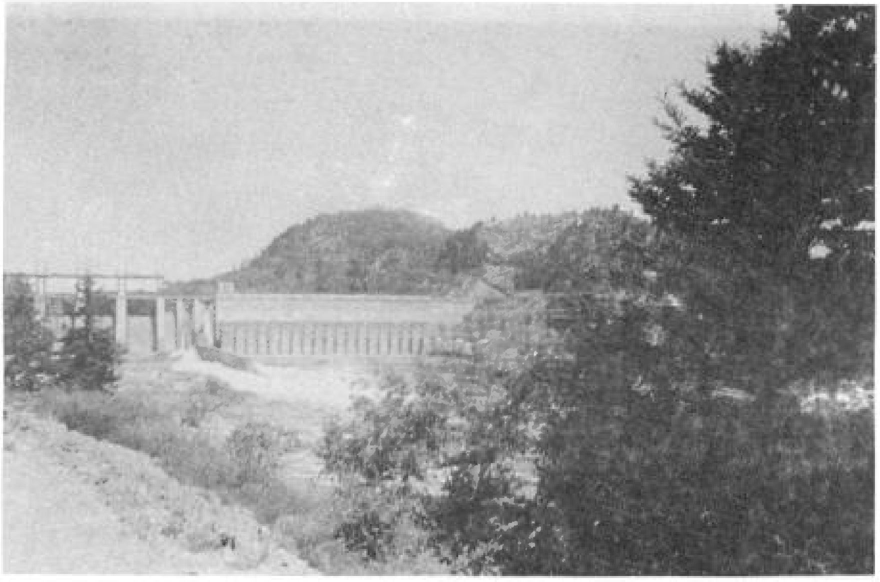

Fig. 5 Shawinigan Power Company dam on St. Maurice river at La Tuque. Photo from east bank of river. The fault is exposed in the first cliff on opposite side of the river.

Fig. 6 Longitudinal view looking north along the fault near La Tuque. The footwall and hanging-wall are composed of highly distorted paragneisses which have been intruded by granite. The fault is filled with chlorite schist.

Fig. 7 View of fault taken perpendicular to the strike.

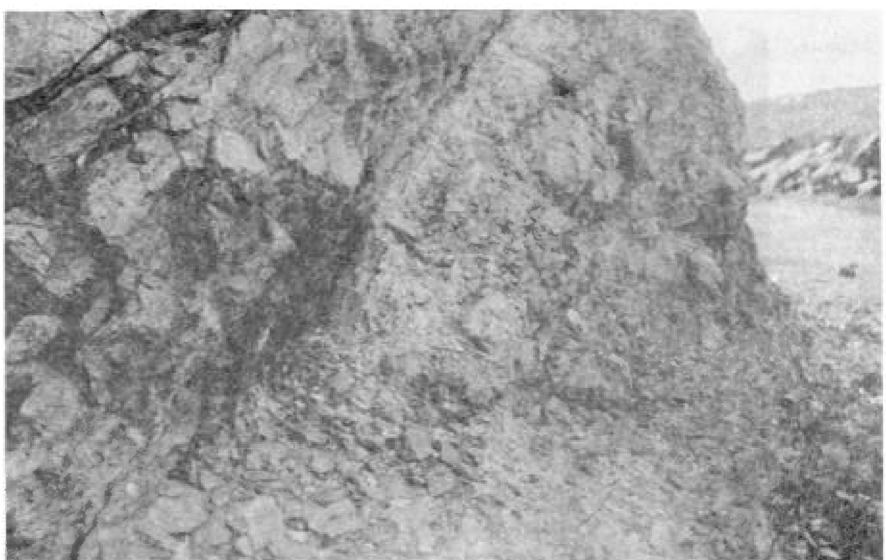

Fig. 8 Close up view of fault showing the chlorite schist in the fracture.

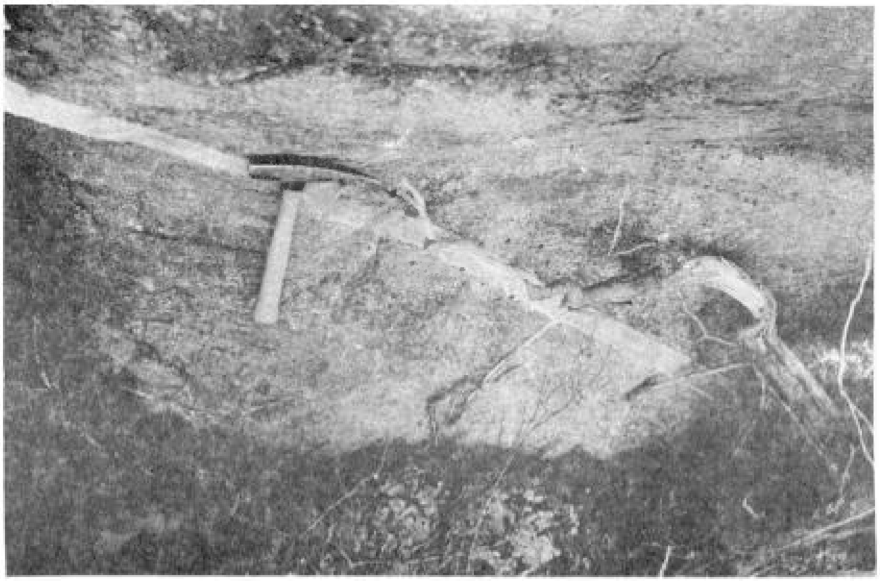

Fig. 9 Well layered hornblende andesine gneiss cut by a mylonite dyke. East bank of St. Maurice river.

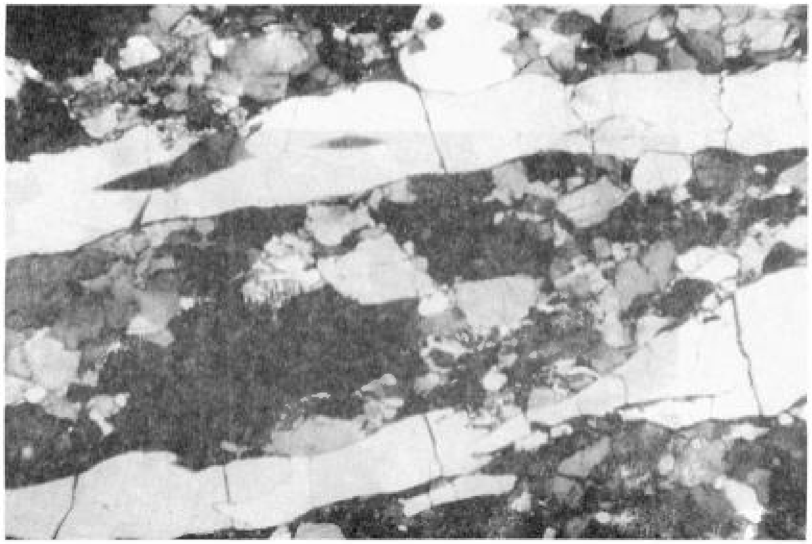

Fig.10 Lit-par-lit injection of quartz into hornblende andesine gneiss. Q = quartz, A= andesine, H = hornblende, S = sphene, Crossed nicols. Width of field = 4.5 mm.

Fig. 11 Photomicrograph showing alteration of hypersthene to hornblende, biotite and magnetite in gabbro. Hy = hypersthene, H = hornblende, B = biotite, M = magnetite, A = andesine.
Ordinary light. Width of field = 4.5 mm.

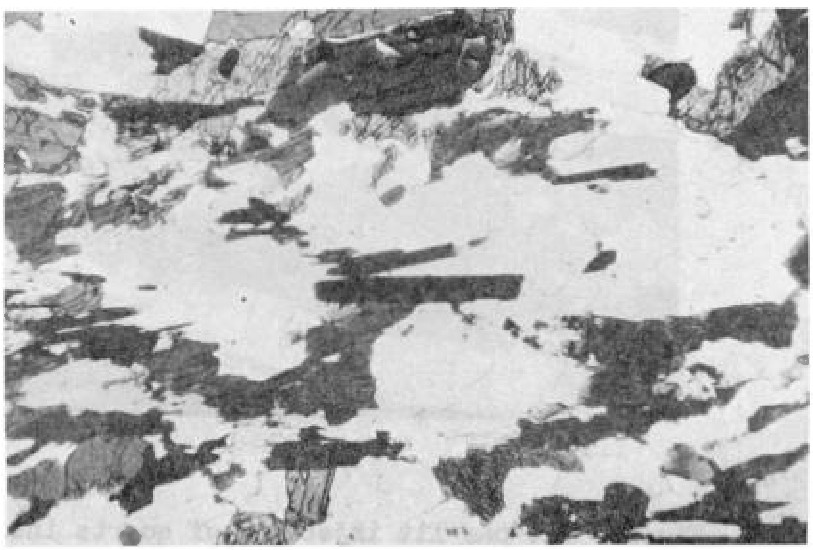

Fig. 12 Photomicrograph showing the gneissic layering in hornblende andesine gneiss. A = andesine, H = hornblende, B = biotite, Ap = apatite, M = magnetite.
Ordinary light. Width of field = 4.5 mm.

Fig. 13 Photomicrograph showing microperthitic intergrowth in the orthoclase of the biotite granite. Crossed nicols. Width of field = 1 m.m.

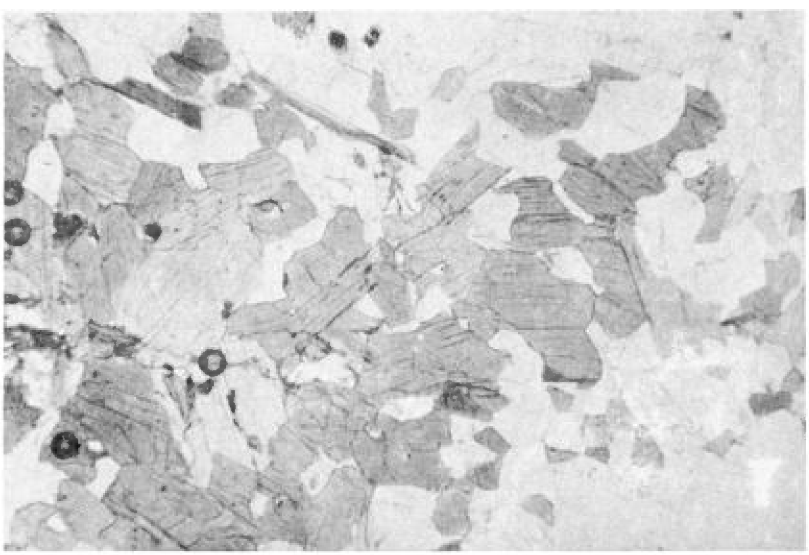

Fig. 14 Photomicrograph showing the dark minerals occurring in elongated pods in the anorthosite. Only the end of one pod is shown. H = hornblende, A = andesine.
Ordinary light. Width of field = 4.5 m.m.

L'ÉDITEUR OFFICIEL DU QUÉBEC
SERVICE DE LA REPROGRAPHIE
Septembre 1976