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PARTS OF SAGARD, SAGUENAY, CHAUVEAU AND CALLIERES TOWNSHIPS

S.H. Ross

## **AVERTISSEMENT**

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GEOLOGY OF PARTS OF  
SAGARD - SAGUENAY - CHAUVEAU - CALLIERES TOWNSHIPS

Charlevoix County, Quebec.

by S. H. Ross

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GEOLOGY OF PARTS OF  
SAGARD - SAGUENAY - CHAUVEAU - GALLIERES TOWNSHIPS  
Charlevoix County, Quebec.

by S. H. Ross

INTRODUCTION

GENERAL STATEMENT

This report gives a brief account of the geology and mineral deposits in the above townships, adjacent parts of which were mapped by the author during the field season of 1945. The object of this field work was to locate, map, and study any mica-bearing pegmatite dykes located in the area. *mainly*

Muscovite (Ruby) mica is a strategic war mineral widely used in the electrical industry. As a result of a shortage of this mica, large quantities of which are obtained from India in peace time, a number of small deposits are operating profitably at the present time in the northeast corner of Bergeronnes township, Saguenay County, 30 miles northeast of the map-area. Deposits similar in character to those being worked in Bergeronnes township were known to exist in the region selected for field work, since records are on file of mica mining operations in Gallieres township dating back to 1911.

Approximately 108 square miles, an area 9 by 12 miles, were traversed every half-mile. Rock outcrops on the accompanying map were located by pace-and-compass surveys tied to road and trail junctions, lot posts, stream intersections, and prominent topographical features. Approximate elevations were obtained from barometric determinations.

LOCATION AND MEANS OF ACCESS

The area lies roughly between latitudes  $47^{\circ}56'.55''$  and  $48^{\circ}04'.7''$  north and longitudes  $69^{\circ}52'$  and  $70^{\circ}08'$  west in Regional Map No. 3 of the Department of Lands and Forests, Quebec. The topography of the area was compiled from township plans of both the Bureau of Mines and the Department of Lands and Forests, issued on a scale of two inches to the mile, and from inventory survey maps of timber limits of Price Brothers and Company, Limited, and the George Hall Coal and Shipping Corporation.

The St. Siméon - Chicoutimi highway (route 16) crosses the west half of the map area from north to south and the Maritime highway (route 15) following the north shore eastward from Quebec to Tadoussac passes one-half mile east of the southeast corner of the map sheet. Other gravel, graded, and unimproved roads and trails lead to the various lakes and fishing clubs for which the district is famous. In the summer, the Canada Steamships Lines maintains a regular service, by way of the St. Lawrence river, between Montreal and Bagotville, (near the head of the Saguenay river) stopping at St. Siméon, 15 miles south of Lac Brouillard, on the southern boundary of the map sheet. In addition, a ferry service exists between St. Siméon and Rivière-du-Loup, on the south shore of the St. Lawrence.

The Ibtit-Saguenay river, rising in the southwest of Sagard township, flows east until it joins the Deschênes river then north through the north-west quarter of the map sheet, emptying into the Saguenay river. The eastern half of the map area is drained northeast and east by a chain of nine lakes, named numerically from One to Nine from east to west, emptying into the St. Lawrence river at Rivière-aux-Canards.

#### PREVIOUS WORK

The following is a list of most of the published geological accounts dealing with the area in general.

LaFlamme, Abbe' J. C. K.: "Geological Investigations in Charlevoix County, P. Q."; C. G. S. Sum. Rept. 1890, pp. 48-50. C. G. S. Sum. Rept. 1892, pp. 45-6.

Drosser, J. A.: "Traverses". Q. B. M. Rept. on Min. Oper. 1928, pp. 164-174.

Fassler, C.: "Geological Reconnaissances Beauport and Saguenay River". Q. B. M. Rept. Min. Oper. 1928, pp. 175-184.

#### ACKNOWLEDGEMENTS

The writer was capably assisted in the field by Pierre Dufresne and Clement Simeon. He wishes to express his thanks to Messrs. G. A. Brouillard and A. Imbault, both of St. Simeon, for their material assistance, ready cooperation, and valuable advice. Notes on the flora of the region were kindly contributed by Dr. Pierre Dausereau of Montreal. Information concerning the fauna was obtained from publications of the Division of Biology, National Museum, Ottawa, by R. M. Anderson; and from the well-known book entitled "Life and Sport on the North Shore" by Napoleon A. Comeau. The early history of Charlevoix County was generously contributed by the Rev. L. Boivin, Cure', Les Eboulements. Notes on the beginning of the Parish of St. Simeon were obligingly supplied by Victor Tremblay, ptre., La Societe' Historique du Saguenay. Mr. Gerard Guay, Quebec Land Surveyor, working in the map-area, also provided the writer with useful topographical data.

## HISTORY

Baie St. Paul, founded in 1649, is the oldest community in the country. Les Eboulements was established in 1722. La Malbaie, separated from Les Eboulements in 1797, was settled by the Bergeron, Blackburn, and Bouchard families. The early settlers of St. Simeon came from La Malbaie.

In 1810, William Price, adventurer and colonist, came to Canada from England to buy mast lumber for British ships. He was favorably impressed by the timber resources of the Saguenay district and as a result established the well known lumber firm of Price Brothers and Company, Limited. Price Brothers brought out some of the first settlers in 1838 and the company has taken a prominent part in the exploration, settlement and development of the region ever since.

At Tadoussac, where Jacques Carter landed in 1535, Baie St. Catherine, and River Canard cutting operations were in progress in 1840. On River Noire cutting was under way in 1841. A short time after Price Brothers purchased Peter McLeod's saw-mill at River Noire in 1842, the name of this small settlement on the north shore of the St. Lawrence was changed to St. Simeon. Apparently the parish of St. Simeon began by the establishment of a saw-mill and lumber yard for exploration of the Black River by Peter McLeod, Junior, a few years before 1842. According to a memoir by Lord Elgin (Governor of Upper and Lower Canada) in March 1849, lumbering at Black River declined rapidly after 1842. In this memoir, the Black River is referred to as a difficult mountain stream where a small saw-mill has been the chief means of support of a large family of Simards residing there. This family may be the founders of St. Simeon.

Before 1850, lumbering had extended northward twenty miles as far as the Petit-Saguenay river in Sagard township. Most of this area was burned over in 1920 and forest fires had swept through it about 100 years prior to this. Much of the region mapped is still a wilderness of deep silent forest and lonely, rocky hills characterized by long, cold winters and short, fly-infested summers.

## TOPOGRAPHY

### Regional

The north shore of the St. Lawrence river west of the Saguenay river to St. Anne de Beaupre is rugged and mountainous. The Laurentian highlands, beginning a short distance north of the St. Lawrence river extend northward for 500 miles. The precipitous character of the shore line, consisting of steep rocky cliffs rising abruptly to a maximum height of 3000 feet above the water, is due to the dissection of the elevated Laurentian plateau by the St. Lawrence river. North of the shore toward the interior the rough rolling plateau is broken by deep broad valleys, running roughly north and south, containing the rivers and small lakes which form a network of water ways throughout the northern part of the province (photo. 5526). In general, the surface of the granite, gneiss and other crystalline rocks outcropping in the region have been planed and, in many cases, swept bare of soil by the

ice sheets and remain as a vast expanse of ridges and hills that reach a maximum height of 2000 feet above the valleys (photo 5527). These rocks are clearly exposed in the Saguenay river fiord where at Cape Trinity granite cliffs rise perpendicularly 3000 feet from the waters edge to the level of the surrounding upland above. On the whole, the region is in a youthful stage of topographical development with immature drainage characterized by steep-sided, v-shaped valleys, canyons, gorges, water-falls, and small lakes, ponds, bogs, and muskegs.

#### Local

The area mapped is characterized by strong relief. Elevations of the main rivers and larger lakes are about 1000 feet above sea level. Prominent hills and ridges rise abruptly to considerable heights above the streams. The highest point recorded, in the northwest corner of the map-area, has an elevation of 2000 feet above the valley of the Petit-Saguenay river or about 3000 feet above sea level.

The west half of the map area includes the eastern escarpment of Orford mountain, rising 2000 feet above the valley floor with steep talus slopes (photo 5907); and the watershed of Lac Deschenes and the Petit-Saguenay river which drains to the north (photo 5809). The Deschenes-Petit-Saguenay valley, varying from one to two and one-half miles and averaging one and one-half miles in width extends northward eight miles across the map sheet (photo 5704). The eastern section of the map area is more regular, (photo 5905), the topography being dominated by the drainage basin of 6th, 7th, 8th and 9th lakes, (photo 5899) which slopes to the northeast, flanked on the east and west by rough rolling hills and ridges. The highest elevation, one mile east of the north end of Lake Port aux Quilles, is approximately 1200 feet above the water level in 9th lake.

The mountainous area in the west consists of precipitous, rocky hills and ridges whose summits have an elevation of about 3000 feet above sea-level. The visible horizon formed by the hill crests is comparatively level and regular (photo 5903). The relief is considerable averaging 1600 feet. The summits of the hills are usually rocky, windswept, and treeless (photo 5908). Many of the hills are block-like with flat tops. They are separated frequently by prominent long, straight or gently curving nearly perpendicular rock scarps which form the upper walls of narrow valleys 500 to 1000 feet deep (photo 5525). V-shaped canyons, 50 to 300 feet wide dissect the scarps in all directions. The streams which flow through the gorges, canyons and narrow valleys are turbulent and descend rapidly in cascades, chutes, and water-falls over rock ledges to the various lakes and rivers which drain the area. Long talus slopes of large angular boulders rise 200 to 500 feet above the main valleys to the foot of the scarp cliffs.

The main water courses, which flow north and east, are fed by swift flowing streams, in many cases draining small, rock-bound lakes at elevations from 1500 to 2000 feet above sea level. Many of these lakes are from 300 to 600 feet above the valleys and the small streams which drain them descend abruptly in a series of falls and steep rapids.

map

## Glaciation

The map-area lies in a region which was glaciated by ice sheets that moved southward following roughly the prominent, deep, broad valleys and major relief forms. Glacial striae "Knife Edge" ridges, "V-shaped" valleys, and other characteristics glacial erosional features and deposits indicate that the area was completely covered by ice during a portion of the Pleistocene period. Succeeding the retreat of the ice, post-glacial lakes and streams, reworking the morainic deposits, formed beaches and terraces of sand and gravel. Since then the forces of erosion have had little effect upon the topographical features of the district.

## NATURAL RESOURCES

The principal industries upon which the population depend for a living are lumbering and farming. The only soils suited to agriculture are in the narrow valleys and their limited area together with the rigorous climate makes the region as a whole more suited to lumbering than farming. The rainfall ranges from 25 to 45 inches. Temperatures range from a summer maximum of 95° to a winter minimum of -40°f, with a growing season of 60 days. Although the land is mountainous and rugged the soil is generally rich and in addition to grain, potatoes and tobacco, can produce apples, plums, raspberries and cherries. During the winter the farmers cut pulp for shipment to the paper companies and firewood for their own use. These farmers who have maintained the true form of peasant economy usually own their farms.

### Water Power

The two largest streams in the district are the Petit-Saguenay, which flows north 18 miles into the Saguenay river and the Noire, which flows southeast 13 miles, emptying into the St. Lawrence river at St. Simeon. The Petit-Saguenay, averaging 200 feet in width and the Noire, having a maximum width of 100 feet, have steep gradients but small volumes. Some water powers may be worth developing for local uses when the population increases sufficiently to justify the expense of doing so, but no large hydroelectric development within the area is possible.

### Flora

The Laurentian forests, which are the best and most valuable in the province, comprise approximately 168,000 square miles, 100,000 square miles of which are in the Saguenay and Labrador Reserve. Much of this area has been leased to lumber companies and has been cut over. However, in spite of destructive and extensive forest fires it is estimated that 75% of this area is capable of yielding merchantable timber.

The best forests of the province are located adjacent to the north shore of the St. Lawrence river. This belt contains many lakes and streams and is largely covered with coniferous and mixed

coniferous and deciduous forests, (Photo 5524). Here, White and Black Spruce, Balsam fir, some Aspen, Poplar and White Birch are mixed with White and Red Pine, Arbor Vitae and near the river a mixture of such hardwoods as Yellow Birch, Ash and Maple.

In the primeval state, Charlevoix-Saguenay counties were covered by the "Canadian forest", interspersed with lakes, bogs, rivers and streams.

The forest proper was composed mainly of White and Black Spruce and Balsam Fir, with occasional occurrences of Yellow Birch and Mountain Ash. The primeval forest afforded little opportunity for a shrub-layer and only a few individuals of Black Haw, Blue Berry, and Deer Berry may have risen here and there. The herbaceous layer was well developed with abundant Dog Wood, Herbs, Wood Sorrel, Lily-of-the-Valley, Ferns and occasional Lesser Rattlesnake Plantain, and other orchids. The moss layer was usually greatly developed with Swamp Moss, Mountain Fern Moss, etc. Extensive remnants of this primeval forest are still to be found.

The bogs are dominated by species of heath such as Sheep Laurel, Labrador Tea and Deer Berry in the parts that become dry in summer, Leather Leaf and Bog Rosemary in moister parts. Here and there, at more mature stages of development, grow Black Spruce and Larch.

The water edges, when boggy, have the above species and in addition, Bridle Wreath, Sweet Gale, Willow, Alder and Sedges. The rocky and sandy shores are colonized by Aspen or Poplar, Hob Horn Bean, and Hoble Bush.

The rocky, windblown ledges have a few depressed conifers such as Black (ground) Spruce and forms of Cedar. In addition, Juniper and many grasses, among them some subarctic species such as Tufted Hair-grass, Tufted Grass, Cowberry, Foxberry and Black Crowberry are very abundant.

Such are the dominating elements of the undisturbed landscape. However, a few other species have taken on great importance as a result of degradation. For instance, Canoe Birch and Quaking Aspen, in the primeval state more or less restricted to forest margins (near water or cliffs), have spread considerably, sometimes covering miles of burned or damaged forest sites. In the drier, sandy soils, Jack Pine is very important. It also invades dried-up bogs. An occasional stand of Red Pine is to be found and some scattered individuals of White Pine.

The timber in most of the country adjacent to the roads and lakes has been cut. In less accessible areas, west of Lake Deschenes, and the valley of the Petit-Saguenay river near its source, there are still excellent stands of Black Spruce, Balsam Fir, White Spruce and Birch.

#### Fauna

The animals of the region are similar to those found in other

parts of the Canadian north. The Eastern Moose and Northern White-tailed Deer are scarce. The Eastern Black Bear is present in considerable numbers hibernating in the winter. The Northern Hair or Snowshoe Rabbit fluctuates rapidly in numbers attaining a maximum every nine or ten years. It forms one of the principal foods for small carnivores hence its abundance or scarcity has considerable effect on local fur returns. The Eastern Muskrat is fairly common, the Eastern Canada Mink less so due to steady trapping. The Eastern Red Fox is fairly common and small numbers of the Eastern Timber Wolf are present in the less settled regions. The Eastern Canada Skunk, which destroys insects, grubs, and small rodents, is common. Lynx and Otter are occasionally seen. The Bonaparte Weasel is fairly abundant. Canadian Beaver are rare but fresh beaver cuttings were observed at a number of localities. The Northeastern Chipmunk, hibernating in winter is fairly common. Hudson Bay Red Squirrels are common and active during good weather all winter. They are of considerable economic value as one of the favorite foods of the Martin. The Little Brown Bat is the most common bat found in Quebec and one of the hardiest of the species. The Labrador Porcupine is occasionally met with. Harbour Porpoise are abundant in the St. Lawrence river in the vicinity of the Saguenay river.

Many different species of birds have been reported from the district. Canada and Brant geese are common migrants, brooding in Western Labrador. Several species of duck namely, Northern Black, Blue-bill, Golden-eye, Red-breasted Merganser and Scaup are fairly numerous, breeding in fresh-water lakes. Mallard ducks are not common and Green and Blue-winged Teal are rare. Loon and Heli Divers are common in lakes in the interior. Spring Grouse, Ruffed Grouse, abundant in some years and Willow Ptarmigan, very abundant during the early part of some winters, are a source of food. Black-birds and Snipe in bogs and marshes, and Sand-pipers along inland streams and ponds are fairly common. The Great Blue Heron, wading in the rushes and horsetails at the edges of lakes, is not uncommon. The Sand Martin, nesting in sand banks and dunes is quite numerous. On sand flats along the North shore Gulls, Tern, Sea Pigeons, and Kittiwake are abundant, feeding on molluscs and marine animals. In burnt over areas of scrub pine several varieties of Woodpeckers including the Downy, Hairy, Black, Golden-winged and Banded Woodpecker are common residents. The Canada Jay (Whiskey Jack) an ambitious thief, is very common. The Raven, hated by trappers on account of its habit of robbing the bait from fox traps, is a common resident. Crows are also quite numerous. The King-bird is not very common, the Woodcock is rare. Golden and White-headed Eagles breed locally and are not uncommon. Hawks are always present, the most numerous species being the Goshawk, Pigeon Hawk, Fish Hawk, Chicken Hawk, and Night Hawk. The Great Horned Owl, usual resident, is a bold bird, occasionally attacking human beings. The Screech Owl, easily attracted by fire, is a very noisy bird, able to bark, whistle, and yell. The Snowy Owl, Hawk Owl, and Richardson's Owl are common winter residents. Several species of Sparrow, the most common of which is the White-Throated Sparrow, are habitual residents. The Brown Thrush (Canada Bird) is very common and its easily recognized song can usually

be heard anywhere in the woodlands of the North. The Hermit and Olive-backed Thrush are not uncommon. The Robin, Chickadee, and Bob-o-link are common summer residents. The Nuthatch, Snow Bunting, Winter Wren, and Dovekie (in large flocks) are usual winter residents.

The district is very popular as a fishing resort, the lakes and streams abounding in salmon and trout.

#### INTRODUCTORY STATEMENT

The map-area lies on the Southeast border of the Canadian Shield and is wholly underlain by Precambrian rocks. Unconsolidated glacial clay and sand deposits of Late Pleistocene age overlie the consolidated rocks of the area.

In the central part of the area is a complex of gneisses and schists intruded by pegmatite and aplite dykes, large masses of quartz and quartz veins. This highly metamorphosed series, generally characterized by well-developed augen structure, is invaded by and intimately associated with, granitic rocks, chiefly pink biotite granite, which occupy the greater part of the map-area and extend beyond its borders for great distances. Also intimately associated with the granites, gneisses and schists of the region are narrow bands, lenses and dykes of amphibolite.

*This appears to be on the series*

In the following table the various formations and rock types are tabulated in the order in which they are described

#### TABLE OF FORMATIONS

Recent and Pleistocene		Sandy clay, sand, boulder clay, morainic deposits
Precambrian		Quartz masses and veins Pegmatite and aplite dykes Basic dykes.
		Pink, biotite granite and granitic gneiss.
		Brown Hornblende Granite Gneiss.
	Grenville Series	Paragneisses and Metasedimentary rocks  Amphibolites

## DESCRIPTION OF FORMATIONS

## AMPHIBOLITES

*Hornblende gneiss is better  
word. The rocks are too  
high in pH.*

The term amphibolite includes the dark coloured basic metamorphic rocks in the area under consideration. They are small in areal extent, irregular in form and erratic in distribution. Several fairly well defined bands, varying in width from 400 to 1600 feet and striking roughly northeast or northwest, occur in the northeast quarter of the map area.

By far the most common occurrence of the amphibolites is in form of inclusions, which may represent either portions of the rock forming the wall or roof of a batholith which had fallen into the granite magma or fragments of altered basic igneous intrusions. Frequently, they have been injected, parallel to the foliation, by granite, and many gradations, from granite with amphibolite inclusions to amphibolite with thin sheets of granite injected lit-par-lit, have been observed.

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fuller in  
H & B.  
manoir*

The amphibolites consist of hornblende chiefly, replaced in part by biotite or occasionally pyroxene, and plagioclase feldspar. Quartz, garnet, iron ore, apatite, and sphene are frequently present as accessory constituents. They may be classified according to two different types namely: (1) metamorphosed sediments; and (2) altered basic igneous intrusions.

(1) Metamorphosed Sediments

A narrow belt of well-banded hornblende and biotite gneisses, about 600 feet wide and two miles long, trending northeast, crosses 8th Lake in the southwest corner of Saguenay township. The rocks outcrop along the northeast and southwest lake shore and are well exposed across a continuous width of 350 feet on a small island in the southwest bay of the lake.

The strike of the gneissoid banding varies from North 50° East in the northeast to North 70° East in the southwest where the belt begins to swing westward. The bands dip 50 to 60 degrees to the southeast away from the granite mass to the north.

The rocks exposed on the island, from north to south, consist of coarse-grained biotite-hornblende gneiss grading into medium grained biotite schist, striking N 70° E and dipping 56° to the southeast. The coarse gneiss, composed of biotite and hornblende bands, one-eight inch wide, alternating with granular quartz and feldspar, is considerably contorted and drag-folded across a width of six feet. It consists of biotite mainly (laths 5 mm. long), green hornblende, quartz and andesine. The rocks outcropping on the lake shore southwest of the island range in composition from biotite gneiss to hornblende gneiss and schist.

In a thin section under the microscope, a typical specimen of hornblende gneiss ( $\frac{1}{2}$  mm. grain size) is seen to consist of hornblende 60%, feldspar 30% and quartz 5-10%. The feldspar is mainly andesine and microcline. Only a few laths and skeleton crystals of badly altered biotite are present. The accessory constituents are magnetite, apatite and sphene. Chlorite, sericite, and kaolinite occur as secondary alteration products of the hornblende and feldspar.

A specimen of hornblende gneiss from the northeast shore of the 8th lake east of the <sup>dam</sup> eclose consists of hornblende 70% oligoclase-andesine 20%, and quartz 5-10%. Apatite and magnetite are also present as accessory constituents.

Another band of biotite-hornblende gneiss and biotite gneiss, 1000 feet wide, striking N 65° E, occurs directly south and west of a small lake,  $2\frac{1}{2}$  miles east of Lac a David, on the north boundary of the map-sheet in the southeast corner of Dumas township. The banding of the rocks in this belt, which follows roughly a narrow valley, dips 65° NW on the south slope of the valley and 80° SE on the north slope. A branch band, 400 feet wide, bends east and south around the north border of a large granite mass to the south and dips 65° to the NE. The biotite-hornblende gneiss is well exposed on the cliffs above the creek at the southwest end of the lake. It is essentially a fine grained ( $\frac{3}{4}$  mm) thinly banded rock. Under the microscope it is found to consist largely of biotite altering to chlorite, some green hornblende, microcline, albite and quartz. Biotite and hornblende gneiss are exposed continuously in the branch striking E 20° S, for a distance of  $\frac{1}{2}$  of a mile. They are composed essentially of biotite, hornblende, and plagioclase feldspar. A circular mass of excellently banded biotite and hornblende gneisses and schists extends west, approximately one mile, from the west shore of the 7th lake, which drains 8th lake to the northeast. It is flanked on the west by a large body of pink biotite granite. The banding and schistosity of the rocks in the south part of the mass strikes northeast and dips 25 to 50 degrees to the southeast. In the north the corresponding strike is northwest and the dip 45 degrees to the northeast. A typical specimen of hornblende schist ( $1\frac{1}{2}$  mm grain size), outcropping on the lake shore, is seen under the microscope to be composed almost exclusively of green hornblende and plagioclase feldspar. A small amount of calcite and a few biotite laths are practically the only other constituents present.

A band of pyroxene and hornblende gneisses and schists, 1800 feet wide, trending northwest, intruded by quartz and pegmatite dykes, is exposed in cliffs directly east of Lac Port aux Quilles in Collieres township (photo 5900). The banding and schistosity have been considerably disturbed and vary rapidly over short distances. The pyroxene gneiss when examined in thin section is seen to consist of pyroxene 35%, microcline 50%, and quartz 15%, a few laths of biotite and several ~~laths~~ sections of hornblende. The pyroxene, in the form of rounded individuals traversed by fractures, appears to be hedenbergite. Iron ore, sphene, and apatite are present in small amounts as accessory constituents.

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Sgo.

121-2

Since the banding of the rocks described above, due to variations in grain size and composition, is decidedly uniform for short distances along the strike, they are thought to be of sedimentary origin. However, they may be large igneous lenses whose stratiform appearance is the result of dynamic forces which pulled or squeezed them into flat, lenticular, or band-like forms.

*not  
good  
evidence*

## (2). Altered Basic Igneous Intrusions

Massive fine and coarse-grained amphibolites occur as angular, semi-angular and lenticular inclusions in the granite and gneiss. They are usually dark, nearly black, heavy rocks much less foliated than the associated gneiss. The foliation generally coincides with that of the enclosing gneiss except in cases where inclusions have been broken up into fragments by later movements of the gneiss.

A series of coarse-grained (2-4mm) lenticular bodies of schist and gneiss, exposed at intervals over a width of 1200 feet, occurs one and one-half miles west of 8th Lake in the southeast corner of Sagard township. The foliation of this mass, flanked on the northeast by pink biotite granite and on the southwest by coarse biotite schists and gneisses, strikes E 20°-30° S paralleling that of the biotite gneiss to the south. When examined under the microscope these rocks are seen to consist essentially of hornblende chiefly, andesine, and a small amount of biotite.

*not on  
map*

*OK*

A lenticular body of hornblende schist, 100 feet wide and 300 feet long, occurs associated with biotite gneiss striking N 50° W, about one and one-fourth miles west of Club Auger on 9th Lake, in the northwest corner of Calliers township. In a thin section under the microscope it is found to consist of hornblende 75%, laboradorite 15%, and quartz 10%. A few grams of sphene and iron ore are also present. The secondary alteration products are chlorite, quartz and sericite.

*OK  
SP 286-7*

A similar body of hornblende schist, 200 feet wide and 300 feet long, outcrops on an east-facing cliff, one-half mile south and one-fourth mile east of the exposure described above, striking N 10° W and dipping 62° to the southwest. It is a black, fine grained ( $\frac{1}{2}$  mm) rock with a distinct foliation and porphyroblastic structure consisting almost entirely of green hornblende and large sparse pink garnets,  $\frac{1}{4}$  to  $\frac{1}{2}$  inch in diameter.

*OK  
SP 291*

A lens-shaped mass of flat-lying coarse-grained (3-5 mm) hypersthene gneiss, associated with siliceous schists striking NW, is exposed  $\frac{3}{4}$  mile south of the hornblende schist outcrop. It dips 40° to the north and appears to be a sill. When examined in thin section it is seen to consist of hypersthene 70%, laboradorite, 20%, and quartz 10%. The hypersthene crystals occur as porphyroblastic prisms, 3-5 mm. long, paralleling the foliation. A fair amount of rounded grains of iron ore and a few prisms and grains of apatite are also present. Small amounts of chlorite, quartz and sericite are present as secondary alteration products.

*SP 294*

## PARAGNEISSES AND METASEDIMENTARY ROCKS

Miscaceous gneisses and schists, which in many cases are of sedimentary origin and in all cases contain sedimentary material, are much more abundant than the amphibolites. Some of these gneisses and schists apparently represent alterations of rocks varying in composition from argillaceous sediments to quartzite and arkose. Others are principally altered sediments with admixtures of volcanic material.

In general, they are well-banded, highly foliated, medium grained grey rocks with a rusty weathered surface. They are rich in mica, principally biotite, and granular quartz and feldspar. Sillimanite in fibrous aggregates is often present. Garnet is sometimes present, usually as large porphyroblasts up to one and one-half inches in diameter. Mica also occurs as porphyroblasts up to one inch long.

These rocks outcrop in the central part of the map-sheet, occurring in two parallel bands which normally strike N 35°-40° W, paralleling the stratification foliation. However, their strike has been modified locally by the intrusion of masses of granite and granite gneiss and in the north part of the area the strike corresponds with the direction of the curved margin or border of the intrusives. The dip of these metasedimentary rocks, which in most cases is the same as the banding and schistosity, is steep, averaging 65°. The direction of the dip varies with the strike but the dominant trend is to the east.

The northern band is exposed at intervals for a length of four miles. It begins one-half mile west of the south end of 8th Lake, in the southeast corner of Sagard township, strikes N 40° W for about a mile, then swings north for one and one-third miles and bends eastward around the pink biotite granite mass to the east for one mile, crossing from Sagard township into Dumas township, thence traversing this township in a northeasterly direction beyond the north boundary of the map sheet where it appears to pinch out. Its width as exposed varies from 1200 to 3000 feet, averaging 2000 feet. It is flanked on the east by pink, biotite granite and granite gneiss and on the west by coarse biotite gneiss with pronounced "augen" structures. At the south end of the band the schistosity dips steeply to the southwest whereas, at the center and northeast end it dips about 65° to the southeast. The sedimentary gneisses and schists are intruded, parallel to the schistosity by a considerable number of large lenticular bodies and dykes of mica-bearing pegmatite, numerous aplite dykes, and quartz veins.

The rocks of this belt are chiefly muscovite-biotite schists and gneisses with sillimanite frequently present and a few narrow intercalated bands of highly siliceous, fine-grained schists. They have a characteristic rusty weathering and are frequently considerably drag-folded and contorted, especially in the vicinity of pegmatitic intrusions (photo 5902). A few narrow bands of garnetiferous biotite schist are also present.

*proof  
not much out to  
Genville*

*is drag fold  
in gneiss to*

The largest development of these rocks observed occurs at the southern end of the band where rusty, micaceous, sillimanite gneisses and schists are exposed continuously across a width of 3000 feet. A typical specimen of the rock was taken from a cliff of micaceous schist and gneiss, striking N 25° W, 4500 feet west of the south end of 8th Lake. When examined under the microscope, it was found to consist of alternate bands of muscovite, biotite and sillimanite, with a marked parallel alignment, and fine-grained ( $\frac{1}{2}$  mm) aggregate of quartz and plagioclase feldspar. The muscovite occurs as porphyroblasts up to three-fourths inch long. The biotite is in the form of small flakes averaging 2 mm in diameter and sillimanite is present as colorless acicular needles and felted masses.

ok

Another characteristic variety of rock from this belt of metamorphosed sediments occurs two miles north of the south end in the center of the band. Under the microscope the rock is a rusty, fine-grained (1 mm) muscovite-biotite gneiss with porphyroblasts of bleached mica up to one inch in length. The micaceous gneisses and schists are intruded parallel to the schistosity, which strikes north and dips 60° east, by a number of pegmatite stringers, three to four inches in width, bearing muscovite "books" one-half inch square and one-fourth inch thick.

Sp  
119

A body of contorted, rusty, garnetiferous schist and gneiss, 400 feet wide, striking N 40° E and dipping 67° to the southeast, outcrops in the Sagard-Dumas township line at the north end of the belt. A microscopic examination of this rock shows that it consists of muscovite and biotite mainly, sillimanite, a small amount of ferruginous quartz and a fibrous, olive green mineral, probably chlorite. There is present as an accessory constituent a small amount of violet garnet averaging 1 mm in diameter.

Sp  
153-4

The southern band of metasedimentary rocks may be traced from Lac Port aux Quilles, in Calliers township, on the south edge of the map sheet, N 35° W for five and one-half miles through Lac la Roche into the southeast corner of Sagard township. It is parallel roughly to the north band and situated about one mile west of it. The north band may represent the continuation northward of the south band which has been offset to the northeast by a northeast fault corresponding to a line of weakness through 8th and 7th Lakes. The exposed width of the band varies from 2000 to 6000 feet, averaging 3000 feet. It is flanked on the west by coarse garnetiferous biotite granite gneiss and in the east by a narrow band of amphibolite. The strike of schistosity and banding in general varies from N 40° W in the south to N 20° W in the north with considerable local divergence. The dip is also variable, changing from 45° northeast in the vicinity of Lac Port aux Quilles, to vertical and steep to the west, in the central and northern part of the belt. A number of large lenticular bodies of pegmatite and quartz intrude the sedimentary gneisses and schists. Narrow bands of quartzose schists and fine-grained siliceous rocks are frequently intimately associated with the micaceous schists and gneisses especially at the southern end of the band. These foliated quartz-rich rocks may represent altered quartzites.

In general, the composition of the rocks of the north and south bands is essentially the same namely, muscovite-biotite schists and gneiss with or without sillimanite. However, the rocks of the southern band are richer than quartz and contain a much greater admixture of siliceous material.

At the south end of the band rusty, micaceous and siliceous schists and gneisses, injected locally by narrow pegmatite stringers outcropping on the west shore of the southwest bay of Lac Port aux Quilles, extend westward continuously for 4500 feet terminating against coarse, garnetiferous biotite gneiss. The average strike of the schistosity is N 30° W. The dip is 45° to the northeast. The rocks are exposed on the abrupt north wall of a well defined E-W ravine and are frequently highly disturbed. Under the microscope they are seen to be composed essentially of muscovite and biotite, numerous fine needles of sillimanite (3-4 mm) long and a fine-grained ( $\frac{1}{2}$  mm) aggregate of quartz and feldspar.

An excellent exposure of muscovite-biotite schists and gneiss, striking N 15° W with a vertical dip, occurs in the middle of the band 3000 feet east of Lac à la Roche, in the northeast corner of Calliers township. These rocks are exposed continuously west to Lac à la Roche where they are intruded, parallel to the foliation, by a large lenticular body of muscovite-bearing pegmatite about 1000 feet wide and three-fourths mile long. In addition, they are cut by numerous, narrow pegmatite dykes ranging from a few inches to one foot in width. A number of narrow siliceous bands intercalated in the schists appear to be metamorphosed quartzose sediments approximating quartzite in composition. Drag-folding across a width of 600 feet is especially pronounced at a point 2500 feet east of Lac à la Roche. In thin section under the microscope a typical specimen of these rocks is found to consist of muscovite 12%, biotite 4%, orthoclase 60%, albite 4% and quartz 20%. A few grains of sphene and zircon are also present as accessory constituents. The muscovite and biotite occur as intergrowths and as shreds and fibres in radiating and wavy forms. The average grain size is 2 mm but porphyroblasts of bleached mica three-fourths inch long are quite common. The muscovite often contains secondary quartz in well developed vermicular forms.

In the northern part of the band a metasedimentary series of micaceous and siliceous schists and gneisses intruded by pegmatite dykes is well exposed one and one-fourth miles west of Lac du Pouco, in the northeast corner of Callieres township, extending west for a distance of three-fourths of a mile. The foliation of these rocks strikes N 30° W and dips practically vertical. Mica schists rich in biotite prevail. Muscovite-biotite schists are less common. The schists and gneisses contain considerable siliceous material both in the form of uniform narrow bands and as irregular injections of quartz and pegmatite. A microscopic examination of the injected gneiss shows that it consists of one-fourth inch bands of fine-grained ( $\frac{1}{8}$  mm) biotite and quartz in about equal amounts and minor quantities of muscovite alternating with one-half inch bands of coarse (2mm) quartz and small amounts of feldspar.

The rocks at the north end of the band, in the southeast corner of Sagard township, strike N 30° W and dip either vertical or steep to the west. They outcrop on the east edge of a large prominent ridge rising to the west and are exposed continuously across a width of several hundred feet. They consist mainly of coarse-grained (2-3 mm) muscovite-biotite gneisses and schists considerably injected by quartz. When examined in thin section under the microscope they are seen to be composed of biotite 15%, muscovite 5%, quartz 77%, and microcline and albite 3%. A small amount of zircon is present as an accessory constituent.

An unusual association is the occurrence of a narrow band of garnetiferous hornblende-biotite schist, four to ten feet wide, on the eastern margin of both belts of metasedimentary rocks. In the south belt, the band has been located at three widely separated points, from Lac Fort aux Quilles north three and one-half miles to the northwest corner of Calliores township. From south to north the strike of the band varies from W 5° N to E 20° W. The dip is steep to the east. The garnetiferous band has been located at two points, four miles apart, at the north and south ends of the north belt of metamorphosed sediments, striking N 45° E and N 50° W respectively. The lithologic similarity of the rocks from these five widely separated outcrops may be taken as further evidence for the theory, already stated above, that the north belt may represent the faulted offset of the southern belt. The rock for the most part is fine grained (1 mm) and dark in color, holding large lumps of red garnet, in some cases as much as one and one-half inches in diameter. It has a well marked foliated structure and the weathered surface shows an extremely nodular character due to the differential weathering of the garnets, which project as much as one-half inch from the surface of the rock. Under the microscope the rock is seen to be made up of hornblende 25%, biotite 15%, quartz 10%, plagioclase feldspar 5% and garnet 40%. In addition to these minerals numerous grains of magnetite and several crystals of apatite are present in the rock as well as a small amount of sericite and chlorite as secondary alteration products.

#### GARNETIFEROUS BIOTITE GNEISS

*should be on the name*

A large triangular-shaped body of coarse (3mm) garnetiferous biotite gneiss occurs in the east half of the southwest quarter of the map area. The base of this triangular mass, at the south edge of the map-sheet, is four and three-fourths miles wide east and west and the distance north to its apex is five miles. It is flanked on the east by the above described south band of metamorphosed sediments whose sinuous contact strikes N 35° W. On the west, the garnetiferous biotite gneiss disappears abruptly in overburden in the N-S valley of Lake Deschenes and the Deschenes river (Photo 5703). The gneissoid banding and foliation, which strike N 30° W and N 30° E in the southeast and southwest sections respectively, changes to a north and south direction at the north end of the body. The average dip is 50° to the east.

The gneiss is intruded, parallel to the foliation, by biotite-bearing pegmatite dykes varying in width from ten to one hundred feet and exposed continuously for lengths up to eight hundred feet. In addition, there are present in the gneiss, adjacent to the metasedimentary rocks, a number of bodies of rusty micaceous schist seventy-five to four hundred feet wide and three hundred to twelve hundred feet long. These schists, whose foliation is parallel to that of the enclosing gneiss, are intruded by pegmatite dykes varying in width from five to forty feet and having a maximum exposed length of one hundred and fifty feet.

This entire mass of gneiss, approximately twelve square miles in area, is particularly uniform in composition, texture and structure. <sup>In the hand specimen</sup> the rock is dark grey with a brownish tint. The average grain size is 5 mm. Porphyritic feldspars, in lens-shaped crystals due to granulation, up to one and one-half inches in length and one-half inch in diameter (averaging three-fourths inch in length) lie, with micaceous laminations forking around them, with their long axes parallel to the foliation, forming pronounced "augen" structures, which are a characteristic of this whole body of rock. Red garnet, averaging 6 mm in diameter, is uniformly disseminated through the rock, comprising 5-10% of its composition. The microscope shows that the average composition of the gneiss is biotite 20%, microcline and microperthite 45%, quartz 25%, and garnet 10%. A typical specimen of coarse (3-5 mm) garnetiferous biotite gneiss with well-developed "augen" structure was taken 3000 feet east of Long Lac, in Callieres township near the Chauveau-Callieres township line, on the south border of the map sheet. When examined under the microscope it is found to be composed essentially of biotite 10%, microcline and microperthite 60%, quartz 25% and garnet 5%. Small quantities of sphene and apatite are also present. Large eye-shaped crystals of microcline up to one inch in length are quite common, producing the characteristic "augen" structure. Red garnets, averaging one-half inch in diameter, are irregularly distributed through the rock. Quartz is present as large interlocking grains mainly and in vermicular form in the feldspars.

A specimen of garnet-rich, biotite gneiss, taken 500 feet from the paragneiss contact west of Lac Port aux Quilles in Callieres township, is seen under the microscope to consist of biotite 20%, oligoclase 40%, quartz 20% and garnet 20%. The quartz occurs as large and small interlocking grains, and secondary as an alteration of the feldspar. Apatite and sphene are present as accessory constituents, in very small amounts.

Some marginal facies of the gneiss are non-garnetiferous but retain the other characteristics common to the whole rock mass. In general, biotite and quartz in equal amounts make up 50% of the rock, the other half consisting of microcline. Such is the case on the east edge of the garnetiferous biotite gneiss directly northeast of Lac Ecluse, in Callieres township, 1000 feet from the Chauveau township line. Here, coarse "augen" gneiss is exposed at intervals over

7 gneiss  
size  
garnet  $\frac{1}{4}$ "

size

3 on map

a width of 2000 feet east and west. The foliation strikes N 30° W and dips 70° to the southwest.

A similar body of gneiss occurs on the east wall of the Deschones river valley, one mile north of the apex of the triangular-shaped mass of garnetiferous biotite gneiss to the south, on range line II-III, lot 26, Sagard township. Under the microscope this rock consists essentially of biotite 25%, microcline 55% and quartz 20%. Oval-shaped, crushed crystals of microcline, one to two inches in length, with their long axes paralleling the foliation, are responsible in part for the well developed "augen" structure of the rock. No garnet is present.

not  
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map

Another exposure of this same gneiss in its typical development occurs on the west wall of the Lake Deschones valley directly west of Lac Castor, in lot 64, Range III, Chauveau township. This rock also exhibits the partly crushed or "augen" structure typical of the large body of garnetiferous biotite gneiss to the east. A microscopic examination of the rock shows it consists of biotite 15%, hornblende 5%, microcline 65%, orthoclase 5% and quartz 8-10%. Eye-shaped microcline crystals, attaining a length of one and one-half inches, are common. Garnet is absent.

BROWN HORNBLende GRANITE GNEISS

Not in map area

The principal development of this rock is in the western portion of the map area, where, as the eastern escarpment of Orford Mountain it forms the west wall of the N-S valley of the Deschones and Petit-Sagehenay rivers, rising precipitously, with steep talus slopes, 1500-2000 feet above the valley floor (Photo 5528). The surface character of the heavily timbered country underlain by this rock is quite different from that already described to the east. Vertical cliffs, rising 150-200 feet above the water in small lakes averaging one-fourth mile in diameter; and deep, narrow, steep-sided valleys, ravines, and gorges with swift-flowing streams falling rapidly in a series of water-falls, cascades, and rapids to the main drainage basin, are characteristic of the youthful topographical stage of development of the area.

not  
in  
map

In general, the character of the rock exposures is very uniform. The rock is medium to coarse grained, averaging 2.5 mm in grain size. It has a typical cinnamon brown, granular appearance on fresh surfaces, a grey to brown, smooth spherical weathered surface, and a distinct foliation. Well defined narrow bands and lenticular segregations of hornblende are fairly common. Coarse feldspar up to one-half inch in diameter is not unusual. A microscopic examination of the rock shows that the average composition is hornblende 12%, feldspar 53%, and quartz 30-35%. Some biotite is invariably present in subordinate amounts. Rarely augite may take the place of hornblende. Myrmekite is often present, at times, making up 2% of the rock. The feldspar consists of orthoclase mainly and a small proportion of microcline and plagioclase of the composition of oligoclase and oligoclase-andesine. Occasionally, microcline is the dominant feldspar present. A specimen of medium grained (1-2 mm) brown granitic gneiss was

collected by the author on the Sagard-Chauveau township line, two-thirds of a mile west of the Chicoutimi highway, in the central west part of the map area. In thin section under the microscope it consists of augite 10%, feldspar 60%, and quartz 25%. Most of the feldspar appears to be microcline. Orthoclase is next in abundance, then oligoclase. Quartz is present as large anhedral individuals and myrmekite. Opatite, magnetite, and sphene occur, in small amount, as accessory constituents. A typical specimen of medium grained (2 mm) brown hornblende granite gneiss was taken, by the author, one-fourth mile south of Lac aux Bouleaux near the west boundary of the map sheet, two and one-half miles west of the highway in Sagard township, in the north-west quarter of the area. When examined in thin section it is seen to consist of hornblende 7%, biotite 3%, feldspar 70%, and quartz 20%. The feldspar consists of microcline chiefly, orthoclase, and a few grains of oligoclase. A small amount of myrmekite, as well as a few grains of magnetite and apatite, are also present. Another typical specimen of medium grained (1.5 mm) brown hornblende granite gneiss was collected by the author one-half mile west of the highway in lot 25, Range I, Sagard township, in the northwest quarter of the map area. When examined under the microscope it is seen to consist of hornblende 15%, feldspar 50%, and quartz 35%. Orthoclase is the dominant feldspar. Microcline, oligoclase and andesine are also present in subordinate amounts. A typical specimen of medium grained (1 mm) brown hornblende granite gneiss taken on the west shore of Lac Louis (Photo 5705), two miles west of Lake Deschenes in Chauveau township, in the southwest corner of the map sheet is seen under the microscope to consist of hornblende 15-20%, orthoclase 50% and quartz 30%. A few grains of plagioclase are also present.

#### PINK BIOTITE GRANITE & GRANITE GNEISS

Out of a total area of approximately 108 square miles, in the district described by this report, pink biotite granites and granite gneiss occupy about forty square miles or 37% of the whole. The major development of these rocks is in the eastern section of the map-area, extending east from the N-S belt of paragneisses in Sagard township, in the central part of the area, to the eastern boundary of the map sheet.

The rolling, hilly character of the country underlain by these rocks is typical of the Laurentian plateau. The terrain has been lumbered over and burnt, exposing low, rounded hills with thin sandy, gravelly soil, and bare rock ledges, and "roches moutonnee" ridges. Numerous small lakes, among the hills or at the heads of V-shaped valleys, with sand, gravel, and boulder deposits, occupy rock basins scoured out by glacial erosion. The west margin of the pink biotite granites and granite gneisses disappears gently in overburden in the broad, flat, gradually sloping valley occupied by 9th and 8th Lakes, draining to the northeast. These rocks are usually foliated, however, in certain areas the foliated structure changes to a granitoid one, and practically every stage of transition from one structure to the other is represented. Large dome-like intrusions which are massive at the center and foliated on the edges, and well-foliated sheet-like masses prevail, although many different structures are present. The schistosity is usually parallel to the banding or regional structure

except in local shear zones which tend to strike northeast and northwest. Spheroidal weathering and horizontal and vertical jointing are typical.

Amphibolites, previously described above, frequently occur as long narrow bands and lenticular inclusions in the granite gneiss and in many cases have been injected, lit-par-lit, by the granitic magma, resulting in the presence of many gradations from granite to amphibolite in the contact zone on the margins of the granite. The pink biotite granite and granite gneiss is repeatedly cut, in all directions, by narrow branching pegmatite and aplite dykes and quartz veins, varying in width from a few inches to several feet. The color of these granitic rocks, which varies from pink to grey, appears to depend on the composition of the most abundant feldspar present. The definite grey types of biotite granite and granite gneiss are rich in plagioclase feldspar namely albite and oligoclase, whereas, in the typical pink types, which are the most prevalent, potash feldspar predominates consisting of microcline mainly and subordinate amounts of orthoclase. In general, the rocks are medium to coarse in grain (averaging one and two-thirds mm in grain size), and light in color, weathering to a pink, pale reddish grey, or grey. Porphyritic textures are occasionally met with. The average composition, of thirty representative specimens collected by the author from various points throughout the area of the pink biotite granite and granite gneiss, and examined under the microscope, is feldspar 60%, quartz 35%, and biotite 5%. Potash and plagioclase feldspar are present in about equal amounts consisting of microcline 20-27%, orthoclase 5-10%, and albite and oligoclase 51-55%. Biotite is invariably present occasionally making up 25% of the rock composition. The amount of quartz present varies from 30-55%. A few grains of hornblende or augite are sometimes present. As accessory constituents, magnetite, sphère, zircon, and rarely graphite are present in small amounts. The common secondary alteration products are chlorite, sericite, and kaolinite.

not same  
not by composition  
of rocks.  
colour

how produced?

A dome-like intrusion of pink, biotite granite gneiss, six miles long east and west and two miles wide, borders 6th and 7th lakes in Saguenay, Dumas and Sagard townships, extending east from a point three miles west of 7th lake, in Sagard township, to the east edge of the map sheet in Saguenay township. It is flanked on the west by the north belt of paragneisses described above and, in addition, contains a number of prominent bands and numerous large inclusions of amphibolite. The direction of the foliation on the margins of the mass varies considerably and appears to correspond roughly with the borders of the intrusion. The rocks are exposed continuously on hills and ridges for considerable distances. The composition of the majority of the rocks included in this intrusion is fairly uniform, ranging from biotite granite gneiss rich in albite to a variety made up almost entirely of microcline and quartz. Contact facies of the granite and amphibolite are usually grey, contain a higher than average percentage of biotite, and are well foliated.

Part of

contact f.  
grey

A typical specimen of medium grained ( $1\frac{1}{2}$  mm) pink biotite granite gneiss, taken from the center of the dome-like mass directly west of 7th lake, in Sagard township, is seen under the microscope to

out  
of area  
pink

Quartz content seems to be too high

consist of biotite 5%, microcline 30%, albite 20% and quartz 45%. Another massive, coarse-grained (2-3 mm) specimen was collected half a mile to the south in Saguenay township. In thin section under the microscope it consists of biotite altering to chlorite 5%, albite altering to kaolinite 75%, microcline 2%, and quartz 16%. Small amounts of sphene, magnetite, and hematite are present as accessory constituents.

An occurrence on the east shore of Lac Trois Etages, in Saguenay township, which drains southeast into 7th lake, is typical of the coarse-grained (2-3 mm) pink biotite granite gneiss on the north border of the intrusion. Here, the foliation is practically east and west. A microscopic examination of this rock shows it to be composed of biotite altering to chlorite 5%, albite 35%, microcline 25%, and quartz 35%. A few grains of magnetite are also present.

pink.  
out of area

A specimen of medium-grained (1-2 mm) pink, biotite granite gneiss, taken on the northwest margin of the mass, in Dumas township, when examined under the microscope consists of biotite 5%, microcline 55%, and quartz 40%. The foliation here strikes about N 75° E. Another specimen of medium-grained (1-1½ mm), pink, biotite granite gneiss, collected at the west border of the intrusion, in Sagard township, one-fourth mile east of the band of paragneisses, is seen under the microscope to be made up of biotite 5%, albite 50%, and quartz 45%. A specimen of pink biotite granite gneiss, collected by the author, one-half mile west of 8th lake in the south border of the dome-like mass, consists of biotite 5%, microcline 30%, albite 20% and quartz 40%.

pink.  
OK

Another body of pink, biotite granite gneiss, similar in composition and texture to the above described dome-like intrusion, one and one-third miles long and about one mile wide, encircles Lac a David, on the Sagard-Dumas township line on the north boundary of the map area. It is separated from the main mass of granite gneiss to the east by the north belt of paragneisses and metasedimentary rocks which at this location strikes N 35-40° E. The rock outcrops in small scattered knolls, ridges and flat-lying ledges. A typical, medium-grained (2 mm) specimen of the rock, exposed on the west shore of Lac a David, is seen under the microscope to consist of biotite and hornblende 5%, feldspar 60%, and quartz 35%. The composition of the feldspar present is microcline chiefly, orthoclase, and microperthite with a very small amount of albite.

pink  
OK

A sill-like mass of medium grained massive red granite outcrop on the north and south shore of 7th lake, in Saguenay township, at the entrance to the deep southeast bay. Under the microscope it is found to consist of microcline mainly and orthoclase 60%, albite 10%, and quartz 30%. Magnetite and hematite are also present in small amounts.

not in area

A small body of medium grained (2 mm) grey, biotite granite gneiss is exposed near the contact of the pink, biotite granite gneiss and amphibolite on the northwest border of the intrusion, in Dumas

grey  
OK?  
small exp.

township. A microscopic examination of this rock shows that it is composed of biotite 15-20%, microcline 45%, and quartz 40%.

Another excellent exposure of coarse-grained (2-3 mm) grey, biotite granite gneiss representing a contact metamorphic phase of the granite occurs on the north shore of the deep southeast bay of the 7th lake. When examined under the microscope this rock is seen to consist of biotite 5%, albite 60%, microcline and orthoclase 10%, and quartz 25%. A few grains of augite and sphene are also present. The foliation strikes N 60° E and dips 30° to the north.

A small body of contact metamorphic grey, medium-grained (1-2 mm) biotite granite gneiss outcrops on the west shore of 8th lake, in Saguenay township, flanking the 8th lake belt of amphibolites to the east. Under the microscope this rock is found to be made of biotite 15-20%, microcline 50%, and quartz 35%. At this location the foliation strikes N 45° E and dips 55° to the southeast.

Another large mass of pink, biotite granite gneiss, two miles long and one and one-third miles wide, trending northeast, which appears to be an outlier of the 7th lake intrusion, lies in the creek valley between 8th and 9th lakes in the southwest corner of Saguenay township. The rocks of this mass, in the form of small, low lying ridges and "roche moutonnee" surfaces, are well exposed on the south shore of 8th lake; along the creek draining 9th lake into 8th lake; and on the north shore of 9th lake. A typical specimen of medium grained pink, biotite granite gneiss was taken on the south shore of 8th lake directly west of the creek entrance from 9th lake. When examined under the microscope it is seen to consist of biotite altering to chlorite 5%, microcline 40%, albite 20%, and quartz 35%. Small "roche moutonnee" ridges of massive, coarse-grained (2-3 mm) pink, biotite granite outcrop along the creek north of 9th lake for a distance of three-fourths of a mile. Under the microscope these rocks are found to be composed of biotite altering to chlorite 3%, microcline 40%, oligoclase 20%, and quartz 35%. A specimen of medium grained pink, biotite granite gneiss was collected, by the author, on the north shore of 9th lake, one-fourth mile east of the creek. A microscopic examination of this rock showed it to consist of biotite 10%, microcline 70%, and quartz 20%.

An elliptical stock of medium-grained (1-2 mm) pink, biotite granite, gneiss, three miles long north and south and two miles wide, lies between 9th lake and Lac Port aux Quilles in Callieres township, extending east from the valley of 8th and 9th lakes to Long lac. This dome-shaped mass rises gradually from north to south, attaining a maximum elevation of about 1100 feet above the water level in 9th lake, at a point one mile east of Lac Port aux Quilles, then descends abruptly, in a series of steep cliffs, southwest to Lac Port aux Quilles where it is flanked by a belt of amphibolites intruded by large quartz bodies. A typical specimen of the rock taken one-half mile northwest of Antonin lake in the northern part of the intrusion, is seen in thin section under the microscope to consist of biotite 10%, orthoclase 25%, microcline 5%, albite 35%, and quartz 25%. A few grains of magnetite are also present. Another specimen of well foliated pink, biotite granite gneiss was collected on the south border of the mass, one-fourth mile east of the belt of amphibolites. Under the microscope it is found to consist of biotite 20-25%, microcline 45%, and quartz 30-35%. The foliation strikes S 30° E, paralleling that of the

high?  
not high

not  
grey on

is this?  
sp. 261?  
possibly  
226

OK

OK

amphibolites.

A small boss of fine to medium-grained ( $\frac{1}{8}$ -1 mm) massive pink biotite granite, about one mile in diameter, occurs in range III northeast, and adjoining range IV, Callierges township, bordered on the north Lac de l'Ecluse, on the west by Long Lac and on the south by Lac de la Baie des Rochers, in the southeast corner of the map-area. The microscope shows that the rock is composed of biotite, greatly altered to chlorite, 5%, microcline 45%, and quartz 55%. A few grains of plagioclase feldspar and magnetite are also present.

A large area of coarse-grained (2 mm) grey, biotite granite gneiss, about two miles east of 8th lake, in Saguenay township, extending southward, from the southeast shore of the deep southeast bay of 7th lake, to Lake Traverse. The rock is exposed in low hills, relatively flat ridges, and "roche moutonnée" ledges in gently rolling brule moraine, regularly broken by abrupt-walled, narrow, N-S valleys and ravines containing small lakes and streams draining to the north. The strike of the foliation varies from N 20° E in the south portion of the mass to N 35° E in the north, paralleling roughly a zone of weakness northeast through 8th lake and the southeast bay of 7th lake. A typical specimen of the rock was taken one-half mile west of Lac Traverse. In thin section under the microscope it consists of biotite 5-10%, orthoclase 25%, albite 35%, and quartz 25%. A small amount of magnetite is present as an accessory constituent.

#### MISCELLANEOUS INTRUSIVES

##### Basic Dykes

A number of basic igneous intrusions in the form of dykes and lenticular masses cut the granite and gneiss at several localities in the map-area. Characteristically they are narrow and of small linear extent. Occasionally they are mineralized. In general, their composition approximates closely that of a hornblende diorite or gabbro. They are usually coarse-grained, massive rocks which differ from the amphibolites in the absence of a prevailing foliated structure. One or two occurrences of these rocks may be taken as representative of this class of intrusion observed in the area.

A coarse-grained (5mm) hypersthene gabbro dyke, 60 feet wide, striking N 25° E, cutting well banded biotite hornblende gneiss, is exposed for a length of several hundred feet on the west edge of the mass of metamorphosed sediments west of 7th lake. A typical specimen of this rock is seen under the microscope to consist of hornblende and hypersthene mainly and plagioclase feldspar.

A narrow dyke of massive, coarse-grained ( $\frac{1}{2}$  inch) pyroxenite, ten feet wide and fifty feet long, cutting a band of amphibolites, outcrops at the rapid on the west shore of the outlet of 6th lake, on the east edge of the map-sheet, in Saguenay township. It strikes N 60° W, paralleling the foliation of the amphibolites, and is flanked on the south by a pegmatite dyke fifty feet wide and 100 feet long. When examined under the microscope, the rock consists essentially of hypersthene with subordinate amounts of uralitic hornblende. A small amount of magnetite is also present.

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## PEGMATITE AND APLITE DYKES

Pegmatite and aplite dykes, representing volatile-rich products, of a solidifying granitic magma, which have been injected into the solidified and cracked margins of the granites and granite gneisses and into the surrounding metasedimentary rocks, occur in all parts of the area under consideration.

In the region east of the valley of Lake Deschenes and the Petit-Saguenay river, in the central part of the map area, granite pegmatites, consisting of feldspar and quartz, with mica, are abundant. These coarse-textured facies of granite in the form of irregularly-shaped bodies, lenses, sheets, dykes and veins which, although found traversing every other rock type in the area, preferred to advance through metasedimentary rather than igneous rocks are thus especially prevalent in the paragneisses on the margins of the intrusives. Consequently, in the two prominent bands of metasedimentary rocks, which lie between large bodies of garnetiferous biotite gneiss on the west and pink, biotite granite and granite gneiss on the east, in the central part of the map sheet, pegmatite dykes abound. In addition, in the dome-like intrusions and sill-like masses of granite and granite-gneiss themselves, pegmatite and aplite dykes are usually present, particularly in zones of rupture cementing the dislocations, fractures, cracks, and fissures of the rock.

The larger masses and dykes of pegmatite are usually parallel and follow the foliation of the schists and gneisses, however, many of the small dykes and veins cut across the structure of the enclosing rocks. They are much more resistant to erosion than the enclosing rocks and project fifty to one hundred feet above the surface, forming some of the most prominent hills and ridges in the area. Some of the pegmatites are foliated but most of them are quite massive. The very large masses and dykes tend to preserve uniformly throughout their extent the exceptionally coarse grain of true pegmatites except at the fine-grained chilled margins. In the smaller sheets, dykes, and veins the structure is more irregular and coarse textures of variably grain size, often with marked intergrowth structures of quartz and feldspar are more common.

The pegmatites vary greatly in thickness from mere strings an inch or less in width up to great dykes several hundred feet across. In the central part of the area they attain a maximum width of 600 feet and lengths up to 3000 feet. The average width of the large dykes is 200 feet.

In general, the pegmatites are composed mainly of alkali feldspar and quartz but may also be rich in muscovite and biotite and contain apatite, magnetite, garnet, and compounds of the rare elements. The usual iron-magnesium constituents present are biotite and magnetite. As a rule, feldspar predominates over the quartz. In some cases, it almost disappears and the dyke develops into a mass of quartz. Ordinarily, the quartz masses and veins are younger and cut the pegmatites.

The pegmatites may be divided into two general types. A white, weathered, muscovite-bearing, pegmatite in which two feldspars,

microcline and albite or oligoclase are practically always present, and a pink pegmatite rich in potash feldspar and usually exhibiting in a very striking manner graphic granite intergrowths of quartz and feldspar. The white type occurs almost invariably in the paragneisses and metasedimentary rocks, whereas, the pink type is characteristically associated with the granitic rocks of the area.

The white pegmatite is generally massive and coarse-textured averaging 2 cm. in grain size. Examination under the microscope of six representative specimens of muscovite-bearing, white pegmatite shows it to consist essentially of microcline principally, in individuals up to four inches in diameter, quartz, attaining a diameter of two and one-half inches, albite, and muscovite. Biotite, in "books" up to one and one-half inches square, is not uncommon. Small amounts of oligoclase-albite and oligoclase mainly, microperthite, and a few grains of orthoclase are also present. Under the microscope, the feldspars frequently show excellent microperthitic intergrowths of albite and microcline and orthoclase and albite. As accessory constituents garnet occurs frequently, in individuals up to 5 mm. in diameter, and magnetite, attaining a diameter of one inch is occasionally present.

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The pink pegmatite is usually massive, averaging two-thirds of an inch in grain size, and characterized by well developed graphic granite structures. Four representative specimens when examined under the microscope are seen to be composed essentially of microcline, up to two inches in diameter, chiefly, vitreous quartz and biotite. Microperthite and orthoclase are also occasionally present. Muscovite is absent. The typical graphic texture displayed by this type of pegmatite is the result of the intergrowth of microcline and quartz; the quartz, in stringers one-sixteenth - one-eighth inch in width, surrounding apparently disconnected patches of the feldspar.

#### WHITE PEGMATITE

Several large bodies of white pegmatite outcrop directly east and west of Lac a la Roche, on the Callieres-Chauveau township line, two miles west of 9th lake. These lenticular masses and associated parallel dykes occur cutting, at a small angle, the micaceous gneisses and schists of the south belt of paragneisses and metasedimentary rocks, striking slightly west of north. The schists and gneisses on the borders of the intrusives are usually very siliceous and have been injected, parallel to the schistosity, by numerous small pegmatite veins and stringers a few inches in width. The largest pegmatite body, exposed near the east shore of Lac a la Roche, is 3000 feet long and 250 feet wide. It contains several rich pockets of good quality "ruby" muscovite mica in "books" up to four inches in diameter averaging one inch in thickness. Exploration of the mass has been carried out at a dozen or more points by means of prospect pits, several of which exceed twenty-five feet in diameter.

The large pegmatite dyke west of Lac a la Roche, striking north and south is 1000 feet long and 300 feet wide (Photo Lac a la Roche). It lies on the west contact of the metasedimentary band with granitic rocks and is thus flanked on the east by micaceous schists and on the west by garnetiferous biotite gneiss. Biotite "books" up to one inch in diameter occur at a number of locations in the dyke. No muscovite was observed.

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A number of large dykes and lenticular masses of white pegmatite occur intruding the sedimentary gneisses and schists at the south end of the north band of paragneisses and metasedimentary rocks, one-half mile west of the south end of 8th lake, in Sagard township. The majority of these pegmatite bodies invade the micaceous schists and gneisses parallel to the schistosity, striking northwest. They vary greatly in size from large lens-shaped masses, 1500 feet long and 250 feet wide, to narrow dykes a few feet in width. They are invariably accompanied by small aplite dykes and quartz stringers. The larger bodies often wedge out suddenly reappearing at some distance along the strike. OK

The northernmost lenticular mass of this group is 1200 feet long and 360 feet wide, striking N 50° W, parallel to the schistosity of the enclosing biotite schist and gneiss. In the hand specimen, the rock is seen to consist essentially of a coarse, graphic intergrowth of white feldspar and vitreous quartz. The feldspar, occurring as irregular blebs and patches up to one inch in diameter, is intergrown with quartz in stringers one-fourth of an inch in width. A small amount of muscovite and biotite, in irregularly disseminated bunches of foils or "books" averaging one-half inch in diameter, is also present. In thin section under the microscope, the feldspar is seen to be composed of microcline mainly, with subordinate amounts of albite and microperthite. Garnets, one-fourth of an inch in diameter, occur sparingly as an accessory constituent.

Another large, wedge-shaped body of white pegmatite, 500 feet long east and west and 250 feet wide, outcrops one-half mile southeast of the northernmost mass, cutting rusty, muscovite-biotite-sillimanite schists striking northwest. The microscope shows that it is made up of microcline chiefly, in individuals up to one inch in diameter, and white quartz. Muscovite and biotite "books" one-half inch in diameter are sparsely disseminated through the rock. Several small concentrations of "ruby" muscovite mica in the pegmatite have been opened up by means of shallow prospect pits and excavations, the largest of which is located at the extreme west ledge of the mass (Photo 5902). At this point, highly contorted rusty, micaceous schists, cut by several narrow pegmatite dykes a few inches in width, outcropping on the east wall of a steep-sided north-south gorge, are exposed in a deep trench, 100 feet long north and south and 30 feet wide. Good quality "ruby" muscovite "books", averaging one inch in diameter, are present in the dykes in negligible quantities. SP-12A

Three long, narrow parallel dykes of white pegmatite, 600 feet apart, striking northeast, intruding muscovite-biotite-sillimanite schists, of the north belt of paragneisses, parallel to the schistosity, occur as steep-sided ridges one-half mile east of lac a David. The western dyke is 1200 feet long and 150 feet wide. The other two are both 900 feet long and 60 feet wide. The associated schists, striking N 40 - 50° E and dipping 70° to the southeast, are cut by numerous small pegmatite veins and stringers branching off from the main dykes, and injected by quartz veinlets. The western dyke is cut off abruptly at the north end by a cliff rising 150 feet above the water in a small lake draining to the east. At the south end it splits into three dykes separated by rusty, micaceous schists. It consists essentially of white feldspar, three-four inches in diameter, quartz, and muscovite in individuals one-fourth - one-half inch in diameter. Some black rounded nodules of the rare uranium compound "thucholite" are also present. "Ruby" muscovite mica "books", one inch in diameter, across a width of one foot, are exposed in several shallow pits at the north not  
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end of the dyke. The composition of the two smaller dykes is practically the same as the western dyke but no concentrations of muscovite were observed in them. In thin section under the microscope the rock consists of microcline and quartz mainly, and a subordinate amount of albite and muscovite. A small quantity of garnet, in grains up to 4 mm. in diameter, is also present.

A small dyke of white pegmatite, fifty feet wide and exposed over a length of 155 feet disappearing in drift, outcrops 2000 feet east of lot 28, range III, in the southeast quarter of Sagard township. The dyke, striking N 35° W, intrudes coarse-grained, rusty, muscovite-biotite gneisses and schists which have been considerably injected by quartz and are characterized by the presence of large porphyroblasts of bleached mica, up to one inch in length. "Ruby" muscovite mica, in "books" up to one inch in diameter, are irregularly distributed through the dyke. A number of large feldspar crystals four-six inches in length were also observed. When examined under the microscope, the rock is seen to consist of albite principally, and white quartz, with minor amounts of microcline and muscovite.

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Another small pegmatite dyke, twenty-five feet long and five feet wide as exposed, outcrops one mile southeast of the above occurrence in the southeast corner of Sagard township. It strikes N 60° W, cutting quartz-injected, rusty micaceous schists and gneisses, striking N 30° W, at the north end of the south belt of paragneisses and metasedimentary rocks. A small amount of "ruby" muscovite mica in "books" up to three-fourths inch in diameter is disseminated through the rock. Quartz crystals, up to two and one-half inches in diameter, are also present in the dyke. Under the microscope, the rock is seen to be composed of microcline chiefly, in individuals up to one inch in diameter, and white quartz, with muscovite.

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An occurrence of white pegmatite, which appears to be oval-shaped, is exposed, at intervals for 450 feet east and west and 350 feet north and south, directly east of lot 11, range III, Sagard township, on the farm of Charles Mailoux, near St. Isidore. It cuts highly disturbed, fine-grained (1 mm), rusty micaceous schists, containing porphyroblasts of bleached mica one-fourth inch in diameter, which strike N 40° - 80° E and dip 30° - 50° to the south. The dyke consists essentially of white feldspar, two-four inches in diameter, quartz averaging one inch in diameter, and biotite and muscovite in books two-three inches across. A small amount of garnet is usually present as an accessory constituent. Several small pockets of good quality "ruby" muscovite mica, in "books" up to three inches in diameter, occur in the pegmatite. These were being explored during the field season by means of shallow prospect pits by Jean Tremblay of St. Simeon.

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A number of fairly large white pegmatite dykes and irregular masses also occur cutting the granitic rocks of the area. For the most part they are biotite-bearing and contain no muscovite. A white, biotite-bearing, pegmatite dyke, 650 feet long and 50 feet wide, cutting garnetiferous biotite gneiss is exposed in a high prominent ridge three-fourths mile west of Lac Port aux Quilles in Callières township, on the south border of the map sheet. It strikes N 20° W, roughly parallel to the schistosity of the metasedimentary rocks and

the metasedimentary-garnet-gneiss contact 200 feet to the east. Under the microscope the pegmatite is found to consist of oligoclase and quartz principally with a small amount of biotite, in "books" up to one inch in diameter. A small quantity of garnet is also present.

#### PINK PEGMATITE

A large pink pegmatite dyke, 800 feet long east and west and 300 feet wide, cutting grey biotite granite gneiss, outcrops one and one-half miles north of the outlet of 6th lake, in Saguenay township, in the northeast corner of the map-sheet. It consists of a graphic intergrowth of microcline, in individuals one-two inches in diameter, and vitreous quartz, in strings one-sixteenth inch in width.

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Another large pink pegmatite dyke, 800 feet long and 250 feet wide, striking slightly north of west, cuts grey biotite granite gneiss about one mile northeast of 9th lake, in Saguenay township. A microscopic examination of this pegmatite shows that it consist essentially of microcline, in crystals up to three inches in diameter, and quartz. A few crystals of microparthritis are also present.

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A narrow, pink pegmatite dyke, twenty feet wide and seventy-five feet long, is exposed, cutting garnetiferous biotite gneiss, 1000 feet northwest of Lac Cross, in Calliores township, on the south edge of the map-sheet. It strikes N 37° W and dips 50° to the east, parallel to the direction of foliation of the gneiss. It consists of a graphic intergrowth of microcline, in individuals up to two inches in diameter, and vitreous quartz, in stringers three-eighths inch in width. A small amount of biotite, in "books" one inch in diameter, is usually present in the dyke.

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A small pink pegmatite dyke, 100 feet wide and 115 feet long, striking N 30° E, outcrops three-fourths mile northeast of Lac a la David, in Dumas township, on the north boundary of the map-sheet. It is exposed cutting fine grained ( $\frac{1}{2}$  mm) biotite schists and gneisses striking N 45° E and dipping 55° to the northwest. The pegmatite consists of a graphic intergrowth of microcline, orthoclase, and vitreous quartz, in stringers one-sixteenth - one-eighth inch in width. A very small amount of albite is also present.

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A number of small-dykes and irregular masses of pink pegmatite, cutting foliated pink biotite granite, are exposed on the west shore at the north end of 8th lake, near the cecuse, in Saguenay township. A typical specimen of the pegmatite consists of a graphic intergrowth of microcline, in crystals three-eighths inch in diameter, and vitreous quartz, in stringers one-eighth inch in width, with minor amounts of biotite. Feldspar crystals four - six inches in diameter are present in some of the dykes.

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#### APLITE

Generally speaking, the aplite intrusions are restricted to areas of the granite and granite gneiss and are not abundant in the amphibolites, paragneisses, and metasedimentary rocks. They contain volatile constituents

in small amounts only and are thus less mobile than the pegmatites and have sharp contacts with the rocks they cut. They occur mainly as narrow dykes, thin veins, and small lenses traversing the granitic rocks. Occasionally they may form intrusions of considerable size.

The aplites are fine-grained (averaging 1 mm. in grain size), equigranular rocks of allotriomorphic texture usually pink in color weathering pinkish grey to white. The average composition is microcline 55%, quartz 40%. Albite, in small amounts up to 25%, is usually present, oligoclase is occasionally met with. Ferromagnesium silicates are either absent or present in very small amounts consisting of biotite altering to chlorite. A few grains of magnetite generally make up the remainder of the composition of the rock.

Several small masses of aplite, 50-100 feet in diameter, occur approximately one-half mile west of the south bay of 8th lake, in Saguenay township. The southernmost mass, located one-half mile west of the portage to 9th lake creek, is a fine-grained ( $\frac{1}{2}$  mm), pink massive rock. In thin section under the microscope it is seen to consist essentially of microcline 65% and quartz 35%. A few grains of albite, biotite, and magnetite are also present. ?

A small body of aplite, twenty-five feet in diameter, outcrops on the Saguenay-Callieres township line, one mile west of the outlet of 9th lake. A microscope examination shows it is composed essentially of equidimensional, anhedral crystals of microcline, albite, and quartz and a few laths of chloritized biotite. ot

A considerable number of fine-grained, narrow, aplite dykes and veins, striking N 45° W, cementing fractures on the west margin of the pink biotite granite gneiss east of Lac Port aux Quilles, are exposed one mile northeast of the north end of the lake, in Callieres township. Under the microscope they are seen to consist essentially of microcline 60%, quartz 35%, and chloritized biotite 5%. A small amount of magnetite is also present.

#### Quartz Masses and Veins

In addition to quartz being present as the principal ingredient in the quartzites and siliceous schists of the Grenville Series, it also occurs in the area as large irregular masses and veins cutting all the other rocks. Quartz veins are numerous within the granite areas, whereas, the large masses invariably occur in the older rocks near the granite contacts.

In the pegmatites, quartz may predominate over feldspar outward from the parent mass and the dyke thus develops into a body of quartz. In these cases, the quartz veins are merely a form or phase of the pegmatite dykes. In the area under consideration, most of the quartz veins are later than the pegmatites and cut them. They are usually white in color, occasionally grey or smoky. The larger masses, which are usually exceptionally pure, are white, and rose tinted due to the presence of minute specks of red oxide of iron.

Three exceptionally large masses of white quartz occur in cliffs on the east and west shores of Lac Port aux Quilles, in Callieres township. The largest mass, 3000 feet in diameter, trending N 40° W parallel

to the banding and schistosity of the enclosing Grenville rocks, rises abruptly, from the middle of the east shore of Lac Port aux Quilles, 450 feet above the level of the water in the lake. It is flanked on the east by a band of amphibolites 300 feet wide and on the west by paragneisses and metasedimentary rocks 600 feet wide (Photo 5900). Several narrow, white, biotite-bearing pegmatite dykes, striking northwest, occur cutting contorted rusty micaceous schists on the south edge of the mass. The quartz has a vitreous, barren quality with rose tints due to included small specks of red iron oxide.

A second, similar mass of quartz, 1500 feet long east and west and 900 feet wide, cutting amphibolites, is exposed in cliffs rising 800 feet above the lake, 1000 feet northwest of the first. It is closely associated on the west edge with a body of coarse red pegmatite, 550 feet long and 300 feet wide, trending northwest.

Another large mass of milky quartz, 1200 feet long and 600 feet wide, trending N 65° W, outcrops on the west shore of Lac Port aux Quilles, rising 500 feet above the lake, due west of the east shore occurrences. (Photo 5898) It cuts rusty, micaceous and highly siliceous injected schists striking northwest and dipping to the northeast. A number of small white, pegmatite dykes, intruding the schists parallel to the schistosity, are closely associated with the quartz body.

A prominent ridge of quartz, 1800 feet long and 350 feet wide, trending N 10° W, cutting metasedimentary rocks, occurs two-thirds mile west of the south end of 8th lake in the Sagard-Saguenay township line. The quartz is the same massive, vitreous, rose-tinted white variety as that comprising the Lac Port aux Quilles masses. The country rock in the immediate vicinity of the mass has been considerably injected by quartz veins and stringers, consequently the composition of the schists and gneisses is high in silica content.

Several smaller masses of quartz, the largest of which is 300 feet long and 75 feet wide, intrude the south band of paragneisses and metasedimentary rocks, parallel to the schistosity, at a number of locations. Some of the adjoining schists and gneisses are highly siliceous.

In general, the foliated rocks intimately associated with the quartz and pegmatite intrusions contain considerable quartz and, in some cases, resemble closely fine-grained quartzites.

#### Unconsolidated Deposits

Erosion within the area has been influenced considerably by the nature of the bedrock. Areas of granite, pegmatite, and quartz are more resistant to weathering than those underlain by the highly foliated schists and gneisses and, therefore, tend to form the prominent topographical features of the district. They are generally exposed as bare, wind-swept, steep-sided hills and ridges projecting high above the softer paragneisses, metasedimentary rocks, and amphibolites which occur at lower elevations and are largely obscured by deep overburden.

The original drainage system of the area has been modified considerably by deposits of unstratified drift damming streams to form lakes, marshes and muskogs with waterfalls, cascades, and stony rapids.

Morainal material consisting of typical boulder clay derived from crystalline rocks similar to the surrounding rock-masses occurs in the valley of the Deschenes and Petit-Saguenay rivers and in the drainage basin of 6th, 7th, 8th and 9th Lakes in the eastern section of the map area. Post-glacial lake deposits such as bedded clays and silts are absent.

Deposits of sand and gravel of both Pleistocene and Recent age occur around the margins of the lakes and on hills in many parts of the area. The shores of the lakes are often steep and rock cliffs, 25-50 feet high, border many of the lake basins. A few small esker ridges are present in the valley of the Deschenes and Petit-Saguenay rivers. Ground moraines are general and quite extensive.

Well developed alluvial river terraces occur along the banks of the Deschenes and Petit-Saguenay rivers. Two sand terraces, 90 and 120 feet above the road, occur east of route 16, in lot 17, range II, Sagard township. West of the Petit-Saguenay, in lot 22, range I, Sagard township, a sand terrace occurs 125 feet above the river level. Further south in lot 25, range I, Sagard township, another sand terrace occurs 180 feet above the river. East of the sand terraces the country rises gradually in a series of morainal slopes to the top of the ridge separating the valley from the lake basin to the east.

The large talus slopes commonly occurring at the foot of the cliffs are composed of huge blocks of rock which have spalled off the cliffs mainly as a result of frost action.

#### Structure

The rocks of the Grenville Series are apparently tightly folded and contain abundant intrusives. They are thus characterized by bands consisting of numerous intrusives separated by narrow layers or inclusions of metasedimentary rocks.

The principal development of these rocks is in the central part of the map area where they form two roughly parallel north and south bands striking northwest. The northern band forms an arc whose convexity is to the west, on the west flank of the 7th Lake, dome-like intrusion of pink, biotite granite and granite gneiss. The north band may be either the faulted offset of the southern band, as already stated, or they may be two separate, distinct bands which have been split by the granitic intrusions. Direct evidence of a fault corresponding with the 8th Lake depression, which would substantiate the former hypothesis, is lacking on account of the absence of outcrops southwest of the lake. The dip of the rocks in the north belt is steep varying from 50° SW to 65° NE. At the south end of the south belt the dip is more gentle, averaging 40° to the northeast. The rocks of these belts of paragneisses and metamorphosed sediments are occasionally highly contorted and drag-folded. The attitude and direction of the drag-folded bands indicate that they are on the west limb of a syncline whose axis, striking northwest, lies to the east. The prevailing structure appears to be that which would result from the intrusion of a band of sedimentary rocks by large

masses of granite; the granite arching up, invading, and disintegrating the sedimentary series into narrow belts, bands, and isolated remnants of the original rock.

Bands of amphibolites, with the exception of the 7th Lake mass, generally occupy narrow depressions corresponding to faults or zones of weakness or occur on the margins of the major intrusives closely associated with the paragneisses and metasedimentary rocks. In the latter case, their strike parallels the outline and foliation of the borders of the granitic masses. They are of no commercial importance.

Because the majority of the large pegmatite masses and dykes invade the Grenville rather than the igneous rocks of the area, they are confined largely to the paragneisses and metasedimentary rocks and in most cases intrude them parallel to the schistosity. Minor dykes and branches of the larger ones frequently cut across the structure of the enclosing rock. In a number of cases, narrow offshoots of the main dykes, in the Grenville rocks, contain the richer deposits of commercial mica. Pegmatite dykes cutting garnetiferous biotite gneiss and other granitic rocks do not carry muscovite mica of economic value.

## ECONOMIC GEOLOGY

### General Statement

The known mineral deposits of Charlevoix County, where the map area is located, are practically all non-metallics and their extent is very limited. In Cote de Beauport Seigniory, small amounts of allanite, barite, fluorspar, galena, graphite, ilmenite, iron sands, marble, rutile, and sapphirine are found. Baie St. Paul, Les Eboulements and Murray Bay are noted for their mineral waters. St. Urbain and Du Gouffre Seigniory have deposits of ilmenite, titaniferous magnetite, and rutile. Small deposits of feldspar, garnet, muscovite, uraninite and radioactive minerals occur at Lacoste. Galena and garnet occur at St. Irene. Sandstone and limestone outcrop at La Malbaie and Cap a l'Aigle. Muscovite is quarried near St. Agnes. Sphalerite has been observed near St. Arsil and "rock crystal" at Baie St. Catherine.

### Mica

The only material of present economic value observed in the map area is "ruby" muscovite mica and its scope is not large. Exploration work and mining operations have been carried out on several small pegmatite deposits in the central part of the area. These properties were inactive at the time the field work for this report was completed. A brief description of several of the largest of these muscovite mica deposits in the area follows.

Statistics indicate that muscovite mica was first exploited, in the area, at the French Mine, west of 8th Lake, in Sagard township, in 1911. Another deposit of mica, staked by Eudore Racine in 1931, occurs one-half mile east of Lac à David near the Sagard-Dumas township line, in the north part of Sagard township. A number of rich pockets of good quality muscovite mica on the Imbeault property east of Lac a La Roche, adjacent to the Chauveau-Callieres township line in the northwest quarter of Callieres township, have been worked by Joe Kelly, of St. Agnes, in recent years. In the spring of 1943, a discovery of a small pocket of muscovite mica was made one and one-fourth miles southwest of Lac a La David, on the farm of Charles Mailloux, in the north part of the Sagard township, by

Jean Tremblay of St. Simeon. Exploration work on this property is being continued.

The mica deposits occur in large masses, dykes, and veins of white pegmatite cutting the paragneisses and metasedimentary rocks of the area. The pegmatites are very coarse-grained facies of granite in which biotite is the principal ferro-magnesium silicate present. These granite pegmatites are the commercial source of the potash variety muscovite, or white mica. Some of the individual crystals of muscovite mica are quite large, attaining a diameter of four inches and a length of two inches. In general, muscovite is less abundant in the pegmatites than biotite but it is usually of good quality. The deposits are very irregular and ore reserves cannot be blocked out easily. Accordingly, simple mining methods are followed which make it possible to abandon one deposit for another when it shows signs of depletion.

The muscovite mica occurring in the area is known as the "ruby" variety because of its beautiful ruby red color in thick plates (1 mm). In thin foils ( $\frac{1}{8}$  mm) it is pale brownish in color and very stiff with a hard brittle appearance. It can be split to one-thousandth of an inch, without the foils breaking up, and used in the manufacture of electrical condensers. Because it is highly refractory, chemically stable, and an excellent insulator it has many important uses in the arts, especially in the electrical industry. Muscovite unsuited for electrical applications because of impurities of iron, and trimmings, are ground for use in the manufacture of roofing, lubricants, tires and decorative materials.

#### Deposits

**Inbeault Mine:** This mine is the property of A. Inbeault, proprietor of Hotel Le Montagne, at St. Simeon. It is situated in the northwest quarter of Callieres township on Lac à la Roche. Several large masses of white pegmatite cutting rusty, micaceous schists and gneisses of the Grenville Series, striking N 30-40° W, outcrop on the property. A large white pegmatite mass, 3000 feet long north and south and 250 feet wide, outcropping directly east of the lake, has been explored for mica by means of prospect pits and trenches.

**Pit No. 1,** near the south end of the dyke, is five by ten feet and ten feet deep (Photo No. 1). The pegmatite, consisting of white feldspar, quartz, and muscovite, with sparse garnets, cuts micaceous schists striking N 30° W. "Ruby" muscovite mica occurs in one by two inch "books".

**Pit No. 2,** 500 feet north of No. 1, is a trench twelve feet wide and twenty-five feet deep driven west into the east edge of the pegmatite for a distance of thirty-five feet (Photo 5897). Muscovite "books", two by three inches, are plentiful on the dump but the mica pocket from which they came appears to have petered out at the end of the trench.

**Pit No. 3,** 720 feet north of No. 2, on the west edge of the pegmatite mass, measures twenty by thirty feet (Photo 5904). The pegmatite, cutting garnetiferous, amphibolite schists striking N 10° E, contains four inch muscovite "books" one inch thick and biotite "books" three inches across.

Pit No. 4, 480 feet north of No. 3, also on the west edge, measures forty by forty feet (Photo No. 3). White pegmatite, consisting of feldspar, quartz, and muscovite and biotite, in one-inch "books", cutting micaceous schists striking north and dipping 75° east, is exposed across the width of the pit.

Jean Tremblay Claims: This property, located in lots 9 and 10, ranges II and III, Sagard township, consists of five, forty acre claims, approximately 200 acres. It was staked on June 23, 1914, by the three Tremblay brothers, Eugene, George Henri, and John under mining license numbers 6352, 6353, and 6351 respectively. Small masses of white pegmatite cutting disturbed, rusty, micaceous schists, are exposed at a number of points within an area 400 feet in diameter. A small quantity of commercial mica, in "books" up to three inches in diameter, is exposed in several prospect pits in the pegmatite. The exploration work is in charge of Jean Tremblay of St. Simeon.

- END -

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