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PRELIMINARY REPORT, GEOLOGY OF MONT VALLIERES-DE-ST-REAL AREA, GASPE-NORTH COUNTY

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Énergie et Ressources naturelles
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P.R. NO. 549

DEPARTMENT OF NATURAL RESOURCES

Honorable GASTON BINETTE
minister

PAUL-EMILE AUGER
deputy-minister

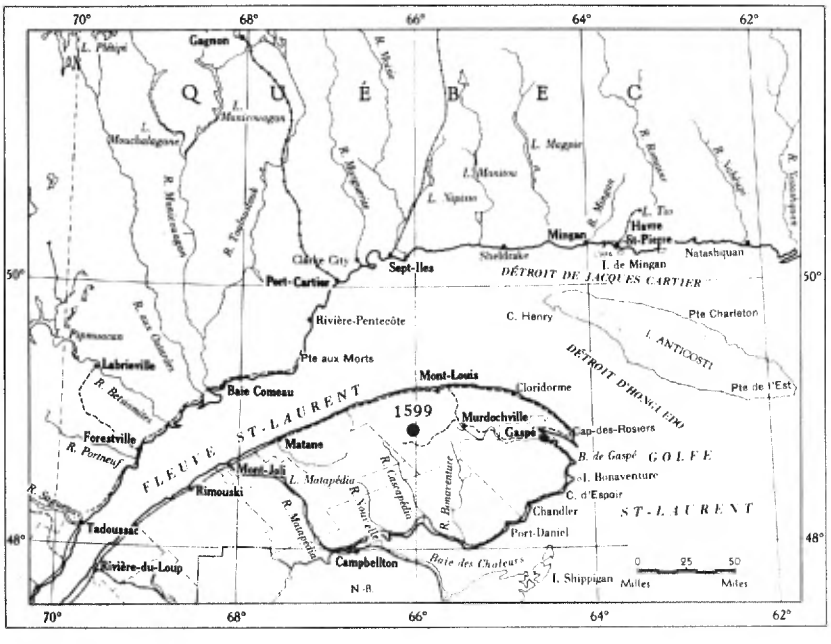
Geology
of
MOUNT VALLIÈRES-DE-SAINT-RÉAL AREA

GASPÉ-NORTH COUNTY

PRELIMINARY REPORT

by

Jean-Louis Robert



QUEBEC

1966

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ERRATA

P. 5 - Delete horizontal line under "Grande Grève Formation" and over "White orthoquartzite".

P. 8 - 2nd paragraph, 5th and 6th lines - Enter "Grande Grève" for "Cape Bon Ami".

P. 18- 2nd paragraph, subdivision 3 - Replace "noses" with "the apices".

P.R. NO. 549

QUEBEC DEPARTMENT OF NATURAL RESOURCES

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PAUL-EMILE AUGER
Deputy Minister

MINERAL DEPOSITS BRANCH
R. ASSAD, Director

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GASPÉ-NORTH COUNTY

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Preliminary Report

on

Mount Vallières-de-Saint-Réal Area

by

Jean-Louis Robert*

INTRODUCTION

The geological work done during the 1964 field season is a continuation of a detailed geological mapping program inaugurated during the preceding summer in the Mount Hog's Back area. The Mount Vallières-de-Saint-Réal map-area is directly east of the Mount Hog's Back area and is within Gaspé Provincial Park. The opening of the park to prospecting, in November, 1963, caused a staking rush, which affected the present area.

The Mount Vallières-de-Saint-Réal area covers 35 square miles in Lesseps and Lemieux townships. It is bounded by latitudes 48°54' and 48°47' and by longitudes 66°00' and 66°06'. The Lesseps-Lemieux township line crosses diagonally the south half of the area.

The Trans-Gaspesian highway, linking Sainte-Anne-des-Monts, on the north shore of Gaspé peninsula, with Grande-Cascapédia, on Chaleurs bay, follows the western limit of the area. Its northern limit is 25 miles from Sainte-Anne-des-Monts and 5 miles from the "Gîte" at Mount Albert. The highway along Sainte-Anne lake that branches off from the Trans-Gaspesian highway in the southern part of the area leads to Murdochville,

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* Translated from the French.

40 miles farther east. Cottages built by the Provincial government on the north shore of Sainte-Anne lake are 3.6 miles from the junction of these two highways.

An automobile road, in addition to numerous forestry roads, gives access to the northern part of the territory. One of them, the Lepage road, branches off from the Trans-Gaspesian highway 4,800 feet south of Isabelle brook and leads to Madeleine river at a point just above the mouth of Pékans river.

The old Bélanger road, passable by jeep for its first two miles, is the only trail giving access to the interior of the territory. Its junction with the Murdochville highway is 400 feet northeast of the bridge crossing Sainte-Anne lake. This road skirts Mount Vallières-de-Saint-Réal on its west side, turns northward a short distance south of Pékans river and then turns eastward.

The topography of the area is very rugged and is a good reflection of the diversified lithologic nature of the bedrock. The mountain in the northeast corner of the area belongs to the McGerrigle (Tabletop) chain. Its 3,750-foot summit is the highest point in the area, whereas Sainte-Anne river, with an altitude of 950 feet at the same latitude as the mountain, represents the lowest level. The maximum local drop is 1,750 feet.

Waters of the area flow into St. Lawrence river and Chaleurs bay. The height of land follows the crests of hills in the eastern part of the area. Sainte-Anne river, along the western limit of the area, and Pékans river, in the northeast corner, drain part of the waters into the St. Lawrence; Lesseps brook drains into Chaleurs bay through the Petite Cascapédia river.

For the present work, a base-map drawn to the scale of one inch to 500 feet and aerial photographs at the scale of one inch to 1,320 feet were used. The numerous lines, at 400-foot intervals, cleared for mining exploration in the northern part of the map-area allowed a systematic study of this section. The remaining territory being very difficult of access, the author followed all watercourses and made traverses in the more suitable locations. All rock fragments seen along traverses were carefully studied and noted.

Geological reconnaissance surveys were made by Mailhiot (1917 and 1918)* and Alcock (1926) in the area under study. The territory east of the present area was mapped by Jones (1931 and 1933); the one south of it, by Jones (1930) and Carbonneau (1959). The area just west of it was mapped by Robert (1965).

GENERAL GEOLOGY

Most of the bedrock of the area is made up of Siluro-Devonian sedimentary rocks overlying, in the northern part of the territory, Ordovician and pre-Ordovician metasedimentary and metavolcanic rocks. During various periods granitic masses were injected into sedimentary rocks, folding and fracturing them. The Mount Vallières-de-Saint-Réal granitic plug constitutes the most considerable intrusive body of the territory. Sedimentary rocks are wrapped around this plug, especially on its east side. South of the plug, sedimentary and volcanic rocks have been folded into two small synclines by a body of felsic rocks. Numerous sills and layers of felsic rocks are intercalated with beds of the Silurian sedimentary sequence. The granitic mass outcropping in the northeast corner of the area represents the southwest end of the McGerrigle range. A wide alteration zone is found south of this mass.

Ordovician and pre-Ordovician metasedimentary and metavolcanic rocks form tight synclinal and anticlinal folds, the axes of which have a general east-west trend and a plunge to the east.

The overburden in the Mount Vallières-de-Saint-Réal area presents the same characteristics as in Mount Hog's Back area. In general, it is very thin and, on the surface of certain plateaus, is made up of residual soil. Outcrops are scarce except in the northern part of the area. In places, rock debris and talus provided the only information on which the author's geological interpretation is based.

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* Dates in brackets refer to the bibliography at the end of the report.

CAMBRIAN

Shickshock Group

Rocks of the Shickshock Group constitute the bedrock of the northern part of the area, and there they form a one-mile-wide belt.

In the eastern part of the belt, schists of volcanic origin and others of sedimentary origin are found. These are the chlorite and epidote schists containing variable amounts of albite, quartz, carbonate, epidote, and amphibole. Sedimentary schists are in general finely bedded and, in places, have graded beds and crossbedding. Finely laminated, crumpled, gray and green phyllites have been noted. Volcanic schists are more massive and homogeneous and contain a greater amount of chlorite than sedimentary schists. A few pillows have been noted in these rocks.

Rocks of the western part of the belt are more altered than those in the eastern part, owing to the presence of the Mount Albert ultramafic mass. Most are coarse grained and foliated, and are homogeneous amphibolites. They include lenses of plagioclase, quartz, muscovite, and epidote schist.

Rocks of the east end of the belt are streaked with numerous quartz and feldspar veinlets apparently related to the McGerrigle granite.

Rocks of the Shickshock Group show a well-developed schistosity with a general east-west trend and a steep north or south dip. They form tight anticlines and synclines, the axes of which have a general east-west trend and an eastward plunge under Ordovician rocks.

ORDOVICIAN

Ordovician rocks form two thin bands, one of which follows the southern margin of the Shickshock Group rocks and the other, a wider one, occurs along the McGerrigle granite.

Table of Formations

Recent and Pleistocene		Alluvial deposits; moraines
Devonian		Mafic rock dikes Felsic and porphyritic dikes and sills Rhyolitic rocks with granular and vitreous groundmasses Vallières-de-Saint-Réal, Hog's Back and McGerrigle granites
Lower or Middle Devonian	York River Formation	Feldspathic sandstone Basalts and mafic pyroclastic rocks with interbeds of shale and of volcanic detritic rocks Felsic crystal tuffs Nodular chert tuffs
Lower Devonian	York Lake Facies	Mixture of sandstone (York River type) and limestone (Grande Grève type); calcareous sandstone
	Grande Grève Formation	Silty and siliceous limestone; calcareous siltstone and cherty limestone
		White orthoquartzite
	Cape Bon Ami Formation	Argillaceous and carbonaceous limestone
Upper Silurian	Saint-Léon Formation	Green and red shales Greenish siltstones; a few beds of lenticular limestone and calcareous sandstone
Middle Silurian	Sayabec Formation	Dolomitic limestone with interbeds of quartzite at the base and of granular limestone at various levels
	Val-Brillant Formation	White, creamy gray and red quartzite
U N C O N F O R M I T Y		
Ordovician		Chlorite, muscovite and quartz schist; hornfels; metaandesite; epidote tuff; quartzose, calcareous and chloritic sedimentary rocks
Cambrian	Shickshock Group	Metasedimentary and metavolcanic rocks: schists and phyllites Contact metamorphism rocks: amphibolites and schists

The band along the McGerrigle granite is composed of hornfels and of chlorite, muscovite, and quartz schists. The hornfels are bedded and dark, and resemble Ordovician hornfels of Petit mont Sainte-Anne, 8 miles north of the area. Chlorite, muscovite and quartz schists show a good cleavage and resemble schists of sedimentary origin of the Shickshock Group.

The other band, 500 feet wide, might possibly be a mass thrust northward over the Shickshock Group. On the north side the fault is revealed in certain drill cores by a thick zone of sheared and mylonitized rocks. On the south side the presence of a fault is based on the sole fact that unmetamorphosed Silurian rocks are in direct contact with metamorphosed Ordovician rocks.

The band of rocks in the raised mass contains metaandesites, epidote tuffs, hornfels, and calcareous and chloritic sedimentary rocks. It is assigned to the Ordovician. It does not belong to the Pre-Silurian formations (Shickshock Group), owing to the fact that volcanic rocks are intercalated with chloritic sedimentary rocks and that they contain hornfels resembling Ordovician hornfels noted elsewhere; neither does it belong to the Silurian, as it contains mafic volcanic rocks which are not found in the Silurian stratigraphy of the area.

Andesites resemble those of the Shickshock Group except that they are slightly more recrystallized, amphibolite crystals (actinolite variety) being quite visible to the naked eye. They are dark colored, frequently purple-tinted on weathered surfaces, and, locally, pillowed. In general, they are magnetic and contain variable amounts of sulfides.

Epidote tuffs are intercalated with mafic lavas. Beds are less than one inch thick. Bedding is revealed by alternating green and gray bands. The greenish coloring of the bands is caused by the presence of epidote.

Volcanic rocks form thin, crumpled and discontinuous lenses.

Hornfels generally form very thin beds not exceeding a fraction of an inch thick. They are very hard, dark colored on weathered surface and gray when fresh.

Sedimentary rocks in general form thin beds of calcareous and chloritic shale alternating with more calcareous and, in places, quartzose beds. The weathered surface of shales presents alternating dark and light bands. Diamond drilling cut gray quartzite beds in the lower part of the Ordovician sequence.

Certain Ordovician rocks are schistose; others are bedded. The trend of foliation generally corresponds to the trend of the Shickshock Group rocks but its dip, mainly to the south, is less steep.

SILURIAN

Silurian rocks form an 8,000- to 13,000-foot-wide belt south of the Shickshock Group and of the Ordovician rocks. The central part of this belt contains numerous sills and beds of rhyolitic rocks.

This belt consists almost wholly of rocks of the Saint-Léon Formation except in its western part where the Val-Brillant and the Sayabec formations, 200 and 600 feet wide respectively, could be traced. These formations terminate against the thrust fault delimiting the southern part of the band of the Shickshock Group rocks.

The Val-Brillant Formation is composed of white, creamy gray and red quartzite; it is massive bedded, fine to medium grained and grades into the Sayabec Formation.

The Sayabec Formation includes some very coarse-grained dolomitic limestones. Predominant colors range from beige to pink. At various levels of the formation a few granular, in places highly fossiliferous, limestone beds can be seen. Quartzite interbeds are found at the base.

The Saint-Léon Formation is essentially composed of greenish siltstones which are laminated or fine bedded and frequently calcareous or argillaceous. At the base of the formation are lenticular, in places fossiliferous, limestone beds, and nodular limestone beds. Shale beds occur at different levels in the formation. The siltstone shows a very noticeable increase in the quantity of argillaceous material in the upper part of the formation, which appears to terminate with a calcareous sandstone bed.

Silurian rocks are completely altered east of Chauve (Bald) mountain.

LOWER DEVONIAN

Cape Bon Ami Formation

Black argillaceous limestones making up this formation form only a thin band about 500 feet wide south of the Chauve Mountain granite sill. This band is interrupted by faults and rhyolitic rocks at its eastern end. At its western end the formation seems to have been segmented by the Chauve Mountain granite sill.

The thin band of hornfels underlying the sill at its north side is possibly altered Cape Bon Ami. It is equally possible that the fragments of white orthoquartzite found in numerous localities in the east-central part of the area belong to the same stratigraphic level as the marker beds of the Cape Bon Ami Formation mapped by the author in the Mount Hog's Back area. Those marker beds, which contain a white quartzite bed, have been correlated with the base of the Grande Grève Formation.

Grande Grève Formation

Rocks of the Grande Grève Formation form about a 2,000-foot-wide band south of the Cape Bon Ami limestone band terminating against the fault east of Petit Lac brook. However, these rocks likewise occur close to the eastern limit of the area.

The Grande Grève here is composed mainly of silty and siliceous limestones with calcareous siltstone laminae; in the lower part of the formation a few beds of cherty limestone can be seen. Limestones of the whole stratigraphic succession of the Grande Grève Formation are lighter in color and harder than those of the Cape Bon Ami Formation.

York Lake Facies

The York Lake facies represents a lithologic transition between the Grande Grève and York River formations. It is composed of York River type sandstone beds, of Grande Grève type limestone beds and of a few beds of calcareous

sandstone. The limits of this facies extend from the first lower bed of sandstone in the Grande Grève Formation limestones to the last upper limestone bed in the York River Formation sandstones.

Rocks of the York Lake facies cover a much larger area than those of the Grande Grève Formation. The band west of Mount Vallières-de-Saint-Réal is cut by important breaks that have folded these rocks into a south-plunging syncline.

LOWER OR MIDDLE DEVONIAN

York River Formation

The York River Formation is composed of sandstone and of volcanic rocks including felsic and mafic tuffs, and mafic lavas.

Sandstone

The only sandstone of the York River Formation noted in the area directly underlies the series of mafic volcanic rocks. It is mainly feldspathic and includes siltstone and a few shale beds. It is greenish gray to beige and is fine to coarse grained. A 450-foot-thick section of it can be seen in the gorge of Petit Lac brook. Clay discs with a diameter ranging from a fraction of an inch to a few inches and primary structures such as crossbedding and ripple-marks have been observed in a few beds. In the lower part of the formation the cement in a few sandstone beds is calcareous.

Volcanic Rocks

Volcanic rocks are widespread in the southern part of the area where they constitute the core of two synclinal folds. Felsic and mafic varieties have been noted. The former are less abundant than the latter and are found only at Lyall mountain.

The mafic volcanic rocks are basalts, lapilli tuffs and agglomerates. They are 750 to 1,000 feet thick. On the north side of Mount Lyall, a few shale beds are intercalated at various levels, and a few volcano-detritic beds are found in the lower part.

Felsic volcanic rocks consist of tuff beds with chert nodules and of crystal tuff beds.

The crystal tuff beds, with a total thickness of 350 feet, overlie mafic volcanic rocks and form the top of Lyall mountain. The rock is syenitic in composition, is red or salmon-pink and contains 5 - 10% feldspar crystals, for the most part randomly oriented.

Tuffs with chert nodules are intercalated in the lower beds of the mafic volcanic sequence on the north side of Lyall mountain, at about the 2,000-foot level. Thicknesses of beds range from a fraction of an inch to many inches. The series attains a thickness of about 100 feet. Nodules are flattened ovoid masses, the larger axis of which ranges from a fraction of an inch to close to one foot. They are concentric, variably-colored envelopes of chalcedony and are, in fact, agates of apparently good quality.

One outcrop of nodular tuff has been noted in the bed of the second main brook southeast of the triangulation point on top of Lyall mountain and another was seen in the brook tributary to the first one. The outcrop, on azimuth 208°, in the main brook is 3,100 feet from the south end of the jeep road leading to cottages on the south side of the bridge crossing Sainte-Anne lake. The second outcrop is 200 feet from the junction of the tributary brook with the main one. Both outcrops seem to belong to the same stratigraphic horizon. In the first outcrop, which measures 100 feet in length, nodules are up to 3 inches in diameter, whereas in the second, with a length of 125 feet, the nodules have a diameter of up to one foot. Furthermore, fragments of nodular tuff have been seen at about the same altitude in two brooks east of the two mentioned above.

DEVONIAN

Felsic rocks

Granite

Three types of granite occur in the area: Hog's Back, Vallières-de-Saint-Réal and McGerrigle. The first two, which are alike except for the presence of hornblende in the Vallières-de-Saint-Réal type, probably originated from the same magma. They are red and pink porphyritic granites and are fine to medium grained. They contain a small amount of chloritized biotite.

The Hog's Back type granite tops Chauve mountain in the west-central part of the area. It forms a 550-foot-thick sill and represents the eastern part of the granite sill that constitutes the base of Hog's Back mountain. This sill abuts against the fault that follows the valley east of Chauve mountain. It apparently plunges eastward under Silurian sedimentary rocks.

The Vallières-de-Saint-Réal type forms the base of the similarly-named mountain in the central part of the map-area.

The McGerrigle-type granite constitutes the bedrock of the northeast corner of the area and represents the southwest end of the McGerrigle mountains granite mass. This red granite shows a coarse-grained holocrystalline texture that clearly distinguishes it from Hog's Back and Vallières-de-Saint-Réal porphyritic granites. Moreover, quartz is more abundant and represents more than 10% of the volume of the rock.

Rhyolitic Rocks

Rocks of rhyolitic composition and, in some places, of porphyritic texture are very widespread in the north half of the map-area where they form sills and bands that appear conformable with the formations. Another important area of rhyolitic rocks has been noted in the southern part of the

map-area. These rocks seem to have folded the mafic volcanic rocks into two synclines. Altered surfaces are, in many places, kaolinitized.

Rhyolitic rocks have been divided into two groups according to their granular or glassy texture. Distinction between the two is often arbitrary. The first group includes the greater portion of rhyolitic rocks of the area. Most of these rocks are tinted red. The second group is represented by a few areas within bands of rhyolitic rocks of granular texture. Beige and light tan are the main colors of these rocks.

Phenocrysts in rhyolitic rocks are not abundant. They consist of quartz and feldspar and are smaller than those found in porphyritic granites.

The origin of the rhyolitic rocks is uncertain. The rocks are generally homogeneous. The intrusive nature of part of these is clearly indicated by certain structural relations and by traces of contact alteration in adjacent sedimentary rocks. On the other hand, layering noted on a few outcrops and the relation existing between these rocks and certain beds of felsic tuff on the side of Chauve mountain suggest a volcanic origin. In places they seem to be the product of a thermal alteration of sedimentary rocks as shown by certain sections along Petit Lac brook and certain outcrops close to the Vallières-de-Saint-Réal granite. In short, it is believed that rhyolitic rocks are the result of hypovolcanic phenomena.

Felsic dikes and sills

Felsic and porphyritic intrusive rocks cut, in places, rocks of various formations. They are leucocratic and contain numerous pink feldspar phenocrysts. They form either narrow dikes trending roughly north-south, or sills.

Mafic rocks

A few narrow mafic dikes occur in the map-area. Locally these rocks have a diabasic texture. Age relations between mafic and felsic dikes are not known.

PLEISTOCENE AND RECENT

Bedrock is almost everywhere covered by a very thin mantle consisting mainly of rock fragments mixed with soil, of till and of alluvial deposits.

The area at the foot of the McGerrigle mountains along the northern limit of the mapped territory is covered with non-stratified till composed of a great quantity of McGerrigle granite pebbles and of gravel. Sections along Castor brook show, over a thickness of about 20 feet, till of fluvial origin. Tops of mountains south of this locality are covered mainly with a thin layer of rock fragments and humus; in many places the presence of residual soil has been noted.

Thick alluvial deposits have been found at the foot of Lyall mountain. They contain rounded rock fragments from Lyall mountain and agates of excellent quality.

ALTERATION

The word "alteration" applies here to an alteration caused by contact metamorphism, and not by regional metamorphism.

The most important alteration zone of the area is situated in the northeast corner. It extends east of the area and, at first sight, appears to follow the south side of the McGerrigle granite mass, which, in the author's opinion, caused this alteration. Altered rocks within this zone are related to the Saint-Léon Formation. The approximate southern limit of alteration reaches the lower levels of the Cape Bon Ami Formation. Calcareous rocks at the base of the Saint-Léon Formation are altered to skarns and marbles, whereas siltstones, characteristic of the formation, are altered to hornfels and siliceous rocks bearing a resemblance to quartzite and rhyolite. Among the silicified sedimentary rocks the presence of types resembling porcelanites of the Murdochville mining area has been noted.

The second most important alteration zone of the area is located at the periphery of the Mount Vallières-de-Saint-Réal granitic pluton. Alteration here takes the form of a silicification giving rocks an appearance identical to the

tan or light cream-colored rhyolites. In fact, rhyolitic rocks covering wide areas northeast of Mount Vallières-de-Saint-Réal may be, in places, altered rocks. This zone could not be traced fully, owing to the absence of outcrops. It is believed that the small area of skarn on the west side of Petit Lac brook in the central part of the area is the result of an alteration caused by a low-depth tongue of the Mount Vallières-de-Saint-Réal intrusion.

Elsewhere in the area, numerous other small alteration zones have been noted, among which are a narrow band of silicified rocks at the north contact of the Chauve Mountain granite sill and a zone of silicified strata along the break that follows the valley west of Petit Lac brook.

Rocks bordering the thrust fault that separates Shickshockian from Ordovician rocks in the Castor brook area are chloritized. The chloritization is particularly marked in sedimentary rocks.

Finally, it should be noted that rocks in the western part of the Shickshockian band have a higher degree of metamorphism than rocks in the central and eastern parts of the band, owing to alteration caused by the emplacement of the Mount Albert ultramafic mass.

STRUCTURE

Bedding - Schistosity - Fracture cleavage

Schistosity has been noted solely in rocks of the Shickshock Group. It is well developed, dips steeply and has a general westward trend that changes to northwest in the west part of the band. Bedding parallel to schistosity can be seen in a few places.

Bedding in Siluro-Devonian sedimentary rocks shows that these constitute a southward ascending stratigraphic sequence strongly deformed by intrusive masses and by breaks. It generally trends east-west and its average dip is from 20° to 35°.

A fracture cleavage with a general northeast trend affects rocks of the Shickshock Group. A less well-developed

fracture cleavage can be seen here and there in Siluro-Devonian rocks. Rhyolitic rocks also show a fracture cleavage with a general north-south trend and it is believed that this cleavage is younger than the one affecting rocks of the Shickshock Group.

Folds

Schistosity in rocks of the Shickshock Group outlines tight folds with axes generally trending east-northeast and plunging eastward. These structures are in contrast with open folds in the Siluro-Devonian rocks.

In the southern part of the area, the rhyolitic mass that splits the band of mafic volcanic rocks into two parts has folded the latter into two open synclines, one on each side. The east limb of the syncline north of the mass forms a tongue that extends northward into sedimentary rocks wedged up between two breaks.

Lastly, the strike of bedding in sedimentary rocks east and northeast of Mount Vallières-de-Saint-Réal appears to be directly controlled by the granitic mass forming this mountain.

Faults

Numerous faults caused by the igneous activity that prevailed at various intervals have been noted in the area. These faults control to a certain degree the hydrographic network of the area. Criteria that allowed their identification are: sharp variations in bedding trends, stratigraphic discontinuities, and minor structures such as shear planes and slickensides.

The main faults follow the network of northeast-southwest-trending valleys. On topographic maps and aerial photographs, valleys appear as marked rectilinear structures suggestive of breaks. Sainte-Anne river and lake, both following a rectilinear structure trending roughly north at an oblique direction with other structures, possibly follow the trace of a break.

A thrust fault that in part outlines the southern limit of the band of rocks of the Shickshock Group crosses the area in an easterly direction. In the field this fault is

identified by a shear zone dipping steeply to the south. Data on the orientation of displacements show that rocks south of the fault moved to the north.

Unconformity

The major unconformity that separates Silurian from Ordovician rocks is not visible in the map-area.

Joints

Joints are numerous in Siluro-Devonian rocks. The two predominant systems are oriented roughly west-northwest and east-northeast. Felsic and mafic dikes fill joints of the west-northwest system in many places.

ECONOMIC GEOLOGY

During the course of the geological mapping of the area, much metallic mineralization was noted, mainly in Ordovician and Shickshockian rocks. Mineralization differs according to the formation in which it is found. Pre-Silurian rocks contain lenses of copper-rich massive sulfides. Siluro-Devonian rocks present possibilities of disseminated sulfide deposits.

Mineralization

Rocks of the Shickshock Group

Metallic mineralization is abundant in the various formations of this group. However, localities are very few where mineralization deserves mention. Almost everywhere only a few sparse sulfide grains are found.

The minerals forming the specks that are more abundant in metavolcanic than in metasedimentary rocks are pyrite, chalcopyrite and pyrrhotite. Volcanic rocks are likely to contain

massive-type sulfide deposits, the reason being that, where volcanic rocks have been sheared, sulfides have been remobilized and distributed along fractures.

Magnetite and specularite are very abundant minerals in the metaandesites. In the eastern part of the Shickshock rocks, the formations carry several quartz veinlets, many of which are filled with magnetite or specularite ribbons. This type of mineralization is well illustrated on a few outcrops visible in trenches on the property of the Syndicat des Pays-Bas.

Ordovician Rocks

In Ordovician volcanic rocks, metallic mineralization is widespread, generally in very small quantities. However, it is in more important concentrations at Castor prospect, which contains the "A" and "B" showings. These are located about 2,000 feet east-southeast from Castor Brook camps on Sullico Mines Limited property. The "B" showing is 100 feet west of the "A" showing, in a lower stratigraphic horizon.

Mineralization consists of chalcopyrite, pyrite, magnetite, specularite, and pyrrhotite. It is distributed irregularly in metavolcanic rocks intercalated with hornfels beds. Oxides are omnipresent in volcanic formations, in quantities slightly inferior or roughly equal to sulfides. Surfaces of this mineralization have been weathered into gossan. Diamond drillings have been made by Sullico Mines Limited on these showings. Numerous mineralized intersections of variable lengths and tenors were obtained, the main intersection being at the same stratigraphic level as the "B" showing. This mineralization occurs for a distance of 25 feet and consists of massive sulfides containing up to 8% copper. At the "B" showing, sulfides are in small quantities and contain only traces of copper; a selected sample, believed to be representative of the mineralization, assayed 0.86% copper.

Rocks outcropping at the "B" showing form a small anticline overturned southward, the limbs of which are strongly crumpled and fractured. Axial planes of drag-folds trend east and dip 65° south. Axes plunge steeply to the east. Volcanic rocks form two layers at the nose of the anticlinal structure. The main layer occupies the core of the structure and is 20 feet thick; the other is 2 feet thick.

Mineralization in the "A" showing is much more abundant than in the "B" showing. It covers an area 20 feet long by 3 feet wide and is confined to metaandesite beds of the lower part of the outcrop. A fault marks the south contact between these metaandesites and banded rocks that are folded into a southward overturned anticline with a 60°E. plunge. A selected sample, believed to be representative, assayed 4.87% copper. Drillings on this horizon gave commercial values in only one 10-foot-long intersection.

The author's studies in the field and of drill cores lead to the following conclusions:

1) copper is genetically related to volcanic rocks;

2) sulfides were remobilized by sudden tectonic activities,

3) the main controls for the trapping of sulfides are of a tectonic nature, some of them being noses of anticlinal folds and fault planes;

4) there exists a possibility of finding, in layers of volcanic rocks, lenses of ore with a sharp dip to the east.

Siluro-Devonian Formations

Mineralization in Siluro-Devonian rocks is scarce. Minerals noted are pyrite, chalcopyrite, sphalerite, and galena as disseminations or veinlets in sedimentary rocks.

Specks of syngenetic pyrite and chalcopyrite were observed in siltstones of the Saint-Léon Formation north and east of Chauve mountain, as well as in a few localities in similar sedimentary rocks along Petit Lac brook.

One of the holes drilled by Sullico Mines Ltd. cut the Siluro-Ordovician contact and revealed that the Silurian sedimentary rocks are altered in skarns and hornfels. All these rocks contain small quantities of disseminated chalcopyrite and pyrite. In a few intersections, sphalerite and minor galena were noted; these sulfides are fine grained in disseminations and coarse grained in veinlets.

Alteration zone in northeast corner of the area

The few outcrops within this zone, with the exception of those found along Petit Lac brook, are in general devoid of metallic minerals. Specks of pyrite and chalcopyrite were noted in a few outcrops in the south part of the alteration zone. Moreover, the presence of sphalerite veinlets in blocks of altered rock has been reported along Bélanger road.

The most important showing within this zone occurs close to the eastern limit of the area just south of Pékans brook. Newmont Mining Corp. of Canada Ltd. reported the presence of angular blocks of tremolitic rock containing up to 2% chalcopyrite. However, the source of these rocks has not been found. In view of the angularity of blocks and of their lithologic character compatible with altered rocks of the lower part of the Saint-Léon Formation, it is believed that the source of these blocks is rather close, possibly the mountain south of the alteration zone.

This alteration zone is particularly interesting for the following reasons: 1) rocks in this zone are similar to those occurring within the alteration aureole on the property of Gaspé Copper Mines; 2) it extends to the stratigraphic level of the Cape Bon Ami Formation, which, at Gaspé Copper, contains the "C" ore body; 3) it contains a copper and a zinc mineralization.

Other alteration zones

Finely disseminated pyrite and traces of chalcopyrite have been noted in a few outcrops occurring in the northern part of the alteration aureole of Mount Vallières-de-Saint-Réal and along the brook west of Petit Lac brook.

Agates

The discovery of agates in felsic tuff beds at Mount Lyall is worth mentioning again. These beds are the source of agates found in fragments at the foot of the mountain. According to lapidaries who cut some of them, the agates possess excellent properties as semi-precious stones.

Geochemistry

Stream sediment samples were taken as part of a program aimed at establishing the feasibility of carrying out geochemical work at the same time as surveying an area geologically.

The present area is well suited for geochemical prospecting, owing to the thin cover of overburden that locally is replaced by residual soil and also owing to the rugged terrain and its rapid drainage.

At the end of the season two men spent one week collecting samples from stream sediments. Samples were taken at stations spaced at approximately 500-foot intervals along the main streams and at one station only in each tributary. At each station, two samples were taken a few feet apart in the active zone of the bank. Observations pertinent to sampling were recorded on prepared information slips. The samples were sent to the Department's laboratory in Quebec for assays in copper, zinc, lead and molybdenum. These values are shown on the map by use of a special color and the following notation:

20, 50, 30, 6
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, the dot representing the point where the sample was taken, and the numbers between commas giving the values in parts per million (p.p.m.) of the elements in the order: copper, zinc, lead, molybdenum.

Results obtained indicate a major zone of abnormal values in zinc, copper and lead in the brook northeast of Mount Vallières-de-Saint-Réal. Maximum values obtained are 720, 350 and 150 p.p.m. for zinc, copper and lead respectively. The maximum value for zinc is more than 10 times that of the average. The distribution zone extends over a length of about 3,000 feet and dilution effects below each sterile tributary are well marked. The explanation for this anomaly is not known. It is known, however, that it is related to a zinc mineralization since prospectors have reported the presence of blocks mineralized with zinc on Bélanger road at the same altitude as the depression marking the head of the brook.

A few other sampling stations gave abnormal values in copper and zinc, but these values were of an intensity inferior to the aforementioned. Some of the abnormal copper values correspond to known mineralization, such as values in Castor brook close to a copper mineralization.

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