RP 602(A)

PRELIMINARY REPORT, GEOLOGY OF THE NORTH HALF OF MONTBEILLARD TOWMSHIP

P.R.-602

GOUVERNEMENT
DU QUÉBEC

DEPARTMENT
OF NATURAL
RESOURCES

MINES BRANCH

MINERAL DEPOSITS SERVICE

PRELIMINARY REPORT

GEOLOGY OF

THE NORTH HALF OF MONTBEILLARD TOWNSHIP

MARC VAN DE WALLE

1971

INTRODUCTION

Montbeillard township is situated some ten miles from Rouyn-Noranda, and is bounded approximately by longitudes 79°05'00" and 79°18'02" and latitudes 48°00'00" and 48°08'25".

The major part (9/10) of the north half of the township was mapped in 1969 at a scale of 1 inch equals 1,000 feet.

The area is readily accessible by a network of roads. A paved highway, No. 46, linking Rouyn-Noranda to Ville-Marie crosses the township from north to south.

The area has been superficially explored on several occasions,by Robert Harvie in 1910, by M.E. Wilson between 1910 and 1912, and by J. Holubec in 1967.

PHYSIOGRAPHY

The area is one of very moderate relief. The only noticeable topographic feature is a straight ridge trending N.60°E. and coinciding with a diabase dike. The highest elevation along this ridge is slightly more than 1,100 feet, while the lowest points in the area (Opasatica and Beauchastel lakes) are about 850 feet above sealevel. The hardest and more massive formations, such as the silicified schists (lot 50W, of range VII and lot 54, of range IX) and the granitic intrusives, produce some moderate relief. A series of eskers located north and west of Montbeillard lake are

---

*Translated from the French

the only unconsolidated deposits showing a relief of more than 150 feet.

TABLE OF FORMATIONS

<table>
<tr><td colspan="2">PLEISTOCENE</td><td colspan="2">Clay, sand, gravel, boulders.</td></tr>
<tr><td rowspan="5">PRECAMBRIAN</td><td>UPPER</td><td colspan="2">Diabase dikes.</td></tr>
<tr><td rowspan="4">LOWER</td><td rowspan="3">Intrusive rocks</td><td>Pyroxenite dikes</td></tr>
<tr><td>Granite
Pegmatoid syenite</td></tr>
<tr><td>Opasatica complex: hornblendite, amphibolite, serpentinite, talc schist</td></tr>
<tr><td>Pontiac Group</td><td>Amphibolitic rocks (some of which are intrusives of uncertain age)

Metasedimentary quartzofeldspathic rocks: chloritic schist, mica schist, staurolite mica schist</td></tr>
</table>

GENERAL GEOLOGY

All the underlying rocks of the area are of Precambrian age. Three quarters are of sedimentary origin, more or less metamorphosed, and belong to the Pontiac Group. Various amphibolite masses are intercalated with the Pontiac Group and a few cut across it. The formations have been folded, but their dips rarely exceed 30°. At the eastern end of the township, dips up to 75° were observed.

In the vicinity of Evain and Opasatica lakes, wide sills of ultramafic rocks intrude the mica schists of the Pontiac Group. These contemporaneous concordant intrusives have apparently been subjected to the same degree of metamorphism and folding as the rocks of the Pontiac Group. The term metaperidotite could be appropriately applied to these rocks.

Small bodies of granitic material cut through the above formations. They are generally stretched out, paralleling the trend of the bedding.

Outcrops of a pegmatoid syenite occur in the southern part of the area between lots 30 and 35 of range VI. It was not possible to determine the relationship between this rock and the surrounding formations.

A pyroxenite dike which crosses the area in a north-south direction appears to be late. A large diabase dike cuts all the Precambrian formations in a northeast direction. This dike has been mapped outside the township for a length of over 50 miles. Smaller dikes were also observed east of Montbeillard and Beauchastel lakes.

PONTIAC GROUP

Approximately 85% of the area is underlain by sedimentary rocks of the Pontiac Group. These are divided into quartzofeldspathic sedimentary rocks and amphibolitic rocks of probable volcanic origin.

Quartzofeldspathic metasedimentary rocks

The quartzofeldspathic rocks, mainly greywackes with minor impure arkose and argillite, constitute about 90% of the formations of the Pontiac Group.

The fresh fracture is more or less dark grey in color, but on the weathered surface the color becomes grey-beige to rusty brown, due to the presence of iron oxides.

These rocks, in general, are thickly bedded but poorly stratified. The few observed beddings are generally discontinuous. The beds appear to be better developed in the northern part of the township.

Graded bedding was seldom observed and may have been obliterated by recrystallisation. Cross-bedding was not observed. However, many tiny joints, at a generally low angle to the stratification, may be mistaken for cross-bedding.

The quartzofeldspathic rocks are so featureless that it would be vain to try to establish a stratigraphic succession, unless one could observe a long and uninterrupted cross-section, and then proceed on a statistical basis. These rocks have been greatly diversified by the metamorphism, which increases from north to south. Short of stratigraphic criteria, the mineralogical association may serve in the field for classification. According to the isograde zones, the rocks are characterized from north to south by key minerals as follow: chlorite greywacke; chloritoid schist; muscovite and biotite mica schist; garnet mica schist; and staurolite mica schist. While all of these rocks were observed, in pratice three units may be distinguished:

1.- At the northeast corner of the map-area a chlorite zone barely enters the township, and was observed only on the northern parts of lots 54 and 62 of range X. Based on a rough estimate, the mineralogical composition is as follow: 20 to 25% quartz, 20 to 25% chlorite (biotite), 5% muscovite-sericite, 30 to 40% feldspar (albite or untwinned orthoclase)

2.- To the southwest of the chlorite zone a band from 1 mile to 2 miles wide, trending approximately N.65°W., is characterized by the presence of mica (mostly biotite) representing the mica schists of the Pontiac Group. Garnet is sometimes present, but because of its light color and its fine grain, it may be easily missed. A thin-section of the biotite mica schist gave the following mineralogical assemblage: 30 to 40% quartz, 20% biotite, 5% chlorite, with epidote, sphene, and opaques as accessory minerals.

3.- The staurolite zone theoretically occupies all the area south of the mica zone. The staurolite does not necessarily occur in all outcrops. Wide zones in which this mineral is absent alternate with the mica schist containing up to 15% staurolite. The composition of these rocks is approximately as follow: 20 to 40% quartz, 5 to 30% feldspar, 0 to 15% staurolite. Accessory minerals are clinozoisite, sphene and opaques.

The staurolite is generally altered to fine aggregates or clusters of sericite and iron minerals. The outline of these aggregates perfectly duplicates the pre-existing crystal outlines. Thin-sections show chloritoids in this zone as in the biotite mica schist zone. The degree of alteration often renders the identification uncertain.

Amphibolitic rocks

The amphibolites constitute a small part of the Pontiac Group. They form lenticular bodies of highly variable dimensions, apparently interstratified with the sedimentary rocks. Lenses of less than 80 feet long by 1 foot thick have been observed, while others 100 feet in thickness were also seen. Their relationship to the sedimentary rocks is not always evident; however, they are generally conformable.

In the area of Evain and Opasatica lakes, the amphibolite zones are less well-defined. The alternating mica schists and amphibolites are thin and the contacts may be gradual. In this area, amphibolites occur which appear to be related to the ultramafic sills.

The amphibolites are completely recrystallized rocks and do not exibit any clues as to their origin. The grain may be fine to very coarse. They contain various fragments which generally occur close to the contacts. These fragments are made up of amphibolite, lighter or darker colored than the matrix, and more rarely of mica schist.

The mineralogical composition revealed by thin-sections is as follow: 60 to 85% amphibole (hornblende or actinolite); 2 to 30% biotite; 5 to 15% plagioclase (albite-oligoclase); 0 to 5% quartz (often secondary); occasional microcline; up to 15% clinozoisite-epidote, calcite (carbonate), sphene, and apatite.

Sulphide mineralization (pyrrhotite and sometimes chalcopyrite) may be found disseminated in the amphibolites and more particularly in the pegmatoid varieties.

Some rocks of the same type have an intrusive character. They are, however, completely recrystallized by the metamorphism that affects the rocks of the Pontiac Group and, therefore, pre-date it. They comprise dikes at an angle to the strike of the beds, and ill-defined masses sometimes having an irregular chimney-like shape. These chimneys, with a diameter of 100 to 200 feet, are for the most part a breccia, with a cement of basic amphibolitized rock and fragments of mica schist or rarely of pale green amphibolitic rock (tremolite). At the periphery, the frequency of fragments increases to the point where the rock appears to be formed of slightly dislocated metasediments penetrated by a network of criss-crossing dikelets. It is probable that these formations represent pipes filled by volcanic breccia. The best examples of these formations are on lots 50, 52 and 55 of range VII.

The thin-sections reveal a mineralogical assemblage similar to the amphibolites previously described, i.e., in order of importance: amphibole, plagioclase, biotite, potassic feldspar, epidote and pyroxene.

OPASATICA COMPLEX

In the areas bordering Evain and Opasatica lakes, rocks of mafic to ultramafic composition, completely altered by metamorphism, are interstratified with the mica schists of the Pontiac Group.

Examination of the surface outcrops and of diamond-drill cores suggest that the ultramafic complex is made up of a series of subhorizontal to wave-like, superimposed sills, more or less concordant with the sedimentary formations. The thickness of some the sills obtained from drill holes ranges from a few tens of feet to 200 feet.

The metamorphism has produced a series of rocks with quite a varied mineralogical assemblage, but probably of more uniform chemical composition. In the field, 4 types may be recognised: hornblendites, amphibolites, serpentinites, talc schists. All of these are retrograded mafic and ultramafic rocks.

Hornblendites

This rock is massive and consists of more than 90% green hornblende crystals, 2 mm. to 5 cm. in length. It is recognizable in the field by its pegmatoïd character. The few observations made on surface outcrops and on drill cores seem to indicate that the hornblendites occur at the periphery of the ultrabasic masses, i.e. at the top and at the base of the sills, in contact with the mica schists.

A thin-section study gives the following minerals: 90% hornblende (up to 2cm); 3% biotite; 5% quartz-feldspar (secondary). Accessory minerals are sphene, calcite, apatite.

Amphibolites

The amphibolites differ from the hornblendites by their foliated texture and finer grain. The amphibole is in acicular crystals, sometimes fibrous, whereas in the hornblendites the crystals are stocky and large. A mineral believed to belong to the clintonite group is generally well represented in the amphibolites and may constitue more than 60% of the rock.

Amphibolite-serpentinite or amphibolite-talc schist end members are generally encountered in the field. The amphibolites referred to here are distinguished from those of the Pontiac Group mainly by their intimate association with the ultramafic rocks of the Opasatica complex. Other distinctive characteristics are the lack of inclusions and fragments, and a gradual transition to serpentine and the talcose rocks. Finely disseminated magnetite is sometimes characteristic in thin-sections. Neoformation biotite may be present and is sometimes abundant around granitic dikes.

Serpentinites

This rock is not common in the Opasatica ultramafic complex. However, it has been mapped in several places by its megascopic characteristics. The rock is massive, cryptocrystalline, very resilient and has a characteristic dark green color. In some areas, it is cut by numerous veinlets (2 to 4mm.) of magnetite. Veinlets lined with asbestiform minerals are sometimes associated with the magnetite veinlets. Some thin-sections show quite variable quantities of amphibole and talc.

Talc schists

These include various rocks resulting from a certain type of alteration (hydration and carbonatization). The term talc schist is based principally on the megascopic appearance; it designates more or less massive, greasy feeling, light gray-green, soft, fine-grained rocks. At a distance the rock resembles an andesite that has been altered to greenstone. Pseudo-pillow structures may increase the confusion. These are produced by a criss-crossing pattern of sinuous carbonatized fractures. These pseudo-pillows are often fragmented to the point of resembling a breccia.

The talc schists form the largest part of the ultramafic sills of the area. They are generally composed of talc, chlorite, and carbonate. Amphibole and serpentine are generally present, but do not constitute typical minerals. The carbonate may be found either disseminated in the mass or as brownish rose rhomboidal crystals. The talc and the chlorite are found in all proportions.

The accessory minerals are pyrite and magnetite. The pyrite, in cubes up to 1 cm., is sometimes abundant in the carbonate-rich rocks, and in some cases is magnetic, probably because of microscopic inclusions of magnetite. Magnetite, in octahedra, shows a preference for varieties rich in talc.

Locally, biotite concentrations give the rock a lamprophyric appearance. In core from a drill hole on the Essberger claims a biotite zone directly associated with a small intrusion may be seen.

Contact Aspect

In the host mica schist, stratiform bands rich in pyrrhotite (5 to 20%), 1 to 15 feet thick, envelop the ultrabasic sills in a discontinuous manner. The pyrrhotite is variably nickeliferous and chalcopyrite is locally visible. Iron formation (banded magnetite) and garnetiferous bands occur in a similar manner.

OTHER INTRUSIVE ROCKS

Syenite

On lots 31, 32 and 33, range VI, a massive rock of pegmatoid texture outcrops. Amphiboles (20 to 30%), in prisms of 1 to 2 cm., may be recognized megascopically. Biotite (10 to 15%) occurs in plates up to 0.5cm. diameter, and feldspar in coarse grains, sometimes up to 5 cm. in length, impregnated poikilitically by the previous minerals.

The thin-sections show that the feldspar is strongly perthitized; the amphibole is in the process of biotitization, and the apatite is present in greater amount than that of a common accessory mineral.

In the field, the relationship between the syenite and the Pontiac Group is not readily visible. The body has, however, a discordant attitude. Without the abundance of feldspar, the rock could be easily classified among the pegmatoid amphibolites to which it may be related.

Granite

The granitic intrusives not only cut the rocks of the Pontiac Group, but also the ultramafic sills of the Opasatica complex. These rocks were recognized further to the south by M.E. Wilson (1912).

Structurally speaking, the granitic intrusives are characterized by flat-dipping contact planes, generally conforming to the bedding. Dislocations and deformations are typically of low intensity.

The major axes of the elongated granitic masses more or less parallel the strike of the beds. A notable exception to this occurs on Joe hill (lots 26 to 27, range VI).

Contact phenomenon, particularly biotitization, are more obvious in the ultramafic rocks.

The examination of ten thin-sections gave the following mineralogical composition: 10 to 30% quartz; 5 to 10%

biotite (sometimes chloritized); 0 to 10% amphibole; 20 to 60% plagioclase (oligoclase); 5 to 30% orthoclase; 0 to 10% microcline; occasional muscovite. Sphene, apatite and allanite are the accessory minerals.

Locally, and mainly to the west, the rock tends to become porphyroid. The phenocrysts are generally oligoclase, and rarely orthoclase. Microcline is generally poorly represented in these granites, nevertheless it is found in samples from the southern part of map-area. It is often antiperthitic in the oligoclase.

Pyroxenites

The pyroxenites form dikes of massive, dark to black, medium-grained rock. The dikes rarely exceed 100 feet in thickness, although one of them extends for a distance of nearly 3 miles. They cut sharply across the mica schists of the Pontiac Group. The relative freshness of the pyroxenite indicates that it is probably subsequent to the metamorphism which has affected the other rocks and it has been classified as later than all the other intrusions except the diabase.

The thin-section reveals the following mineralogical composition: 50 to 60% pyroxene (diopside-augite); 0 to 10% olivine (often the nucleus in the pyroxene); less than 5% plagioclase (andesine); 3% biotite (probably deuteric); 10% opaque minerals (magnetite); 5 to 30% alteration minerals (talc, serpentine).

Diabase

The late diabase forms continuous dikes of great regularity. The main dike, striking N.60°E., marks the topography in the northwestern part of the township. Because of its importance it was named "Dike de la carriere". Canada Black Granite works a quarry in this dike, on lots 42 and 43, range X, Beauchastel township. The other diabase dikes are less important in size and have a sinuous attitude which makes any correlation questionable.

The diabase is petrographically very uniform along its length. On the other hand, the grain size is directly related to the thickness of the dike and the distance from the enclosing country rock. The diabase close to the contact is typically fine grained and may show an aphanitic texture.

A thin-section of the diabase shows the typical ophitic texture as well as a relative abundance of micropegmatite. The approximate mineralogical composition is 48% plagioclase (andesine), 40% pyroxene (+ ouralite), 10% micropegmatite, 2% opaque minerals.

PLEISTOCENE

The areas of clay deposits commonly coincide with either the cleared land or swampy ground where the drainage is inadequate. Sandy zones of limited extent occur south and east of the village of Beaudry, particularly in the hills bordering the northwestern shore of Montbeillard lake. These sands are commonly stained red by iron oxide.

The only glacial deposits providing a relief are eskers trending north-northeast between the south end of Beauchastel lake and the northwestern end of the Montbeillard lake. The other glacial deposits cover broad areas but their presence is only indicated by a few erratic blocks. The thickness of these deposits should not be very great because they intervene between outcrop areas over relatively short distances. This is particularly true on the far northern part of the township.

The nature of the erratic blocks indicates that the source was the area directly to the north. The blocks of less than one foot consist mostly of volcanic rocks. Most of the blocks larger than one cubic meter are made up almost entirely of conglomerate of the Cobalt series, more rarely of the late diabase, and exceptionaly of metagreywacke of the Pontiac Group.

Striae and grooves observed on lots D and 52 of range X and on lot B of range IX indicate a north-south to N10°W. orientation.

In the center of lots 54 and 55, a small swampy depression surrounded by glacial deposits may represent a typical example of a kettle.

STRUCTURAL GEOLOGY

In the northern part of the map-area, the predominant structural feature of the rocks of the Pontiac Group is their low dip of 20 to 40° to the north, or slightly east of north. At the far eastern end, dips of more than 60° were observed.

To the south slight undulations were noted. The folds are too few and irregular to permit the identification of synclines and anticlines. This identification is made even more uncertain due to the absence of marker horizons.

A weak anticlinal structure may be visible at the periphery of the Opasatica ultramafic complex. The folds are much more upright to the east of Montbeillard lake.

The general attitudes of the formations is not really disturbed by the granitic intrusive masses. Although the attitude of the sedimentary rocks of the Pontiac Group is relatively regular there are local flexures accompanied by intense folding on a small scale. It is not impossible that these folds represent subsidence structures.

No major fault was found in the area. However, on a small scale, most of the outcrops are cut by a network of fractures that almost completely obliterates the few beds that were found. The granite masses themselves are not always exempted from this phenomenon. The degree of fracturing appears to decrease and disappear in the more metamorphosed formations to the south.

MINERALIZATION

Three types of mineralization were recognized in the mapped area.

1.- Lead-zinc-copper, associated with the quartz veins and zones of silicification in the metagreywackes.

2.- Minor molybdenite, associated with a granitic intrusive.

3.- Copper-nickel, associated with the Opasatica ultrabasic complex.

The other indications of mineralization are more difficult to classify. Disseminated sulphides in amphibolites, interstratified with the metagreywacke, is an example. Pyrrhotite is the most common sulphide; however, chalcopyrite was found associated with it at two locations; on lot 18 (south) of range IX and on lot 34 (south) of range VIII. In both cases the host rock is a pegmatoid facies of the amphibolite, rich in biotite. A sample picked up by the writer at the latter location assayed 0.12% Cu.

Some traces of chalcopyrite were observed in serpentinite (lot 7 west, range IX), 2000 feet northwest of "Baie de l'Orignal" (Moose bay).

Among the industrial minerals, massive talc, in which octahedral magnetite seems to be the only impurity — which incidentally could be easily removed — occurs in the Opasatica complex, on lots 4 and 5, range IX.

Asbestos is very rare in the ultrabasic rocks of the area. Its scarcity may be due to the absence of non-talc-carbonatized or non-amphibolitized serpentinite. A few tiny veinlets of asbestiform minerals are associated with magnetite in the serpentinite. A few fibrous minerals are present in some shear zones.

The lead-zinc-copper mineralization is always associated with quartz veins or with silicified zones. The veins are, in fact, made up of a network of closely spaced, interlaced stringers which form a stockwork. Frequently, the rock may appear to be a breccia due to blocks of metagreywacke remaining between the quartz veins. In other places, the silicification took place by replacement of the metagreywacke. The rock then has a greenish, cherty appearance and is hard and brittle.

Two main silicified zones were recognized in the northern part of the township (range IX and range X): the Diadem zone to the west; the Morin zone to the east. They both strike N15°W, and dip close to the vertical. Their maximum width is in the order of 200 feet. Despite the discontinuity of the outcrops, the length of the Diadem zone is estimated to be about 11,500 feet; the Morin zone, about 8,500 feet.

A similar silicified zone, striking N55°E., is located well to the south on lots 50 and 51 of range VII. A little pyrite is the only visible mineralization.

The control of the silicified zones appears to be completely independant of the stratigraphy. The attitude of the veins is generally a cross-cutting one but no fault or major fracture with which they might be associated was observed. A few quartz veins have cut through and altered the diabase on lot 52, range X and on lot 54, range IX. The conclusion drawn is that, in general, the silicious hydrothermal activity was post-diabase, and relatively recent in the Precambrian context.

DESCRIPTION OF MINERALIZED ZONES

Lead-Zinc-Copper

Diadem zone

Sudnor Mining Company Ltd., holds ground formerly held by New Norzone Mines Ltd., Diadem Mines Ltd., and Odyno Exploration and Development Ltd., covering lots 34 to 37 of range X and lots 35 to 38 of range IX.

The silicified rocks, 90% of which are made up of a network of quartz veins, outcrop on a hill, 800 feet long by 100 to 150 feet wide. Other similar but smaller outcrops extend northward. The density of the network of veins, or stockwork, lessens towards the borders and the rock grades to a more or less silicified greywacke. Pockets of dark sphalerite occur irregularly within the body of quartz. The mineralization is difficult to see on the surface unless a fresh surface is available. Just north of the main outcrop, a trench has uncovered a lens of 120 to 140 feet, heavily mineralized with sphalerite and galena, and locally with chalcopyrite. Banded zones of pyramidal-pointed, geodic quartz are quite common. Another feature of this stockwork is the existence of feldspathic lenses (30 X 6 feet), in considerable number adjacent to the mineralization. Because of their coarse grain these feldspathic occurrences have sometimes been called "pegmatites" by the miners. The early stage of kaolinization makes the feldspar difficult to identify in thin-section. It might be altered adularia as this is the normal feldspar found in this type of deposit.

The main deposit was opened up by underground workings, with levels at depths of 150, 300, 450 and 580 feet, and was followed horizontally over a length of about 300 feet.

The vein was also explored by trenches and exploratory diamond drill holes along a length of 1900 feet. The mineralization becomes leaner to the south despite the persistence of the stringer zone. Exploratory holes have encountered sphalerite to a depth of 900 feet in the shaft area. The mineralization consists of numerous small rich pockets and lenses. No continuity appears to exist between these, which makes grade and tonnage estimation difficult. Furthemore, the mining of such a deposit would have involved a considerable dilution of the ore. Mining activities were discontinued in 1949. According to the records of Diadem Mines Ltd., the development work outlined 87,700 tons having a grade of 8.5% zinc, 0.74% lead and 0.24 oz. silver per ton. Between January and April 1952, a little more than 7,000 tons were shipped to the concentrator of McWatters Gold Mines. The in situ upgrading of 3,500 tons produced 1,485 tons of zinc ore with low values in lead, silver and gold. A stockpile of mineralized material remains near the shaft.

In August 1968, Kerr Addison Mines Ltd. carried out an E. M. survey around the shaft. The survey failed to indicate any conductor.

Three thousand feet to the north, on lot 35 of range X, quartz veins, slightly mineralized with galena and sphalerite, occur. These veins are located exactly on the N12°W. strike of the main zone.

This hydrothermal deposit shows many of the characteristics described by Lindgren as being typical of epithermal deposits. This type of deposit is rare in the Precambrian formations of the Canadian Shield.

On lot 38 of range IX, another parallel silicified zone was explored by Shearzona Mines Ltd in 1947. In 7 exploratory drill holes the best intersection obtained was 3.46% zinc over 1 foot.

Lots 34 to 38, range VIII

Seventeen holes were drilled in 1947, by Shearzona Mines Ltd., in the central part of lot 38, range VIII, on the southern extension of the silicified Diadem zone. The zone, which measures 4000 feet by 30 feet, strikes N15°W. It is slightly mineralized with copper and zinc. Carbonate and feldspar were also observed. The best values reported were 2.14% copper over 2 feet and 1.74% zinc over 2 feet.

A little further to the north, Zoneore Rouyn Mines Ltd., drilled 3 holes in the northeastern part of lot 37 at an undetermined location. One of them is reported to have shown traces of sphalerite and chalcopyrite. Another hole was drilled in the northwestern part of lot 34 and a little sphalerite was reported.

Morin zone

These claims, previously held by Cook Copper and Fluorite Corporation Ltd., and then by Morin, are now held by Y. Vezina. They cover lots 51 to 55 of range IX and straddle the silicified zone (Morin zone) situated 2½ miles to the east of the Diadem zone. Work was carried out mainly at the northern end of the zone. The start of an adit on the hillside east of the outcrop shows a well-mineralized vein. This vein, 2 to 6 feet wide, strikes N40°E, and cuts obliquely across the silicified zone, from which it is distinguishable with difficulty. In May and June 1957, L. Morin put down 7 shallow holes to intersect the vein at depth. Erratic copper assays were obtained. The best intersections reported were 5.77% copper over 1.5 feet and 4.86% copper over 3 feet. Some fluorite was noted in one of the holes. The sampling of the trenches also gave erratic results. A trench located 250 feet to the north of the above-mentioned workings intersected a lens rich in fluorite, in the middle of the quartz body. A 300-pound sample shipped to Ottawa several years ago assayed 53.4% CaF_2.

Further north, near Beauchastel lake, a diabase dike is cut by a few quartz veins originating from the main stockwork. This shows that the siliceous injections are later than the diabase.

To the south, a series of outcrops of silicified rocks follows a N15°W strike. The largest of these outcrops is crossed by the Beaudry-Bellecombe road at the top of lot 54, range VIII. It is made up of veins containing a few pockets of sphalerite mineralization and, more rarely, chalcopyrite.

In an outcrop near Montbeillard lake, at the southern end of lot 55, range IX, silicified rocks show a slight copper mineralization. A few shallow holes showed intense silicification accompanied by less than 1% pyrite with a little chalcopyrite. The total length of the Morin zone, as followed in the field, is about 8,500 feet.

Molybdenite

A weak molybdenite mineralization on Moly island, in the northern part of Montbeillard lake (upper range VII), is only visible with difficulty in an old trench that is partly caved-in. The debris is made up of mottled vein quartz speckled with a few flakes of muscovite, pyrite, and molybdenite. The closest outcrops indicate that biotite granite forms the host rock of this occurrence. It is solely of academic interest and is mentioned here only for the record. This mineralization is well north of the granite batholith of the southern half of Montbeillard township with which the molybdenite is associated.

Copper-Nickel

The copper-nickel mineralization associated with the ultrabasic rocks is all located west of route 46. It appears to occur, by preference, in the sedimentary rocks (metagreywacke) in the immediate vicinity of the ultramafic sills of the Opasatica complex. In only one case has nickeliferous pyrrhotite been observed in the ultramafic rocks (chlorite-talc schist). This occurrence is in range V, on the south shore of Opasatica lake near the boundary between Dufay and Montbeillard townships.

Bourrassa, Pepperess, Bedard Claims

This property comprises lots A, B, 1, and the northern part of lot 2, range IX. Copper-nickel mineralization was found by G. Bourrassa on the southern part of lot 1, in 1960. It consists of an impregnation of nickeliferous pyrrhotite and a little chalcopyrite in quartzitic mica schist and amphibolite of the Pontiac Group, lying almost flat and close to highly altered, basic to ultrabasic rocks. In an adjoining zone, a band of massive pyrrhotite, almost 1 foot thick, assayed a little more than 1% nickel. In 1961, 8 shallow holes were drilled, 5 in the vicinity of the first mineralized discovery on lot 1, and 3 on lot 4. Altered ultrabasic rocks were intersected under most of the mineralized zone and one hole cut across pyroxenite. In 1964, Sullico Mines Ltd. took an option on the Bourrassa claims which then comprised lots A, B, and 1 to 5, range VIII. The company carried out geological, magnetometer and E.M. surveys and drilled 15 holes on lot B of range VIII, lot B of range IX and along the boundary between Dufay and Montbeillard townships. The results were disappointing. The best assays were 0.15% copper and 0.11% nickel over 6.5 feet, of which 6 inches gave 0.45% copper and 0.16% nickel. A 4-foot intersection assayed 0.30% copper, 0.37% zinc and 0.00% nickel. The zinc assays are characteristic of this zone, sometimes reaching 1.50% over 1- to 2-foot lengths. The pyrrhotite impregnated zones vary from 2 to 6 feet in width. The drilling results are quite interesting in that they reveal existence of sub-surface ultrabasic sills interstratified with the slightly warped metagreywackes. Based on the results of some of these exploratory holes, there must be a succession of many sills, from 15 to 100 feet in thickness, separated by variable thicknesses of metagreywacke. It is difficult in some cases to determine whether a mineralized zone is related to the upper or lower sill. Sometimes this sulphide mineralization occurs in the sedimentary rocks at a distance of 10 feet from the contact with the sill.

In the group of holes drilled to the south (lot B of range VIII), the drill cores show magnetiferous beds (approximately 50% magnetite), 2 to 3 feet in thickness, associated with and parallel to the sulphide beds. Garnet also occurs in the vicinity of the mineralization. Molybdenite was noted near a granite dike.

Essberger (Henderson) Claims

This property was staked in 1969 and 1970, and surrounds the Bourrassa ground. An electro-magnetic survey carried out during the winter of 1969-1970 on lots 3,4,5 of range IX revealed two conductors that were each checked by an exploratory hole. The results broadly confirmed those of Sullico of the existence of basic to ultrabasic sills, reaching 200 feet in thickness, intercalated with more or less amphibolitic mica schists. Here, too, sulphide zones occur in the sediments near contacts with the sills. The drill-holes cut pyrrhotite impregnated (10% to 30%) sedimentary rocks over approximate lengths of 6 to 18 feet. In some intersections the pyrrhotite was nickeliferous. Copper and zinc assays were also obtained. Sometimes chalopyrite was visible to the naked eye. Banded iron formation, made up of almost massive magnetite, forms the roof of sulphide zones near the base of ultrabasic sills. Their true thicknesses are of the order of 3 to 4 feet. Horizons rich in brown-red garnet occur in the roof and in the walls of the pyrrhotite and magnetite zones. Such garnets are not found elsewhere in the sequence. Erratic assays in platinum were reported from some of the sulphide zones.

GEOCHEMISTRY

A total of 172 stream sediment samples were collected in the northern half of Montbeillard township. After screening to -80 mesh, these samples were assayed for uranium, copper, zinc, lead, nickel, uranium, cobalt, tungsten, manganese, tin, gold, silver, and antimony.

High values in nickel, copper and zinc were obtained. These values appear to be significant as the samples from which they come are, for the most part, not distributed haphazardly over the area but are grouped around specific geological features. This is illustrated by the high nickel assays found in the northwest part of the township where a large mass of peridotite outcrops. It is noteworthy that high assays in copper and zinc were also obtained in this area. This metallic association of nickel, copper and zinc is known from the mineralized showings of the area.

Several high copper and zinc assays were obtained from samples taken on lots 33 to 39 of ranges IX and X. These seem to be associated with a dike of silicified porphyry which cuts the sedimentary rocks.

The samples showing high assays were re-assayed and the initial results were confirmed. Nitric acid was used to dissolve the samples to wnsure the solution of metallurgically refractory nickel carried in silicates.

The results from assays of the geochemical samples are appended to this report. The location of the samples is shown on the accompanying maps (1730-31) which also displays the assay results and the sectors with high values in copper, nickel, and zinc.

The frequency of distribution of nickel, copper, and zinc is shown hereunder.

NICKEL				COPPER		ZINC	
PPM	No	PPM	No	PPM	No	PPM	No
5	1	58	4	0	1	25	10
6	1	60	10	6	6	40	11
15	1	63	6	10	14	50	29
18	1	65	8	16	24	60	13
28	2	67	4	20	48	75	13
30	1	68	1	24	18	90	7
33	2	70	12	30	9	100	19
35	6	73	2	40	27	110	12
38	11	75	4	44	2	125	27
40	5	80	1	50	9	140	18
43	19	85	2	60	7	150	6
45	16	105	1	70	1	175	1
47	2	120	1	76	1	200	1
48	5	125	1	80	3	250	2
50	18	130	1	120	1	280	2
53	6	150	1	180	1	600	1
55	9	180	1	300	1	1250	1
57	3	440	1				

PPM - Values in parts per million
No - Number of samples.

BIBLIOGRAPHY

Ambrose, J.W - 1944 - Duparquet-Larder Lake-Rouyn area. Geol. Survey Can., Paper 44-29.

Chagnon, J.Y. - 1961 - Brodeur - Basserode area. Qué. Dept. Nat. Res. P.R. 456.

- 1962 - Remigny - Villars area. Qué. Dept. Nat. Res., P.R. 578

- 1963 - Guigues - Pontleroy area. Qué. Dept. Nat. Res., P.R. 511.

Cooke, H.C. - 1922 - Opasatika map-area. Geol. Survey Canada; Summary Report 1922.

Cooke, H.C. *& al.* - 1931 - Rouyn-Harricana area. Geol. Surv. Can., Memoir 166.

Holubec, J. - 1967 - Lithostratigraphy, structure and deep cristal relations of Archean rocks, Rouyn-Noranda area. Geol. Survey Can., Rapport inédit.

Harvie, R. - 1910 - Opasatika district. Que. Dept. of Colonization, Mines and Fisheries, Min. Op; pp. 82-90.

Wilson, M.E. - 1912 - Larder Lake district and adjoining portions of Pontiac County. Geol. Survey of Can., Memoir 17E.

" " - 1962 - Rouyn-Beauchastel area. Geol. Surv. of Canada; Memoir 315.

20.4.13A

Sample No. on the map	Code No. of sample in files of Dept.	RESULTS OF ANALYSES IN P.P.M. Cu	Zn	Pb	Mo	Ni	U	Co	W	Mn	Sn	Au	Ag	Sb
1	10061	24	150	20	0	80	2	30	0	2836	8	0	0.5	30
2	10060	20	75	24	0	57	1	23	-	-	20	-	-	-
3	10062	26	50	30	0	45	0	18	0	388	12	0	0	15
4	10076	20	125	40	0	125	1	31	0	-	40	-	-	-
5	10065	20	75	30	0	85	1	35	0	-	12	-	-	-
6	09905	16	50	20	0	50	2	23	0	568	0	0	0.5	5
7	09904	10	100	10	0	63	3	30	0	555	8	0	0.4	5
8	09906	16	40	16	0	55	1	25	0	955	0	0	0.4	5
9	09903	10	125	6	0	50	6	25	0	793	8	0	0.4	5
10	09910	16	600	16	0	53	2	28	0	-	8	-	-	-
11	09909	24	50	20	0	70	4	30	0	620	8	0	0	4
12	10059	16	90	20	0	85	1	33	0	871	12	0	0.5	21
13	10063	10	50	20	0	60	0.5	23	0	503	20	0	0.4	22
14	10099	30	75	30	0	68	1	130	0	15427	0	0	0.6	9
15	09892	Lost sample												
16	10040	30	40	20	0	65	0.5	20	0	558	0	0	0.7	22
17	09886	24	110	10	0	50	0.5	20	0	503	0	0	0.6	16
18	09887	16	100	80	0	43	1	90	-	-	0	0	-	-
19	09894	40	25	20	0	45	0	10	0	97	8	0	0.4	0
20	09898	10	50	20	0	65	0	25	0	368	0	0	0	0
21	10049	10	100	10	0	70	0.5	50	0	516	8	0	0.4	16
22	10044	24	60	24	0	60	2	20	2	678	0	0	0.4	18
23	10045	20	60	40	0	50	0.5	18	0	615	0	0	0.6	24
24	10053	40	50	16	0	57	1	20	0	456	8	0	0	20
25	10054	24	100	40	0	50	1	28	0	1205	8	0	0	18
26	10055	16	50	10	0	50	0	30	0	933	8	0	0	16
27	10057	20	40	20	0	45	1	10	0	228	8	0	0.6	18
28	10056	24	25	30	0	35	0.5	8	0	-	12	-	-	-
29	10058	16	100	60	0	35	1	15	-	-	20	-	-	-
30	09901	50	100	40	0	67	0	43	0	420	12	0	0.5	0
31	09902	20	60	16	0	45	0	20	0	358	0	0	0.4	0
32	10013	60	125	60	0	-	2	-	-	-	-	-	-	-
33	09923	50	125	20	0	75	2	25	0	2150	8	0	0.4	11
34	09922	20	100	20	0	67	2	28	0	863	0	0	0.5	12
35	09924	40	100	16	0	60	1	20	0	603	0	0	0	7
35A	10064	20	75	30	0	85	1	35	0	-	12	-	-	-
36	10066	40	100	40	0	180	1	23	0	-	0	-	-	-
37	10067	20	50	40	0	70	0.5	25	0	828	8	0	0.4	16
38	10086	40	150	60	0	440	2	30	0	380	0	0	0.5	8
39	10071	16	50	16	0	58	0	13	0	595	8	0	0	17
40	10073	10	40	10	0	50	0.5	20	0	372	8	0	0.4	14
41	10072	16	50	20	0	60	0.5	18	0	368	16	0	0.4	15
42	10032	20	40	36	0	60	2	23	0	1300	12	0	0.4	16
43	10039	16	25	20	0	47	1	15	0	700	8	0	0.6	24
44	09926	50	60	60	0	70	3	23	0	630	0	0	0.4	8
45	10031	16	50	16	0	43	1	17	0	495	0	0	0.4	9
46	09925	20	60	10	0	43	1	18	0	348	0	0	0	7
47	09890	6	100	16	0	50	1	25	0	758	8	0	0	16
48	09891	16	110	10	0	53	1	17	0	926	8	0	0	18
49	09888	6	50	20	0	40	1	15	0	327	8	0	0	9
50	09889	10	125	20	0	60	1	33	0	858	0	0	0.4	16
51	10041	20	25	30	0	50	1	12	-	-	0	-	-	-
52	10043	20	50	20	0	50	1	23	0	-	0	-	-	-
53	10042	16	50	16	0	33	2	13	0	382	0	-	-	-
54	09896	20	100	16	0	50	0	30	0	1081	0	0	0	0

Sample No. on the map	Code No. of sample in files of Dept.	RESULTS OF ANALYSES IN P.P.M.													
		Cu	Zn	Pb	Mo	Ni	U	Co	W	Mn	Sn	Au	Ag	Sb	
55	09897	16	125	30	0	63	0	35	0	-	0	-	-	-	
56	09899	6	25	20	0	30	0	20	0	283	8	0	0	4	
57	10051	20	50	20	0	60	1	23	0	561	12	0	0.5	18	
58	10046	40	40	20	0	55	1	20	0	451	8	0	0.6	24	
59	10050	16	90	30	0	55	0.5	38	0	3026	12	0	0	26	
60	10052	20	90	30	0	60	0	27	0	730	8	0	0	24	
61	09900	10	25	20	0	43	0	23	0	410	12	0	0	5	
62	09911	20	150	20	0	55	2	25	0	-	8	-	-	-	
63	09919	24	90	16	0	70	2	25	0	753	8	0	0.5	12	
64	10070	20	75	20	0	130	0	30	0	1021	20	0	0	12	
65	10075	10	40	16	0	150	0.5	20	0	568	12	0	0.4	16	
66	09908	40	25	10	0	105	2	27	0	775	0	0	0	5	
67	09907	20	40	20	0	50	2	25	0	738	0	0	0.4	5	
68	10074	5	40	16	0	33	5	10	0	217	0	0	0.5	3	
69	09912	20	50	20	0	60	1	30	0	756	0	0	0.4	5	
70	10030	20	60	16	0	50	0.5	20	0	575	16	0	0.4	16	
71	10029	20	50	20	0	45	0.5	55	0	4445	8	0	0.4	16	
72	10028	50	50	30	0	65	0.5	18	0	633	0	0	0.4	24	
73	09893	6	50	30	0	63	0	30	0	796	8	0	0.4	26	
74	09895	40	125	20	0	75	0	23	0	619	0	0	0.5	7	
75	10024	20	150	20	0	38	2	25	0	833	0	0	0.4	18	
76	10025	16	140	24	0	35	3	13	0	831	0	0	0.5	21	
77	09877	50	140	16	0	55	2	8	0	392	6	0	0.4	16	
78	09871	20	125	24	0	43	2	13	0	2624	0	0	0.7	18	
79	09873	16	110	16	0	43	2	10	0	685	4	0	0.4	18	
80	09874	24	75	24	0	43	3	10	0	407	2	0	0.4	18	
80A	10094	40	60	20	0	73	0.5	33	0	780	0	0	0.4	13	
80B	10091	60	75	30	0	-	2	30	0	975	8	0	0.4	10	
81	10098	24	100	10	0	50	1	20	0	503	0	0	0.6	16	
82	10093	20	125	20	0	55	0.5	33	0	1208	8	0	0.4	12	
83	09918	40	110	20	0	70	2	30	0	978	16	0	0.5	11	
84	09917	40	50	20	0	63	1	20	0	650	0	0	0.6	4	
85	09854	16	90	40	0	48	1	5	0	1730	4	0	0.8	6	
86	09878	20	100	16	0	43	2	13	0	770	0	0	0.4	21	
87	09870	20	140	20	0	38	1	15	0	885	0	0	0.6	13	
88	09879	16	125	20	0	45	1	13	0	536	0	0	0.6	24	
89	10027	40	150	50	0	40	2	43	0	1839	2	0	0.5	21	
90	10026	40	125	24	0	43	4	25	0	525	0	0	0.5	21	
91	09872	24	125	20	0	38	1	8	0	603	0	0	0.4	18	
92	09921	70	125	24	0	70	3	33	0	1218	0	0	0.4	8	
93	10080	40	175	50	0	70	-	80	-	-	-	-	-	-	
94	10079	20	140	40	0	65	2	30	0	1355	8	0	0.4	15	
95	10090	20	75	20	0	58	2	23	0	530	12	0	0.4	8	
96	10092	20	140	20	0	70	2	35	0	1376	16	0	0.5	10	
97	10095	20	100	16	0	75	0.5	30	0	716	8	0	0.5	10	
98	10097	40	140	40	0	65	3	57	0	1064	12	0	0.5	5	
99	09920	24	110	20	0	58	2	25	0	600	8	0	0	8	
100	10096	40	140	60	0	63	1	27	0	508	8	0	0.4	6	
101	09884	50	250	80	0	58	2	5	0	1011	0	0	0.6	18	
102	09869	10	150	20	0	43	2	10	0	735	0	0	0.5	16	
103	09865	44	250	50	0	43	2	13	0	475	0	0	0.8	13	
104	09860	60	125	60	0	38	1	30	0	-	2	-	-	-	
105	09869	10	150	20	0	43	2	10	0	735	0	0	0.5	16	
106	10011	60	60	60	-	-	-	-	-	-	-	-	-	-	
107	10012	20	125	20	0	43	4	18	0	428	2	0	0.4	16	

Sample No. on the map	Code No. of sample in files of Dept.	RESULTS OF ANALYSES IN P.P.M.												
		Cu	Zn	Pb	Mo	Ni	U	Co	W	Mn	Sn	Au	Ag	Sb
108	09864	24	110	30	0	43	2	13	0	636	0	0	0.6	17
109	09863	30	125	16	0	50	5	13	0	650	0	0	0.4	18
110	09867	10	140	60	0	40	1	28	0	1266	0	0	0.7	16
111	10010	10	110	30	0	38	2	13	0	260	2	0	0.4	16
112	10009	24	125	24	0	45	2	18	0	738	2	0	0.4	22
113	10008	20	110	24	0	48	3	13	0	373	4	0	0.4	17
114	09853	24	40	36	0	28	0.5	5	0	120	2	0	0.8	7
115	09851	24	100	24	0	50	1	10	0	480	2	0	0.6	8
116	09857	20	60	20	0	35	1	18	0	283	2	0	0	12
117	10015	20	280	24	0	45	2	25	0	583	4	0	0	18
118	09859	16	50	24	0	53	1	18	0	535	4	0	0.5	20
119	10001	180	140	30	0	75	2	18	0	623	2	0	0.6	17
120	10000	16	140	20	0	38	1	10	0	483	6	0	0.4	17
121	10007	80	140	80	0	45	8	15	0	738	2	0	0.7	18
122	09858	20	25	20	0	65	1	5	0	373	2	0	0.6	13
123	10006	80	125	30	0	38	1	8	0	515	4	0	0.5	17
124	10005	120	140	90	0	48	2	15	0	680	2	0	0.6	21
125	10004	40	140	20	0	43	3	18	0	743	0	0	0.6	21
126	10003	50	125	24	0	48	2	20	0	778	0	0	0.6	17
127	10002	50	75	24	0	45	4	13	0	1135	0	0	0.5	21
128	10033	10	100	30	0	45	3	13	0	325	0	0	0.5	16
129	10038	40	60	20	0	18	3	8	0	–	2	–	–	–
130	09862	20	110	20	0	28	5	8	0	193	2	0	1.5	11
131	09861	76	125	20	0	55	4	8	0	300	2	0	0.5	17
132	09866	300	1250	600	0	15	4	3	0	–	0	–	–	–
133	09852	30	25	36	0	5	0.5	3	0	20	2	0	0	0
134	10047	20	25	16	0	48	–	13	0	–	12	–	–	–
135	10048	20	50	16	0	50	1	20	0	425	8	0	0.4	26
136	10082	40	125	24	0	70	1	40	0	1038	0	0	0.4	22
137	09914	40	140	10	0	70	2	33	0	–	8	0	–	–
138	09913	24	140	10	0	67	2	27	0	750	0	0	0.4	8
139	10077	30	60	20	0	67	1	28	0	656	8	0	0.4	20
140	09875	20	90	20	0	38	2	25	0	633	2	0	0.5	18
141	09876	44	110	20	0	43	1	10	0	616	2	0	0.6	18
142	10023	20	110	30	0	35	2	10	0	686	6	0	0.	17
143	10022	30	60	60	0	40	2	35	0	1025	2	0	0.4	25
144	10034	40	125	20	0	53	2	18	0	833	0	0	0.4	25
145	10037	16	50	24	–	43	1	13	0	496	0	0	0.4	14
146	10035	20	50	20	0	45	1	13	0	435	0	0	0.4	21
147	09883	20	140	20	0	43	1	5	0	298	0	0	0.4	17
148	09880	40	125	16	0	43	2	8	0	500	2	0	0.6	24
149	10017	20	90	24	0	40	2	5	0	243	0	0	0	16
150	10016	24	75	30	0	35	1	3	0	170	2	0	0.4	12
151	10014	40	140	24	0	45	3	8	0	282	2	0	0.4	16
152	10085	60	100	30	0	73	2	28	0	–	0	–	–	–
153	10068	30	60	36	0	63	1	35	0	890	8	0	0.6	24
154	09915	80	200	70	0	120	0.5	100	0	3535	12	0	0.6	8
155	10081	20	50	20	0	57	0.5	35	0	561	12	0	0.4	13
156	10069	20	50	20	0	45	0.5	23	0	431	12	0	0.6	16
157	10078	30	75	40	0	65	0.5	28	0	–	8	–	–	–
158	09885	40	125	30	0	53	4	13	0	405	0	0	0.5	18
159	09882	20	140	24	0	50	2	6	–	–	2	–	–	–
160	09881	24	125	24	0	43	2	8	0	383	2	0	0.4	18
161	09856	20	50	24	0	6	0.5	6	0	55	2	0	0	0
162	09855	40	75	30	0	55	0.5	5	0	765	4	0	0.9	11

20.4.13A

Sample No. on the map	Code No. of sample in files of Dept.	RESULTS OF ANALYSES IN P.P.M.													
		Cu	Zn	Pb	Mo	Ni	U	Co	W	Mn	Sn	Au	Ag	Sb	
163	10019	50	110	24	0	38	1	8	0	243	2	0	0	12	
164	10018	40	100	20	0	45	1	5	0	415	0	0	0.4	16	
165	10021	60	280	80	0	38	1	33	0	1095	6	0	0.4	18	
166	10020	40	125	16	0	38	0.5	18	0	421	4	0	0.8	18	
167	09927	60	125	20	0	55	2	20	0	418	20	0	0	9	
168	10083	6	50	24	0	70	0.5	45	0	760	0	0	0.6	32	
169	10084	30	75	20	0	53	0.5	25	0	543	8	0	0.4	16	
170	09916	80	200	70	0	120	0.5	100	0	3535	12	0	0.6	8	

The dash (-) indicates absence of result for the element

The zero (0) indicates that the element was not detected.