RG 138(A)

CLERMONT TOWNSHIP, ABITIBI-WEST COUNTY

QUEBEC DEPARTMENT OF NATURAL RESOURCES

Honorable Paul-E. Allard,
Minister

Paul-Emile Auger,
Deputy Minister

MINES BRANCH

GEOLOGICAL REPORT 138

CLERMONT TOWNSHIP

Abitibi-West County

by

Camille Thibault

QUÉBEC
1970

TABLE OF CONTENTS

Page

I L L U S T R A T I O N S

Maps

GEOLOGY OF CLERMONT TOWNSHIP*

Abitibi-West County, Quebec

by

C. Thibault

INTRODUCTION

General statement

During the summers of 1963 and 1964, the writer carried out geological mapping of Clermont township, Abitibi-West county, to the scale of one inch equals 1,000 feet. This work is part of a program of detailed mapping in the neighborhood of the Normetal mine, located in Desmeloizes township, adjacent to the western part of Clermont township. The horizon of sheared felsic and fragmentary rocks occurring in the Normetal Mining Corporation deposit, along which are found disseminated or weakly concentrated sulfides, crosses the township. The presence of copper, zinc, lead, silver and gold mineralization has been revealed in many places through the work of prospectors and mining companies.

The area is within the band of intruded volcanic rocks in which several Abitibi mines are located. This band occurs in the southern part of the Superior Province of the Canadian Shield. Clermont township is underlain largely by a folded assemblage of volcanic rocks cut by various types of intrusive rocks. A band of detrital sedimentary rocks crosses the southern part of the township.

Geographic location and extent

Clermont township has an area of 100 square miles. It is bounded by approximate longitudes 79°05' and 79°18' and by latitudes

* Translated from the French

48°52' and 49°01' and separated from the interprovincial Quebec-Ontario boundary to the west by Desmeloizes township.

The twin cities of Rouyn and Noranda, which constitute the principal social and economic hub of the district, are 65 miles from the center of the area. The towns of Normétal and La Sarre are located 11 miles to the northwest and to the south respectively.

Access

Access to La Sarre, a town served by Canadian National Railways, is gained either from Amos by Highway 45 or from Rouyn by Highway 46. From La Sarre, a paved section of Highway 63 crosses the center of the township in a north-south direction. Gravelled range-roads, at right angles to Highway 63, and 2 or 4 miles apart, give easy access to the interior of the area.

A landing field, accessible to smaller aircraft, is located in the center of Clermont township.

Turgeon and La Sarre rivers, flowing respectively to the north and to the south of the area, were used as means of access before the building of roads.

Field methods and personnel

Vertical aerial photographs at a scale of one inch to 2,600 feet by Photo-Air Laurentides, Quebec, were used. Photographs at the scale of mapping were available only for the eastern half of the township. The smallest differences in level were observed from the photographs with the aid of a stereoscope and later examined on the ground. Systematic traverses were avoided in perfectly flat, low ground, swamps, and beds of former ponds or small lakes, but all streams of any importance were examined. Pace and compass traverses were run by teams of two men. Nearly all the range lines, most of them recut in 1962, were clearly visible on the ground, but, since most of the range lines lacked lot posts, their plotting on the map with respect to topographic and hydrographic features was generally impossible.

Samples of stream sediments from the eastern half of the area were taken to be geochemically assayed for copper, zinc, lead, and molybdenum. This work consisted in taking two samples from the active zone of the banks of streams at intervals of a few feet.

A base map at a scale of one inch to 1,000 feet was compiled from aerial photographs by the Cartography Service of the Department for the western half of the township and by Photo-Air Laurentides for the eastern half and used to record observations taken on the ground. More than two thirds of the outcrops occur on low, elongate ridges lying in discontinuous, parallel bands in the center and northwest part of the area. A few were also observed in the bed of a large stream,as well as on the banks of Turgeon river.

In 1963, the author was aided by N. Blouin of McGill University, as senior assistant, and R. Guillemette of Ecole Polytechnique and A. Kinderman of McGill University, as junior assistants. During the summer of 1964, D.T. Shanks of McGill University was senior assistant, and the junior assistants were R. Bargiel of Ecole Polytechnique and A. Clark of the University of Montreal. E. Pinard was cook during both seasons. All these men performed their respective duties in a highly satisfactory manner.

The writer is indebted to Jean Dugas, then resident geologist of the Department for the Rouyn-Noranda district, and to his successor, John Sharpe, for their much appreciated advice and friendly criticism during the course of this work.

Previous geological work

J.F.E. Johnston (1901), during a reconnaissance geological survey along certain streams of the region, including La Sarre river, was the first to record geological information on this part of western Quebec.

In 1906, W.J. Wilson (1910) made a preliminary geological survey along the proposed route of the Transcontinental railway.

M.E. Wilson (1913) was the first to give a general description of western Quebec and to map it geologically at a scale of one inch to 4 miles. The vast area described covers approximately 6,500 square miles and is bounded to the north by latitude 48°50', which is immediately south of Clermont township.

In 1914 and 1915, T.L. Tanton (1919) mapped a vast area, including Clermont township, at one inch equals 4 miles.

The most complete and detailed geological survey of the area and adjoining townships was made by J.B. Mawdsley (1928), at a scale of one inch to the mile.

G.F. Flaherty (1936) mapped the Perron-Rousseau area contiguous to the north portion of the area mapped by Mawdsley.

DESCRIPTION OF AREA

Topography and drainage

The mean altitude of the area is 1,000 feet, but it ranges generally between 900 and 1,125 feet. The relief is therefore very small. On lots 56 and 57, range IX, a rocky ridge rises to an altitude of more than 1,125 feet. Another ridge on lot 59, range III, attains 1,100 feet.

Elongate rocky hills are arranged in discontinuous, parallel bands, particularly in the central part of the area. They form a unit 2 or 3 miles wide, trending N.70°W. This rocky zone is bordered to the south by a land surface some 2 miles wide without any outcrop. Scattered, low rocky hills occur in the northern part of the area. The exothermic action of the wide diabase dikes has hardened the enclosing volcanic rocks, thus rendering them more resistant to erosion.

Elsewhere, the substratum is covered with a thick layer of clay and numerous deposits of sand and gravel. These form low hills, generally somewhat elongated and oriented toward the northwest or the north. They are particularly abundant in the western half of the township. Their whale-back shape thins off toward the south and southeast. A major esker, trending north-south, crosses the central part of the area. In ranges IV, V, and VI, this esker spreads as a wide area of sand with a little gravel, and is occupied by many small lakes,which fill steep-sided basins. Parts of two other eskers located in the western half of the township can be seen on the accompanying maps. Except for the low rocky hills, the sand and gravel deposits, and a number of rounded mounds of clay, the area is flat and swampy, particularly in the eastern half. A few, shallow lakes, 1,500 to 3,500 feet long, still exist in the northwest and southeast quarters of the township. Their surroundings are swampy and they are overgrown by vegetation on their peripheries.

The drainage system is part of the James Bay hydrographic basin. The waters flow slowly through large brooks usually fringed with marshland. In the northern part of the area, these brooks generally meander in marshy plains or shallow valleys, whereas, in the southern part, the brooks cut their beds deeper and deeper in the thick clay layer, thus forming steep banks. The flowing waters carry a fair amount of clay and organic matter. Those of the northern half of the area drain into Turgeon river, which crosses the eastern half of range X and flows into Harricana river much farther north. The small Portage river winds through the eastern part of ranges II and III, and, together with the two large brooks, which are also tributaries of La Sarre river, drains the remainder of the township. La Sarre river flows into the large Abitibi lake.

Inhabitants and natural resources

The villages of Saint-Vital and Val-Saint-Gilles are respectively in the southwest and northeast quarters of the township. Inhabited ranges occur 2 miles apart in the western half of the area. On the other hand, settlers live only in ranges I, II-III and VIII-IX of the eastern half. The local manpower finds employment at the Normetal mine, a sawmill at Beaucanton in the southern part of Rousseau township, and a newly erected sawmill at Val-Saint-Gilles.

Numerous farms are abandoned and many others are not worked to capacity. The milk industry is the chief source of income in the area. Forage and potato constitute the main crop.

The predominant tree species are trembling poplar, birch, spruce and jack-pine. Spruce grows mostly in lowlands and jack-pine in sandy areas, whereas birch and trembling poplar flourish in rocky ground.

GENERAL GEOLOGY

All the rocks of the area are of Lower Precambrian age, except diabase, which is considered as Upper Precambrian.

The area is underlain chiefly by intermediate and felsic volcanic rocks intruded by numerous diorite and gabbro sills. The wide zone of detrital sedimentary formations mapped in the adjoining townships to the east and to the west crosses the southern part of the area, where a few outcrops of arkosic graywacke and slate occur. Minor amounts of carbonaceous schist and iron-formation were observed in the volcanic and sedimentary rocks.

All these rocks are highly deformed in a series of apparently isoclinal folds, and they have acquired a schistosity generally parallel to the strike of the formations, which ranges from N.75°W. to east-west.

Peridotite, which occurs as elongate and roughly concordant masses, would be classified among the oldest intrusive rocks. The youngest intrusive rocks of the Lower Precambrian are related to the Mistawak batholith; they include biotite granite, hornblende granodiorite and granophyre. A dioritic intrusive mass, later than the folding and the deformation undergone by the volcanic and sedimentary rocks, would be prior to the granitic intrusion. Leucophyre, lamprophyre and granophyre of various ages were also observed.

Table of Formations

CENOZOIC	Recent		Sediments	Mold; stream, river and marsh deposits; peat
	Pleistocene			Lacustrine clay; silt; sand; gravel; boulders; fluvio-glacial deposits
UNCONFORMITY				
PRECAMBRIAN	Upper		Intrusive rocks	Diabase (quartz,olivine, normal)
	Lower		Intrusive rocks	Granophyre; lamprophyre Mistawak batholith { Biotite granite; Chlorite granite; Hornblende granodiorite } Diorite (amphibolite)
				Major folding
			Intrusive rocks	Leucophyres: feldspar porphyry; hornblende porphyry Lamprophyre Diorite; gabbro; peridotite
			Sedimentary rocks	Arkosic graywacke; slate; breccia
			Sedimentary rocks associated with volcanic rocks	Carbonaceous schist (tuff), slate, graywacke, iron-formation
			Lavas and pyroclastic rocks	Andesite; dacite; rhyolite (trachyte) Lapilli tuff; agglomerate

Wide quartz diabase and olivine diabase dikes striking northeast, as well as much narrower ones striking north or northeast, cut all the other rocks.

Lavas and Pyroclastic Rocks

Intermediate lavas: andesite and dacite

A band of lava flows of intermediate composition some 4 miles wide with accompanying sills of dioritic and gabbroic rocks underlies the central part of the area. They include dacite and andesite, the latter occurring principally in the southern part of the band.

These rocks are generally dark green or blackish on weathered surface, whereas on the fresh surface they are various shades of green. The andesite is dark green, more opaque and softer than the dacite, which is pale green or gray on fresh surface. The grain size ranges from very fine to medium, so that the rock grades to a dioritic texture. The medium-grained, massive rocks, having no flow structure and in many places cut by cooling joints rather characteristic of intrusive rocks, are shown on the map as diorite. They may represent the central part of thick lava flows or sills. The distinction is rendered more difficult by the widespread development of secondary minerals which give the rocks their schistose character. These minerals are chlorite and fibrous or acicular amphibole in the andesitic rocks, and sericite and chlorite with here and there amphibole in the dacitic rocks.

Pillows are a conspicuous feature in most andesite outcrops but are less abundant in dacite. The pillows in dacite are generally smaller and have thinner and more distinct rims. In andesite, they may reach a few feet in diameter, though it is ordinarily difficult to estimate their original dimensions owing to deformation in the plane of schistosity. A distinction between the dip of the flows and the dip of the schistosity is generally impossible to make. However, where the pillows are little deformed, the observed dip is parallel to that of the schistosity. The discontinuity of the pillow structure within a single flow may be observed at several places owing to the nearly vertical attitude of the strata.

Amygdules are relatively scarce, particularly in the coarser grained, massive facies and in the highly schistose rocks. In these two cases, the vesicular structure may have been obliterated.

Part of the dacite and andesite is more or less carbonated, in which case it is locally spotted with rust.

Thin-section examination shows that the andesite is a microgranular and schistose rock. The minerals are xenomorphic except for a few amphibole crystals. The amygdules generally consist of quartz or carbonate. Tremolite-actinolite and hornblende, with varying amounts of chlorite, constitute up to 40% of the andesite. Epidote and other minerals of this group make up from 10 to 30% of the rock. The proportion of carbonate varies widely and is lower than in the dacite and the rhyolite. Andesite is thus altered by saussuritization, uralitization, chloritization and a little carbonatation. Granular sphene or leucoxene is always present in amounts greater than 5%. Zircon is scarce. The felsic material is too fine grained to be identified.

Under the microscope, the dacite is distinguished from the andesite by the presence of quartz (up to 10%), by the cloudiness of the amphiboles, as well as their smaller proportion, by the presence of widespread phenocrysts (completely saussuritized plagioclase, a little pyroxene more or less converted into bastite) and, in a few cases, by the presence of white mica. The alteration resembles that of andesite, except that carbonatation is stronger. Saussurite is as abundant in clusters more or less aligned according to the schistosity.

Rhyolite

A one-mile-wide band consisting mostly of rhyolite trends southeast across the township, from the northwest corner of the township. Andesite, pyroclastic rocks, dacite and diorite are intercalated in this band. The intermediate rocks become more abundant toward the south, but they are everywhere accompanied by rhyolitic flows, ordinarily carbonated and rusted. Rhyolite is the only volcanic rock of the area in which flow breccias are relatively abundant.

The rhyolitic rock is very fine grained or aphanitic, soapy lustered and light colored, whitish-yellowish, greenish, grayish, and, in places, pink. Weathered surfaces show a white or cream tint. Locally, the rhyolite contains clear quartz eyes, particularly in the southern part of the band. Regional metamorphism and folding with added local shearing have transformed the rhyolite into sericite schist with chloritoid or chlorite in places. It is generally carbonated to varying degrees, especially in the vicinity of the township center-line facing range-lines III-IV and VII-VIII. In extreme cases, carbonate is the chief constituent of the rock. The presence of fine rusty spots, common in the carbonated rhyolite, would indicate that the carbonate is ferruginous.

In thin-sections, the rhyolite is a microgranular rock of commonly panxenomorphic and nearly everywhere schistose texture. In many places, automorphic chloritoid phenoblasts (0.1 - 2mm.) constitute 5 to

15% of the rock. Quartz with undulating extinction is abundant in the matrix, although some highly carbonated facies do not contain more than 15%. Carbonate is everywhere conspicuous and constitutes locally at least half of the rock. The rhyolite is everywhere highly sericitized and contains little or no chlorite. Apatite and zircon are the accessory minerals with, here and there, rutile (1%) and magnetite (1%). Pyrite is present in many places and amounts exceptionally to 6% of the rock.

A porphyric rhyolite band outcrops on lots 12 and 13, range IX, and on lot 52,range VII. Feldspar phenocrysts and quartz eyes were observed under the microscope in a sample from lot 52. The rock, of schistose and cataclastic texture, has a felsic microgranular matrix with chloritoid rods aligned parallel to the schistosity. A little chlorite also occurs as thread-like patches around isolated phenocrysts or in clusters. With the small amount of chlorite present, colored minerals constitute about 10% of the porphyric rhyolite. The thin-section contains about 15% fractured phenocrysts (up to 3mm. long), rendered more conformable with schistosity by deformation or granulation. Nine out of 10 consist of poorly twinned plagioclase or partly perthitic potassic feldspar; smaller phenocrysts consist of bipyramidal quartz. Carbonate makes up about 10% and pyrite approximately 5% of the rock. Accessory minerals include sphene and granular leucoxene containing iron ore (1%), apatite, topaz, rutile and zircon.

One of the samples examined under the microscope was a trachyte of the rhombic microporphyry type. Most of the feldspar phenocrysts in this rock consist of irregularly twinned plagioclase; the others are potassic and microperthitic. The sample contained 8% microgranular leucoxenitic sphene.

Pyroclastic rocks: tuff, lapilli tuff, agglomerate, graphitic tuff.

Pyroclastic rocks outcrop nearly exclusively in the northern half of the area, especially in the northwest quarter of the township. Here, they occur as thin beds or thicker layers, particularly between lots 10 and 15. They are concentrated in the transition zone between the rhyolitic and the dacitic-andesitic lavas.

These pyroclastic rocks are almost everywhere of the same composition as the adjacent lavas, of which they also have the color, hardness and superficial alteration. They are formed of 10 to 60% macrofragments, more felsic, harder, more resistant, and lighter colored than the enclosing matrix. Finer fragments and microfragments, and, in certain cases, a widely variable proportion of lava, constitute the matrix. The size of the macrofragments ranges from 1/8 of an inch to 10 inches. Apparently there exists no relation between the diameter of the macrofragments and the thickness of the bed. Quartz has filled the small, rounded or ellipsoidal cavities of the fragments which were originally vesicular. Many other fragments are completely devoid of amygdules. Where the macrofragments are not too much deformed, one can see that they were angular or slightly rounded, but they are commonly well deformed and flattened. In a section perpendicular to the plane of schistosity, they may attain a length of 2 feet and a thickness of 2 inches.

In the pyroclastic rocks, fragments of all dimensions occur randomly, and only in rare cases was sorting observed.

Sedimentary rocks associated with volcanic rocks

Carbonaceous schists (tuffs)

On lots 32 and 33, range VII, and in the northern part of lot 62, range III, thin beds of carbonaceous schists were observed. They probably represent a subaquatic deposition of tuff in a sequence of volcanic and pyroclastic rocks.

At the first locality, a bed of subaquatic lapilli tuff, 20 feet wide at the most, occurs in well-exposed rhyolite. Parallel lenses and masses of very fine siliceous material, colored deep black by graphite, occur 20 feet to the south. These thin lenses may be observed at intervals over a length of 1,000 feet. The graphitic lamellae are conspicuous only along the schistosity planes of the tuff. The rock contains pyrite (see "Economic Geology", under "Sanctae Rosaelis")

Two miles eastward in range VII, four diamond drill-holes would have cut thin beds of graphitic tuff. Tuff and shale with a little schistose graywacke outcrop on lot 52.

Each of the two layers of carbonaceous schist exposed in the northeast corner of range III is about 50 feet thick, and one of them is interstratified with a little gray graywacke. The black carbonaceous rock breaks along undulated cleavage planes. In thin-section, it exhibits the character of a fragmentary lapilli tuff. Relics of deformed felsic fragments are seen in microgranoblastic texture. By devitrification cryptogranular to microgranular and microspherulitic textures were formed. The orientation of the microlites varies from one place to another in thin-section, as though the microlites were within different fragments. The rock is composed of quartzo-feldspathic material clouded with dust of amorphous carbonaceous matter associated with a little iron oxide. It is very weakly magnetic and contains chloritic minerals and minerals of the epidote group.

Slate, graywacke

On lot 52, range VII, the canalization of a large stream uncovers an almost continuous section some 900 feet long. All the rock is strongly schistose. The azimuth of the schistosity ranges from 80° to 100°, with a dip of 70° to 85° toward the south. The top of the beds is southward.

At the northern end of the cut rhyolitic lapilli tuff is converted into sericite schist in which the macrofragments, stretched to 3 or 4 times their thickness, are generally ½ to 1½ inches long and exceptionally attain 3 inches. In this rhyolitic tuff are interbedded thin beds of silty tuff and gray or light to dark gray-green schistose graywacke which are devoid of macrofragments. From 45 to 75 feet southward along the cut, there is a rapid decrease in the size of the fragments down to 1/8 of an inch in length with some fragments reaching 1/4 of an inch. From 75 to 220 feet, the tuff becomes more felsic. Its color changes from yellowish or grayish to whitish or colorless. It becomes impossible to distinguish the fragments with the naked eye. From 220 feet onward, silty or clayey interbeds gradually appear, discontinuous or lenticular at first, and then become more and more abundant, so that from 250 to 290 feet the rock is a dark gray sericitous and carbonated slate. Farther on, 80 feet of fine-grained rhyolitic tuff carbonated and partially converted into sericite schist follow toward the south. The passage to the rhyolite southward is gradual through a transition zone about 10 feet wide.

A little slate and graywacke are interbedded with volcanic rocks on lots 60 and 62 near range-line III-IV. These sedimentary rocks are quite similar to some bands of the wide zone of sedimentary rocks of the southern part of the area.

Iron-formation

A stratiform lens of iron-formation 15 inches thick and about 10 feet long occurs in a bed of felsic tuff 5 feet wide in the northwest part of lot 4, range VIII. This bed also contains a few thin, discontinuous chert bands an inch thick or less. To the north it is in contact with agglomerate and to the south, with lapilli tuff of intermediate composition. Banding in the iron-formation is due to thin black and gray layers.

Microscopic examination indicates a recrystallized cherty iron-formation. The palest bands consist almost exclusively of quartz with a little stilpnomelane. The dark bands contain up to 40% iron oxide, which everywhere occurs as microgranules or cryptogranules elongated parallel to the bedding. Stilpnomelane is much scarcer than in the pale bands and is not found in bands richer in iron.

Sedimentary rocks

Outcrops and cores of diamond drill-holes indicate the presence of a zone of detrital sedimentary rocks about 2 miles wide in the southern part of the township. These rocks outcrop in the southern part of lots 14 to 17, range II, as well as on lots 32 and 56 to 62, range I. A more precise delimitation of the zone of sedimentary rocks was made possible from holes drilled by the Department of Agriculture and Colonization at the south end of lots 32 and 55, range I, and at the north end of lots 18 and 33, range II.

A small outcrop of microporphyric dacite was found in the southern part of lot 14, range II. A short distance to the south and to the southeast, drill-holes would have cut volcanic and pyroclastic rock in contact with an intrusive mass of peridotite. On the other hand, another hole located toward the center of lot 28, range X, La Sarre township, would have been drilled in the sedimentary rocks. Volcanic rocks outcrop close to the south and to the east. Therefore, it seems that bands of volcanic rocks are interstratified with the sedimentary rocks near the south contact. Gilman (1961) notes similar relations near the contact between the volcanic and sedimentary rocks. This indicates that the sediments accumulated during periods of volcanic activity.

The sedimentary rocks consist of arkosic graywacke interbedded with a little slate. The granularity of the coarser fragments of the graywacke ranges from coarse sand to silt, according to the bands. These bands are generally 1 foot to 30 feet wide, but may attain 50 feet. Locally they alternate with thinner slate bands.

Arkosic graywacke

Nearly all sedimentary rocks outcropping in the area consist of arkosic graywacke. On fresh surface, the rock is generally pale gray but is slightly greenish in places. The surficial weathering, which attains a depth of ½ inch, gives a gray or pale brown shade to the rock. The rock is sandy or schistose. Locally, the planes of schistosity have a silky luster as in phyllites. The thin beds are generally finer grained than the large massive beds.

In the typical arkosic graywacke, quartz and feldspar are in equal proportion and constitute about 80% of the rock. Their undulating extinction indicates that they have sustained deformation strains. The grains of these minerals, particularly feldspar, have been slightly attacked at their periphery by the phyllitic mesostasis. Many among them are obscured by crypto-inclusions. The feldspar consists of orthoclase or other alkaline feldspar and twinned plagioclase. It is more or less altered by sericitization and saussuritization.

The lithic fragments, easily distinguished under the microscope, may constitute 10% of the graywacke. Others probably exist, but they could not be distinguished from the almond-shaped accumulations of grains caused by deformation. Likewise, the rock contains 1 to 2% of lenticular accumulations of chlorite and white mica with other alteration minerals including epidote; these accumulations may have resulted in part from the alteration of fine-grained lithic fragments of intermediate composition. Most lithic fragments observed consist of micropegmatite and, only a few, of microperthite. The micropegmatite contains locally feldspar microlites. The graywacke also contains microgranular quartzo-feldspathic fragments which in places include feldspar microphenocrysts and chlorite possibly derived from the alteration of ferromagnesian minerals. In other lithic fragments, quartz is coarser grained, feldspar microlites are more abundant, alteration minerals consist of epidote and sericite, and sphene and zircon occur. For reasons already mentioned, these last types of lithic fragments could be in greater number than they appear at first sight. Rare lithic fragments made up of automorphous quartz grains without interstitial material, as in recrystallized chert, were also observed.

The graywacke contains about 10% pelitic material partly recrystallized as flat minerals (white mica and chlorite), with a little rust. The accessory minerals are apatite, zircon and rusty pyrite. Apatite and zircon also occur as inclusions in quartz and feldspar.

The grains are angular or subangular and are irregularly shaped. Some have lost their angularity through deformation and marginal alteration. There is no sizing or sorting and no evidence of recrystallization of the grains. Compaction is complete.

The rock exhibits a fairly well marked almond-shaped schistosity; the micaceous minerals have a tendency to form sinuous filaments around the fragments. The angularity of the fragments has been partly chipped and many of the fragments have been reoriented parallel to the schistosity, but many others are lengthened perpendicular to it. Where the graywacke is finer grained, the schistosity becomes more conspicuous and tight, and there is a beginning of recrystallization.

In the finer-grained graywackes and in the siltstones, there is a greater proportion of micaceous minerals, which then constitute up to 15% of the rock and attack more deeply the periphery of the quartzo-feldspathic grains. Biotite has formed locally at the expense of chlorite, the tenor of which is greater. A minor amount of actinolite is also present. In places, there are some microporphyroblasts of leucoxenitic sphene, of chlorite, and, rarely, of epidote. The finer grains are in greater amount and the lithic fragments and feldspar grains are scarcer, but the rock remains essentially the same.

In the southern part of lots 14 and 15, range II, close to the intrusive masses of peridotite and granodiorite, the graywacke is transformed into carbonated phyllite with rust spots, as well as into biotite and muscovite schist.

Slate

The slate is a soft, dark gray or blackish rock and splits into fairly resistant plates having an average thickness of 5mm. to 1 cm. These plates, commonly separated by a thin rust border, are made up of many thinner booklets. Plates and booklets are limited by a stuffing of microscopic phyllitic flakes disposed flat in the foliation plane. The slate generally occurs as thin beds, but some of these attain a width of 25 feet. Locally, the slate is interbedded with arkosic graywacke.

The detrital grains in the rock are more evenly sized and better sorted than in the graywacke, but the coarser fragments remain fairly angular. They are made up of quartz grains the size of very fine sand, and constitute only about 5% of the slate. The remainder of the thin-section is a dense aggregate of indistinct, barely colored micaceous minerals, containing still finer felsic grains, which constitute about 10% of the rock. Among the phyllitic minerals, apparently sericite for the major part, there are also some chlorite, a little biotite, impurities consisting of minerals of the epidote group, and some rare actinolite rods. Rounded microgranules of massive sphene, iron oxide and hydroxide complete the composition.

Sedimentary breccia

In the northern part of lot 18, range II, and in the southern part of lot 32, range I, diamond drill-holes have cut intraformational breccia in graywacke interbedded with a little slate.

Origin of detrital materials

The abundance of the arkosic graywacke indicates a rapid accumulation of detrital material resulting from the erosion of a nearby source. The sedimentation would have been continuous, precluding the formation of slowly depositing sediments. The sedimentary rocks of the area are composed chiefly of minerals derived from quartzo-feldspathic rocks. Moreover, the angularity and size of the graywacke grains, as well as their very irregular forms, indicate that their source is a rather coarse-grained rock. Therefore, it seems that the major part of the detrital material results from disintegration of a felsic igneous rock. The lithic fragments easily identifiable as such come from a very fine-grained felsic source rock, either volcanic or of granophyre type, or possibly both at the same time. The absence, or at least the very minor proportion, is noticeable in the grains of detrital minerals, as well as in the lithic fragments, of material which would originate from intermediate volcanic rocks of the type of those outcropping on each side of the zone of sedimentary rocks.

Intrusive rocks

General statement

The diorites and gabbros found in the volcanic rocks, generally as sills, have undergone regional folding and most probably can be regarded as the oldest intrusions. An elongate and roughly concordant peridotite mass located in the southern part of the area seems to be the next younger intrusion chronologically. Thin leucophyre dikes and sills, composed of various felsic porphyries, as well as a few lamprophyre dikes, also appear to be pre-tectonic. In the category of probably post-tectonic intrusive rocks may be included the diorite mass of the southwest part of the township and the granitic rocks associated with the Mistawak batholith in the northeast part. The diabase dikes are definitely younger than all the other rocks.

Diorite

Diorite sills occur throughout the band of volcanic rocks, but become abundant and fairly thick only within the intermediate lavas, principally in the southern part where the lava is more mafic. At this locality, the diorite and gabbro sills constitute nearly half of the outcropping rock. They alternate with dacitic and andesitic lava flows and cut them in places. It is very difficult to distinguish a sill from the roughly granular center of a thick flow.

The intimate association of these sills with the volcanic flows, the similarity in composition and in texture of adjacent units and their gradual transition from one to another, and their conformity, as well as the absence of lateral dioritic dikes, seem to indicate that they are shallow-seated intrusions nearly contemporaneous with the lavas. In the andesite north of lot 20, range VI, are found plastically deformed pillows around the bulbous end of a thin sill of fine-grained diorite.

In the large sills where the grain is fairly coarse and the schistosity weak, it can be seen that the texture of the diorite varies. It may be massive, intergranular*, intersertal**, glomeroporphyric, and, particularly in the fine-grained facies, hyalo-ophitic or pilotaxitic. On fresh surface the rock is green, in places gray, pale or dark depending on whether the diorite is quartzic or mafic. It alters according to its more or less mafic composition into very dark green shades, nearly black or rusty brown, buff, orange or gray, and is generally carbonated. A deep carbonatation results in bleaching the rock, obscuring its granularity, mottling it with rusty spots, and causing a thick weathering surface.

Typical medium-grained diorite contains up to 25% amphibole and pyroxene as stout, fairly well-developed, dark green crystals, and up to 7% leucoxene as fine grains or as opaque and dull, pale gray or purplish matter.

The colored minerals of the diorite are indented and composed in great part of metacrysts, 3mm. or less in diameter, particularly of uralitized pyroxene. Light-colored actinolite is the prominent mineral of the group; other minerals are hornblende and chlorite. Prochlorite becomes the only colored mineral where the schistosity is well marked. These colored minerals contain inclusions of sphene, epidote, zoisite and a little carbonate. Sphene is leucoxenitic and occurs as incomplete metacrysts and as skeletal pattern pseudomorphic after ilmenite. It constitutes about 7% of the rock.

The plagioclase, which occurs as irregular and intermingled laths up to 2mm. long, is strongly saussuritized and slightly carbonated. A small amount of clear quartz, in interstices or in small patches, is commonly associated with chlorite.

In the schistose diorite, quartz may represent 10% of the rock. Part of it is in coarser crystals, clear and without undulating extinction. Rhombohedral carbonate, rather equally distributed as automorphic or xenomorphic metacrysts, constitutes up to 15% of the diorite. It contains inclusions of clear quartz grains, opaque iron oxide and leucoxene pseudomorphic after ilmenite.

---

* Intergranular texture: the angular interstices between the feldspar laths are mostly filled with ferromagnesian minerals.

** Intersertal texture: the interstices are filled with non-granular cryptocrystalline or vitreous material.

Gabbro

To the naked eye, this rock can be distinguished from the diorite by its greater proportion of pyroxene and other ferromagnesian minerals which gives it a very dark green or black color on fresh surface, and a dark brown or rusty brown color on weathered surface. Ordinarily, the gabbro is slightly magnetic and contains here and there a little very fine-grained quartz. It outcrops only in the southern and more mafic section of the intermediate lavas, where it occurs within dioritic sills.

Microscopic examination reveals two types of gabbro which could not be differentiated on the map. One is a quartz hornblende gabbro which has a color index of 55; the other is a pyroxene metagabbro with an index of 70. Both types exhibit a slightly schistose texture.

The hornblende gabbro contains 40% colored minerals, chiefly hornblende as partly chloritized, ravelled and elongate xenomorphic crystals. Fibrolamellar actinolite and prochlorite are also present. The actinolite, generally in stout bundles, would result from the uralitization of pyroxene, but the hornblende appears to be primary. The other more finely crystallized minerals are about 3% carbonate, 2% opaque minerals, 12% leucoxenitic sphene partly pseudomorphic after ilmenite, 16% epidote, and 12% clear quartz. The quartz is xenomorphic and interstitial, but it may be well crystallized, particularly when it is in contact with carbonate. Quartz crystallized late; it replaces more or less completely lamellae, as well as large crystals of feldspar. The indistinct plagioclase remnants in saussurite constitute about 15% of this gabbro.

Colored minerals constitute about 55% of the metagabbro and 15% of the opaque minerals. The rest are a semi-opaque aggregate completely saussuritized and clouded with iron oxide dust. The outline of the plagioclase crystals is no longer visible. The principal colored mineral is actinolite, generally fibrolamellar with a little chlorite. These minerals result from the uralitization of pyroxene, of which they have retained the shape. The crystals are equant and orthogonal, and have a core different from the surrounding ring. They are clouded mostly in the center and along the cleavages by iron oxide and probably some ilmenite. Very little biotite and pyrite occur locally with the opaque minerals.

Peridotite

This rock type does not outcrop in Clermont township, but geophysical surveys followed by diamond drilling have revealed the presence of an elongate body or sill of peridotite. This intrusion, oriented N.70°W., crosses lots 11 to 24, range I, and constitutes other lenses in the northern part of La Sarre township. In the area under study, the sill would be

200 to 500 feet wide. The author did not observe the peridotite, but it is described on the whole as speckled black rock with local apple-green facies. Olivine crystals attain 1 inch in diameter. In places the rock is altered into serpentine and contains thin asbestos veinlets.

The transition from the intrusive ultrabasic rock to the enclosing volcanic and pyroclastic rocks commonly consists in alternating thin bands of these rocks with peridotite. The last-mentioned type contains inclusions of volcanic rocks and is cut by felsic dikes.

Lamprophyres

A few thin dikes and sills of lamprophyre occur in the intermediate volcanic rocks and in the sedimentary rocks. The intrusions associated with the volcanic rocks are generally schistose and consequently appear to be pre-tectonic. On the other hand, the lamprophyres cutting the sedimentary rocks are not everywhere schistose, and a small dike cuts the granite. Although they are of different ages, all the lamprophyres are described below. Two ages have been indicated in the table of formations.

In the northern part of lots 13 to 21, range VI, dikes of dark green rock cut the volcanic rocks and the associated diorite sills. These dikes, with generally well marked contacts, are 1 foot to 2 feet wide, but exceptionally up to 15 feet. They are conformable or slightly oblique with the general direction. The oblique dikes are oriented east-west. This type of lamprophyre also occurs as small masses intercalated between pillows.

The rock is rather soft, pale, and porous on weathered surface, and dark gray-green on fresh surface. It is schistose and is carbonated and composed of fibrolamellar amphibolite.

Numerous thin sills of non-schistose lamprophyre, which may have been introduced after the regional tectonic activity, occur in the outcrops of sedimentary rocks of the southern half of range I, in lots 32 and 57 to 59. They appear to be composed of serpentinized ferromagnesian minerals with small amounts of micaceous minerals and 1 to 2% transparent, clear, green crystals (undoubtedly apatite) in a microgranular white matrix.

Microscopic examination reveals a uralitized and serpentinized lamprophyre having a diablastic texture and composed of 3/5 tremolite-actinolite in a felty matrix of antigorite with a little chromiferous muscovite (mariposite, fuchsite). Chromite, magnetite and picotite constitute about 3% of the lamprophyre. Microfine zircon and sphene complete the composition.

Hybrid rocks were formed by the intrusion of mafic rock in schistose and carbonated sedimentary rocks. The facies closer to the lamprophyre may contain 2/3 intermingled complex amphibole phenoblasts (tremolitic-actinolitic) with a poikiloblastic texture, intergrown with pale brown biotite. The remainder of the rock is composed chiefly of cordierite and carbonate with a little chondrodite and axinite and very little quartz. Part of the cordierite occurs as big porphyroblasts containing inclusions, particularly apatite.

In the facies containing more sedimentary material and carbonated to about 30%, cordierite occurs in amounts between 15 and 25%. The other minerals are chiefly biotite and chlorite (clinochlore) with rutile and apatite.

On lot 56, range IX, on the edge of a granite outcrop, a mass (8 feet by 40 feet) of blackish rock is terminated by a dike less than a foot wide. This rock contains 20% feldspathic material interstitial to well crystallized hornblende. Near the contact with the granite, the grain size of the lamprophyre diminishes and the rock becomes foliated.

Under the microscope, the hornblende is seen as phenocrysts in a fine-grained matrix of quartz with a little feldspar. A little epidote, chlorite, iron oxides, apatite and zircon are also observed.

Leucophyre dikes

Various pale-colored porphyries cut the volcanic and sedimentary rocks, as well as the diorite and gabbro sills. These narrow intrusives, ranging from 2 to 50 feet wide, are generally designated as dikes, although they are parallel to the formations in places. Except for those which intrude the sedimentary rocks at the eastern end of range I, all these dikes occur in volcanic rocks sequences commonly remote from granitic and granodioritic intrusive masses. These porphyritic rocks show nearly the same schistosity as that of the enclosing rocks. The leucophyre dikes would then have been emplaced before the granite and granodiorite, which are not schistose. They could be related to the volcanic activity. It should be noted that in the intermediate volcanic rocks, the leucophyre contains hornblende, whereas in the rhyolitic volcanic rocks it is more felsic and has a composition equivalent to rhyolite.

Leucophyre can be seen on lots 56 to 60 near range-line IV-V; on lots 58 to 62 near range-line III-IV; at the eastern end of range I, on lot 15, range VII; and on lots 10 and 11, range IX.

The rock of these dikes is grayish to whitish or slightly tinted grayish green or pink. It is fine or very fine-grained and has a porphyritic texture. To the naked eye, up to 15% altered feldspar phenocrysts can be seen, with locally a little hornblende, chlorite or chloritoid, as well as clear quartz in the more felsic dikes.

Under the microscope, 10 to 40% altered feldspar phenocrysts, with 2 to 20% hornblende, chlorite, and locally chloritoid phenocrysts, can be seen. Up to 3% bipyramidal quartz phenocrysts with a corroded aspect is also present. These minerals occur in a felsic matrix, which is sericitized, carbonated and epidotized, and contains biotite locally. The accessory minerals are sphene, rutile leucoxene, apatite, zircon, pyrite and iron oxide.

Diorite (amphibolite)

This rock forms a 4-square-mile stock in the southwest corner of the area. The major part of the dioritic mass is in the adjoining township to the west. Gilman (1961) believes this diorite to be pre-granitic and post-tectonic.

The outcrops in Clermont township show a greenish black or dark gray coarse-grained rock consisting essentially of black sub-automorphic hornblende in a white or pinkish feldspathic matrix. Gilman reports the presence of numerous xenoliths, which would explain the variability of this rock. To the naked eye, its texture appears dioritic and schistosity is not evident.

The thin-sections examined under the microscope reveal that it is a schistose or granoblastic amphibolite composed of 25 to 35% hornblende, 50 to 60% feldspar, 7 to 15% epidote and 4 to 8% opaque minerals. An epidotite facies contains 25% epidote and is devoid of opaque minerals.

In the lowest grade metamorphic rock the schistosity is weak and remnants of untwinned sub-automorphic crystals of green faintly pleochroic hornblende occur in chloritized hornblende or aggregates of fibrolamellar amphibole, which is strongly pleochroic from green to blue and highly birefringent. In the more metamorphic facies, the amphibolite is strongly schistose and the hornblende is strongly pleochroic (in blue tints) and birefringent. Its crystals are finer, and are better formed and crowded in irregular and discontinuous parallel bands. In all facies a more or less important part of the hornblende occurs as coarse, indented or sieve-like crystals, as well as large patches made of a felty aggregate of crystals more or less strained in the same direction.

The feldspar crystals are largely sericitized and contain epidote grains. Their original outlines are much altered owing to the formation of strongly indented xenoblastic grains. Locally, a little albite is present especially around plagioclase crystals.

In the less metamorphosed rock, the iron oxide grains are bordered by abundant leucoxenitic sphene which disappears when the metamorphism attains a higher degree.

The amphibolite contains locally up to 3% granoblastic quartz and close to 1% pyrite. The accessory minerals are mostly apatite and zircon.

Mistawak batholith

The Mistawak batholith underlies the northeast corner of the area, particularly the major part of ranges IX and X, east of lot 16 and the northern part of the east half of range VIII. This batholith comprises three units: a biotite granite, a chlorite granite which appears to be associated with the biotite granite, and a core of hornblende granodiorite.

Hornblende granodiorite

The hornblende granodiorite outcrops on lot 31, range X, and discontinuously on lots 42 to 48, range X, and on lots 40 and 41, range IX.

On fresh surface this rock is spotted black on a greenish, pinkish or white background. The weathered surface is marked with black spots on a cream-colored background. Prominent hornblende and quartz grains give a rough appearance to the rock on surface. To the naked eye, the composition of the rock is estimated as follows: feldspar, 40 to 65%; hornblende, 25 to 35%; and quartz, 10 to 20%. The feldspar locally occurs as well-crystallized grains measuring 1/8 to 1/4 of an inch. The hornblende may be in stout and well-formed crystals about 3/16 of an inch in diameter. Clear xenomorphic quartz fills the interstices.

Some of the granodiorite contains small finer-grained masses or trains much poorer in quartz and richer in dark minerals.

Under the microscope the texture of the granodiorite appears granitic. Quartz and feldspar are commonly concentrated in large parts of the thin-section. Where the quartz is more plentiful, there are fewer ferromagnesian minerals and iron oxides. Biotite becomes more abundant, and hornblende is more deeply altered.

The plagioclase consists of oligoclase (An_{10-20}) in stout crystals or in rods. It is completely damouritized or saussuritized. A little secondary albite and actinolite may be observed here and there.

The colored minerals are hornblende and biotite. Biotite, which constitutes 1/6 to 1/2 of the whole, is everywhere altered, mainly into chlorite, magnetite, with or without ilmenite, and also leucoxenitic sphene and epidote. The biotite is intimately associated with hornblende and both minerals generally appear under the microscope as large corroded patches. They contain inclusions of iron oxide, apatite, sphene, quartz, and, in places, zircon and sagenite twinned rutile needles. Locally, there is some white mica, which could result from the alteration of feldspar inclusions. The hornblende is green and is only locally chloritized with the formation of iron oxides on the margin of crystals. A more pronounced chloritization of the hornblende patches infiltrated with vermicular quartz or partly replaced by quartz may be observed. Other colored minerals occur only in minute quantities; they are actinolite, cummingtonite and allanite.

Quartz occurs in large xenomorphic and serrate crystals with undulating extinction which unite in patches attaining 10 to 15 mm. This quartz has replaced a part of all the essential minerals; all degrees of interlocking and replacement are present. Quartz also occurs as fine, individual grains or as smaller patches. It is then interstitial and angular, and does not corrode the adjacent feldspar. Moreover, in places it contains a few automorphic fine crystals of slightly altered feldspar and hornblende.

The granodiorite contains about 1 to 2% accessory minerals, chiefly omnipresent apatite except in quartz, and very little sphene, zircon, rutile and allanite.

The opaque minerals are iron oxides and a few pyrite grains. They are associated with the colored minerals, especially with biotite, and represent 2 to 4% of the rock. In many places they are altered into massive sphene.

<u>Biotite granite</u>

This rock has not the potassic feldspar content of a normal granite, but, on the other hand, its plagioclase is too alkaline to classify the rock as a granodiorite. Hence, it would be a sodic granite.

The biotite granite is pink or pale salmon-pink, grayish white or whitish. In a few places it is red,owing to the presence of hematite. Biotite is generally replaced by chlorite.

The weathered surface is white or slightly rusty, where the biotite is more abundant. The weathered surface is ¼ to ½ of an inch thick.

To the naked eye, the rock appears to contain a little more feldspar than quartz (up to 60% feldspar). These two minerals occur as grains 1/8 to 1/4 of an inch in diameter.

The quartz is colorless and clear, and the feldspar well crystallized. On the whole, the granite contains 3 to 12% biotite and a little hornblende. On lots 50, 51, 55 and 56, range IX, a larger part of the outcrop rock carries only 1% biotite or less. Hornblende can be distinguished only locally with the naked eye.

Under the microscope, the granitic-textured rock contains 34 to 47% plagioclase and 4 to 22% microperthitic microcline, 35 to 51% quartz in equant grains with undulating extinction, less than 1 to 16% biotite, and 4% hornblende.

The plagioclase occurs as stout crystals, generally finely twinned and commonly zoned. Its composition ranges from albite to oligoclase (An_6 to An_{17}). Some crystals are slightly deformed. The alteration, which consists in saussuritization, is moderate and generally more intense in the central part of the crystals.

Microperthitic microcline constitutes less than 4% to 22% of the biotite granite. It occurs as fine, angular, unaltered, interstitial and nearly equant grains. In the samples containing more microperthite, large interstitial patches of several crystals have a common optic orientation. Big xenomorphic crystals also occur. The microcline contains locally up to 20% microscopic blebs of quartz and 35% clinozoisite in rosettes of bacillar crystals. The sodic plagioclase (oligoclase and albite) is generally along the microcline twins. The other minerals are locally slightly corroded along their margin by microperthitic microcline, which was, with quartz, the last mineral to crystallize.

Brown biotite occurs generally as uniformly distributed, disrupted flakes, as well as in large lamellae commonly indented and sieve-like. The less abundant the microcline, the more plentiful is the biotite. The following minerals may be found as inclusions in biotite or may be associated with it: sphene, with or without ilmenite; commonly well-crystallized epidote, locally disposed between the biotite lamellae; zoisite; zircon; apatite; abundant quartz inclusions in the form of microgranules or stripes, very little opaque iron oxides; a few sagenite twinned rutile needles on biotite cleavage faces; and garnet partly surrounded by a chlorite ring (kelyphite).

The reddish granite contains about 0.5% microscopic hematite around the quartz grains.

Chlorite granite

The chlorite granite occurs within the biotite granite, particularly in the southern part of the batholith between ranges VIII and IX.

The granite is a white rock with medium green or pale gray-green spots and a very rough-weathered surface. It has the following composition: feldspar, 40 to 75%; chlorite, 6 to 20%; and quartz, 15 to 40%. The main characteristic of this rock is the presence of rounded quartz grains having a slightly bluish opaline luster and measuring 1/16 to 3/16 of an inch in diameter. The only dark mineral seems to be chlorite. The feldspar is white, and is locally well crystallized in grains 1/8 to 3/16 of an inch gathered in patches attaining 1/2 an inch in diameter.

In the only thin-section examined, quartz microperthite and feldspar have the same characteristics and relation as the biotite granite. Complete saussuritization precludes the optical determination of the plagioclase. On the other hand, the microperthite is very slightly altered and only a few microcline crystals have been identified.

The thin-section contains 17% colored minerals made up of a lamellar intergrowth of partially or completely chloritized biotite, clear quartz and sphene. Epidote, clinozoisite and carbonate are also found. Sphene may occur as reniform masses with a core of iron oxides.

Contact relations with granite

In the outcrops of lots 47 and 48, range X, near the contact with the hornblende granodiorite, a gradual decrease in grain size of the granite was observed, as well as different facies of granite. On the other hand, the hornblende granodiorite is coarsely grained at the contact with granite, and it is locally enriched in quartz. The granite contains granodiorite inclusions up to 3 inches in diameter. A sinuous granite dike a few inches wide cuts the granodiorite. The granite is then a late phase of the batholith.

In the north outcrop of lot 31, range X, the hornblende granodiorite becomes highly chloritized from north to south and grades into a quartz-rich biotite granite over a short distance. The joints in the granodiorite strike from north to south, whereas the granite is cut by a faint joint system. A schistosity striking N.70°W. appears over a width of 50 feet in the contact zone.

On lot 50 along range-line VII-VIII, a vertical diamond drill-hole cut the volcanic rocks first before reaching the chlorite granite at a depth of about 800 feet. This indicates a plunge of the intrusive mass towards the south at this place.

Granophyre

The granophyres are fine-grained, felsic, intrusive rocks, generally microporphyritic, in which the granophyric texture is seen only under the microscope. Generally the rock is not schistose as in the case of the leucophyres.

This rock is more abundant in the chloritized granite of the southern part of the Mistawak batholith. It may be considered as formed from a residual liquid of crystallization. At this place, the rock is much like a gray or greenish gray, very fine-grained, hard, siliceous rhyolite. The weathered surface yields a whitish layer. Under the microscope, the phenocrysts are seen to constitute about 5% of the rock and consist chiefly of perthitic, slightly sericitized albite. Quartz phenocrysts are much less numerous. The remainder of the rock is made up mostly of micropegmatitic quartz and feldspar, a little sericite, brown biotite, carbonate, chlorite and magnetite.

On lot 4, range X, a small mass of very fine-grained felsic and porphyritic rock intrudes and replaces the volcanic rocks. This rock is pale on fresh surface. A microspherulitic porphyritic texture and a flow structure are noted in thin-section.

A schistose granophyre outcrops on lots 17 and 18, range VI, and to the east of ranges I and III. At these localities, the rock resembles an arkose and contains 4% hornblende.

North of lot 4, range VIII, near the diabase dike, an andesite flow is intruded and replaced by aplitic material. The andesite is recrystallized into amphibolite.

Diabase

The larger diabase dikes strike northeast, whereas thinner ones trend north-south. The former consist of olivine or quartz diabase and the latter of normal diabase.

Quartz diabase - A large quartz diabase dike strikes northeast across the western boundary of the township in ranges V and VI as far as lot 12. From there it bends northward as far as the center of lot 14, range VII, where it resumes its northeast direction along the extension of a large olivine diabase dike. Its width ranges from some 150 feet in the north-south portion to 1,300 feet in range VIII.

The steep dip of the cooling joints is conducive to the belief that the dike is nearly vertical. In the west half of Clermont township, the magnetic anomaly produced by the dike indicates a north dip. A dip of 60°N. was measured on lots 40 and 41, range IX.

The contacts are sharp. Near the border, the diabase is fine grained, black and poor in quartz, and possesses an ophitic texture. Toward the center of the dike, the grain attains 1/4 and even 1/2 of an inch. Quartz becomes more abundant and the texture is rather intergranular and glomeroporphyritic. The pyroxene is dark green or black. The feldspar is white or more or less colored. The following variations in the composition of the rock were observed: 40 to 65% feldspar, 20 to 40% dark minerals, and 2 to 20% quartz. The quartz is associated with the feldspar in granules of less than 1/32 to 1/8 of an inch.

From microscopic examination, plagioclase with a composition of An_{58} constitutes 60 to 65% of the rock in the central part of the dike. It occurs as stout, more or less saussuritized lamellae about 2 mm. long. Many damourite flakes in the plagioclase attain large dimensions. There is very little epidote in the plagioclase or at the contact with quartz. A little clear neo-formed albite between the plagioclase and quartz grains can be seen where there is a vermicular intergrowth of quartz and albite. Generally the plagioclase is not zoned.

Dark minerals constitute 20 to 26% of the rock. They consist mostly of pigeonite with much hypersthene and a little augite. These minerals occur either as: a) large rectangular and corroded, locally elongate (up to 7 mm.) patches generally containing several crystals and including subophitically the adjacent lamellae of plagioclase; or b) finer angular grains interstitial between the plagioclase crystals. Two varieties of pigeonite can be distinguished with maximum 2V angles of about 12° and 28°.

Pyroxene occurs in all stages of alteration into hornblende. This mineral is green and pleochroic and is generally well colored. Part of it is blue, chiefly at the ends or edges of crystals. Chlorite (pennine) is a common alteration mineral. The altered pyroxene patches are slightly and irregularly peppered with iron oxide. The other colored minerals include very minor primary hornblende and a little pale brown biotite. There is also a small amount of chlorite in the quartz.

The coarse-grained quartz diabase contains 3 to 4% opaque minerals, chiefly titaniferous magnetite in lamellar intergrowths with ilmenite altered into leucoxenitic sphene, and a few grains of pyrite.

Quartz constitutes up to 20% of this rock. It was intruded late and tends to replace all the essential minerals which it penetrates as a mosaic of small patches with simultaneous extinction, and as angular automorphic crystals. Several inclusions of plagioclase and ferromagnesian minerals are in optic continuity, with incomplete crystals of these same minerals located around the quartz patches. Some of these patches contain perthitic feldspar.

Quartz, plagioclase and ferromagnesian minerals may contain automorphic apatite in bacillar and acicular crystals attaining 1.3 mm. in length. A very small quantity of fine sphene crystals and phlogopite is associated with the iron oxides.

The fine-grained quartz diabase is distinguished from the coarse-grained facies by the weak tenor of quartz, a greater proportion of pyroxene, a weaker alteration of the plagioclase and pyroxene, and a neatly ophitic texture. The plagioclase, in stout rods, is An_{74} and constitutes 57% of the rock. The alteration may be null or attain a complete saussuritization.

Pyroxene in aggregates of subautomorphic crystals forms 36% of the rock. The orthopyroxenes are bronzite and hypersthene and the monoclinic pyroxenes are pigeonite and augite. Besides hornblende, the alteration minerals consist of chlorite and lesser amounts of bastite and antigorite.

There is only 3% quartz and this mineral is mostly interstitial, although locally it replaces the other minerals.

Olivine diabase - A dike of olivine diabase, which attains a width of 800 feet, crosses the southern part of the first lots of range VI and extends in a N.60°E. direction as far as lot 12 in the center of range VII. A little farther in the same direction, only quartz diabase is observed except for a small outcrop of olivine diabase south of lot 30, range IX.

To the naked eye this rock appears to be composed of 20 to 30% olivine and other colored or opaque minerals which fill the spaces between the feldspar laths. The weathered surface of the olivine grains is black-brown and rather opaque, but on fresh surface the mineral is dark brown and translucent and has a glassy luster. The weathered rock disintegrates along the grains, thus becoming weakly resistant to erosion. At the contact of the dike with the enclosing rock, the diabase is a dense and black basaltic rock. The grain is uniformly coarse in the central part where the olivine aggregates attain 3/8 of an inch in diameter and the plagioclase laths 1/2 of an inch in length.

In thin-section the rock shows an intergranular, glomeroporphyritic and subophitic texture. Grains of an iron-rich variety of olivine enclose the extremity of adjacent plagioclase lamellae and, in places, one or a few complete rods. Much of the olivine is in large and, locally, in finer, better-formed and isolated crystals, interstitial to the plagioclase or in incomplete marginal inclusions in augite. The textural relations indicate that one part of the olivine has crystallized simultaneously with the plagioclase, and the other, later.

On the whole, the olivine is little altered. More or less chloritized biotite borders the olivine or is associated with it.

The plagioclase occurs as thin, finely twinned, zoned and, locally, grouped laths. The composition of the twinned plagioclase is An_{50-68}. The rock contains an appreciable amount of faintly twinned or untwinned plagioclase and rare grains with microperthitic texture.

The diabase contains only 4.5% unaltered augite and pigeonite in large angular and corroded patches.

The rock contains 6.5% magnetite chiefly as dense patches or locally as a sieve structure, almost everywhere more or less fringed with brown biotite, which, with chloritized biotite, constitutes 1% of the rock. Conspicuous throughout the rock and also occurring as inclusions in all the other minerals is 1.5% automorphic apatite.

Normal diabase - A diabase dike 40 to 60 feet wide strikes north-south across lot 4, ranges VIII, IX, and X. Sections which could belong to another dike were also observed on lot 5, range II; lot 14, range V; lot 21, range VI; and lot 30, range VIII.

These narrow dikes have sharp contacts and a black porphyroaphanitic border, and are almost vertical.

The fresh surface is spotted black and gray-green and the weathered surface is rusty brown and rough. The pale green feldspar and the black ferromagnesian minerals (pyroxene), less well crystallized, occur in nearly equal proportions. Minute amounts of quartz are also visible.

Certain facies of this rock are related to the quartz diabase.

The thin-section examined under the microscope contained 48% plagioclase laths, which attain 3.5 mm. in length. The more calcic composition observed is An_{72}. On the margin of the quartz and micropegmatite patches, the outer part of some plagioclase laths is made up of albite or clear andesine.

Pyroxene constitutes about 40% of this diabase. Some crystals are very well formed. Pigeonite appears to be the more abundant pyroxene. It is found in two different forms: 2V angles of about 10° and 30°. The other is augite with a 2V angle of 40° and 50°. The pyroxene is much less altered than in the quartz diabase. Apart from being altered into uralitic hornblende, the pyroxene is partly chloritized, and, in places, large patches of chlorite have formed. A little xenomorphic biotite is associated with the other colored minerals.

The rock contains about 5% quartz and partly interstitial micropegmatite. The greater part occurs in patches of several crystals. The presence of chlorite and clinozoisite as inclusions in quartz would indicate that quartz replaced some plagioclase.

There is approximately 7% magnetite containing ilmenite partly altered into massive or leucoxenitic sphene. Some apatite is associated mostly with quartz.

PLEISTOCENE GEOLOGY

The orientation of striae and glacial deposits is south-southeast. The role played by the glacial erosion in the shaping of the rocky ridges of the area is limited to a polishing effect of the northern end (stoss-side) and a tearing effect on the opposite limit. This is particularly evident in the diabase, which is commonly cut by longitudinal joints, and in the principal dikes, which are oriented almost perpendicular to the direction of ice movement. In most of the low rocky ridges, however, the steep face is at the north end, whereas the lee-side is buried under a train of glacial deposits.

Slightly east of the center line of the township, the most prominent esker lies across the area in a general north-south direction. Starting from range VII, a branch esker deviates northward for as much as 2 miles west of the main esker. An approximate mile-wide sandy deposit, in which many small lakes fill the bottom of basins, has formed along the esker in ranges IV to VII inclusively. A branch of another esker is located in the southwest corner of the township. In the western half of the area, glacial deposits of sand and gravel constitute a great number of low hills elongated in the direction of the ice movement. These hills have various forms, among which are recognized drumlin outlines and conical kame hillocks.

The few boulders observed are concentrated mainly in the northern part of the township. Generally their composition is that of the rocks outcropping immediately to the north. Thus granite blocks are found on the margin of areas where this rock is exposed. Other blocks of various compositions were deposited here and there on the eskers, as well as on certain hills, whether rocky or not. In rare instances, piles of boulders are exposed at ground-level, but nowhere could linear trains be seen. A thick clay layer, probably deposited in the former glacial lake Barlow-Ojibway (Coleman, 1909), covers all the low-ground areas.

METAMORPHISM

The volcanic and sedimentary rocks of the area have been converted by regional metamorphism into chlorite, sericite and carbonated schists. This metamorphism does not exceed the greenstone facies.

The intermediate volcanic rocks in contact with granite have been invaded by felsic material and are partly recrystallized into amphibolite.

At the contact with the large diabase dikes and over a width of a few hundred feet, the volcanic rocks have undergone an essentially thermal metamorphism which is superimposed on the regional metamorphism. The schistose volcanic rocks thus affected have acquired locally a finely gneissic structure. In other places they have become porphyroblastic. In thin-section, the gneissic structure appears to be due to the segregation of hornblende and epidote in discontinuous lenticular bands amidst a felsic, granoblastic and generally clear groundmass. Quartz and feldspar are mostly recrystallized and no longer show signs of deformation (such as undulating extinction). Nearly all the carbonate has been removed but the tenor of sphene and iron oxides was increased. Besides chlorite and hornblende, the colored minerals commonly include some tremolite - actinolite, and, in the mafic rocks, a little antigorite and serpophite with locally some anthophyllite. Microporphyroblasts of idocrase have formed in places.

The presence of a few garnets was noted in a sample of hornblende granodiorite taken near the contact with the quartz diabase.

The metamorphism is similar at the contact to the smaller diabase dikes but affects a width of about only 100 feet.

In the southern part of lots 14 and 15, range II, near the peridotite and granodiorite intrusive masses, the sedimentary rock has been converted into carbonated phyllite, and biotite and muscovite schist.

The intrusion of thin lamprophyre sills in the schistose sedimentary rocks has produced hybrid rocks already described in the section on lamprophyres.

STRUCTURAL GEOLOGY

Schistosity and stratification

The schistosity and stratification strike from N.70°W. to east-west. Dips are at least 70° north or vertical except south of the granitic and granodioritic intrusive mass where they are steeply inclined toward the south up to 2 miles away from the intrusion. The intrusive masses of diorite, granodiorite and granite, as well as the diabase dikes, are not schistose.

Folds

In the area, synclines seem to alternate with anticlines. Their axes are oriented northwest parallel to the strike of the formations.

Two fold axes, a syncline to the north and an anticline, were traced over a length of about 3 miles in the western part of ranges V and VI. A little farther south, at the western end of range V, the axis of another syncline extends for more than one mile. The north flank of the synclines and the south flank of the anticline would be overturned. The axis of another anticline is located in the western part of range X. The presence of folds is based on the determination of flow tops from the observation of the shape of pillows.

The few tops determined by the gradation of fragments in the pyroclastic rocks have confirmed the attitude of the formations.

In the eastern half of the area, nearly all determinations of tops were made in the southeast quarter of the township and they indicate that the formations face south. However, since the bands of outcrops are separated one from the other by wide tracts of overburden, one may not conclude that folds are absent.

Small drag-folds were observed in the rhyolite and schistose tuff on lot 52, range VII.

The fact that the folded rocks of the area are all schistose and generally parallel to the strike and dip of the formations indicates the presence of tight isoclinal folds.

Shear zones and faults

The longitudinal shear zone of Normetal mine crosses Clermont township from the north-west end through the center of range IX and the intersection of range-line VII-VIII with the township center line where it would be more than 2,000 feet wide. The few strongly schistose outcrops of the eastern half of range VII would indicate the eastward extension of this shear zone. The rocks are more strongly deformed and schistose along the zone than anywhere else in the area. However, since all the pre-tectonic rocks are schistose to variable degrees, it could not be ascertained which part results from fault shearing rather than from folding.

The shearing observed in the southern part of the granitic intrusive mass would indicate the presence of a second longitudinal shear zone.

A fairly pronounced shearing, oblique with the formations which are slightly bent, is noted at many places near range-line V-VI, on lots 6 to 14.

From an interpretation based on geophysical work and drilling, the peridotite sill could have been displaced by a fault on lot 15, range I. The small outcrops of sedimentary rocks bordering the road about 1,500 feet north contain quartz veinlets which might represent the filling of tension cracks.

Structure in the zone of sedimentary rocks

The strike of the sedimentary rocks appears concordant with that of the volcanic formations. The top faces south in the southern part of the volcanic band, except at the western end of the area and the adjacent part of Desmeloizes township. Gilman (1961) reports the presence of minor folds in the extension of the band of sedimentary rocks in Desmeloizes township. From evidence of graded bedding he considers that the sedimentary rocks constitute an overturned syncline. This interpretation is somewhat confirmed by the presence of intraformational breccia in the sedimentary rocks on both sides of the zone.

It has already been noted that the interlayering of volcanic rocks with sedimentary rocks in the contact zone would indicate that sedimentation occurred during a period of low-volcanic activity. It may also be added that the zone of sedimentary rocks includes equivalents of the sedimentary rocks interstratified with the volcanic rocks in the southeast part of the volcanic zone.

Noticeable too in the sedimentary rocks is the absence of diorite and gabbro sills, which are so abundant in the volcanic rocks. It is thought that these rocks were intruded during the same cycle of activity as that of the volcanic rocks.

ECONOMIC GEOLOGY

The extension in the map-area of the horizon of sheared felsic fragmentary rocks containing the Normetal mine orebody constitutes the predominant favorable element of the area. The outcrops of this horizon contain occurrences of disseminated or weakly concentrated sulfides consisting chiefly of pyrite with some chalcopyrite and pyrrhotite, and a little galena and sphalerite. Analyses have indicated the presence of gold and silver in some places. This horizon is located in the contact zone between a band of felsic volcanic rocks, commonly fragmental and porphyritic, and another of intermediate composition. It is characterized by the presence of veins or aggregates of quartz and small amounts of sedimentary rocks such as graphitic tuff and iron-formation. Quartz-feldspar porphyry dikes and felsic masses occur at the western end of the zone.

The south sheared border of the granitic intrusive mass and the contact zone with the volcanic rocks constitute another favorable area for mineral deposition in range VIII. The few outcrops which could be observed are slightly mineralized with pyrite, chalcopyrite and pyrrhotite. A drill-hole in lot 39 crossed similarly mineralized rocks with a little gold, silver and copper. The occurrence of erratic gold assays up to several ounces to the ton is reported from lot 52, range I, of Rousseau township,adjacent to the north. Gold is associated with quartz veinlets cutting the hornblende granodiorite. The peridotite mass of range I, partly altered to serpentine, is favorable to the presence of asbestos, which has been noted elsewhere.

Apart from these favorable areas and the localities described herein, disseminated pyrite with locally a little chalcopyrite is found at the following places: northern part of lots 23, 30, 31 and 32, range III; lots 40 to 56, range III; band of carbonated volcanic rocks containing disseminated pyrite: lots 5, 42 and 50, range V; southern part of lot 22, range VII; lots 3 and 9, range X. A little molybdenite was observed in the biotite granite on lot 49, range IX.

Exploration Work and Mining Properties

Range I, lots 7 to 13 - Toward the end of 1955, Cyprus Exploration Corporation Ltd. performed an electromagnetic survey on this ground and drilled a hole 318 feet deep on lot 3. This hole crossed a few quartz veinlets containing very little pyrite and traces of chalcopyrite in coarse-grained porphyritic diorite.

Range I, lots 11 to 22 - In 1950-51, Asbestos Corporation Ltd. and Dominion Gulf Company financed a magnetometer survey followed by 12 drill-holes

(Ingham 1953). This work has outlined a peridotite sill, parts of which are altered into serpentine and contain narrow asbestos veinlets. These are too thin and not concentrated enough to have any economic significance.

Range II, northern part of lots 1 to 7; range III, southern part of the same lots - In 1948, Anglo-Huronian Mining Company performed a magnetometer survey followed by the drilling of five holes totalling 2,932 feet. The four holes drilled on lot I, range III, would have crossed a 100-foot-thick zone of altered tuffaceous sedimentary rocks containing much pyrite and pyrrhotite, as well as a little chalcopyrite. The fifth hole, bored on lot 4 of the same range, would have cut the same zone mineralized only with pyrite and pyrrhotite. These five drill-holes are located at the contact of a diorite mass to the south with a band of sedimentary rocks to the north. The company reports the presence of a long section of granodiorite containing a few thin quartz veinlets mineralized with pyrite and pyrrhotite in the core of the fifth drill-hole.

Range VI, lots 1 to 6; range VII, lots 1 to 4 - In 1956, Desmond Mining Corporation carried out an electromagnetic survey followed by the drilling of a hole 700 feet deep to explore an anomaly outlined by the survey. The hole crossed a few thin graphitic zones, as well as a little pyrite and hematite.

Range VIII, lots 1 to 6 - Three holes were drilled in 1952 by Mining Corporation of Canada Ltd. on lot 4, east of a narrow diabase dike (Dugas, 1959b). Augdome Exploration carried out a magnetometer survey on the same property in 1955, followed in 1956 by four diamond drill-holes. Two of these holes probed weak magnetic anomalies on lot 6; the other two explored some shearing west of the diabase dike. Only narrow sections containing pyrite and a few chalcopyrite grains were cut.

Range VIII, lot 22 - A diamond drill-hole bored to a depth of 699 feet by Malartic Gold Fields Ltd. in 1955 to explore a potentiometer anomaly revealed only narrow sections mineralized with pyrrhotite and pyrite.

Sanctae Rosaelis Mining Corporation - This company holds the mining rights on the north half of lots 30 to 37, range VII, and the south half of lots 28 to 31, range VIII.

The bedrock is composed of a sequence of lava flows and beds of pyroclastic rocks mostly rhyolitic, with dacitic and andesitic interbeds, as well as a few sills of intermediate composition. The whole, which is strongly sheared parallel to the trend of the formations, could be part of the south limb of an anticline. The felsic volcanic rocks have been converted into sericite and chloritoid schists, and the intermediate rocks into chlorite and amphibole schists. They are all carbonated and commonly spotted with rust. Mineralization is found in shear zones parallel or slightly oblique to the strike of rock units, as well as in fractures striking north-south, northeast and northwest. Generally disseminated, some of the mineralization contains fair amounts of lead and zinc with a little silver and traces of copper and gold. Quartz generally accompanies the mineralization, locally with carbonate, but, on the other hand, several quartz veins and masses rarely exceeding a few feet in thickness and located in shears and fractures are completely devoid of mineralization.

In lots 32 and 33, range VII, a thin, discontinuous bed of graphitic tuff forms siliceous and graphitic lenses and masses in sheared, carbonated and commonly rusty rhyolite. Along this bed, some of the pyrite, in places nodular, is found disseminated or in veinlets in rhyolite and locally concentrated in a quartz gangue or in graphitic tuff.

The early exploration work on this property dates back to 1928 (Dugas, 1959a; Ross, 1939). During that year, Clermont Mining Syndicate did some stripping and trenching. The company reported the presence of three zones mineralized with gold, silver, lead and zinc on lots 29 and 30, range VIII. Sampling would have revealed some high tenors of zinc and lead and a few good assays in silver, as well as traces of copper and gold. One sample showed a high tenor of gold. Between 1929 and 1931, 13 diamond drill-holes totalling some 2,000 feet were drilled. The cores were not retained and the logs are not available. The following assays, chosen among the higher ones, are reported by the engineer who supervised the work:

1.00 ounce of silver per ton, 4.60% zinc and 12.90% lead over 5 feet;

0.77 ounce of silver per ton, 5% zinc and 9.90% lead over 10 feet;

0.77 ounce of silver per ton, 6.10% zinc and 9.30% lead.

Ramsay Gold Mines Ltd. did some exploration work on the property in 1936.

In 1948 and 1949, Sanctae Rosaelis Mining Corporation undertook some stripping and trenching in the south part of lots 31 and 32 of range VIII. A preliminary channel sampling would have given 8.48% zinc over 8 feet. An electrical resistivity survey and detailed geological mapping covering the entire group in 1949 did not reveal any major concentration of sulfides.

In 1952, Beattie-Duquesne Mines Ltd. sampled some trenches dug in the mineralized zones in the south part of lots 29 and 30, range VIII. The analysis showed a tenor of about 3.5% combined zinc and lead with an average of slightly more than one ounce of silver per ton over lengths of 3 to 8 feet.

Geophysical surveys undertaken by Malartic Gold Fields Ltd. in 1954 did not reveal any important anomaly. Other geophysical surveys by Mining Corporation of Canada in 1955, Cyprus Exploration Corporation in 1957 and by Camflo Mattagami Mines Ltd. in 1959 have covered the property. Some of them were extended far beyond the boundaries of the present property.

Two holes totalling 1,040 feet were drilled in 1958, one in the northern part of lot 32, range VII, and the other in the southern part of lot 32, range VIII. These did not cut any mineralization of commercial value.

In 1962, another hole 291 feet deep was drilled in the southern part of lot 32, range VIII, parallel to a trench oriented N.10°E. which exposes the contact between intermediate lavas and rhyolite to the north. The trench shows a few small lenses and pockets mainly of pyrite with a little black sphalerite and a few grains of chalcopyrite. A second trench, 350 feet to the west, shows the same dacite-rhyolite contact. Two hundred feet northwest, near the center line of the township, an andesite-rhyolite contact was explored through a pit. The mineralization consists chiefly of white pyrite.

Another prospect pit in the southern part of lot 31, range VIII, near lot 30, shows schistose rhyolite containing minor disseminated white pyrite with a little galena and chalcopyrite, in thin lenses (¼ of an inch to 6 inches thick) or pockets (1 inch to 6 inches in diameter). Quartz accompanies this mineralization.

At the end of 1964, Newbaska Gold and Copper Mines performed geophysical work on part of the property. Trench samples gave 11.25% zinc and 0.18% copper. After carrying out this geophysical work the company drilled seven holes totalling 2,865 feet. One of the two holes located in the southern part of lot 31, range VIII, cut a 1-foot mineralized section containing 2.82 ounces of silver per ton, 0.01 ounce of gold per ton, 5.79% lead and 1.70% zinc. The next few feet yielded low assays of the same metals. According to the core logging, the mineralized rock is a tuffaceous rhyolitic breccia. Other holes cut thin veins and veinlets of quartz and carbonate at various places, as well as some sections of pyrite mineralization, part of which is nodular. A little sphalerite and galena would locally be present in quartz. Sampling of mineralized sections in the trenches would have given 3.05% zinc over 8.5 feet and 8.48% zinc over 8 feet.

Range VIII, lots 50 to 54 - Chlorite granite cut by thin granophyre dikes outcrops in lot 54. Rockridge Gold Mines Ltd. dug trenches in 1946 and drilled a few holes on the showing and to the southwest as far as lot 50. Good assays in copper over several feet in the trenches, as well as gold over 2 feet, are reported. According to Enterprise Mining Company Ltd. a selected sample picked in 1956 gave high values in copper along with a little silver.

A personal examination of the showing and trenches revealed only scarce pyrite with a few chalcopyrite grains. However, in a trench located at the eastern end of the showing, a chalcopyrite film locally covering fracture planes in chlorite granite was observed between two thin granophyre dikes. Here the chalcopyrite also occurs as disseminated grains in the granite, but none were seen in the granophyre.

Range VIII, lots 59 and 60 - In the southern part of the lots, a sheared and fractured zone borders the south side of a group of very slightly schistose dacite outcrops. The rock is chloritized along the shearing and weakly mineralized with pyrite and very little chalcopyrite.

The contact between intermediate volcanic rocks and chlorite granite can be seen 2,000 feet to the north. The granite has intruded the other rocks, which are partly recrystallized and locally mineralized with pyrite and traces of chalcopyrite.

In 1960, Matte-Adamson Mineral Exploration Partnership undertook trenching and prospect pits. A reconnaissance electromagnetic survey and pack-sack drilling were also carried out. In 1962, The Consolidated Mining and Smelting Company of Canada Ltd., which held an option on the property, conducted a detailed electromagnetic survey.

Range IX, lot 1, Clermont township, and lot 62, Desmeloizes township - Recent stripping and two trenches have exposed three outcrops of sheared rhyolite. Two short holes were also bored with a pack-sack drill. Minute concentrations of pyrite, pyrrhotite and chalcopyrite, generally in lenticules from 3 to 4 inches up to a foot long, can be seen in the trenches. Some of these concentrations contain fair tenors of copper.

At the end of 1963, Noranda Mines Ltd. conducted geophysical work on this property.

GEOCHEMISTRY

Samples of stream sediments were taken while the geological survey was being carried out.

The procedure in the field consisted in taking two samples a few feet apart in the active zone of stream banks. The samples were analysed in the Department's laboratories in Quebec in order to determine their content of copper, zinc, lead and molybdenum. The results obtained are reported on the maps accompanying this report.

APPENDIX

GEOCHEMICAL RECORD

Results of analyses in p.p.m — Results of analyses in p.p.m

Sample No. on the map	Code No. of sample in files of Dept.	Cu	Zn	Pb	Mo	Sample No. on the map	Code No. of sample in files of Dept.	Cu	Zn	Pb	Mo
1	1	24	85	16	1	39	132	36	45	10	1
2	2	4	60	10	5	40	130	8	15	4	1
3	3	24	85	14	2	41	48	20	60	12	7
4	13	8	50	14	3	42	11	16	60	20	3
5	14	24	65	14	1	43	8	40	80	16	5
6	20	30	70	12	8	44	9	20	100	12	2
7	15	20	85	14	4	45	129	20	85	12	1
8	16	24	45	16	2	46	128	36	60	6	1
9	17	8	45	8	1	47	126	20	30	14	7
10	18	22	75	14	2	48	127	18	45	12	2
11	19	18	65	8	7	49	113	24	50	12	8
12	22	10	90	16	1	50	125	10	50	4	8
13	21	12	75	14	4	51	124	16	65	8	6
14	23	14	45	14	2	52	123	14	36	16	8
15	12	20	70	12	2	53	105	12	40	6	8
16	4	10	90	34	4	54	104	10	15	4	6
17	5	20	75	18	2	55	112	34	60	12	10
18	50	8	20	2	1	56	106	24	45	20	10
19	51	12	20	4	1	57	103	6	20	4	2
20	45	6	20	2	1	58	107	18	45	12	5
21	52	30	40	4	1	59	108	16	65	14	2
22	55	50	75	14	2	60	110	36	70	16	8
23	56	34	65	14	1	61	109	6	35	14	5
24	24	18	55	2	3	62	111	40	70	10	10
25	59	20	60	12	2	63	92	8	45	12	3
26	49	40	75	18	10	64	91	10	45	16	3
27	46	14	40	8	4	65	89	6	25	4	1
28	44	6	20	4	1	66	90	8	40	4	1
29	6	26	80	24	3	67	94	14	35	8	2
30	7	30	85	14	2	68	93	10	80	26	2
31	10	22	60	10	4	69	95	6	25	8	1
32	47	16	50	8	4	70	70	6	25	4	1
33	53	22	60	12	1	71	73	8	10	4	2
34	54	26	50	14	1	72	71	6	20	6	1
35	57	16	30	4	1	73	72	6	10	4	2
36	58	34	65	16	1	74	38	6	30	6	1
37	133	24	40	8	1	75	74	8	15	4	2
38	131	8	20	4	2	76	37	10	50	4	4

Results of analyses in p.p.m

Results of analyses in p.p.m

Sample No. on the map	Code No. of sample in files of Dept.	Cu	Zn	Pb	Mo	Sample No. on the map	Code No. of sample in files of Dept.	Cu	Zn	Pb	Mo
77	36	10	45	4	2	106	31	26	95	14	8
78	40	6	35	4	4	107	32	36	75	10	12
79	39	12	65	14	8	108	33	34	75	16	12
80	43	14	90	24	7	109	34	26	90	18	1
81	41	10	85	18	7	110	77	24	100	28	2
82	42	10	140	18	5	111	75	30	90	18	1
83	114	32	75	16	2	112	76	22	85	32	1
84	117	14	100	16	3	113	85	40	110	16	2
85	115	14	60	40	12	114	82	44	75	14	2
86	118	12	90	14	2	115	80	32	125	14	4
87	35	10	90	16	7	116	62	6	60	10	2
88	27	12	45	8	2	117	68	24	90	12	1
89	26	36	90	18	6	118	88	36	115	14	3
90	121	10	15	8	2	119	63	12	50	14	2
91	122	10	10	4	3	120	64	14	60	10	3
92	120	8	10	10	2	121	66	24	115	18	2
93	119	20	10	4	1	122	65	12	125	12	3
94	87	18	40	8	1	123	81	30	105	20	6
95	69	12	40	6	2	124	83	46	86	18	2
96	67	10	35	8	1	125	86	36	90	16	2
97	61	20	50	8	4	126	96	30	70	14	2
98	60	8	45	4	2	127	98	40	85	18	6
99	25	16	80	10	2	128	97	30	75	16	1
100	79	44	90	16	2	129	99	24	65	14	7
101	28	12	60	10	2	130	100	36	70	34	8
102	29	30	90	16	8	131	101	44	75	16	5
103	78	40	175	26	1	132	102	40	65	16	3
104	30	28	85	6	1	133	116	12	90	16	8
105	84	34	115	14	1						

BIBLIOGRAPHY

COLEMAN, A.P. (1909) - Lake Ojibway: Last of the Great Glacial Lakes; Ont. Bur. of Mines Rept., Vol. XVIII, pt. 1, pp. 284-293.

DAVIES, Raymond (1964) - Collet - Laberge Area, Abitibi-West County, Quebec; Que. Dept. of Nat. Res., G.R. 116.

DUGAS, J., et al. (1959a) - Description of Mining Properties Examined in 1958; Que. Dept. of Mines, P.R. 406, p. 7.

DUGAS, J., et al (1959b) - Description of Mining Properties Examined in 1956 and 1957; Que. Dept. of Mines, P.R. 390, p. 23.

FLAHERTY, G.F. (1936) - Perron-Rousseau Sheet, Abitibi Territory and Abitibi County, Quebec; Geol. Surv. of Can. Maps 482A and 483A.

GILMAN, W.F. (1961) - Preliminary Report on Desmeloizes Township, Abitibi-West County, Quebec; Que. Dept. of Nat. Res., P.R. 462.

INGHAM, W.N., et al. (1953) - Mining Properties and Development in Abitibi-East, Abitibi-West and Rouyn-Noranda Counties during 1950 and 1951; Que. Dept. of Mines, P.R. 283, p. 15.

JOHNSTON, J.F.E. (1901) - Eastern Part of the Abitibi Region; Geol. Survey of Can., Summ. Rept. 1901, pp. 130A-143A.

MAWDSLEY, J.B. (1928) - Desmeloizes Area, Abitibi District; Geol. Surv. of Can. Summ. Rept. 1928, Part C.

Desmeloizes Sheet, Abitibi County, Quebec; Geol. Surv. of Can., Map 284A.

ROSS, S.H. and ASBURY, W.N. (1939) - Mining Properties and Development in Abitibi and Temiscamingue Counties during 1938; Que. Dept. of Mines and Fisheries, P.R. 135, p. 8.

TANTON, T.L. (1919) - The Harricanaw-Turgeon Basin, Northern Quebec; Geol. Surv. of Can. Mem. 109. Includes Map 183A.

WILSON, M.E. (1913) - Kewagama Lake Map Area, Quebec; Geol. Surv. of Can., Mem. 39. Includes Map 93A.

WILSON, W.J. (1910) - Geological Reconnaissance along the Line of the National Transcontinental Railway in Western Quebec; Geol. Surv. of Can., Mem. 4.

GEOL. SURV. OF CANADA - Map 43G of the aeromagnetic series. Desmeloizes.

ALPHABETICAL INDEX