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MINISTÈRE
DE L'ÉNERGIE
ET DES RESSOURCES

DIRECTION GÉNÉRALE DE
L'EXPLORATION GÉOLOGIQUE
ET MINÉRALE

SOUTHERN PASCALIS TOWNSHIP AND PART OF SOUTHWESTERN TIBLEMONT TOWNSHIP

D.P. McDougall

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PROVINCE OF QUEBEC, CANADA

Department of Mines

Honourable C.D. Franch, Minister   A.O. Dufresne, Deputy Minister

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MINERAL DEPOSITS BRANCH

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GEOLOGICAL REPORT

THE GEOLOGY OF SOUTHERN PASCALIS TOWNSHIP AND PART OF SOUTHWESTERN TIBLEMONT TOWNSHIP

Abitibi-East County

by

David J. McDougall

QUEBEC
REDEMPTI PARADIS
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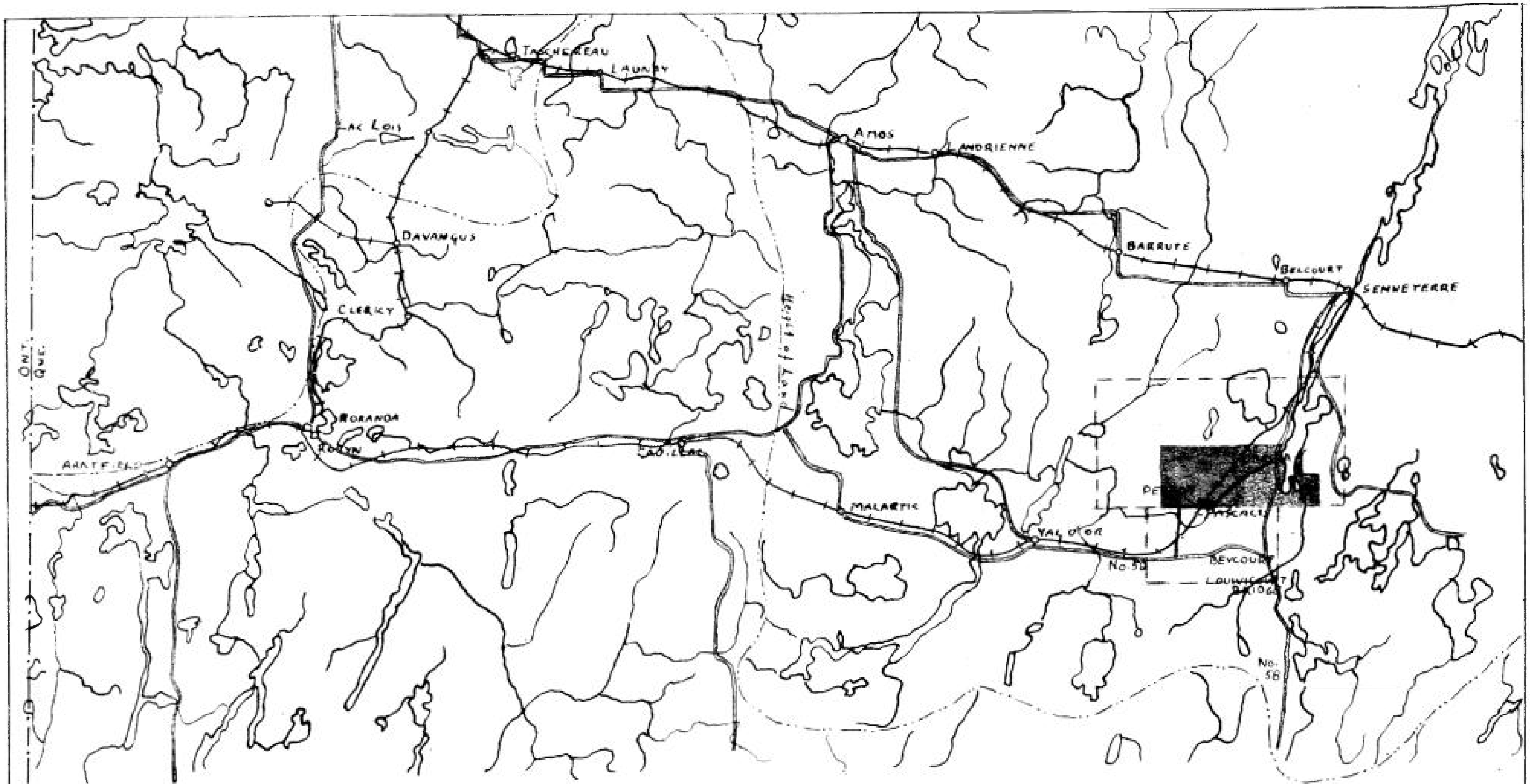

NORTHWESTERN QUEBEC MINING DISTRICT

Scale; 1"=12 Miles

Railways ⟼ Roads ═ Height of Land -·-

FIGURE I

DJMcD '51

THE GEOLOGY OF SOUTHERN PASCALIS TOWNSHIP AND PART OF SOUTHWESTERN TIBLEMONT TOWNSHIP, ABITIBI-EAST COUNTY, QUEBEC

Location and Access

The map area is located near the present eastern limits of the mining district of northwestern Quebec. It is about 350 miles by road northwest of Montreal, 10 miles northeast of the town of Val D'Or and 12 miles southwest of the village of Senneterre.

It is easily accessible from any of the principal centers of northwestern Quebec or northern Ontario by either train or road. The Noranda-Senneterre branch line of the Canadian National Railway passes diagonally through the township of Pascalis, with a regular mail stop at Pascalis Station on the southern township boundary. The Mont Laurier-Senneterre highway (Highway No. 58) runs parallel to the western shore of Lac Tiblemont, and the Noranda-Val D'Or highway (Highway No. 59) joins No. 58 about five miles south of the map area. A good gravel side road from Highway No. 59 leads northward to the burnt-out mining village of Pascalis, the village of Perron, Pascalis Station, and joins Highway No. 58 at the community of Obaska. A number of bush roads permit relatively easy access to many parts of Pascalis township. A few of these are passable to motor vehicles over all or most of their length. The best maintained of them starts about two-thirds of a mile west of Pascalis Station and crosses the map area in a northerly direction, ending at Petit Lac Pascalis. Pascalis township has been largely subdivided into ranges and lots, but Tiblemont township has not been subdivided in this fashion. Where such range lines are present, they are frequently the best marked and most direct routes for foot travel.

The most southeasterly part of Pascalis township and all of the portion of Tiblemont township presently under consideration are most easily reached by canoe from the vicinity of Obaska. A less direct water route to the southeastern part of the map area is via the

Louvicourt River from Louvicourt Bridge on Highway No. 58. A short portage is necessary in passing from the Louvicourt River to Lac Tiblemont.

Previous Work

The earlier geological investigationswhich have been carried out over all or parts of the area, include the reconnaissance surveys of W.J. Wilson (1910) and M.E. Wilson (1912), which touch parts of the map area; the regional mapping of Cooke, James and Mawdsley (1931), the eastern edge of whose map includes a part of Pascalis township; Hawley (1930) whose map also includes a part of the western edge of Pascalis township; L.V. and A.M. Bell (1931, 1932, 1933) who did detailed work in the southwestern corner of Pascalis township and more general areal mapping of a region which includes the map area; Norman, who includes a portion of the southwestern corner of Pascalis township in his Cadillac-Bourlamaque sheet (1943) and a portion of the southern edge of Pascalis in his Dubuisson-Bourlamaque-Louvicourt sheet (1947c); and MacLaren (1949) whose Senneterre map sheet includes the map area. Norman has mapped the adjoining townships of Louvicourt (1945) and Vauquelin (1947a) on a scale of 1000 feet to the inch and Ingham has mapped Senneville township (1949) on the same scale.

Field Work

During the field seasons of 1950 and 1951 the geology of the map area was mapped by the writer on a scale of 1000 feet to the inch. Field work was by pace and compass traverses at intervals of 500 feet over most of the area, with the interval occasionally increased to 750 feet if the sparseness of outcrop and openness of the country made it warrented. Control of the traverses was by means of range lines and lot posts, with the addition of picket lines and transit surveys where the range lines had been wiped out by bush fires or were lacking as in Block A. Along most of the eastern shore of Lac Tiblemont it was found convenient to locate traverse points from aerial photographs.

Amount of Outcrop

Large parts of the area are covered by swamp, sand and gravel deposits, particularly in the northwest, central and southeast parts of Pascalis and the southern part of Tiblemont township. The principal outcrop areas occur as broad zones which run diagonally across the area from the southwest towards the northeast. Outcrop represents about one quarter of the total area, varying from zero in parts of the swampy and sandy areas to nearly 100% over large parts of the outcrop zones.

Population

The total population of the entire area is probably less than 1000. Six hundred or less people inhabit the village of Perron, and with the removal of the Perron mine staff to Bevcourt in 1952, this figure will probably decrease markedly. At the junction of Highway 58 and the Pascalis road, the Obaska Inn and a church form the nucleus of a small farming community of about 250 people locally known as Obaska. A few additional families live in the vicinity of Pascalis Station.

Vegetation

Large parts of the original vegetation has been burnt off by a series of forest fires, the most recent of which occurred in 1942. This fire wiped out the mining village of Pascalis, and burnt over large parts of the townships of Senneville, Pascalis, Louvicourt, Vauquelin and Tiblemont. Large parts of the remaining coniferous timber has been cut for pulp or timber. Some birch is present near the shores of Lac Tiblemont, and some large cedar has been observed in the swampy areas of Tiblemont township. Thick alder growth has grown up in many of the burnt or cut over areas.

Physiography

The height of land between the rivers flowing south towards the St. Lawrence River and the rivers flowing northward to Hudson Bay, lies about 20 miles south of the map area. This proximity to the height of land and the disorganized stream systems resulting from the hummocky post-Pleistocene terrain of glacial material has produced large areas of swamp. Marshy lakes are commonplace and the smaller streams are sinuous and slow moving.

Within the map area the principal drainage features are Lac Tiblemont, the Baie du Lac Tiblemont, the Louvicourt and Obalski Rivers. A number of small streams drain into these bodies of water, the largest of which enters Lac Tiblemont near the northeast corner of the map area. Farther west Landing Lake, Lac Rougias and several small swampy ponds drain westward via the Perron stream, the Colombiere River and northward via the Pascalis River. Numerous small water courses either drain into the above lakes and streams, into Petit Lac Pascalis north of the map area or into Lac Laverdiere in Senneville township. Most of these smaller streams are dry during the summer months.

Based on bench marks established by the Geodetic Survey of Canada and a number of barametric elevations at several points in the southern part of Pascalis township, two principal "levels" of outcrop areas have been deduced. These are at 1000 to 1050 feet above sea-level and 1100 to 1200+ feet above sea-level. The lowest known elevation is 1000 feet above sea-level and the highest is 1285 feet above sea-level. Deep valleys of a graben-like form, which are presently filled with water or unconsolidated deposits cut diagonally across the area. One of these grabens, Lac Tiblemont is in excess of 300 feet deep in some places and a second, east of the village of Perron, is filled with unconsolidated material which is in excess of 100 feet deep.

Several "horsts" in the form of outcrop zones which are probably all bounded by faults, strike diagonally across the map area. The most westerly starts near the southwest corner of Pascalis township and passes through Block A, the second is close to the western shore of Lac Tiblemont and the third crosses the eastern boundary of the map area immediately south of the stream entering Lac Tiblemont in the northeast corner of the map. These horsts have been broken by a number of fractures which form a series of low scarps. Most of the scarps are probably due to late movement along joint sets in the Pascalis-Tiblemont batholith.

Pleistocene Geology

The Pleistocene glaciation and the subsequent post-glacial lakes have left a considerable amount of evidence of their presence within the map area.

During the Wisconsin stage of glaciation the area was completely covered with ice. The principal direction of advance was slightly west of south (S5^{o}W) although local outcrop areas served to modify this direction in some cases. There is some evidence of a much more westerly direction of advance (S50^{o}W), but whether this took place before, after or concurrently with the main direction of advance is unknown. It is known, however, that the southerly direction moved much of the coarser material, while the southwesterly direction only moved fine material.

With the final retreat of the ice the post-glacial lake Barlow-Ojibway was impounded between the height of land to the south and the ice front, and a part of the southeastern margin of this lake covered the present map area. Esker-deltas formed along the southern edge of the ice and two such deltas are to be found in Pascalis township.

Varved clays were also deposited in the vicinity of Lac Tiblemont and may also be present in other parts of the map area.

Sand bars along the western edges of many outcrops and unconsolidated deposits, beaches, wave cut and wave washed faces indicate that the prevailing wind direction during the lifetime of the lake was from the northwest.

General Geology

Preliminary Statement

The rocks of the map area are typical of the rocks of the general region, where Keewatin-type lavas and Temiscamian-type sediments are intruded by a number of intrusive bodies ranging in composition and size from acidic, soda-rich masses of batholithic dimensions to dykes and sills of peridotite, diorite and diabase, and dykes of smaller sizes composed of rocks which range from acidic to basic in composition.

A small portion of the Bourlamaque batholith underlies a small strip along the southwestern edge of Pascalis township and a portion of the Pascalis-Tiblemont batholith underlies a major part of the northeastern part of the area. The remainder of the area is underlain by andesites, dacites, tuff, agglomerate, and some trachyte rhyolite quartz porphyry, and greywacke. Small bodies of peridotite occur near the Bourlamaque batholith, diorite sills occur in a zone to the west of the Pascalis-Tiblemont batholith and a Keweenawan-type diabase dyke cuts the rocks of the Pascalis-Tiblemont batholith and the extrusives to the south of it. Quartz veins, some of which carry tourmaline, sulphides and carbonates cut all the rock types. Economic gold deposits have been found in the quartz veins in the margin of the Bourlamaque batholith, and a massive pyrite-marcasite deposit carrying very low values in gold and base metals is located south of the Pascalis-Tiblemont batholith. Despite extensive prospecting elsewhere within the map area, no other economic deposits of minerals have been found.

Table of Formations

Quarternary	Pleistocene and Recent	Swamp deposits, Lake deposits, Glacial deposits	Silt, muskeg, sand, gravel, varved clays, stratified and unstratified drift, rounded and angular boulders.
Pre-Cambrian	Post-Keweenawan	Veins	Late quartz veins, sometimes containing carbonates. Massive sulphides in lavas possibly of same age.
	Keweenawan-type	Dyke	Diabase and quartz diabase. Small syenitic dykes.
	Post Keewatin-type	Veins	Early quartz veins with sulphides, tourmaline, carbonates and occasional gold mineralization.
		Bourlamaque batholith	Basic and acidic dykes. "Granodiorite"
		Pascalis-Tiblemont batholith	Leucogranite dykes. Biotite granite, gabbro, monzonite and syenite. Granite, granodiorite, quartz diorite and diorite. "Spotted syenite" and amphibolite.
		Minor intrusives	Peridotite, diorite
	Keewatin-type	Lavas, Pyroclastics, minor amounts of sediments	<u>Perron Andesites</u> Andesite, dacite, agglomerate and tuff <u>Landing Lake Pyroclastics and Sediments</u> Tuff, tuffaceous agglomerate, agglomerate, greywacke <u>Central Diorites, Lavas and Tuffs</u> Diorite, andesite, dacite, acid and basic tuffs. <u>Pascalis Lavas and Pyroclastics</u> Andesite (?), dacite (?), agglomerate and tuff (silicified in part). Rhyolite and quartz porphyry.

Keewatin-Type Volcanic Rocks

In the discussion of the Keewatin-type rocks it has been found convenient to subdivide them into four lithological groups to which local names have been given. No definite age relationships could be determined.

The Perron Andesites

These rocks include all the lavas lying between the Bourlamaque batholith and the pyroclastic and sedimentary bands to the east. ~~The rocks are principally andesites, although locally some dacite and pyroclastics are present.~~ They are continuous with similar rocks to the south and northwest.

The rocks of this group are essentially andesitic in composition although some dacite, agglomerate and tuff are present. Pillows are common although they are often much distorted by stretching and shearing. Flow structures, in the form of narrow undulating ribbons which weather somewhat lighter than the rest of the outcrop are of moderately frequent occurrence. In the southern part of the band globular or blob-like masses were sometimes found embedded in the andesite. These masses ranged from one inch to six inches in diameter.

Andesite

The weathered surfaces of the andesites have a rather varied appearance, ~~but in general fall within the boundaries of the generalized classification given above~~. The colours of the weathered surfaces are dark greens with tints of grey and brown in some specimens. The fresh surfaces are usually dark green, olive green or grey green of a somewhat lighter shade than the weathered surfaces. The texture of the weathered surfaces is often somewhat granular due to differential weathering of relics of the original minerals. This effect is sometimes sufficiently marked so that it is possible to gain an approximate idea of the percentages of light and dark minerals of which the original rock was composed. All rocks do not show this granular texture, some having a fine grained texture which presents a smooth weathered surface in which the individual minerals cannot be distinguished. In some specimens, greenish feldspars can be seen and in others, whitish grains of carbonate are present, but the rocks are generally fine grained masses of chlorite or amphibole in which individual minerals cannot be distinguished on the fresh surface.

Under the microscope, the feldspars are so thoroughly altered that few reliable determinations can be made. In a few cases they indicate a composition of about An 30, corresponding to oligoclase-andesine. The ferro-magnesian minerals are completely altered to masses of chlorite and amphibole. These minerals are set in a matrix of fine grained chlorite, epidote, some sericite and small feldspar laths which appear to correspond to albite in composition. Some carbonate is occasionally present.

Dacite

The rocks classified as dacites are not always easily separable in the field from the andesites and some of the finer grained tuffs. In colour they sometimes grade to that of the paler andesites, and the texture of the weathered surface occasionally resembles the "cellular" appearance of the tuffs. In the darker dacites, quartz is very fine grained and often can only be seen in thin section. Except for the occurrence of quartz, these rocks closely resemble the andesites both in hand specimens and thin section.

Agglomerate and Tuff

Some agglomerate and tuff are present in the Perron andesites, but apart from areas of such rocks in the anticlinal area in the southern part of the band, most occurrences are not large enough to be mapped. Except for a greater degree of chloritization near the Bourlamaque batholith, these rocks very closely resemble the agglomerates and tuff of the Landing Lake band which are described below.

The Landing Lake Pyroclastics and Sediments

This group comprises an irregularly shaped band of rocks which oonsists mainly of tuff and agglomerate with a little greywacke. South of Block A these rocks have been approximately outlined by means of a magnetometer survey data. They are continuous with other pyroclastics and sediments to the south in Louvicourt township. Norman (1947a) shows a "structural discontinuity" in this band close to the southern boundary of Pascalis township, along which he believes the greywacke band to have been offset to the east. No evidence for this was found either in the field or in the available geomagnetic data.

To the northwest, outcrops are lacking and the extension of the band is somewhat uncertain. However, further to the northwest in Senneville township both sediments and pyroclastics are present.

The rocks of this group generally have a characteristic banding. In the vicinity of Pascalis Station the rock is a well banded tuffaceous agglomerate which probably was deposited in water. Somewhat farther north in Range II, the rock is a tuff, in which the banding is less well developed but still visible. A short distance to the northeast, a small area of greywacke was found in which cross bedding could be seen. In Range III, most of the rock is tuffaceous in appearance but lacks a well developed banding. In the southwest corner of Block A and extending into Ranges IV and V, the rocks of this band are a distinctive, fine grained, banded rock, which may be either a tuff or sediment. Good banding is characteristic, but the bands vary considerably in thickness. Most bands range from one quarter to one half inch in thickness with some cases of six, eight and twelve inch bands. The narrower bands are frequently crumpled and folded, small chevron-like folds being common in Ranges IV and V, while farther south, open symmetrical folds of small amplitude are more common.

The appearance of the weathered surface of the various types of pyroclastic or sedimentary rocks varies but in general the colour is some shade of grey with tints of brown or green. Most of the tuffaceous rock is characterized by a brownish, almost rusty tint, whereas the sediments are predominently greenish. The fresh surfaces of the rocks are variable in their colour, showing various shades of greens, greys and browns.

On the weathered surface there is a considerable difference in texture between the various rock types of this band, since it is strongly dependent on the grain size. The grain size of the rocks found near Pascalis Station has a considerable range due to the agglomeritic fragment set in a fine tuff matrix, but elsewhere the tuffs are more equi-granular, with the grain size ranging from about 1/2 mm to 2 mm. The finer grained types may be easily confused with dacitic rocks. However, the type of weathering of the tuffs can often be depended on to differentiate the pyroclastics from the extrusives. Many of the small fragments have weathered out leaving small, closely spaced lenticular depressions which give the surface of the rock a cellular appearance.

Under the microscope the greywacke has been found to consist of quartz, carbonate and sericite, with a few grains of feldspar. The tuffs and agglomerates are composed of feldspars completely altered to sericite, or kaolin; carbonate and rarely a little quartz. The banded rocks contain much biotite, quartz, carbonate, sericite and some altered feldspar grains.

The Central Diorite, Lavas and Tuffs

These rocks consist of a band about a mile wide in which numerous bodies of diorite occur intermingled with andesite, dacite and acidic tuffs. To the southeast, the band is an extension of similar rocks in Louvicourt, Vauquelin and Pershing townships.

Except for the frequent occurrence of bodies of diorite in this group, the rocks do not differ materially from those previously described. A few narrow bands of quartz-rich rocks have been observed which are sufficiently distinctive to serve as marker beds. The extrusives which comprise the principal parts of the outcrop areas consist of pillowed and non-pillowed lavas of an andesitic composition, some dacite, and discontinuous bands of tuff which are somewhat similar to those described in the foregoing section. Due to the marked similarity of the lavas to the Perron andesites, they will not be described, and the diorites are treated in a later section on intrusive rocks.

The narrow bands of quartz-rich rocks have a weathered and fresh surface of a yellowish white colour with a granular texture. In the outcrops a good banding can be seen. Megascopically, the rock consists entirely of quart grains and under the microscope it is made up of angular or sub-rounded grains of quartz, rare fragments of altered feldspar and much sericite. The origin of the rock is doubtful, but the angular grains suggest a pyroclastic.

The tuff bands closely resemble the banded tuffs which have been previously described in southwestern Block A. The principal difference is in the colour and type of alteration. In the field these rocks have the same narrow, closely spaced banding but are a dark brownish green in which there are irregular streaks of a darker green parallel to the banding. In thin sections, the rock consists of quartz, carbonate sericite and much chlorite, some of which is present in lenticular streaks.

The Pascalis Lavas and Pyroclastics

Rocks of this group consist of a number of bands of andesitic, dacitic and rhyolitic lavas, agglomerates and tuffs which adjoin the

Pascalis-Tiblemont batholith. In large part, these rocks have been extensively altered by the intrusion of the batholith, and in some cases they are present in the batholith as inclusions.

The rocks of this group consist of andesite, dacite, rhyolite and quartz porphyry, agglomerate and tuff. Along the western edge of the batholith there has been extensive shearing and silicification of the rocks but farther to the south and east the alteration of the rocks is not as pronounced. A small deposit of massive and disseminated pyrite and marcasite is located in silicified tuffs south of Lac Tiblemont.

In the following descriptions the emphasis will be on the silicified portions of this band since elsewhere there is no appreciable difference from rocks which have been previously described.

Agglomerate

The weathered surface of these rocks is usually some shade of grey in which lighter grey fragments of a silicious appearance are set. The fresh surface is usually a uniform light grey. Under the microscope these rocks are seen to consist of lenticular quartz grains which generally show some granulation around the edges, much sericite and a little biotite. In some sections the quartz is completely granulated.

Tuffs

On the weathered surface these rocks have a rough, granular appearance and vary in colour from a light, creamy grey to a dark grey. Quartz is visible in hand specimens, with the remainder of the rock consisting of some feldspars, mica and usually a little iron oxide. Under the microscope the rock is almost entirely made up of quartz and altered feldspar fragments set in a fine matrix of similar material. The quartz often occurs in rounded grains which are grouped in clusters of two, three or four. On the basis of the published descriptions (Tremblay, 1950) and thin sections provided to the writer by Dr. Tremblay, these rocks are very similar to "altered volcanic rocks" found in Fiedmont township in a similar relation to the batholith contact. The only determinable difference appears to be a larger amount of biotite in the thin sections of the Fiedmont rocks. These silicified tuffs appear to grade sharply into tuffs which are of the same composition as the chloritized tuffs in the Central diorite, lava and tuff band. A narrow zone of epidotization has been found outside the silicified zone.

Rhyolite and Quartz Porphyry

Acid lavas are present in the map area in very small amounts and are only found close to the margin of the Pascalis-Tiblemont batholith. These lavas are a very light grey and have rounded phenocrysts of quartz. In thin section, the rock consists of quartz, some feldspar and sericite.

Notes on the Alteration of the Extrusives

The alteration of the Perron andesites that occurs close to the Bourlamaque batholith and in roof pendants in it, contrasts sharply with the alteration of the lavas and pyroclastics adjacent to the Pascalis-Tiblemont batholith. Near the Bourlamaque batholith, the lavas consist almost entirely of a fine grained amphibole and chlorite of uncertain composition. Such feldspars as are present are generally completely altered to masses of saussarite. The basic dykes in this vicinity have suffered a similar type of alteration.

At a distance of about 3000 feet from the contact, the amphibole is generally absent, the percentage of chlorite has diminished and carbonate becomes moderately plentiful.

The alteration adjacent to the Pascalis-Tiblemont batholith is of a different type. Here, in addition to the occurrence of quartz, there is often much biotite, some epidote and relatively little chlorite. This may be partly due to the different rock types which have been metamorphosed, but it could be due to a higher grade of metamorphism near the Pascalis-Tiblemont batholith than near the Bourlamaque batholith.

Post-Keewatin Type Rocks

The rocks of this group are of a wide range of composition, but all are of probable intrusive origin. These rocks consist of the Bourlamaque and Pascalis-Tiblemont batholiths, dykes and veins associated with them and small bodies of peridotite and diorite.

Peridotite

This rock probably occurs in the form of sills in the lavas near the Bourlamaque batholith.

The weathered surface is grey green in colour with rusty brown patches and is marked by radiating grooves and stringers of amphibole. On the fresh surface, the rock is green, often showing the greasy conchoidal fracture of serpentine. The amphibole stringers are composed of hard, brittle "cross" fibres, in which concentrations of magnetite are sometimes present. Coarsely crystalline aggregates of dolomite are sometimes present in the rocks.

Under the microscope the rock consists of chlorite, serpentine, amphibole and a little magnetite. Highly altered olivine crystals outlined by tiny magnetite grains are occasionally present.

Diorite

The weathered surface is mottled dark grey with green or brown tints. The fresh surfaces are light grey or greenish grey with spots of chlorite. The grain size is moderately coarse (2 to 4 mm) and contrasts sharply with the finer grained lavas.

Under the microscope the rock is composed about equally of secondary hornblende and plagioclase feldspars (oligoclase to andesine). Magnetite, pyrite and some chalcopyrite are accessory in most specimens.

The problem of the intrusive or extrusive origin has not been solved, but these rocks may be intrusive sills.

Bourlamaque Batholith

A detailed petrographic examination of this batholith which included a number of chemical analyses has suggested that the batholith as a whole consists of quartz gabbro with a marginal zone of albite tonalite (Gussow, 1937). In the literature and by local geologists in the mining districts surrounding it the dominant rock type in the batholith is commonly referred to as granodiorite. Within the present map area it has been found convenient to divide the rocks of the marginal zone into two principal groups corresponding to degrees of alteration. In the following descriptions these will be referred to as "fresh" and "altered" granodiorite.

During the mining operations at the Perron mine, it has been found that the "altered" rock forms a marginal shell to the batholith, 500 to 1500 feet thick, which is transitional westward into the "fresh" type (H.G. Ames, unpublished notes). To the east, the contact with the greenstone is a zone, ten to twenty feet wide, formed of inclusions of the greenstone in the granodiorite and small intrusions of granodiorite into the greenstone.

Fresh Granodiorite

In the hand specimens this rock presents a weathered surface of various shades of dark grey, in which the quartz usually stands out in relief. The fresh surface is a mottled grey of a relatively light shade in which there are angular, pale yellowish white feldspars and blue quartz "eyes" set in a matrix of dark green, chloritic material. It is distinguished from the "altered" variety by the relatively light colour of the fresh surface and the angularity of the feldspars. In thin section the rock can be seen to consist of large, irregular grains of strained quartz, albitic (An 5-10) feldspars which have been considerably seriticized and much secondary chlorite. The chlorite probably represents an original ferro-magnesian mineral which may have been a pyroxene.

In this connection, an earlier study has found the mineral to be augite, with occasional cores of augite remaining in the most altered types (White, 1942). In some cases there is a moderate amount of carbonate associated with the chlorite.

Altered Granodiorite

The megascopic and microscopic descriptions of this rock are very similar to the "fresh" variety, except for the much darker colour of the fresh surface due to an increase of the chlorite content and the blurry, irregular outlines of the feldspars. Under the microscope the feldspars can be seen to have suffered a much greater alteration, so intense that it is impossible to determine their composition by optical means. Chlorite and carbonate are much more common than in the previously described type.

Basic Dykes

In the granodiorite and the adjacent lavas for a distance of about 5000 feet east of the batholith contact, a number of small basic dykes have been found. These have been variously called "andesite" dykes (Hawley, 1930; Bell and Bell, 1931), greenstone inclusions (Brossard, 1940) and lamprophyre dykes (McDougall, 1951). Due to their extensive alteration and apparent disconcordant relationship, it appears preferable to employ the rather non-committal term "basic dyke".

In the field, the dykes have a weathered surface which is dark brown or black and may either be smooth or with irregular phenocrysts standing out in relief. The fresh surface of the non-porphyritic types is black and aphanitic, whereas the porphyritic types are moderately coarse grained and a dark grey colour. Under the microscope these rocks are seen to consist of chlorite and some fine grained amphibole.

Aplite

Two types of aplite have been observed. The first type is a light grey rock with a sugary texture. It consists of quartz, feldspar and small amounts of a green amphibole. Under the microscope the rock consists of quartz, slightly sericitized oligoclase-andesine and fresh hornblende. A coarse grained pegmatitic equivalent of this rock has also been noted.

The second type of aplite is composed principally of a pink feldspar with some quartz and occasional needles of black tourmaline. Strained quartz and sericitized feldspars are found in thin section. The plagioclase is more sericitized and the texture is finer and more sugary than seen in the aplites found in outcrops.

Quartz Veins

Many quartz veins have been found in the batholith, particularly in the "altered" rocks near its margin. The greatest number are present in the vicinity of the Perron mine, where many have been found to carry considerable amounts of gold. The quartz is of two types: a) semi-vitreous of a milky white colour and b) sugary textured with a greasy grey colour. Most of the gold has been found in the first type of vein, but some good values have been obtained from the second, on the lower levels at Perron. Other minerals found in the veins are calcite, orange weathering ankerite, black tourmaline, chlorite, sericite, fuchsite, scheelite pyrite (occurring as large rectangular aggregates of cubic crystals or irregular aggregates of fine grains), and chalcopyrite. Pyrrhotite has been reported on the lower levels at Perron and galena, bornite and molybdenite have also been reported. Gold occurs in the pyrite and free in either quartz or white calcite. The sequence of primary mineralization is said to be: pyrite and carbonate; tourmaline and quartz; and the late sequence is: chalcopyrite; carbonate; galena and gold. Pyrite geothermometry tests suggest a temperature of formation of the pyrite possibly of 450° to 600°C. (Compliled from personal observations, personal communications from H. Kempthorne, P. McCarthy, F. Clarke and

R. Blais; and Bell, 1932; Brossard, 1940; W.H. White, 1944).

Pascalis-Tiblemont Batholith

The principal rock types of this batholith have been variously referred to as quartz monzonite (Bell and Bell, 1931), soda granite with gabbro and diorite (Bell and Bell 1933), biotite granite (Norman, 1947b) and albite granite with amphibole and diorite (Tremblay, 1950). The writer's work in southern Pascalis township has shown that the rocks can be subdivided into several mapable units, which range in composition from gabbro to granite.

"Spotted Syenite"

The "spotted syenite" is a white weathering rock composed of fine grained feldspar in which there are irregular green blebs of amphibole and chlorite, which on the weathered surface appear as raised nodules one quarter to one half inch in diameter. Under the microscope the rock is seen to consist of highly altered feldspars and aggregations of fine grained amphibole and chlorite.

Associated with this rock and grading into it are banded rocks of about the same composition. A little quartz can sometimes be seen in these rocks. A small amount of amphibolite is also found in the vicinity of the largest area of "spotted syenite".

Pascalis"Granite"

The Pascalis "granite" is the most widespread of the batholithic rocks in the southwestern part of Pascalis township. It includes granite, granodiorite, quartz diorite and diorite. Pegmatites are also found associated with some of the rocks. A distinctive "blue quartz" phase of this group is found close to the batholith-extrusive contact. The quartz of this phase is an opalescent blue which despite a generally smaller grain size, closely resembles the opalescent blue quartz "eyes" of the Bourlamaque batholith. Elsewhere, a chloritic phase can be observed which appears to be closely related to the N80°E shear zones.

On the weathered surface, all these rocks have a grey colour which is bluish in the more acid members of the blue quartz and greenish in the chloritized type. Because of the differential weathering of the various minerals, the weathered surface is rather rough to the touch. The component minerals are all medium grained (2-5 mm) and consist of quartz (either blue or white), yellowish feldspars, and altered ferro-magnesian minerals, chlorite and occasionally a little epidote. The amount of quartz varies from about two thirds in the granite to nearly zero in the diorite, while the ferro-magnesian minerals vary from very little to about half. The pegmatites are principally associated with the contact between this suite and the "spotted syenite". They have a much coarser grain (5-10 mm and up to 15-20 mm) with a mineral composition corresponding to that of the granodiorite. Under the microscope, these rocks are seen to consist of quartz, feldspars, biotite, some hornblende, chlorite, epidote, carbonate and very rarely zircon. The quartz of the blue quartz phase is usually strained and fractured, while in the ordinary phase, it only rarely shows such features. The feldspars are usually much altered and undeterminable. In part they are zoned, with the central part most intensely altered. The composition is believed to be close to oligoclase or andesine. Rarely, very small grains of microcline are present in the granite or granodiorite.

Monzonite

This unit includes rocks whose composition in hand specimens grades from monzonite to syenite. It weathers to a dark grey colour, whereas the fresh surface has a distinctive mottled olive green colour. The minerals are fine grained, rarely being larger than 1 mm. They consist of about equal parts of a white feldspar and an olive green amphibole. Rarely a little quartz is present. Under the microscope the feldspars are altered to secondary minerals; there is usually a considerable amount of very small quartz grains and much amphibole which may be secondary after augite. Some biotite is also present.

Biotite Granite

Rocks of this composition are present only in the northern part of the map area. The rock weathers grey which sometimes has a yellowish tinge. On the fresh surface it is a light grey. The grain is essentially medium to fine (1 to 3 mm), but occasionally small lens-like segregations of biotite are present. The rock consists of milky quartz, white feldspar and black biotite. Under the microscope the rock is seen to consist of much quartz and biotite, a badly altered and zoned feldspar, small amounts of microcline, some secondary feldspar which is about An 5 and a considerable amount of sphene.

Gabbro

On the weathered surface this rock is a very dark brown or brownish grey, and the fresh surface is almost black. It is fine to medium grained with an ophitic texture which can sometimes be seen in the hand specimens. The minerals are a black pyroxene and some white feldspar which may be stained pale red or yellow. Some bluish quartz is occasionally present. Pyrite, pyrrhotite and perhaps a little chalcopyrite are sometimes present. Under the microscope the rock is seen to be composed of much secondary hornblende, a fresh looking feldspar with a composition corresponding to andesine-labradorite, some quartz and magnetite.

Leucogranite

The leucogranite occurs as small dykes which cut all of the previously described members of the Pascalis-Tiblemont batholith. The weathered surface is a very light grey sometimes with a pinkish tint and the fresh surface varies from a light grey to a yellowish grey. It is medium grained (2-3 mm) and consists of grey quartz and white or yellowish feldspars. Occasionally a very small amount of a very fine-grained black material is present.

Quartz Veins

Quartz veins cut most of the rocks of the batholith. Some contain tourmaline and small amounts of carbonate and sulphides, but many others are unmineralized. Many of the veins are believed to have formed at relatively low temperatures due to the presence of a type of rude banding in which well formed crystals of quartz project into a central band of carbonate. Quartz of this type has been found to have a low temperature stage of decrepitation of about 120° C (personal communication, R. Blais).

Keweenawan-type Rocks

Diabase Dyke

The only late Pre-Cambrian type rock in the area is a diabase dyke which roughly parallels the west shore of Lac Tiblemont. This dyke corresponds closely to many other similar dykes in the Rouyn-Bell River district. It weathers to a dark grey colour, and under the microscope is seen to consist of fresh laths of labradorite with fresh augite filling the interstices. Some magnetite and pyrite are also present as accessories. Quartz in small irregular masses, and small veins is present in some parts of the dyke. Occasional small stringers of a pink syenitic rock have been noted.

Structure

Folding

The presence of folds within the area have been inferred from several types of data. Outcrop patterns and top and dip determinations have been used as far as possible. Within restricted areas, the sequence of flows and pyroclastic bands have been used also, but because of the limited extent of any recognizable markers, this type of information could only be used with caution. Two small folds were actually observed in the field. In an area covered by a ground magnetometer survey in the southwestern part of the township, some correlation was possible between the magnetic anomalies and the folding. In many cases it was found that certain magnetic highs corresponded to crests of anticlines and magnetic lows with the troughs of synclines. From this type of information, extensions were made to some of the folds.

Interpretation of the major folding in the area is uncertain due to lack of data on age relationships between the various lavas and pyroclastics, and of top determinations in the pyroclastics. However, if certain assumptions are made, a series of large synclines and anticlines may be interpreted from the available data. The necessary assumptions are: the pyroclastics and sediments are interbedded in the lavas; the various portions of the Landing Lake Band are anticlinal in form; and a number of small folds occur on the limbs of the major folds.

If these assumptions are true several anticlines and synclines of major proportions occur between the southern boundary of the township and the Pascalis-Tiblemont batholith contact. In general they strike to the northwest and plunge either northwest or southeast. Figure II illustrates the possible mode of occurrence of these folds in the southwestern part of the township.

The peridotites in the Perron andesites and the diorites of

Block diagram of a possible structural interpretation in southwestern Pascalis township.

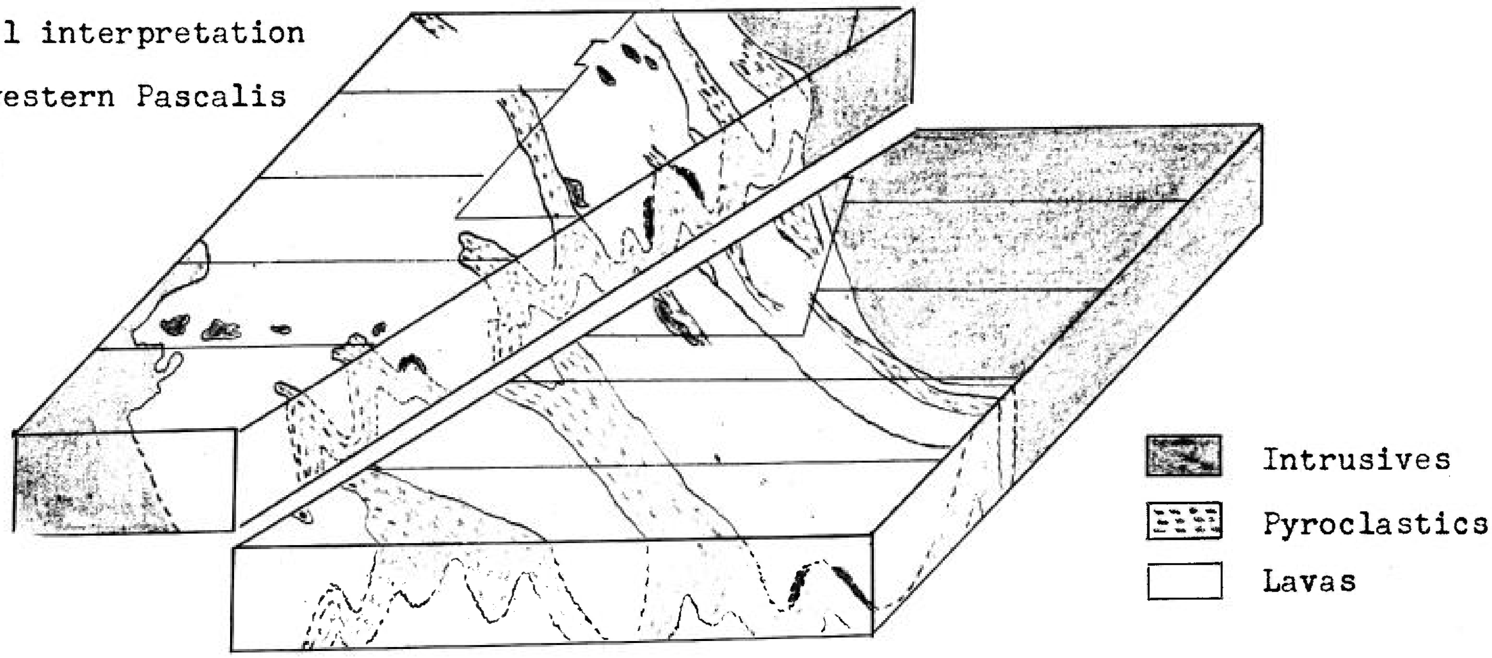

FIGURE II

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the Central diorites, lavas and tuffs appear to have some relation to the folding. The peridotites occur at or near the crests or troughs of folds, and the diorites occur roughly parallel to the axes of the folds. Thus, if these rock types are intrusive they should be classed as sills or, if extrusive, as flows which possess their present composition or texture due to special conditions of extrusion or later alteration. The presumed relation of these rocks to the folds is shown in Figure II.

Norman finds that the peridotites occur at the crests of folds in Vassan, Dubuisson and Bourlamaque townships and suggests that the same condition holds true in Vauquelin township. He states in part: "The occurrence of sill-like peridotite bodies in the lowermost andesite group ... suggests that the peridotite and associated andesite ... are part of the lowermost rocks brought up by folding along a narrow anticlinal structure." (Norman, 1947b).

Fracturing - (Shearing, Faulting and Jointing)

Faults and shear zones on the scale of the "breaks" which occur in the principal mining districts of northern Ontario and north-western Quebec are unknown in southern Pascalis township. However, almost all the lavas and pyroclastics show a certain amount of schistosity which is parallel or sub-parallel to the strike of the formations. Most of this is believed to be due to folding stresses with only minor amounts due to local cross-faulting.

In and near the Bourlamaque batholith several faults are indicated by offset contacts, shears, and have been deduced from data obtained from diamond drilling and underground mapping. For a distance of about 5000 feet east of the batholith the lavas are much broken up by a large number of variously trending faults.

Underground work has indicated that in the Perron "shear", the north wall has moved down and obliquely to the west with a horizontal displacement of about 1000 feet (Ames, unpublished notes). Movement on the "south" fault, 2300 feet south of the "shear", has apparently caused the volcanic rocks on either side of its probable extension to the east to be dragged as indicated by changes in strike of the lavas. The movement indicated by this dragging of the lavas and data from underground observations (Brossard, 1940), both suggest an apparent right hand component. The offsetting of the steeply east-dipping contact probably indicates that there has been a strong dip component to the movement, with the north side moving down relative to the south side.

Underground mapping has also shown the presence of a post-ore fault striking N30°E and dipping 55°SE which offsets some of the veins and basic dykes in the Perron mine.

In Range III, south of Landing Lake, there is a fault which has been traced by diamond drilling for a distance of about 5000 feet. At the western end it is exposed as a talcose shear zone which dips steeply to the northeast at about 80°. Milky quartz lenses and some sulphide mineralization were noted in the sheared rock.

A band of strong shearing in the southern part of Range I, Lot 15, is about 300 feet wide and has a known length of 900 feet. On strike and 7000 feet to the southeast a fault has been mapped in Louvicourt township which may be the extension of this shear.

South of Lac Tiblemont a probable fault or narrow shear zone strikes N65°E. Massive pyrite-marcasite mineralization occurs in and near this fracture.

In the Pascalis-Tiblemont batholith, shearing and sheeting of the rocks striking about east-west and dipping very steeply to the south, is strongly pronounced near the southern contact. Elsewhere, six prominent sets of fractures are commonly encountered. These consist of a set of nearly vertical normal faults striking about N15°E, several strong shear zones which strike about N80°E, occasional faults which strike N45°W, a set of north-south fractures and vertical joints striking N60°E and N70°W. A less pronounced joint set strikes about east-west and dips flatly to the south.

The N15°E faults bound the Lac Tiblemont depression and in many places along the shore occur as a series of small step-like scarps descending to the shore line. Little is known of the direction of movement but it is believed to have been nearly vertical. The only striations observed on the fault surfaces plunge steeply to the south.

The N80°E shears are zones of pronounced shearing and crushing. Such shears often occur in small stream valleys, and are only poorly exposed. However, outcrops of sheared material were exposed in places and the adjacent rocks also showed some crushing effects.

The N45°W faults are usually of limited extent and where movement along them could be observed it was an apparent left hand strike separation ranging from a few inches to two feet. Some of these faults offset small quartz veins in the diabase dyke.

The north-south fractures are probably tensional in origin, although in places there is a suggestion of translational movement along them. They may be related to the N80°E shearing. Unmineralized quartz veins were often noted in these fractures.

The vertical joint sets are commonly marked by scarp-like forms which suggest that there may have been some movement along the fractures. In some places, fractures having the strikes noted above are marked by the development of a chlorite schist.

Economic Geology

Gold has been mined in the southwestern corner of the map area at the Perron and Beaufor Mines and two adjacent properties, the Pascalis and Resenor Mines, have engaged in exploratory underground work. Elsewhere within the area, no suitable deposits of previous or base metals have been found. Prospecting throughout the map area appears to have been fairly exhaustive, since a great number of the quartz veins have been sampled, and trenching and diamond drilling have been engaged in in several of the more promising areas.

East of Perron, to about the vicinity of Pascalis station, most of the scattered quartz veins in the lavas appear to have received careful attention. In Block A, there has been some trenching on quartz veins and small areas of gossan in the lavas near the Pascalis-Tiblemont batholith contact. Along the southern contact of this batholith, it is understood that some diamond drilling was done some time ago, with unknown results. South of Lac Tiblemont, a small band of massive sulphides containing very low values in gold and base metals has been exposed in a number of trenches. Some diamond drilling has been done on this showing at various times, but the results are unknown. In Tiblemont township, several old trenches are present in the lavas immediately south of the batholith contact, in which some sulphide mineralization was noted. Finally at the extreme north-eastern corner of the map area, a few small quartz veins in the igneous rocks immediately south of a strong, chloritized shear zone have been trenched and diamond drilled.

Several areas may merit renewed attention on the part of prospectors. In the field it was noted that very sparse sulphide mineralization was present in the diorites west of the Pascalis-Tiblemont batholith contact, and sparse sulphide mineralization was also noted in places in the silicified lavas and pyroclastics lying between the batholith contact and the diorites noted above. Within the Pascalis-Tiblemont batholith, the marginal zone of blue quartz "granite" is the host rock for numerous veins with a similar mineralization to that at Perron, and the gabbro in the west central part of the batholith is known to carry very small quantities of copper and nickle. Careful examination of these areas might serve to locate economic deposits of gold or base metals.

No crysotile asbestos has been found in the peridotites of the map area but drilling in similar rocks about two miles to the south in Louvicourt township has shown the presence of small quantities of this mineral. Some of the biotite granite in the Pascalis-Tiblemont batholith may be suitable for use as a building stone, particularly that along the northern edge of the map area. Large parts of the area are covered with deposits of glacial sand and gravel. Some of this has been used in road construction, and a number of other deposits would probably be suitable for this purpose. However, the major parts are probably too thin or too close to the water table to be of use.

Perron Gold Mines Limited

Perron controls a total of 1415 acres in Pascalis and Senneville townships. The portion in Pascalis township starts at the western boundary of the township and lies north of the Beaufor, Pascalis and Pasgil properties and to the east of Pasgil. It consists of twenty-five claims numbered Blocks 9 to 18, Lots 15 to 18, Range I, the northern portion of Lots 7 to 13 and the south half of Lots 15 to 18, Range II. The mine is located in the village of Perron.

Mining has been confined to a small portion of the property near the western township boundary, where the easterly trending Perron "shear" offsets the Bourlamaque batholith contact. The ore is restricted to the "altered" granddiorite shell and occurs in quartz-tourmaline veins which carry some carbonate and scheelite. Gold occurs free and in close association with coarse crystals or pyrite in the veins and wall rock.

Some chalcopyrite is found with the pyrite.

The ore bodies have been classified (*) in order of their importance as follows:

1) Quartz veins following along or branching off as flat off-shoots and "horse-tails" from dyke-filled, northwest striking fractures. The highly productive No. 32 vein which extends from the 625-foot level to the 1,375-foot level is of this type.

2) Quartz filled tension fractures lying "en echelon" between east-west shear zones. Ore bodies of this type are best developed above the 725-foot level.

3) Quartz veins filling east-west shear zones. Such veins are irregular in outline and extent, for they pinch and swell with great frequency. However, they are of good grade and can be mined profitably.

A fault, on the south side of the "shear", striking N33°E and dipping 55°SE offsets the vein and other earlier structures.

Mining operations at this property ceased on or about the first of August, 1951.

(*) C.I.M. Struct. Geol. Can. Ore Deposits. Perron Mine
H.G. Ames. p. 897