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PARTS OF HEBECOURT, DUPARQUET AND DESTOR TOWNSHIPS, ABITIBI-WEST COUNTY

**PROVINCE OF QUEBEC, CANADA**

**Department of Mines**

**Honourable C. D. FRENCH, Minister** **A.-O. DUFRESNE, Deputy Minister**

**MINERAL DEPOSITS BRANCH**

**BERTRAND T. DENIS, Chief**

GEOLOGICAL REPORT 61

# PARTS OF HEBECOURT, DUPARQUET AND DESTOR TOWNSHIPS.

## ABITIBI-WEST COUNTY

by

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TABLE OF CONTENTS

MAPS AND ILLUSTRATIONS

Maps



Figures

<u>Plates</u>

(At centre of volume)

# PARTS OF HEBECOURT, DUPARQUET

# AND DESTOR TOWNSHIPS

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## INTRODUCTION

### General Statement

There has been a gradual accumulation of evidence during the past twenty years indicating that two easterly tranding gold bearing belts in Ontario and Quebec are associated with major fault zones. The faults are usually referred to as the Porcupine-Destor fault and the Larder Lake-Bouzan Lake-Cadillac fault.

This report covers that part of the Porcupine-Destor fault which lies between the Ontario boundary and the Macamic road in Destor township. It includes parts of Hébécourt, Duparquet and Destor townships in Abitibi-West county (see Figure 1). The work was carried out during the field seasons of 1944 to 1948, approximately 25 months being spent in the field. The town of Duparquet, which is centrally located in the area, is reached by road from Rouyn and Noranda 19 miles to the south. Several motor roads traverse the area and from these wagon roads and foot paths lead to the more remote parts. Some points in the southern part of the area are most easily reached from Hébécourt and Duparquet lakes.

Gold is the only metallic mineral exploited within the area. The whole of the production comes from the properties of Consolidated Beattie Mines Ltd. (Plate IV) and Consolidated Duquesne Mining Company Ltd.

The initial gold discovery was made about 1910 by John Beattie in a quartz vein on an island at the north end of Duparquet lake. This island is now part of the East Bay Gold property. In 1923 Beattie staked the group of claims which contain the Beattie orebodies, now held by Consolidated Beattie Ltd. Work on the Duquesne property also dates back to 1923.

## Field Work

The map of the area is published in five sheets:

No.821 - West Hébécourt Sheet
No.822 - East Hébécourt Sheet
No.823 - West Duparquet Sheet
No.824 - East Duparquet Sheet
No.825 - West Destor Sheet

The West Destor Sheet was mapped at 1 inch equals 400 feet and the others at 1 inch equals 500 feet. Air photographs, made by Canadian Pacific Airlines Ltd., were available for most of the area. The geology was mapped directly on the air photographs wherever this was possible. In forested areas, however, the outcrops could not be seen on the air photographs. Here the mapping was done by north-south pace and compass traverses spaced at intervals of 500 feet or less, depending on the complexity of the geology. Trails, roads, the shore lines of lakes and rivers and other topographic features, if visible on the air photographs, were used to control the traverses. In areas where control by air photographs was not practicable, east-west base lines were cut at half mile intervals.

A magnetometer was used to trace extensions of known geological contacts into or across areas covered by overburden. The instrument used was a Schmidt vertical field balance, simplified model Gf-7 by Askania. The scale constant was kept in the vicinity of 18.5 gammas per scale division. It was useful chiefly for locating contacts between sedimentary and volcanic rocks. The sedimentary formations are characterized by a rather uniform low field distribution, whereas the volcanic formations give higher irregular values. In some instances flows of different composition could be distinguished and their dip and the direction in which they face could be determined.

Information obtained from diamond drilling was used and the holes plotted on the maps only if their location was known and the core or drill logs were available for inspection. However, on mining properties where much drilling has been done, only those holes which supply information on major geological features are shown.

## Acknowledgments

The writer gratefully acknowledges the cooperation and courtesy of those in charge of exploration and mining within the area. J. Tuttle, manager of the Beattie mine, and H.S. McGowan, who succeeded him, aided in every way possible. Members of their staff, including F.E. Patton, chief engineer, J. Kerr, geologist, and C. Train, supplied information obtained from exploration work on the Consolidated

Beattie and Central Duparquet properties. G. Kellar guided the writer on visits to several points of interest in the area. B.S. Parkinson, president of Golconda Mines Ltd., provided plans of the Golconda property and kindly permitted use of the camp buildings during the field seasons of 1944 and 1945. A. Lee, consulting engineer, supplied plans of exploration work carried out by Pitt Gold Mining Company, Ltd., Nipissing Mining Company, Ltd., and Consolidated Duquesne Mining Company, Ltd. Fred Thompson guided the writer to points of interest on the Pitt group. J.D. Christian gave the writer the results of exploration work done on the Ottman claims by Teck Exploration Company Ltd. E.W. Gagan provided plans of the Clarry Gold Mines Ltd. A.F. Matheson of St. Francis Mining Company Ltd. and Paul Wettring of Wettring Gold Mines Ltd. kindly supplied plans of their respective properties. L. Brossard supplied geophysical information on the Hébécourt Gold Mines, the Nemrod, and the Brossard properties. B. Germain and D. Giachino provided plans of exploration work carried out on the Donmaque and East Bay properties.

R. Béland in 1944, D. Robertson in 1946, and R. Jooste in 1947, ably performed their duties as senior assistants. L. Trenholm, B. Lee, O. Owens and G. Kellar assisted the writer by doing geological mapping for a short period during the 1948 field season. In 1949 B. Lee mapped the west half of Range IX, Hébécourt township. His work is incorporated in the West Hébécourt sheet.

Student assistants were J. McLeod, J.C. Goyette and J.J. Boulais in 1944, R. Paradis, P. Lachance and R. Laliberté in 1945, B. Veilleux and C. Carbonneau in 1946, P. Beauchesne, F. Dubuc and G. Ferland in 1947, and R. D'Arcy, C. Carbonneau, P. Amyot, A. St-Arnaud and A. Thompson in 1948.

G. Johnston carried out a magnetometer survey in 1946 and 1947, complementing the geological work. Interpretations of the results were provided by L. Massé of Laval University. Johnson's assistants were J. Dugas, R. Pinault, J. Duplessis, H. Girard and M. Couture in 1946, and G. Robinson, D. Pollock and M. Couture in 1947.

## Previous Work

The earliest recorded geological survey in the district was that of McOuat*(1) in 1872 and 1873. Johnston (2) made a reconnaissance survey in the Abitibi district in 1901. Wilson did considerable mapping in the district between 1910 and 1913 (3). The volcanic

*Numbers in parentheses refer to the references at the end of the report.

rocks were named the Abitibi Group. The sediments outcropping on the shore of Lanaudière lake were classified with the Cobalt series. The first reference to the quartz porphyries of the Beattie area, which later proved to contain important gold mineralization, was made by Wilson (4) in 1918. He classified some of these porphyries as intrusive members of the Abitibi Group. Further work was done by James in 1922 (5), but little additional information concerning the map-area was obtained.

Buffam mapped most of Destor and Duparquet townships in 1925 on a scale of one inch equals one mile (6). He accepted Wilson's classification of the volcanic rocks in the area. The band of conglomerate, trending centrally across the map-area, the eastern part of which was classed as Cobalt by Wilson, was termed Temiskaming. The porphyry complex was mapped separately. Buffam described it as consisting of a red feldspar porphyry, which he believed to be a part of the Abitibi Group, and a quartz porphyry which he regarded as in part contemporaneous with the red feldspar porphyry and in part occupying a position between the Algoman and Huronian. Gabbro and peridotite bodies which outcrop in Destor township were first mentioned by Buffam. He believed that the gabbro was younger than the peridotite and both were younger than the Temiscamian-type sediments but older than the granite (Algoman?). He recognized the disconformity between the sedimentary and the volcanic rocks and also a syncline which was later called the Lépine Lake syncline.

In their memoir published in 1931, Cooke, James and Mawdsley (7) discarded the term Abitibi Volcanics in favour of Keewatin Volcanics. Further, they believed the peridotite to be younger than the gabbro, whereas Buffam had believed it to be older. Both the red feldspar porphyry and the quartz porphyry were regarded as older than the Destor-Duparquet sediments.

In 1932 Lang (8) mapped an area which includes part of the area under discussion. In opposition to Buffam, he regarded all the porphyries in the area as younger than the sediments. He recognized a series of pre-Temiskaming sediments which be believed represented the upper member of the Keewatin series. No other significant changes in the chronology of the formations were made.

O'Neill (9) mapped part of the area in 1933. He, like Lang, classified the two varieties of porphyry as younger than the sediments. He apparently considered the gabbro-peridotite complex, only a small part of which extends into his area from the east, to be the same age as the "older gabbro" and hence older than the sediments.

In 1938 Bannerman (10) mapped the area immediately east of the present map-area. He described an older series of sediments which extends from Cléricy township westward into Destor township. Part of this band was undoubtedly mapped by Buffam but was included with the younger "Temiskaming" sediments. Bannerman divided the porphyries, which are continuous from the west, into two groups: feldspar porphyry and quartz porphyry. These two groups correspond to the red feldspar porphyry and the quartz porphyry of Buffam. Bannerman believed the feldspar porphyry to be younger than the sediments and the quartz porphyry to be older. Mapping was done in sufficient detail to differentiate between the gabbro and the peridotite. Bannerman found the gabbro to be younger than the sediments and the porphyries. Thus the complex was regarded as about the same age as the "older gabbro". In 1941 Ambrose applied a further subdivision to the conformable volcanic and sedimentary rocks in Cléricy township (11). This included, from oldest to youngest, the Malartic group of volcanic rocks, the Kewagama group of sedimentary rocks, the Blake River group of volcanic rocks and the Cadillac group of sedimentary rocks. The Blake River and Kewagama groups, as mapped by Ambrose, are continuous into the area under discussion and include all the volcanic rocks and the pre-Temiscamian sediments.

Later, Norman (12) and Ambrose (13) re-introduced the term Abitibi series, which included the Malartic, Kewagama and Blake River groups. The Cadillac group was considered to be a member of either the Temiskaming or the Abitibi Group. They retained the name Blake River group for the volcanic rocks which lie immediately south of the Porcupine-Destor fault. The name Kenojevis group was given to the volcanic rocks north of the fault. The Kenojevis group is believed by Ambrose to be in part contemporaneous with the Blake River group and in part older. Norman, on the other hand, has correlated the Kenojevis group with the Malartic group, but states that it may be in part post-Kewagama.

Shear zones were noted by both Buffam (6) and O'Neill (9), but it was not until Bannerman surveyed the Lépine Lake area (10) that an attempt was made to map them and to show their relationship to faulting and to zones of carbonatization and silicification.

## DESCRIPTION OF THE AREA

The general nature of the region is typical of the clay belt of Quebec, this part having been formed by deposits of post glacial Barlow lake. Rocky upland regions typical of the general district are represented by the Destor hills in the northeastern part of the area and the hills west of Duparquet lake along the southern border of the area. The general relief is between 250 and 400 feet. Range VIII in the western half of Hébécourt township is of low relief but rugged in detail and rocky. In the remainder of the area the surface is rolling and hummocky, with ridge-like projections of rock. The more marked linear features are controlled by the structure of the bedrock. Thus most of the valleys and low ground are underlain by fault zones; also the southern limit of the rocky uplands in Destor township is an expression of easterly and northeasterly trending faults.

The drainage system is youthful. Hébécourt and Duparquet lakes are the drainage basins for all but the extreme southeastern part of the area. Hébécourt lake drains into Duparquet lake which in turn drains into Abitibi lake to the north of the area by way of the Duparquet river.

Extensive lumber operations have been carried on in ranges V and VI of Hébécourt township and range V of Duparquet township. Thick growths of spruce and jack pine occur in the west half of Hébécourt township in ranges VII and VIII. The remainder of the area was burned extensively by forest fires in the spring of 1944. Farming is carried out on a small scale. Crops of fodder and some vegetables are grown, and cattle, sheep and pigs are raised. Most of the farms are in ranges VII, VIII and IX in the eastern part of Hébécourt township and the western part of Duparquet township. There is a small dairy in Duparquet.

## GENERAL GEOLOGY

### General Statement

The consolidated rocks in the area are all of Precambrian age. The general distribution of the formations is shown in Figure 1. Regional group names are not applied, as the regional correlations are uncertain and inclusion of these names could cause confusion. Present knowledge indicates, however, the following correlation of the pre-Temiscamian formations.

| Regional | Map-Area |
|---|---|
| Abitibi (Keewatin) | Keewatin-type |
| Blake River Group | Younger Volcanics |
| Kewagama Group | Cléricy Sediments |
| Kenojevis Group (Malartic) | Older Volcanics |

The oldest rocks in the area are of volcanic origin and have been called Older volcanics. There is some evidence of a period of gentle folding and erosion of the volcanic formations. This was followed by the deposition of the Cléricy sediments. Later, the Younger volcanics were laid down conformably on the Cléricy sediments. Next came a period of intrusion. The intrusive bodies range in composition from peridotite and pyroxenite to granite. After the period of intrusion there was folding and erosion. The Duparquet sediments, were then laid down. After the deposition of the sediments there was further folding. It was at this time that the Lépine Lake syncline and the Duparquet Lake syncline were formed. Subsequent to this, there was another period of folding during the Algoman (?) or the Keweenawan (?) period. Regional evidence suggests that it is related to the forces which caused the major faulting. After the folding which formed the Lépine Lake and the Duparquet Lake synclines, there was a period of major faulting. At this time the Porcupine-Destor fault and its subsidiary zones were formed. Towards the close of this period of faulting bodies of acidic porphyry and related granite and aplite, as well as small dykes of lamprophyre were intruded. They occur along and adjacent to the fault zones.

Faulting during a second period was widespread, although on a smaller scale. Finally, many small dykes of diabase, gabbro, diorite and some pyroxenite were intruded, mainly in the southwestern part of the area. Their emplacement was apparently controlled by the fracturing developed during the second period of faulting.

The mantle of sand, gravel and clay that covers the bedrock in many places was laid down during Pleistocene and Recent time.

Table of Formations

| Era | Period | Group | Lithology |
|---|---|---|---|
| | Recent and Pleistocene | | Sand, gravel, clay, glacial till |
| | | | Major unconformity |
| PRECAMBRIAN | Keweenawan(?) | | Diabase, gabbro, diorite, pyroxenite |
| | | | Intrusive contact<br>Younger faulting and minor mineralization<br>Minor faulting, mineralization |
| | | Post Duparquet Intrusives | Lath porphyry, lamprophyre, basic dykes and siliceous dykes<br>Faulting and mineralization<br>Faulting<br>Porphyry conglomerate breccia<br>Syenite porphyry, plum porphyry and related feldspar porphyry<br>Quartz feldspar porphyry<br>Feldspar porphyry, micrographic feldspar porphyry, aplite, albite granite |
| | | | Intrusive contact<br>Major faulting, folding ? |
| | Temiscamian-type | Duparquet Sediments | Conglomerate, arkose, greywacke |
| | | | Unconformity<br>Folding |
| | | Pre-Duparquet intrusives | Peridotite, pyroxenite, gabbro, quartz gabbro, quartz diorite, diorite, granite (possibly in part later than Duparquet sediments) |
| | | | Intrusive contact |
| | Keewatin-type | | Diabase, quartz diabase, gabbro and diorite, contemporaneous with older and younger volcanics |
| | | Younger Volcanics Upper formation | Agglomerate, some tuff beds, rhyolite, trachyte, andesite, basalt, flow breccia, feldspar porphyry flows and dykes. spherulitic flows |
| | | Younger Volcanics Lower formation | Basalt, variolite, andesite, flow breccia |
| | | Cléricy Sediments | Greywacke and argillite with some basalt and trachyte interbeds |
| | | Unconformity? | |
| | | Folding? | |
| | | Older Volcanics Upper formation | Basalt, andesite, trachyte, flow breccia, tuff |
| | | Older Volcanics Lower formation | Basalt, andesite, variolite, porphyritic andesite and basalt, trachyte, rhyolite, spherulitic flows, flow breccia, quartz-feldspar-chlorite schist, quartz-feldspar-sericite schist, quartz-sericite-chlorite schist, tuff, agglomerate, banded iron formation |

## Keewatin-type Rocks

Keewatin-type rocks in the area comprise the Older volcanics, the Cléricy sediments, the Younger volcanics, and related intrusive rocks.

The mode of occurrence of the Older and the Younger volcanic formations is similar. Individual flows vary in width from a few feet to several hundred. There is considerable interfingering between flows of different composition. Discontinuous bands and lenses of one flow may extend 20 or 30 feet into the other. However, no cross cutting relationships were observed. In places there is a gradation along the strike from a facies of one composition to that of another.

The mineralogy of the Keewatin-type lavas has been modified by extensive low grade metamorphism. Consequently a true petrographic classification could not be applied. The classification used is based on colour, texture, grain size and presence or absence of quartz. The diagnostic features are given below.

The basalt is fine grained, green, occasionally greenish black or black and contains some feldspar.

The andesite is fine grained, grey with a distinct greenish tint, and more compact than the basalt. Dacite may be present. In most cases, however, it could not be ascertained whether the quartz, which is the diagnostic mineral, was of primary or secondary origin. In view of this uncertainty the dacites, if present, are included with the andesites.

The trachyte is fine grained and light to dark grey. Greenish tints are absent. There is no primary quartz. A lath-like to trachytic texture is visible microscopically, and sometimes megascopically on the weathered surface. The trachyte has a more compact texture than the andesite.

The rhyolite is fine grained to aphanitic, light grey to greenish grey and has a greasy lustre. The texture is compact. Quartz is visible.

### Older Volcanics

The Older volcanics, which are the oldest rocks in the area, all lie north of the Porcupine-Destor fault. They have been divided into a lower and an upper formation. The rock types are identical in the two formations, but the proportions of each type vary.

The lower formation of the Older volcanics occupies practically the whole north half of the map-area. It consists mainly of trachyte and andesite, with some rhyolite and basalt and related intrusive bodies.

The upper formation of the Older volcanics outcrop in the east central part of the area in the form of two easterly trending bands separated by the Duparquet sediments. These two bands represent the limbs of the Lépine Lake syncline. The upper formation consists predominantly of flows of basalt with a few discontinuous bands of flow breccia. Some andesite and trachyte occur: these rock types predominate in the vicinity of Lanaudière lake.

No actual contacts between the lower and the upper formation of the Older volcanics were observed. The two formations are separated, for the most part, by a sill-like body of Keewatin-type diabase. The regional structure indicates that the two formations are conformable.

Trachyte

Trachyte weathers reddish brown, greenish brown or grey. It is ordinarily fine grained and compact. At the centres of the thicker members, however, it is medium grained and is difficult to distinguish from the intrusive phases of the lava. Well developed pillows are common. They range in size from 6 inches by 4 inches to 7 feet by 2 feet. Some attain a length of 12 feet or more. Many of the interstices between the pillows are filled with scoria. Amygdules are not abundant. Where they occur, they are very irregularly distributed and cannot be used for structural determinations.

The feldspar occurs as well developed plagioclase laths exhibiting varying degrees of saussuritization. In some specimens the laths impart a distinct trachytic texture. In general, quartz is absent. Rarely it is present as a result of alteration of the feldspar or as minute veinlets. Carbonate is present in all specimens and may replace 75 per cent of the rock in extreme cases. Magnetite, leucoxene and apatite are the common accessories. The grain size ranges from 0.05 to 0.1 mm. in diameter, except in the central medium grained parts of the thicker flows. The plagioclase laths are usually larger than the other minerals in the rock. The groundmass consists of chlorite, sericite, albite and epidote.

The estimated average mineralogical composition of the specimens of trachyte examined in thin section is given in Table 1.

Table 1 - Average mineralogical composition of trachyte

| | |
|---|---|
| Albite and oligoclase .... | 59 |
| Carbonate ............... | 21 |
| Chlorite ................ | 9 |
| Epidote ................. | 7 |
| Leucoxene, apatite, sericite and magnetite.. | 4 |
| Total ........ | 100 |

Andesite

The andesite weathers in a similar manner to the trachyte and exhibits the same flow structures. It is characterized by plates of augite, which comprise 2 to 20 per cent of the specimen. It contains more carbonate and chlorite than the trachyte. The plagioclase is of the same composition as that of the trachyte, but is more stubby. No trachytic textures were observed. Quartz is commonly present, occurring with epidote and clinozoisite as alteration products of the feldspar or as an introduced material. The quartz comprises less than 10 per cent, but, in rare cases up to 25 per cent, of the section.

The estimated average mineralogical composition of the specimens of andesite examined in thin section is given in Table 2.

Table 2 - Average mineralogical composition of andesite

| | |
|---|---|
| Albite and oligoclase ..... | 34 |
| Carbonate ................ | 23 |
| Chlorite ................. | 15 |
| Magnetite ................ | 3 |
| Quartz ................... | 10 |
| Augite ................... | 5 |
| Epidote and clinozoisite .. | 10 |
| Total ........ | 100 |

Basalt

The basalt, like the andesite, weathers brown to green. On the fresh surface it is dark greyish-green to olive-green and, except in the central medium-grained part of the thicker massive flows, has a fine-grained, compact texture. It is often difficult to distinguish between the greenish-grey andesites and the greenish basalts. Pillow structures are common.

In the basalt the lath-like texture, typical of the trachytic rocks, is lacking. The feldspar (albite or oligoclase) is stubby and in many specimens is altered to epidote and sericite.

Augite, or chlorite pseudomorphic after augite, is more abundant than in the trachyte or andesite. Quartz is more common, ordinarily comprising 5 to 15 per cent of the section. The quartz was formed in part by replacement of feldspar. Between the larger plagioclase and augite crystals, the groundmass consists of a mat of augite, very fine needles of plagioclase and quartz anhedra.

Spherulitic lava

The spherulitic lava weathers a variegated reddish-brown to light grey. Pillow structures are well developed: pillows vary from 8 inches to 10 feet in length and 4 inches to 4 feet in width. A zone of spherules up to 4 inches in width commonly occurs at the margin of the pillows. The interstices between pillows contain a small amount of scoriaceous breccia. On the fresh surface, the central part of the pillows is medium to greenish grey and aphanitic. In the spherulitic margins the spherules are the same colour as the central part of the pillows whereas the matrix is dark grey, a little coarser grained, and not so compact in texture.

Rhyolite and Related Pyroclastic Rocks

The rhyolite is light greenish grey, on the fresh surface, and ranges from fine grained to aphanitic. It weathers light grey and is characterized by glassy quartz eyes, up to 1/8 inch in diameter which, in some specimens, form as much as 5 per cent of the rock. Locally, phenocrysts of grey to pinkish feldspar may be present, and, in places, are more abundant than the quartz.

In thin section the rhyolite is seen to consist of phenocrysts of quartz and albite in a groundmass made up of grains of quartz and feldspar less than 0.001 mm. in diameter. The quartz phenocrysts have sharp, well defined outlines, but many of them are shattered and crushed. The albite occurs as stubby prisms. Sericite occurs as an alteration product around the edges of the albite phenocrysts and as shreds in the groundmass. Some specimens contain up to 20 per cent sericite. Epidote occurs as irregular grains. Titanite and apatite are accessory minerals.

The tuff associated with the rhyolite is fine grained and weathers light grey to yellowish grey. It is well banded, the bands consisting of grey-weathering beds of clastic quartzose and feldspathic material up to 2 feet wide, separated by yellow-weathering beds up to 2 inches wide, consisting principally of sericite. The tuff consists of fragments of rhyolite, quartz and albite up to 0.8 mm. in length. These are surrounded by a very fine grained matrix consisting of sericite, chlorite, quartz and feldspar. Lenticular streaks of leucoxene, altered from titanite, and a small amount of carbonate, are also present.

The agglomerate occurs as lenses in the rhyolite and as irregular masses in the tuff. The fragments are rhyolite, angular in outline, and 2 to 4 inches across.

Porphyritic Andesite, Basalt and Related Intrusive Rocks

North of the Duparquet road there are several flows of "porphyritic" andesite and basalt. The "phenocrysts" are white or pale yellowish green on the fresh surface and white on the weathered surface. They range in size from a fraction of an inch to 3 inches across. This variation in size may occur within a few feet. The "phenocrysts" may be angular, round, oval, or irregular in outline. Some have a crystal outline suggestive of the feldspar group. The larger "phenocrysts" have very irregular outlines such as would result from the aggregation of several small "phenocrysts". In some of the pillow lava the "phenocrysts" are so abundant that they mask the pillow structure. They occur in the pillows and also in the selvages between pillows. Except for the "phenocrysts", the porphyritic andesite and basalt are similar to the non-porphyritic varieties. Some of the intrusive phases of the andesite and basalt show features similar to the flows. The occurrence of "phenocrysts" may be, in places, sporadic. Flows of porphyritic andesite have been described by Buffam (6, p.89), Lang (8, p.26), and Bannerman (10, p.8).

In thin section the groundmass of the porphyritic rocks is seen to be similar to the groundmass of their non-porphyritic equivalents. The "phenocrysts" consist of a cryptocrystalline aggregate of grains locally cut by seams of epidote. Spectroscopic and X-ray photographs indicate the grains are a mineral of the epidote group. The variation in size of the "phenocrysts", their skeleton-like form with numerous inclusions of the groundmass around their edges, and the irregular tongues extending into the groundmass, suggest they were formed by replacement. (Plate II-A). It is believed they are derived from a calcic variety of feldspar and have been metamorphosed to their present state. The writer's opinion (see p. 38) is that the porphyritic texture is of porphyroblastic origin.

Flow Breccia

The flow breccia is most commonly associated with pillow lava contacts, but may also occur along the contacts of massive flows. The fragments have an angular to rounded outline and vary in size from 1/4 inch to 1 foot. Some of the wider bands of flow breccia contain local lenses of massive lava.

Tuff and Agglomerate

The tuff, as a rule, is well sorted into beds ranging from 1/8 inch to 4 inches thick. Finely bedded chert occurs locally as interbeds between the coarser bands.

In thin section, the finer grained tuff is seen to consist of quartz, feldspar, hornblende and interstitial sericite. The grain size ranges from 0.005 to 0.025 mm. in diameter. In the coarser grained tuff the grains range from 0.35 to 0.70 mm. in diameter. They consist of sub-angular to rounded anhedra of quartz, sericitized plagioclase and carbonate. The interstices are occupied by limonite, leucoxene and muscovite.

The agglomerate consists of sub-angular to rounded fragments of quartz, chert, basic lava, porphyritic andesite with feldspar phenocrysts, and, in places, fragments of banded iron formation. Some of the fragments are 3 to 4 inches in diameter. The matrix is an aphanitic, olive green material which locally contains finely disseminated pyrite.

Banded Iron Formation

The banded iron formation consists of bands up to 3 inches in width which weather red, light grey or green. Locally this formation is brecciated. There is more iron oxide present in the brecciated zones than in the massive parts of the formation. In thin section the banded iron formation is seen to consist of 50 per cent quartz, 25 per cent hematite and 25 per cent carbonate. Some specimens contain up to 5 per cent magnetite and 2 per cent pyrite, with correspondingly less carbonate. The quartz, as well as forming the major constituent of all the bands, occurs as filling in small fractures which traverse the bedding. The carbonate usually occurs as irregular patches, suggesting replacement. The hematite occurs as dust-like particles and rounded grains, whereas the magnetite and pyrite occur as anhedral to subhedral crystals scattered through the band they characterize.

Cléricy Sediments

The Cléricy sediments were first named by James and Mawdsley (14, pp.107-109) and correlated with the Kewagama group by Gunning and Ambrose (15, pp. 23, 24). They are continuous from Cléricy township to Duparquet township. Their distribution within the map area is shown in Figure 1, which is based on information obtained partly by observation of outcrops and partly by diamond drilling and geophysical work. The belt thus outlined trends N.70°W. It is made up of a basal conglomerate member overlain by beds of greywacke and slaty argillite with some interbeds of basalt and trachyte.

The conglomerate consists of round to elliptical pebbles of chert, rhyolite and andesite, up to 2 inches in diameter, in a matrix of fine grained dark green chloritic material.

The greywacke weathers greenish grey. The beds range in thickness up to 1 foot. Grain grading is in general indistinct. In some of the beds, however, the greywacke grades into an argillaceous top. The tops face south.

The slaty argillite is a dark green fine grained rock. The beds seldom exceed 2 inches in thickness.

Younger Volcanics

The Younger volcanics include all the volcanic rocks south of the Porcupine-Destor fault. They have been divided into a lower and an upper formation, which are conformable, but lithologically distinct.

The lower formation of the Younger volcanics consists predominantly of flows of basalt with some andesite and trachyte. Variolite, though of minor importance, is characteristic of the lower formation.

The upper formation of the Younger volcanics consists predominantly of flows of andesite and trachyte with some rhyolite, basalt, agglomerate and tuff.

Many of the rock types of the younger volcanics are similar to those of the Older volcanics. Only the types not previously described, and varieties showing characteristic features, will be described here.

Variolite (Spherulitic Basalt)

Flows of variolite are characterized by well rounded pillows with scoriaceous and agglomeratic material in the interstices. Marginal zones of the pillows contain white-weathering spherules, varying from tiny spots to well developed spheres 2 inches in diameter, locally deformed to spheroid shape. The spherules in many cases have coalesced to form larger, irregular shaped aggregates. On the fresh surface, the spherules are grey to greenish grey. In cross section they show radial and concentric structures, which are best seen in the hand specimen. The groundmass is fine grained and olive green in colour with patches of an aphanitic smoky grey green material which on microscopic examination was found to be glass.

Some specimens, examined in thin section, contain spherules with a border, 0.15 mm. in width, of clear fibrous albite. The central part of the spherules consists of nearly opaque saussurite in which the original fibrous habit of the feldspars can be detected. About 1/3 of the groundmass is brownish yellow glass with a well developed flow structure. The remaining 2/3 of the groundmass is made up of magnetite, sericite, feldspar, epidote and clinozoisite. The feldspar is a saussuritized plagioclase. The epidote and clinozoisite are alteration products of feldspar. The crystalline part of the groundmass contains scattered rounded nests of quartz grains of an average diameter of 0.1 mm. and has, like the glass, a flow structure.

Other specimens contain spherules which consist of branching fibres of altered feldspar arranged in a plumose pattern and, in some cases, rounded bleb-like inclusions of quartz. The groundmass consists of devitrified glass containing dendritic feldspar needles, irregular plates of chlorite, and veinlets, seams and granular aggregates of quartz.

The composition of the rock in the spherulitic flows, as determined from the refractive indicies of glass remnants found in them (16), is given in Table 3. These rocks are similar in composition to the plateau basalts referred to by Daly (17).

Table 3 - Composition of variolite

| | |
|---|---|
| $SiO_2$ | 47.5 |
| $K_2O$ | 1.0 |
| MgO | 5.7 |
| CaO | 9.5 |
| FeO $Fe_2O_3$ | 13.5 |
| Constituents not determined | 22.8 |
| Total | 100.0 |

Basalt

In general, the basalt of the Younger volcanics is similar to that of the Older volcanics. However, southwest of Hébécourt lake there is a group of basaltic flows of a different type. In general they are greenish black, aphanitic and compact. In places a peculiar type of breccia is developed. The fragments are angular and range from 1/2 to 1 inch in length. They consist of an extremely fine grained mat of hornblende and augite, containing fine laths of plagioclase showing flow structure with aggregates of carbonate granules, chlorite anhedra, occasional quartz anhedra and plates of muscovite. The fragments comprise 80 per cent of the rock. The matrix consists of fine grained quartz and chlorite granules with a little muscovite. Some of the basalt is pillowed. The cores of the pillows are light "trachytic" grey.

Porphyritic Andesite and Basalt

Porphyritic andesite and basalt occur as flows and dykes. The phenocrysts are feldspar and range in size from tiny flecks to lath-like crystals 1/3 inch in length. The groundmass is aphanitic. In thin section the feldspar phenocrysts are seen to be altered to an opaque mass of saussurite and many are skeletal in outline. The groundmass consists predominantly of anhedra of sodic andesine, chlorite, magnetite, hematite and leucoxene. There are a few ragged plates of chlorite and some associated sericite, intermediate in size between the phenocrysts and the grains of the groundmass.

Rhyolite

The rhyolite consists predominantly of feldspar, quartz and greenish ferromagnesian minerals. It is fine grained, and greenish grey on the fresh surface. The weathered surface is light grey to greenish grey with tiny well developed quartz eyes and slender laths of grey feldspar.

Two specimens from this rhyolite were examined in thin section. The quartz phenocrysts were seen to make up from 2 to 30 per cent of the rock and to consist of single euhedral quartz crystals or clusters of quartz anhedra. Some of the phenocrysts have secondary growths of quartz around their margins. The feldspar varies in composition from albite to albite-oligoclase. Most of the groundmass consists of a mosaic-like arrangement of quartz and feldspar. Sericite forms from 1/4 to 1/3 of the groundmass, generally in patchy aggregates. Chlorite, carbonate, epidote, a little hornblende and accessory pyrite and leucoxene make up the remainder of the groundmass.

Agglomerate

Beds of agglomerate are a characteristic feature of the upper formation of the Younger volcanics.

The agglomerate is made up of angular blocks of felsitic rock and rounded fragments of amygdaloidal andesitic and basaltic lava in a tuffaceous matrix. The fragments range in size from 1/16 inch to 4 feet (Plate I-A). The larger fragments are concentrated near the bottoms of the beds. The agglomerate is light grey to light greenish grey. On the weathered surface the larger fragments are light grey and the matrix is brown.

Most of the larger fragments are of felsitic rock, which consists of an aggregation of fine grained epidote, zoisite and quartz or saussuritized twinned feldspar with minor apatite and titaniferous magnetite. The matrix is porous. It consists of sericitized fragments of plagioclase crystals, trachyte and chert cemented by carbonate. The filling of the pores consists of a central core of carbonate with an outer rim of chlorite. Pyrite, magnetite, pyrrhotite and chalcopyrite are disseminated throughout.

Diabase and Quartz Diabase

Intruding the intermediate to basic flows are dykes and sills of diabase ranging in composition from quartz diorite to gabbro. In places they form up to 30 per cent of the complex. The similarity between these intrusive bodies and the massive parts of the lava flows has long been a problem to geologists in the area. In many cases definite intrusive features such as dykes, crumpling between intrusive lobes and rotated inclusions may be observed. In the excellent exposures of the Destor Hills, in the northeastern part of the area, narrow flows or bands of flow breccia 20 to 30 feet wide and up to 1,200 feet long are bounded on either side by diabase sills. The flow breccias are not disturbed but they are cut by small dykes which are offshoots from the sills. In other places the sills, when in contact with pillowed flows, do not truncate the pillows. This relationship also holds where dykes from the sills cut across the flows (see Figure 2, p.19). Elsewhere pillowed flows seem to grade into sill-like bodies which in turn send off dykes into the formations above and below.

This intimate association of the intrusive bodies of diabase with the Keewatin-type volcanic rocks suggests a common genetic origin. Detailed study of the contacts between the flows and the intrusives suggests that the flows were still viscous at the time of the intrusion. It is believed that the intrusives were contemporaneous with the Keewatin-type extrusives. Apparent gradations from intrusive to extrusive facies are believed due to sills finding outlets in areas of irregular topography and forming flows.

The diabase has a rusty brown weathered surface similar to that of the lava. Some surfaces are slightly pitted due to the weathering out of the ferromagnesian minerals. It is medium grained, except at contacts, which exhibit chilled edges. On the fresh surface, the diabase is greenish grey, green or dark green. It is similar in appearance to the lava of the thick massive flows, except for the presence in some specimens of greenish black angular flakes of chlorite. A faint polygonal jointing was noted near some of the contacts with the thinner flows.

At about the central point of lot 59, range VIII, Hébécourt township, an outcrop of gabbroic Keewatin-type diabase contains

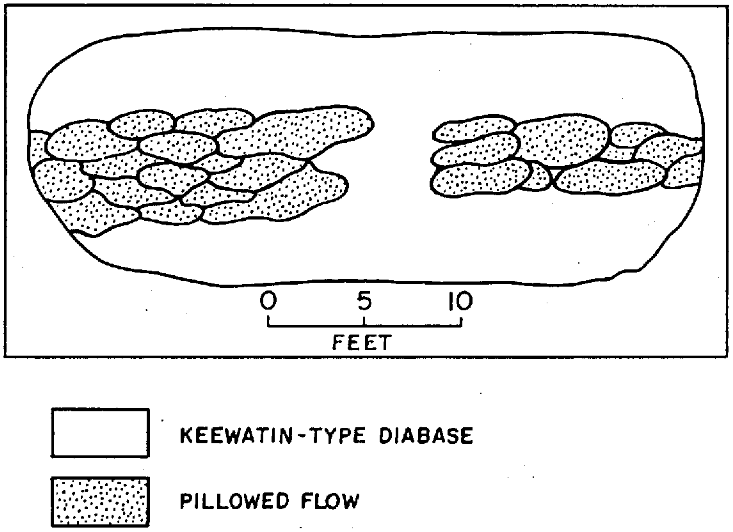



FIGURE - 2

Sketch showing the manner in which a Keewatin-type intrusive mass conforms to pillow outlines of intruded lava.

D.M.Q. no. 992

fractures which are filled with epidote, small quartz blebs up to 1 inch long and axinite crystals up to 1 inch in diameter. The axinite is a pale pinkish mauve colour and weathers to a very pale mauve. It displays a well developed cleavage in one direction.

Representative specimens from the sills and dykes within the area were examined in thin section and it was found that they all exhibit to varying degrees a diabasic or ophitic texture. About 25 to 60 per cent of the rock consists of laths of saussuritized plagioclase. Some of the clearer crystals were identified as albite. Elsewhere they vary from oligoclase to andesine. In one instance, clear labradorite was observed to rim and cut opaque saussuritized plagioclase and is apparently later. The maximum amount of augite present in the slides examined was 30 per cent. Hornblende, a common alteration product of the augite, forms 20 to 40 per cent of the rock. Chlorite is present in amounts up to 20 per cent. Quartz, when present, occurs as veinlets, anhedra and myrmekitic intergrowths with later labradorite. Some of the chlorite and some of the sericite also occurs as veinlets. Zoned titaniferous magnetite, leucoxene and apatite are accesssory minerals. When carbonate is present, it replaces the matrix but not the plagioclase laths and larger amphibole crystals. Sericite, epidote, zoisite, fibrous amphibole and chlorite form the groundmass between the larger feldspar and ferro-magnesian crystals.

The terms Diorite and Quartz Diorite are commonly applied to these rocks. However, within the general district, it has through usage come to mean a post Keewatin-pre-Algoman intrusive rock of basic to intermediate composition. Consequently, a great deal of confusion has arisen over the term Diorite being applied to both the intrusive equivalents of the Keewatin-type volcanics and the post Keewatin-pre-Algoman intrusives. Because of this, the terms Diabase and Quartz-Diabase are given to the Keewatin-type intrusives. This terminology will help to point out the age distinction between the two.

## Pre-Duparquet Intrusives

The rocks in this group are pyroxenite, peridotite, gabbro, quartz gabbro, diorite, quartz diorite and granite. The pre-Duparquet intrusive masses display a strong tendency to conform to the regional structure. In general they are larger and coarser grained than the Keewatin-type intrusive bodies. In places there is sporadic banding, apparently resulting from differentiation. A diabasic texture is locally developed, but it is not so common as in the Keewatin-type intrusive rocks.

### Peridotite

No exposures of peridotite were observed within the map-area. However, eight diamond drill holes intersected peridotite in Hébécourt township. The peridotite apparently extends from lot 12 to lot 29, in the northern part of range VII, as a series of discontinuous sill-like lenses. A few isolated bodies of peridotite have also been intersected by diamond drilling along the Lépine Lake fault in Destor township just north of Lanaudière lake. The peridotite is a blue-grey to blue-black medium grained rock. It is cut by numerous veinlets of serpentine. When sheared it alters to a soft talcose schist.

### Pyroxenite

In Destor township there are several bodies of altered pyroxenite between Lanaudière lake and the Macamic road. These mark the western termination of the ultrabasic intrusives in the Lépine lake area (10, pp.15-18). Much of this formation is amphibolite, which represents a highly uralitized phase of the pyroxenite. These rocks are porphyritic in appearance. In thin section, the phenocrysts are subhedral plates and cross sections of augite. Augite also makes up the groundmass along with tremolite, an alteration product of augite. Carbonate veinlets are present. The approximate proportion of the minerals present is 90 per cent augite, 9 per cent tremolite and 1 per cent carbonate.

Gabbro and Quartz Gabbro

Bodies of gabbro and quartz gabbro are widely distributed throughout the area. The gabbro and quartz gabbro weather reddish-brown to olive-green. They are characteristically heterogeneous in grain size and of variable composition. In general, they are coarse grained. Many veinlets of epidote up to 3 feet long and 1 inch wide were observed. In most of the larger bodies, bands up to 8 inches in width are developed locally. The bands consist of alternating light and dark phases of the gabbro, or, more rarely pegmatitic and medium grained phases. The light coloured gabbro consists of 60 to 80 per cent greenish-grey feldspar with minor amounts of amphibole and chlorite. The dark coloured gabbro consists of 60 to 95 per cent amphibole and chlorite, the remaining 5 to 40 per cent being greenish-grey feldspar. These darker bands generally contain some pyrite.

The pegmatitic phases of the gabbro, which characterize the Lanaudière body, consist of crystals of amphibole and feldspar about 1 inch across. The only other mineral of importance is epidote, which occurs as granules 1/8 inch in diameter.

The gabbro consists of 25 to 35 per cent feldspar which is generally too badly altered to permit identification. Where determinations could be made it was found to vary from oligoclase to labradorite. Amphibole and pyroxene make up 60 to 70 per cent of the rock and the remainder is carbonate, chlorite and magnetite. The pyroxene is augite and locally is abundant enough for the rock to be classified as a pyroxenite.

The gabbro on the Consolidated Duquesne property, while appearing relatively fresh to the naked eye, was found under the microscope to be serpentinized and brecciated. The fragments are cemented by carbonate. The brecciation is probably due to faulting. Diamond drilling has outlined important shear zones on either side of this gabbro.

Diorite

Diorite occurs as dykes, plugs and sill-like masses intruding the Keewatin-type rocks. The most prominent exposures are in Hébécourt township.

The diorite has a granitic texture and the grain size varies from medium to coarse. It consists of feldspar and ferromagnesian minerals in about equal proportions. The feldspar is commonly grey, but in the large diorite mass to the northeast of Hébécourt lake there is a phase characterized by pink feldspar.

In thin section, the feldspar content of the diorite was found to vary between 20 and 60 per cent. The feldspar has been altered to an opaque mat of saussurite or to a fine grained aggregate of epidote and white mica. Augite and hornblende, as prisms and plates, make up 15 to 35 per cent of the rock. The augite is locally altered to hornblende and chlorite, while the hornblende is altered to chlorite. Some of the partially altered hornblende contains inclusions of magnetite in the form of tiny rods. Most of the specimens examined contain some quartz, the proportion ranging from 1 to 15 per cent. Other minerals present are pyrrhotite, ilmenite altering to leucoxene, and a few flakes of muscovite.

Granite

A mass of medium to coarse grained pink granite occurs in the diorite on the northeast shore of Hébécourt lake. The diorite in the neighbourhood of this mass is cut by numerous small dykes of granite. To the south the granite apparently grades through quartz diorite into diorite. Elsewhere the contacts of the granite with the diorite are not exposed. The presence of the granite within a variety of diorite characterized by pink feldspar, and the gradational nature of the contact, suggest that the granite is genetically related to the diorite and, although younger, of the same general age.

In thin section the granite is seen to consist of albite, hornblende, quartz, chlorite, apatite and pyrrhotite. The texture is typically granitic. The albite is considerably altered to white mica and epidote. Quartz occurs as large anhedra containing many fine inclusions. Hornblende occurs as anhedra, prisms and plates, locally altered to chlorite. Apatite, hematite, pyrrhotite and magnetite are characteristic accessory minerals.

## Temiscamian-type Rocks

Duparquet Sediments

The Duparquet sedimentary rocks form an easterly trending belt which extends from the Beattie mine to the Macamic road. The beds are made up of conglomerate, arkose and greywacke. They lie unconformably on the Keewatin-type rocks.

Conglomerate

Conglomerate makes up the greater part of the Duparquet sediments. Typically, it is poorly sorted (Plate I-B) but local exposures with pebbles of fairly uniform size were observed. Rounded to slightly elongated pebbles and boulders up to 3 feet in diameter make up 85 to 95 per cent of the rock. Near and in zones of shearing, the boulders are elongated and generally have a ratio of length to width of about 3 to 1. The boulders in the conglomerate consist of greywacke, argillite, gabbro, diabase, grey granite, chert, basalt, andesite, jasper, rhyolite, quartz-feldspar porphyry and amphibolite. The pebbles corresponded generally to the exposed formations within the area and are megascopically similar. However, many of the pebbles which appeared to be fine grained andesite were found in thin section to consist of massive arkose. A few boulders of greywacke showing bedding were found in the conglomerate. The boulders of sedimentary rock were probably derived from the Cléricy formation which lies to the south and east; the others probably came from the north. The matrix of the conglomerate is arkosic material. Stringer-like lenses of green micaceous material occur in the matrix. They were probably introduced hydrothermally.

### Arkose and Greywacke

Arkose forms a minor part of the Duparquet sediments within the area. A few bands of slaty argillite are present with the arkose. The arkose is most common near the axis of the Lépine Lake syncline, and is considered to lie in the upper part of the conglomerate formation. Bedding, when present, is variable and local. Some beds are lens-like; others consist of regular bands up to several feet in width. Locally, cross-bedding is well developed.

Thin sections show variations from arkose, of uniform texture, consisting dominantly of quartz and sodic plagioclase, to greywacke, of more variable grain size, containing more ferro-magnesian minerals and magnetite than the arkose. The feldspar is commonly recrystallized and untwinned and has an index near that of balsam. It is probably oligoclase. The quartz occurs as angular fragments. The darker phases of the greywacke, found in the vicinity of gabbro masses, contain considerable chlorite and a minor amount of actinolite.

## Post-Duparquet Intrusives

The Post-Duparquet intrusives are predominantly acidic rocks with a porphyritic texture. The group includes syenitic feldspar porphyry of various types, quartz-feldspar porphyry, feldspar porphyry and micrographic feldspar porphyry. A body of albite granite and one of aplite, and a few basic dykes, some of which are lamprophyric, have been included in this group. The quartz-feldspar porphyry grades into feldspar porphyry, producing types which have been termed cherty quartz-feldspar porphyry and quartz porphyry. The porphyry occurs as lenticular intrusive bodies, associated with shear zones, containing many inclusions of sheared country rock. Some are sill-like, with local cross-cutting relations.

Albite Granite

A sill-like body of albite granite outcrops in the central part of range VI, lots 2, 3 and 4, Destor township. It is a massive medium grained rock, dark grey to greenish grey on the fresh surface. The weathered surface is light grey. Stringers and small dykes of this granite may be seen intruding the diabase member of the lava in lot 4.

In thin section the rock is seen to consist of 45 per cent albite in well developed laths. Orthoclase in the form of subhedral crystals, makes up 5 per cent of the rock, anhedral grains of quartz 20 per cent, hornblende about 20 per cent, and bleached chlorite 5 to 10 per cent. The chlorite results from the alteration of hornblende. Apatite, titaniferous magnetite, sericite and carbonate make up the remainder of the rock.

Aplite

Aplite outcrops in the porphyry mass east of Lanaudière lake. In the hand specimen it appears porphyritic, the texture being imparted by the presence of tiny quartz eyes. In thin section, however, these eyes are seen to be no larger than the sericitized albite and microcline crystals which, with the quartz, form 90 per cent of the rock. The average grain size is 0.7 mm. Accessory minerals are titanite, leucoxene, carbonate and apatite.

Micrographic Feldspar Porphyry

Micrographic feldspar porphyry outcrops on lots 1 to 4, range III, Destor township. It weathers grey to white and on the fresh surface is fine grained, dark grey to green in colour, with abundant light grey feldspar phenocrysts. In thin section, 25 per cent of the rock is seen to be made up of clear oligoclase phenocrysts 1 to 2 mm. in length. The groundmass is quartz in mesh-like intergrowth with plagioclase. The plagioclase has been altered to white mica. A crystal of apatite 1 mm. in length was found. Titaniferous magnetite, leucoxene and quartz veinlets containing spherules of quartz, 1 mm. in diameter, make up the remainder of the section.

Feldspar Porphyry

Typical exposures of feldspar porphyry are found just west of the Macamic road in lots 36 to 41. A body of this rock cuts across the Older volcanics and Pre-Duparquet pyroxenite and gabbro between the Lépine Lake fault and the Duquesne fault. Other occurrences are found in the northern part of range IV in Destor and Duparquet townships and on either side of the Duparquet river in range VII, Duparquet and Hébécourt townships. The feldspar porphyry weathers to various shades of grey to red. It is fine grained, with well developed but inconspicuous feldspar phenocrysts visible on the fresh surface. It is generally tough and compact. In the vicinity of quartz-feldspar porphyry, quartz eyes appear and the rock is somewhat cherty and breaks with a conchoidal fracture. These cherty porphyry and quartz porphyry phases weather to various shades of grey, green, pink, and mauve. The rock has a distinctly banded appearance when sheared.

Fresh specimens of feldspar porphyry contain 80 to 90 per cent albite with a small amount of orthoclase. Twenty per cent of the albite occurs as phenocrysts. These phenocrysts are well developed laths averaging 0.75 mm. in length. On some of the albite crystals there are growths of clear albite and in places the original twinning is obliterated as the result of replacement. Almost all the groundmass is made up of albite, at least half of which shows twinning. The albite occurs as very irregular grains 0.01 to 0.02 mm. in diameter. The grains have lace-like borders and deep re-entrants. The remainder of the groundmass consists of 4 per cent chlorite, 2 per cent apatite, 2 per cent carbonate and up to 1 per cent zircon.

Quartz-Feldspar Porphyry

Quartz-feldspar porphyry is the most common of the porphyries within the area mapped. Typical exposures are massive and weather various shades of grey to pink. The fresh surface is light greenish grey, sea green or pink. It has a fine grained, compact texture with well developed quartz phenocrysts up to 5/8 inch in diameter and well developed laths of albite 1/16 to 1/8 inch in length. Generally the feldspar phenocrysts make up about 40 per cent of the rock. These, along with the quartz phenocrysts, give the rock an apparent coarse grained texture.

In thin section quartz and albite phenocrysts are seen to be well developed. The albite phenocrysts vary from 0.25 to 4 mm. in length and are speckled and seamed with white mica. The quartz phenocrysts are not abundant, forming only 1 per cent of the rock. Some are embayed with knife-edge contacts against the matrix, or have lace-like borders. They are larger than the feldspar phenocrysts, averaging 4.5 mm. in diameter. The groundmass is an intimately associated aggregate of quartz and white mica. The average grain size is 0.02 mm. or less. In plain light the quartz phenocrysts are indistinguishable from the groundmass, except for the mica and the few accessory minerals. Chlorite plates are characteristic, and occur as well developed books from 1/8 to 1/4 inch across. Apatite is also a characteristic accessory mineral, commonly forming 2 to 5 per cent of the section. One crystal 0.5 mm. in length was noted, but generally they are 0.2 mm. or less. The apatite is present in the groundmass, in the chlorite plates, and in some of the more highly altered feldspar phenocrysts. Leucoxene altered from ilmenite, pyrite, calcite and magnetite form the remainder of the groundmass.

Table 4 - Chemical analyses of typical quartz-feldspar porphyry

| | 1 | 2 |
|---|---|---|
| $SiO_2$ .......... | 69.37 | 65.36 |
| $Al_2O_3$ ......... | 17.05 | 16.01 |
| CaO ........... | 1.04 | 2.60 |
| MgO ........... | 1.20 | 1.95 |
| $Fe_2O_3$ ......... | 0.59 | 0.55 |
| FeO ........... | 1.09 | 2.17 |
| $K_2O$ ........... | 1.93 | 1.70 |
| $Na_2O$ .......... | 5.53 | 5.02 |
| $TiO_2$ .......... | 0.28 | 0.43 |
| MnO ........... | 0.02 | 0.03 |
| $P_2O_5$ .......... | 0.12 | 0.16 |
| $H_2O+$ .......... | 1.28 | 2.11 |
| $H_2O-$ .......... | 0.05 | 0.09 |
| $CO_2$ ........... | 0.64 | 1.86 |
| S ............. | | 0.05 |
| $Cr_2O_3$ ......... | | 0.02 |
| Total .... | 100.19 | 100.11 |

1- Locality: 800 feet south of the Duparquet road and 200 feet west of the Duparquet-Destor township line.

2- Locality: 170 feet south of the Duparquet road and 1,640 feet west of the Duparquet-Destor township line.

Analyses by the Quebec Department of Mines.

Syenitic Feldspar Porphyry

Included under this heading are a number of intrusive bodies which range in composition from syenite porphyry to nearly pure orthoclase. One of these, the Beattie mass, contains all the varieties and has been studied in detail by O'Neill (18, 19), Davidson and Banfield (20) and Kerr (21). This mass is a tabular body 2 1/2 miles long and 1,000 to 1,500 feet wide. Local apophyses of porphyry are found around the borders of the main mass. The largest of these lies a short distance south of the mass, half way between the Donchester and Central Duparquet shafts. The Beattie porphyry mass has an east-west strike and a vertical dip. At the Beattie mine it plunges about 45° to the east. Diamond drill holes have intersected porphyry beneath a capping of volcanic at points 3,000 feet and 10,000 feet east of the Beattie mine. These bodies of porphyry are probably related to the Beattie porphyry.

Syenite Porphyry

Syenite porphyry is the predominant rock type in the Beattie mass. It is medium grained and pink to reddish pink in colour. The phenocrysts average about 1/2 inch in length and are stubby in appearance. They consist mainly of albite with small amounts of orthoclase. Some perthite is present. The groundmass consists of a felted aggregate of untwinned feldspar. The remaining minerals are hornblende, titanite, apatite, sericite, calcite, ilmenite, magnetite, leucoxene and kaolin.

Plum Porphyry

Plum porphyry is of local distribution in the main syenite porphyry mass. The contacts between the two are generally gradational, although sharp contacts have been formed during underground mapping. The plum porphyry is similar to the syenite porphyry but the phenocrysts are rounded. Many are 1 inch in diameter or larger. A variety of this porphyry mapped at the Central Duparquet mine is called "porphyritic porphyry" because of the extreme crowding of the phenocrysts.

Lath Porphyry

Lath porphyry is the equivalent of the bostonite porphyry described by O'Neill (18, pp.16, 17); (19, pp.306-307). It weathers greyish pink to pink. The phenocrysts are lath shaped and vary in length from a fraction of an inch to 6 inches. Commonly they are 1/2 inch to 2 inches long. Locally the phenocrysts have a parallel arrangement. Dykes of lath porphyry cut the syenite porphyry. The contacts are sharp. They truncate shear zones in the syenite porphyry and in such cases are not deformed.

In thin section the lath porphyry is seen to have a trachytic texture. It consists of 85 to 95 per cent feldspar. The phenocrysts are microperthite and orthoclase. The feldspar in the groundmass is orthoclase. The remaining minerals are apatite, titanite, magnetite, ilmenite, pyrite, carbonate, sericite, leucoxene and kaolin.

The lath porphyry is of two ages and consequently has been divided into two sets, the A and the B set. The dykes of the A set are the older. They strike N.75°W. and dip 50° to 70° north. The dykes of the B set strike east and dip vertically. They clearly cut dykes of the A set in the underground workings at the Donchester shaft. The A set is distinguished from the B set by the crowding of the phenocrysts in the former. The phenocrysts in the B set tend to be somewhat rounded and chipped.

A porphyry similar in appearance to the lath porphyry but of slightly different mineralogical composition occurs as narrow dykes in the feldspar porphyry and quartz-feldspar porphyry intrusives which extend east from the Pitt property and as dykes, bosses and lenses cutting the volcanic rocks along the north boundary of range IV respectively 2,500 feet east and 7,000 feet west of the Destor-Duparquet township line. It weathers dark pink to mauve, the shades grading one into the other from place to place along the dyke. When such a dyke is sheared, the different shades impart a banded appearance to the rock. Where these dykes cut the volcanic rocks which lie between the porphyry bodies extending eastward from the Pitt property, they are dark red with a distinct greenish cast and contain inclusions of greenstone.

This variety of lath porphyry contains phenocrysts of albite and microcline, which make up 35 per cent of the rock. Some of the phenocrysts are unaltered. Many of them, however, while retaining their original outlines, have been recrystallized to a mosaic of untwinned feldspar. The groundmass is a mosaic containing 15 per cent untwinned albite and 15 per cent quartz in the form of anhedra 0.01 mm. in diameter.

Orthoclase Dykes

Dykes of orthoclase have not been observed by the writer. They have been described by Banfield (22) as the youngest porphyry intrusive. They are fine grained, the grain averaging between 0.1 and 0.01 mm. in diameter. They are porphyritic and have a trachytic texture. They consist of 60 per cent orthoclase, 5 to 10 per cent calcite, 5 to 10 per cent chlorite, 5 to 25 per cent quartz and 1 to 2 per cent secondary sphene or leucoxene, kaolin, sericite, and opaque minerals.

Age Relations

Contacts between feldspar porphyry and quartz-feldspar porphyry are indistinguishable, the two types grading imperceptibly into each other. The gradational contact and the similarity in composition suggest that they are close together in time of injection. Aplite is closely associated with the feldspar porphyry and is believed to be a phase of the latter. Albite granite and micrographic feldspar porphyry are not found in contact with each other or with any other porphyry types, but are believed to be a part of the magmatic sequence represented by the feldspar porphyry and quartz-feldspar porphyry. Detailed work at the Beattie mine has shown that the relative ages of the various types, from oldest to youngest, are syenite porphyry, plum porphyry, "porphyritic porphyry", lath porphyry and orthoclase dykes. The lath porphyry dykes are of two ages, an older A set and a younger B set. Dykes of lath porphyry of the B set cut shear zones in the A set lath porphyry, indicating a period of shearing between these two ages of lath porphyry. Syenite porphyry is not found in contact with quartz-feldspar porphyry, feldspar porphyry or related types. Lath porphyry dykes cut both other types of porphyry at many places. They also cut through shear zones which in turn cut the other two types of porphyry. It is probable that the syenite porphyry and related intrusives are younger than the quartz-feldspar porphyry, feldspar porphyry and related intrusives.

The relative ages of the porphyries and of the pyroxenite and gabbro have been disputed in the past (6), (7), (9), (10). The writer made a careful study of the contact relations between these two intrusives both in the field and in the laboratory (23). Dykes of porphyry were observed cutting gabbro in Destor township, in lots 36 and 37, range west of Macamic road. At the contacts of porphyry with gabbro or pyroxenite there is no evidence of chilling in the gabbro or pyroxenite, whereas the porphyry at the contact contains microscopic inclusions of gabbro or pyroxenite. At one of the contacts there is a zone of alteration 3 to 6 mm. wide in the gabbro at its contact with the porphyry. From the above observations it was concluded that the porphyries are younger than the pyroxenite and gabbro. The porphyries were not found in contact with diorite, but it is believed that in general the diorite belongs to the same magmatic sequence as the peridotite, pyroxenite and gabbro.

The relative ages of the porphyries and the Duparquet sediments has long been a controversial issue. Buffam (6) believed the porphyries to be in part older than and in part younger than the Duparquet sediments. Cooke, James and Mawdsley (7) regarded the porphyries as older than the Duparquet sediments. Lang (8), O'Neill (9), Davidson and Banfield (20) classified them as younger than the sediments whereas Bannerman (10) regarded the syenite porphyry and related types as older and the quartz-feldspar porphyry and related types as younger than the sediments. The writer has concluded that the porphyries are younger than the Duparquet sediments. The field evidence is given in the following paragraphs.

Two bodies of quartz-feldspar porphyry were found in Duparquet sediments in range V, 2,000 feet west of the Destor-Duparquet township line. The northerly porphyry mass is separated from the southerly mass by an unbroken sequence of sediments 800 feet thick. Near the contact of the southerly porphyry mass with Duparquet conglomerate, the porphyry contains numerous rounded conglomerate boulders and seams of sedimentary material. In some of the exposures the rock is similar to conglomerate, except that the matrix consists of porphyry.

The Duparquet sediments have been displaced by the Porcupine-Destor fault and its subsidiary faults, whereas the porphyries, although sheared, apparently have not been appreciably displaced by these faults. The emplacement of the porphyry bodies along these faults suggests that they were intruded into the fault zones. Detailed mapping furnishes ample evidence to support this hypothesis.

Basic Dykes

Basic dykes are of widespread distribution and are particularly abundant on the islands of Hébécourt lake and immediately south of the lake. They range up to 30 feet wide, and where fresh have well defined chilled contacts with the country rock. Several dykes of fine grained diorite were found on the islands and along the north shore of Duparquet lake. They cut highly schistose and carbonatized fault zones and are themselves to all appearances unaltered. A swarm of northeasterly trending dykes of fine grained gabbro, diorite and porphyritic diorite traverse Hébécourt lake. These dykes cut the volcanics and Pre-Duparquet gabbro and diorite. The porphyritic diorite contains well developed lath-shaped phenocrysts of grey feldspar. The phenocrysts average 1/4 inch in length, but crystals up to 1/2 inch long in the wider dykes are common.

Acid Dykes

Chert dykes are found in close association with the basic dykes within the swarm of dykes mentioned above. They are characterized by a light grey colour. They definitely cut across the strike of the flows in which they are found. The flows in the vicinity of many of these dykes are altered to light grey, fine-grained siliceous rock in which the pillow structures are well preserved.

A composite intrusive of gabbro, diorite and granite lies a short distance to the south of Hébécourt lake. The extreme difference of composition between the acid and basic dykes suggests that they are diaschistic dykes related to the intrusive which lies to the south. This concept is supported by the increase in abundance of the dykes as the intrusive is approached.

Several small dykes and sills of lamprophyre were noted. In the vicinity of shear zones they have been rendered slightly schistose and are carbonatized and silicified. The unaltered lamprophyre weathers a light greyish brown and has an uneven surface due to the presence of small feldspar phenocrysts. There is an abundant development of flaky chlorite which gives the specimen a micaceous appearance. On the fresh surface the lamprophyre is a fine grained, dark grey, compact rock. The dykes do not exceed 20 feet in width and generally cannot be traced for more than 200 feet.

In thin section the lamprophyre is seen to contain 75 to 80 per cent augite. Much of the augite is altered to chlorite, so that in some of the sections examined only half of the original augite remains. Saussuritized plagioclase forms 10 to 20 per cent and is so clouded that its composition could not be determined. However, a few of the clearer crystals were determined to be albite. A few grains of quartz, epidote and clinozoisite make up the remaining constituents.

Several carbonatized and silicified lamprophyre dykes outcrop in the vicinity of the shear zone across the northern part of the area. On the fresh surface they are grey-green, fine grained and foliated. The foliation is not, however, as strongly marked as in the adjacent volcanic rocks. From the composition of the least altered specimens these dykes have been classified as a variety of spessartite.

Lamprophyre dykes have been found cutting the quartz-feldspar porphyries in the underground workings of the Duquesne mine near the eastern boundary of the area. Consequently they are regarded as younger than the porphyry. They are in all probability post-faulting as they are not so intensely sheared as other rocks of similar composition in the vicinity of shear zones.

Keweenawan (?)

Dykes of diabase, gabbro and diorite intrude the lavas of the district. A dyke of pyroxenite, believed to belong to this group, is exposed in Hébécourt township, near its west boundary. Most of these dykes are less than 20 feet in width and their strike is confined to two well defined directions, N.15°W. to N.30°W. and N.30°E. to N.35°E., which correspond closely to the strikes of the younger faults. A dyke of gabbro in the northwest corner of range VI, Hébécourt township, cuts across a younger fault without any displacement. The dykes are therefore believed to be younger than the younger faulting. They are tentatively correlated with the diabase dykes of the Rouyn-Noranda area. The diabase dyke shown in the western part of range VII, Hébécourt township, does not outcrop at the surface. It was intersected in two diamond drill holes, from which its strike was obtained. A magnetometer survey detected an anomaly about 40 feet east of this dyke, having the same strike as the dyke. Since the magnetic profile suggested a dyke-like body, the anomaly was assumed to represent the course of the dyke.

The diabase is a medium grained, fresh looking rock which weathers dark brown. On the fresh surface it is greenish. This rock consists of augite, plagioclase, quartz, magnetite, biotite, epidote, and apatite. The texture is ophitic and is easily distinguished in thin section.

## STRUCTURAL GEOLOGY

The earliest disturbance recognized within the map-area was gentle folding which preceded the deposition of the Cléricy sediments. There was another period of gentle folding which preceded the deposition of the Duparquet sediments. After the deposition of the Duparquet sediments there was major folding which produced the Lépine Lake syncline and the other folds in the area. These folds have subsequently been warped by further movement, but the time of this later movement is not known. Possibly it is related to the forces which were active during the development of the Porcupine-Destor fault.

Subsequent to the major folding, a major rupture occurred. This rupture is regarded as the main zone of the Porcupine-Destor fault. It is possible that the Lois Lake fault, of which little is known at present, is a second major rupture resulting from the same causes. At the same time, two complementary sets of shear zones were developed north and south of the Porcupine-Destor fault. One set strikes east and the other northeast. The axis of greatest stress has a direction slightly west of north and probably had the same direction during the period of folding.

Some time after these movements had ceased, a second period of faulting occurred. Faults of this period are described under the heading of younger faulting (p.36).

### Folding

#### Lépine Lake Syncline

A synclinal fold, believed to be the faulted extension of the Lépine Lake syncline, extends from Lanaudière lake to a short distance west of the power line in Duparquet township, where it is truncated by the Porcupine-Destor fault. It has not been found beyond the fault.

The north limb of the syncline is overturned; the formations dip 75° to 80° north and tops are south. Towards the south, as the axis of the fold is approached, the dips range through vertical to steeply south. On the south limb of the syncline the beds face north. Dips increase progressively from 15° north near the axis of the syncline to vertical near the contact of the sedimentary rocks with the underlying volcanic formations.

Evidence to indicate the direction of plunge of the Lépine Lake syncline is scanty. The presence of upper arkose beds towards the west, and of scattered conglomerate outliers beyond the eastern termination of the main band, suggests that there is a general plunge towards the west.

Duparquet Lake Syncline

The Duparquet Lake syncline appears to have a vertical plunge. Its axis extends from the south shore of Hébécourt lake to the south shore of the northwest arm of Duparquet lake. From there it trends southeast through Duparquet lake to the south boundary of the map-area.

The south limb dips vertically, local observations indicating slight overturning. The tops are to the north. The north limb has a vertical dip and tops face south. Dips around the nose of the syncline are vertical.

Drag Folding

Several drag folds associated with minor faults were found in the sediments, the most prominent lying south of Lanaudière river in Duparquet township 2,600 to 3,000 feet west of the township line. These folds plunge 20° to 30° to the southwest and the axes trend slightly east of north. Dips on the flanks of the folds are generally 20° to 40°, with occasional steeper dips. The drag folds lie between two shear zones which pass through the two porphyry lenses in the sediments immediately to the east.

## Faulting

There are two distinct ages of faulting. Most of the older faulting occurred after the major folding and before the intrusion of the porphyries. The older faults are marked by broad undulating shear zones which are largely drift covered. Their position is marked by persistent valleys.

The younger faults offset the older faults and all the rock formations except the Keweenawan. There is little or no shearing associated with them.

Older Faulting

The older faults can be divided into three sets, striking respectively northeast, east and southeast. Displacements are left handed along the faults which strike northeast and right handed along those which strike east or southeast.

Numerous breccia zones are associated with the older faults. The fragments are all sizes up to several feet across and are angular in outline. The matrix consists of gouge, quartz, carbonate, or a mixture of these. A good example of a breccia zone is seen in the northwest corner of the property of the Consolidated Duquesne

Mining Company Ltd. It has a length of 2,200 feet and a maximum width of 400 feet.

A peculiar type of breccia consists of angular blocks 3 to 6 inches in length. The rock is made up of very fine lamellae having various dips and strikes. The weathered surface is rough, due to the weathering out of small angular blocks. This type of breccia occurs only where there is a change of direction in the shear zone.

Most of the older faulting movement occurred before the emplacement of the Post Duparquet intrusives. Subordinate movements during and after the intrusion of the feldspar porphyry, quartz-feldspar porphyry, syenite porphyry and related intrusives were sufficient to fracture, shear and brecciate them but displacements are insignificant. The movement ended before the intrusion of the basic dykes.

Porcupine-Destor Fault

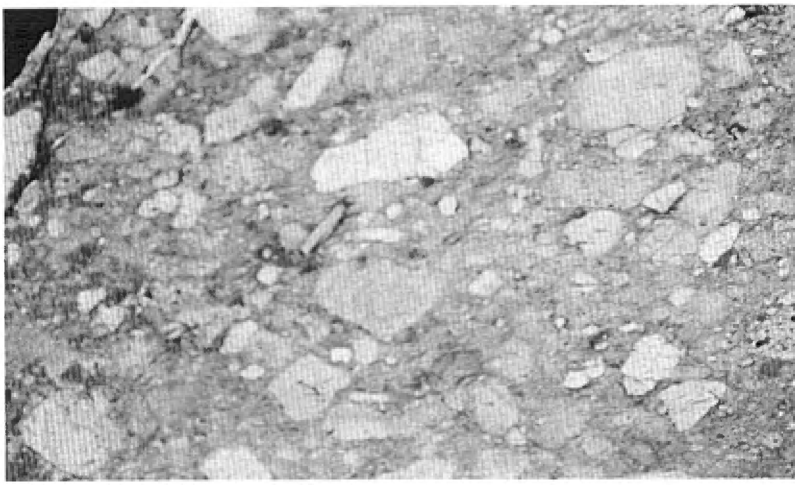
The Porcupine-Destor fault trends easterly across Hébécourt township from the Ontario border to the north end of Duparquet lake. From there to the Macamic road its strike is S.75°E. The trace of the fault is marked by a valley about a mile wide. The Porcupine-Destor fault marks the southern limit of the Older Volcanics and the Duparquet sediments. It marks the northern limit of the Cléricy sediments over most of its length in Duparquet and Destor townships. Elsewhere it marks the northern limit of the Younger Volcanics. Most of the information by which the fault is located was obtained by diamond drilling. The shear zone is 50 to 250 feet wide and is made up of carbonatized chlorite, talc and sericite schists, locally bleached and silicified and in places containing green mica. The dip varies from 50° to 80° south. The formations on the north side of the fault are displaced to the east with respect to those on the south side. The actual direction of the movement, and the amount of the displacement, are not known.

There are numerous faults which branch away from the Porcupine-Destor fault. The most important of these are described below.

Beattie Fault

The Beattie fault branches away from the Porcupine-Destor fault 4,000 feet west of the Beattie shaft. It has been traced east for a distance of 4 miles. The fault zone has a width of 400 to 600 feet. It dips 75° to 80° north.

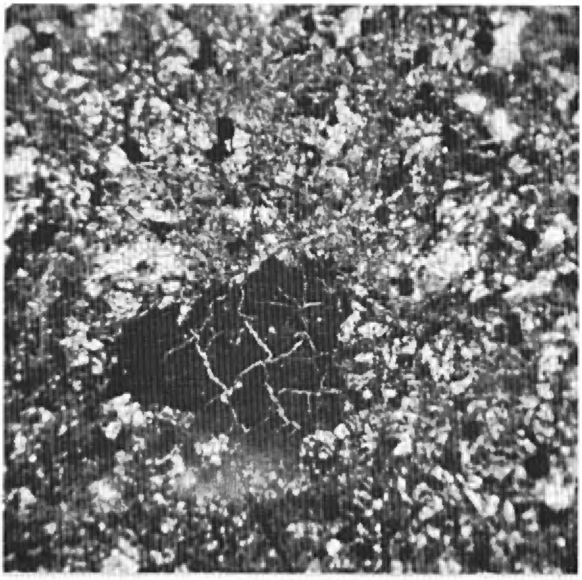
PLATE I



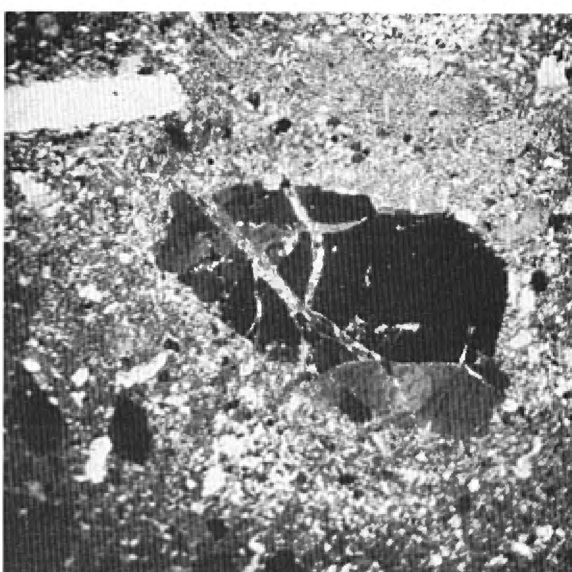
A.- Outcrop of agglomerate.

B.- Outcrop of Duparquet conglomerate on an island in Lanaudière lake.

PLATE II



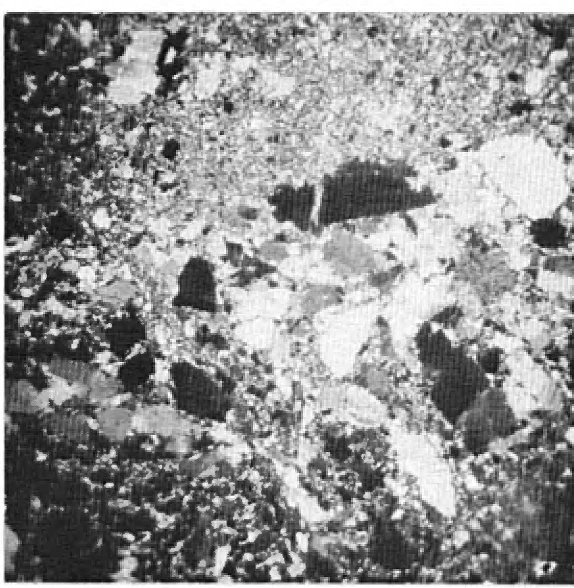
A.- "Phenocryst" in andesitic lava. Crossed nicols x 15.



B.- Matrix of porphyry conglomerate breccia filling fractures in quartz phenocrysts. Crossed nicols x 15.

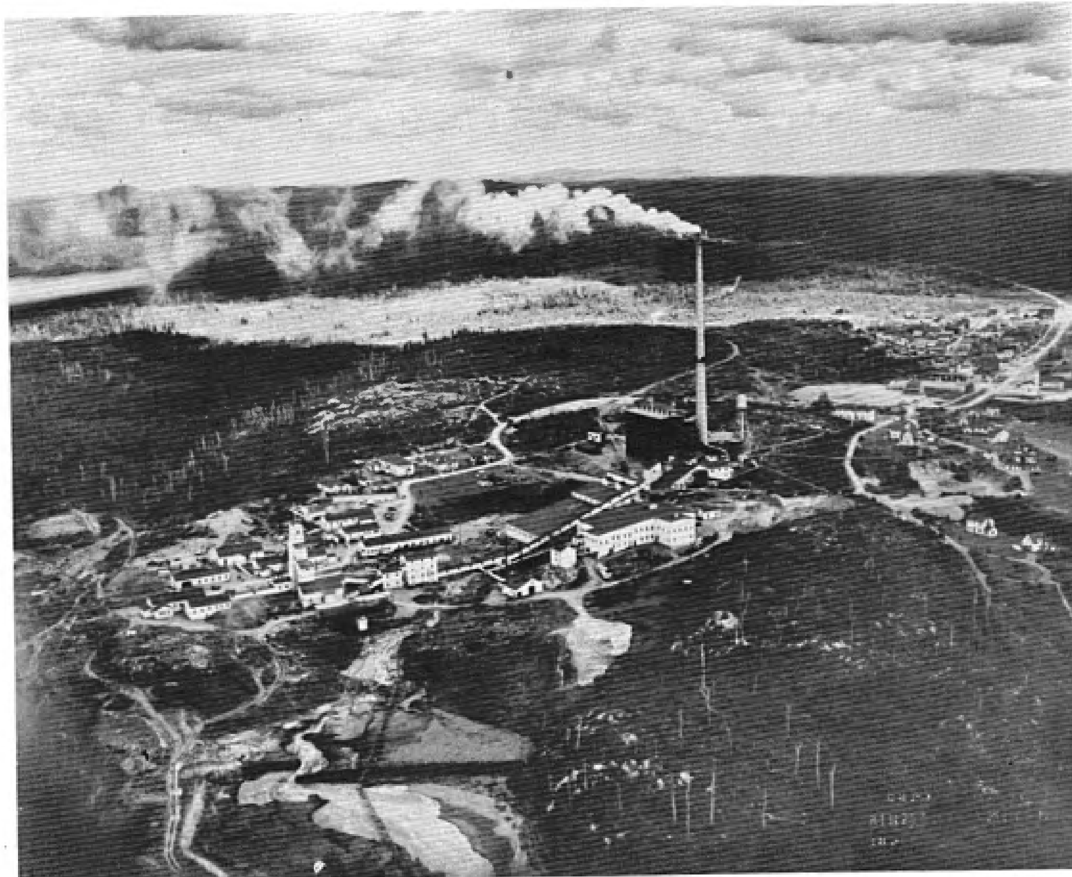
PLATE III

A.- Quartz crystal in porphyry conglomerate breccia. Note porphyry inclusion in middle of crystal Crossed nicols x 30.



B.- Brecciated quartz phenocrysts cemented by a matrix of porphyry conglomerate breccia. Crossed nicols x 75.

PLATE IV



Beattie mine, looking east.

Donchester Fault

The Donchester fault branches away from the Porcupine-Destor fault 6,000 feet west of the Donchester shaft. It trends easterly, parallel to the Beattie fault and dips vertical to steeply north. The shear zone has a width of 100 to 300 feet.

Central Duparquet Fault

The point where this fault branches away from the Porcupine-Destor fault is at the southeast corner of the town of Duparquet, at the junction of the Duparquet-La Sarre roads. At the Central Duparquet mine it lies just south of the shaft, where it is the main structural feature associated with the orebody. It has an easterly strike and appears to dip to the south at a steep angle. Good exposures of the fault zone can be seen in the eastern part of Duparquet township. Here it comprises several pronounced sub-parallel shear zones linked by numerous northeasterly trending faults. Foliation in outcrops between the faults within this zone also trends northeast. All the shear zones dip 70° to 80° north. No displacements along this fault could be determined. However, if the northeasterly trending foliation of the rocks between shears within the fault zone is an expression of fracture cleavage, it is probable that the relative movement was north side towards the east. This fault dies out by "horse tailing" to the east in Destor township.

Ottman Fault

The Ottman fault branches from the Porcupine-Destor fault 4,000 feet west of the centre line of Duparquet township. It trends easterly and dies out in Destor township in a series of northeasterly trending horsetails. On the Ottman group the brecciated, schistose zone has an average width of 70 feet and dips 80° north.

Lépine Lake Fault

The Lépine Lake fault branches away from the Porcupine-Destor fault 4,000 feet east of the centre line of Duparquet township. The course of the fault is marked by a valley along which local bodies of quartz-feldspar porphyry are exposed. A short distance west of the Destor-Duparquet township line, the fault splits, one branch following the north contact and the other the south contact of the gabbro mass north of Lanaudière lake. The two branches converge northeast of Lanaudière lake. At the point of convergence there has been considerable shearing and shattering and there are numerous interlocking shears. Diamond drilling has provided sufficient information to trace the shear zones between outcrops. Dips of schistosity along the south branch vary from vertical to 60° north while on the north branch they are vertical.

Diverging from the northern branch of the Lépine Lake fault are northeasterly trending faults which divide the sediment-volcanic complex into a number of segments. The segments are all displaced west side south and the horizontal component varies from 150 feet to 3,000 feet. The dip of the schistosity ranges from 50° north through vertical to 80° south. The majority of dips are to the north at steep angles.

Duquesne Fault

The Duquesne fault branches away from the Porcupine-Destor fault 3,000 feet east of the power line. It consists of numerous well developed shear zones in the Younger volcanics. The zones vary in width, but rarely exceed 200 feet and dip 80° south. In the porphyry bodies they are smaller and discontinuous and in general their presence is marked by fracturing and shattering rather than shearing. The Duquesne fault splits in the western part of lot 34, range west of Macamic road. One branch strikes east and the other N.60°E. The latter branch is probably represented in the Lépine lake area by the northeasterly trending shear parallel to the south boundary of the southern body of ultrabasic rock in range V (10, p.21).

Lois Lake Fault

The Lois Lake fault lies along the north boundary of the area mapped in Duparquet township. It is believed to be the continuation of a westerly trending shear zone of considerable magnitude which passes through Lois lake. It is marked by a belt of vertically-dipping schists which has a width up to 1,500 feet within the map-area and an additional 1,000 to 2,000 feet beyond its northern limit. The schists are mainly quartz-feldspar-chlorite-schist, derived from trachytic and andesitic rocks, and quartz-feldspar-sericite schist, derived from the rhyolite formations which lie along the north boundary of the map-area. These schists are shown as a separate lithological unit on the East Duparquet sheet. The foliation of the schists strikes in a general easterly direction.

Reconnaissance immediately north of the map-area indicates that this fault has related northeasterly-trending shears which branch away from it.

Younger Faulting

The younger faults strike N.30°W. to N.30°E., and are characterized by a joint-like trace on the outcrop and a steep to vertical dip. On most of the outcrops several of these faults may be observed. Horizontal displacements rarely exceed 700 feet and are generally only a few feet or less (Figure 3). The larger faults occupy pronounced narrow linear valleys. The positions of the faults

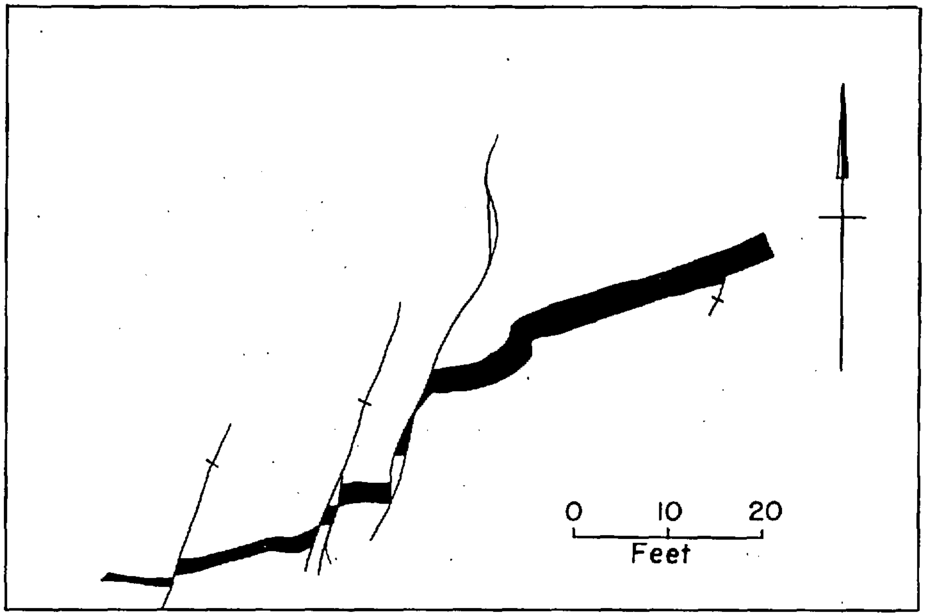



FIGURE- 3

Displacement of diabase dyke along northeasterly-trending younger faults.
Location - lot 43, range West of Macamic road, Destor township.

D.M.Q. no. 993

shown on the accompanying maps are based on the offsets of the formations on either side of the valleys, or on geophysical evidence. Several of these younger faults offset the Porcupine-Destor fault in the vicinity of the outlet of Duparquet lake and to the north of Hébécourt lake. Displacements along the strike of the faults are irregular. However, more than 60 per cent of observed displacements were found to be right handed in the faults which trend northwest and left handed in those which trend northeast.

## Jointing

Jointing is pronounced in the volcanic complex north of the Beattie railway. To a lesser extent it is developed in the sedimentary rocks south of the railway, and in the volcanic rocks farther south. The joints fall into two divisions; those which are parallel to the bedding and those which traverse it. It is believed that the strike joints are related to the folding. The other joints are regarded as related in part to the older faulting and in part to the younger faulting. If this hypothesis is correct, then the strike joints are older than the cross joints.

# METAMORPHISM

## Regional Metamorphism

All the rocks of the area show some alteration. Regionally these changes have not been great. No foliation nor schistosity is present except along the shear zones, where the rocks have been reduced to talc, chlorite and sericite schists. Glass has been preserved in some of the basic lavas. Trachytic and porphyritic textures are well preserved.

The typical basic lava consists of albite or oligoclase, carbonate, chlorite, epidote, zoisite and a little quartz. Augite is not uncommon and is the source of the chlorite. The intermediate lava consists of albite or oligoclase, carbonate, chlorite, a little quartz and considerably less epidote, zoisite and augite. The typical rhyolite consists of albite, quartz and sericite. The mineral assemblage, when associated with what is apparently primary augite, is interpreted as corresponding to an early stage in Harker's calc-albite-chlorite schist zone (24, p.279), indicating that these formations have undergone only the lowest grade of metamorphism.

The pyroxenite intrusives show only a low grade of metamorphism. Tremolite is the typical alteration product of the pyroxene and there has been some serpentinization. Where the pyroxenite has acted as a buttress between faults, as in the Lanaudière lake body, the metamorphism is of a higher grade. In this case the alteration of the pyroxene to hornblende has resulted in the formation of coarse grained amphibolite. Similar changes may be observed in the gabbroic parts of the mass.

One of the most outstanding features of the basic to intermediate volcanic rocks and related intrusives is their widespread carbonatization. Although not intense, it is sufficient to impart a reddish brown colour to the weathered outcrops of all these formations. Qualitative tests indicate that varying amounts of iron and magnesium, with lesser amounts of calcium, are almost always present. Ferrodolomite is believed to be the most abundant carbonate; calcite and ankerite have also been identified optically. The carbonate content becomes higher with increasing basicity of the rock, but is lower in the intrusive than in the extrusive phases. The ratio of the carbonate content of the intermediate rocks to that of the basic rocks is 1:1.8. It is the same whether they are intrusive or extrusive. A possibly higher grade of metamorphism is represented by the "porphyritic" andesite and basalt (see page 13). In these flows carbonate is a rare constituent and, if present, occurs only in minor amounts. In all the other flows it is present, in many cases, as an important constituent. In view of the regional presence of carbonate, it is believed that the "porphyritic" lavas too were subject to carbonatization. Subsequently they were metamorphosed to a higher grade, possibly due to local effects of an underlying granite. This resulted in the calcium of the carbonate forming plagioclase. The plagioclase growing out from centres of recrystallization formed porphyroblasts, giving the rock its porphyritic texture. The plagioclase was later altered to a microcrystalline mass of minerals of the Epidote group.

## Hydrothermal Alteration

The rocks along the more important shear zones exhibit varying degrees of hydrothermal alteration. Along the Lois Lake fault there is a zoning of hydrothermal minerals. The inner zone is characterized by titanite, hematite, apatite and pyrite, the intermediate zone by albite, quartz, carbonate and chlorite and the outer zone by epidote and zoisite. The rocks along the Porcupine-Destor fault and its subsidiary zones have been locally carbonatized, sericitized, chloritized, silicified and bleached.

The carbonate occurs typically in the form of ramifying veinlets. In extreme cases it completely replaces the country rock. An example of this may be found in Destor township, just east of the Macamic road, in the pyroxenite outcrop on lot 39. On the Golconda property and in the shear zone along the Duquesne fault the matrix of the breccia has been replaced by carbonate. In these latter two localities it is a variety of ankerite veined by calcite.

Sericitization is confined mainly to the porphyries and rhyolites. Sericite fills seams in feldspar and, away from the feldspar, it occurs as minute veinlets associated with quartz, chlorite and carbonate.

Chloritization is mainly confined to the basic to intermediate volcanic and intrusive rocks. The chlorite occurs as disseminated masses or as branching veinlets up to 0.5 mm. in width. Associated with the chlorite in the veinlets are epidote, zoisite, quartz, carbonate and saussuritized feldspar.

Bleaching is in evidence in the formations along the Porcupine-Destor fault in Hébécourt township. From the Duparquet river westward to lot 55 this altered zone is 1,800 to 3,000 feet wide. Bleaching is also well developed between the Beattie and Central Duparquet shafts, and in association with the Beattie orebodies. According to Davidson and Banfield (20,p.549), the bleaching effect is due to solutions emanating from the porphyry, resulting in the deposition of soda potash and silica and the removal of magnesia and iron. In support of this conclusion they have given chemical analyses of the bleached and unbleached andesite.

Silicification is associated with the bleached zones and also occurs in carbonatized zones and breccia zones along faults as stringers and replacements.

## Dioritization

Dioritization is most intensively and extensively developed to the west of Hébécourt lake. It occurs as aureoles surrounding diorite intrusions.

On the weathered surface the dioritized lavas are characterized by protuberances of the order of 1/2 inch by 1/4 inch and about 1/8 to 1/4 inch high. On the fresh surface the altered lava is difficult to distinguish from normal diorite. The contacts are gradational.

Eight specimens, collected across a zone of gradation from apparently normal trachyte to normal diorite, were examined in thin section. The plagioclase laths in the trachyte are altered to saussurite and the interstices between the laths consist of granules of quartz and sericitized plagioclase, much of which is replaced by epidote and zoisite. Veinlets of carbonate, zoisite and epidote are present. Pyrrhotite, magnetite and titanite are accessory minerals.

The first phase of the gradation is from normal trachyte to silicified trachyte with some chlorite and carbonate. Flecks and metacrysts, which appeared in the hand specimen to consist of grey or pink feldspar, were found to be a complex aggregate of feldspar epidote, zoisite and chlorite in varying proportions, having a residual prismatic structure suggesting feldspar. In the second phase, nearer to the diorite, quartz makes up about 20 per cent of the rock. Hornblende appears in this phase, and 50 to 60 per cent of the rock consists of well developed plagioclase laths which are completely saussuritized. A little augite is present. Epidote, zoisite and chlorite are minor constituents of the rock. In the third phase augite takes the place of hornblende and the plagioclase is coarser grained. In the fourth phase, nearest to the diorite, quartz porphyroblasts appear, chlorite is more abundant, mainly as an alteration from augite, and fresh, untwinned feldspar is present.

The normal diorite consists of a fine grained aggregate of saussurite and epidote containing relics of stubby plagioclase laths. Quartz makes up about 10 per cent of the section. Augite, which occurs as large subhedral crystals, makes up 25 per cent of the rock. Chlorite and ilmenite make up the remainder of the rock.

A specimen of dioritized trachyte from another locality, with the characteristic protuberances on the weathered surface, was examined. Some of the feldspar was fresh enough for identification. It was found to be sodic andesine and replaced the characteristic lath-like feldspar of the trachyte.

Dioritization is apparently a partial replacement and making over of the volcanic rock into a diorite-like rock. The volcanic rock is first altered to a rock rich in epidote, zoisite and saussurite. Then there is silicification and the development of secondary feldspar, probably andesine, which is itself altered by subsequent action of the diorite. Augite is then formed and the plagioclase becomes more abundant and better developed. The augite is altered to hornblende. The alteration of the augite and of the secondary feldspar is probably the result of retrograde metamorphism.

## Porphyritization

Various stages of porphyritization have been noted in the rocks which are in contact with masses of quartz-feldspar porphyry. Zones containing numerous well developed quartz crystals extend outwards from these masses for distances up to 80 feet. In rare cases the zones attain a width of 200 feet. The quartz crystals are best developed in the Duparquet sediments, but have also been observed in basalt, trachyte, agglomerate, chert, gabbro and older feldspar porphyry, and in breccia zones along the contacts of the quartz-feldspar porphyry. In the Duparquet conglomerate the quartz crystals are developed in both the matrix and the boulders.

A detailed study indicates that the halos are due to replacement of the country rock by porphyritic material (23, pp.128-39). The replacement is attributed to progressively changing solutions which are believed to represent stages in the differentiation of a cooling magma. Because porphyritization is best developed in the Duparquet sediments, the study of the process in this rock and the conclusions to which this study has led are given in the following paragraphs.

During the first stage the main intrusion took place together with some silt-like injections between the beds of the Duparquet sediments. Crystallization had not yet begun. There is no flow structure in the phenocrysts along the contacts.

During the second stage, after most of the feldspar had crystallized, the residual liquid permeated the porous arkose and the arkosic matrix of the conglomerate. Quartz next crystallized as phenocrysts in the sedimentary rock and in the main porphyry mass and the residual feldspar crystallized as fine crystals in the matrix. Finally white mica and quartz crystallized from the remaining liquid. It is possible that the white mica resulted from alteration of the feldspar in the matrix.

During the third stage the quartz-feldspar porphyry became increasingly rigid as crystallization proceeded. Minor movements along pre-existing faults resulted in brecciation. The brecciation provided channels for solutions which subsequently penetrated the more impervious rocks. This was the initial stage in the development of the porphyry conglomerate breccia.

The fourth stage is marked by the introduction of solutions consisting predominantly of silica, with minor amounts of volatile constituents containing some carbonate, chlorite, iron sulphides and iron oxides. During this stage quartz crystallized but the other constituents remained in the fluid state. In the porphyry this resulted in the cementing of fragments and of brecciated phenocrysts by veinlets of quartz. In the brecciated rock adjacent to the porphyry, the matrix is replaced by quartz and quartz "phenocrysts" occur in the replaced matrix and in fractures in the fragments. Quartz phenocrysts were developed in this manner in the matrix of breccia zones and in fractures in the fragments and in conglomerate boulders. This process completed the second porphyritization of the country rock and the formation of the porphyry conglomerate breccia (see p. 43).

The fifth stage completes the crystallization process of the porphyry and is marked by the formation of veinlets containing chlorite, carbonate, hematite, pyrite and a small amount of quartz. There is some overlapping of minerals deposited during this stage with those deposited during the fourth stage.

## Alteration Associated with the Beattie Mass

The alteration associated with the Beattie mass has been studied by Davidson and Banfield (20) and (22).

Banfield (22) concludes that there was a continuous injection of magmatic differentiates consisting, from oldest to youngest, of syenite porphyry, Central Duparquet porphyry, Central Duparquet porphyritic porphyry, lath porphyry, orthoclase, solutions rich in potash, solutions rich in silica and later in arsenic, gold, iron and sulphur, then barren calcium carbonate and lastly solutions which deposited barren white quartz. The injection of the orthoclase dykes was followed by shearing, with local carbonatization. Banfield believes the leaching to be due to the migration of the potash, silica and soda and its reaction with the affected rocks. The bleaching preceded the deposition of the ore minerals and was separated from it by a period of fracturing and brecciation.

Davidson and Banfield (20) noted that (p.546) "the syenite is the nucleus for the halo of surrounding alteration and mineralization in the Keewatin". They also noted an unusual type of alteration and mineralization in the brecciated orthoclase dykes. "Brecciation followed by silicification produced changes resulting in a peculiar pseudo-oölitic texture ... Studies of a series of thin sections indicate that after brecciation siliceous solutions penetrated along the fractures and attacked the orthoclase. The solutions apparently removed the potash leaving the alumina behind as a dusty residue of kaolin-like appearance. When the residue reached a width of about 0.03 mm., further replacement was prevented, and as this reaction was taking place along a network of fractures the unaltered orthoclase protected by the dusty rim appears as rounded or elliptical areas suggesting oölites" (p.552).

## Porphyry Conglomerate Breccia

O'Neill has described a peculiar type of conglomerates containing large numbers of apparent boulders of porphyry. He refers to these as "porphyry conglomerates" and states that "some of these occurrences are clearly breccias; some are due to lenticular injections of porphyry into conglomerate and later shearing; but some are apparently true conglomerates" (9, p.87). The term "porphyry conglomerate" is a misnomer, implying a sedimentary origin. The writer believes that the origin of these rocks is in part mechanical, and therefore prefers the term "porphyry conglomerate breccia".

The porphyry conglomerate breccia is associated with both quartz-feldspar porphyry and syenitic porphyry. It occurs in shear zones which lie along porphyry-conglomerate contacts or extend into the porphyry and adjacent lava. It consists of an aggregate of angular to sub-angular fragments of country rock in a porphyry matrix. The fragments range in size from less than 1 inch up to 20 or 30 feet.

In the zones which occur along porphyry-conglomerate contacts, the aggregate consists of angular to sub-angular fragments of porphyry and conglomerate. There is commonly a gradation from massive porphyry, through porphyry breccia, to fragments of porphyry and conglomerate, to normal conglomerate. In sheared porphyry conglomerate breccia the pebbles in the conglomerate fragments are not elongated as in sheared normal conglomerate.

In the zones which occur within the lava, the aggregate consists almost exclusively of angular to sub-angular fragments of lava.

Several specimens from one of these zones between quartz-feldspar porphyry and conglomerate were examined in thin section. Quartz phenocrysts are present in both the pebbles and the matrix.

The fragments consist mainly of quartz-feldspar porphyry, some conglomerate and fractured and granulated quartz phenocrysts. The matrix consists almost entirely of quartz but some sericite is present. The matrix differs from that of the porphyry in that it is coarser grained and seriated. The larger crystals approach the size of the phenocrysts of the normal quartz-feldspar porphyry and many are lath-shaped. These differ from the typical phenocrysts found in the porphyry in that they have delicate lace-like borders and marginal zones containing many minute inclusions (Plate II-B). The quartz in these marginal zones is in optical continuity with the rest of the crystal and contains inclusions of porphyry fragments (Plate III-A). The smaller quartz crystals of the matrix have indefinite wandering outlines and are characterized by delicate lace-like borders, many of which are crowded with minute inclusions. The matrix fills the fractures in the fragments and cements the granulated quartz crystals (Plates II-B and III-B). There is no indication of crushing or granulation of the matrix in any of the sections of breccia examined. In some of the sections there are numerous quartz veinlets, some of which contain carbonate, pyrite and hematite. These veinlets clearly cut both matrix and fragments. In other sections minute veinlets of chlorite and carbonate fill the fractures but quartz and hematite are absent.

In the zones which occur within the syenitic porphyry mass the aggregate of the porphyry conglomerate breccia consists of fragments of feldspar porphyry. They are generally less than 6 inches in diameter, sub-angular, and surrounded by a narrow rim of alteration. The matrix consists of yellowish sericitic material containing feldspar phenocrysts. In thin section, the rock is seen to consist of fragments of syenite porphyry in a matrix of sericite containing a little quartz. Isolated phenocrysts are also present in the matrix. These are subhedral to rounded and have been fragmented. The fragments have been fractured, the fractures being filled with sericite. The feldspar phenocrysts are more common in the matrix than in the syenite porphyry fragments and are in a better state of preservation. Fracture remnants in the matrix are marked by seams of chloritic material containing stringer-like aggregates of magnetite. A feldspar phenocryst was observed to project from a fragment into the matrix and a narrow rim of very fine grained sericite separates it from the normal sericite of the groundmass. The phenocryst is shot with minute fibres of sericite.

The movements which formed the porphyry conglomerate breccia are believed to have occurred toward the end of the major faulting in the district and between the injection of the syenitic porphyry and the lath porphyry - that is to say, near the end of the injection of the porphyries.

# ECONOMIC GEOLOGY

Gold is the only metallic mineral which has been produced economically within the area. Arsenic is recovered as a by-product from the Beattie ore. Chalcopyrite occurs in several localities but no deposits of economic importance have been found. Several veins of massive pyrite occur on the south shore of Dugros lake in Duparquet township. Sphalerite and galena are found occasionally in small amounts. Molybdenite has been reported from the Beattie mine.

## Gold Mineralization

The mineralization with which gold is associated has been found chiefly along shear zones in or adjacent to the porphyries, associated with finely disseminated arseno-pyrite and pyrite. The gold is found in breccia zones which are highly silicified, or in zones of related alteration such as bleaching and silicification. Bleaching does not necessarily imply gold deposition but in the Beattie orebodies it is a significant feature.

The gold deposits adjacent to quartz-feldspar porphyries are associated with quartz similar to that deposited during the fourth stage in the crystallization of the porphyry (p.42). Further, gold has been observed in veinlets consisting of pyrite, chlorite and carbonate which correspond to those deposited during the fifth stage in the crystallization of the quartz-feldspar porphyry.

The close relationship of the gold, from both a special and mineralogical viewpoint, to the late differentiates of both syenite and quartz-feldspar porphyry, strongly implies a genetic relationship of the gold with these bodies. It is the writer's opinion that the porphyry bodies represent a differentiate of the parent magma which at the time of its separation was enriched with gold-bearing constituents of the magma. After intrusion of the porphyry it was further concentrated in the residual solutions of the crystallizing porphyry and eventually was deposited in and near the breccia zones which received these final differentiates. It has been determined that the late stage solutions, in the case of the quartz-feldspar porphyry, were probably deposited at temperatures in the vicinity of 510°C. and at a pressure of about 2,800 bars. They may thus be regarded as hypothermal deposits.

Since gold is specially related to bodies of syenitic porphyry and quartz-feldspar porphyry and it is believed that this relationship is genetic, any porphyry body may be regarded as favourable in the search for gold. Hence it is important to establish, if possible, the conditions under which porphyry bodies occur. It has been found by field studies that the emplacement of the porphyry intrusives was controlled by the older faulting. It is possible that the porphyry was emplaced at loci of less stress such as might be formed by movement on intersecting faults. Such fault intersections occur along those parts of the Porcupine-Destor fault which have a southeast strike but not along the easterly striking segments. Hence any change in the strike of the fault from an east to a southeast direction may be regarded as significant when searching for porphyry and related gold mineralization.

In the past, much time and money have been spent exploring intensely carbonatized zones along the Porcupine-Destor fault which are not associated with porphyry intrusions. The sterility of carbonate zones with regard to gold mineralization is a regional feature, and one would be well advised to consider this carefully before doing extensive work on these admittedly attractive-looking zones.

Little mineralization has been found in the younger set of northerly trending faults. A few quartz and carbonate veins were noted but no metallic mineralization was observed.

## Description of Properties

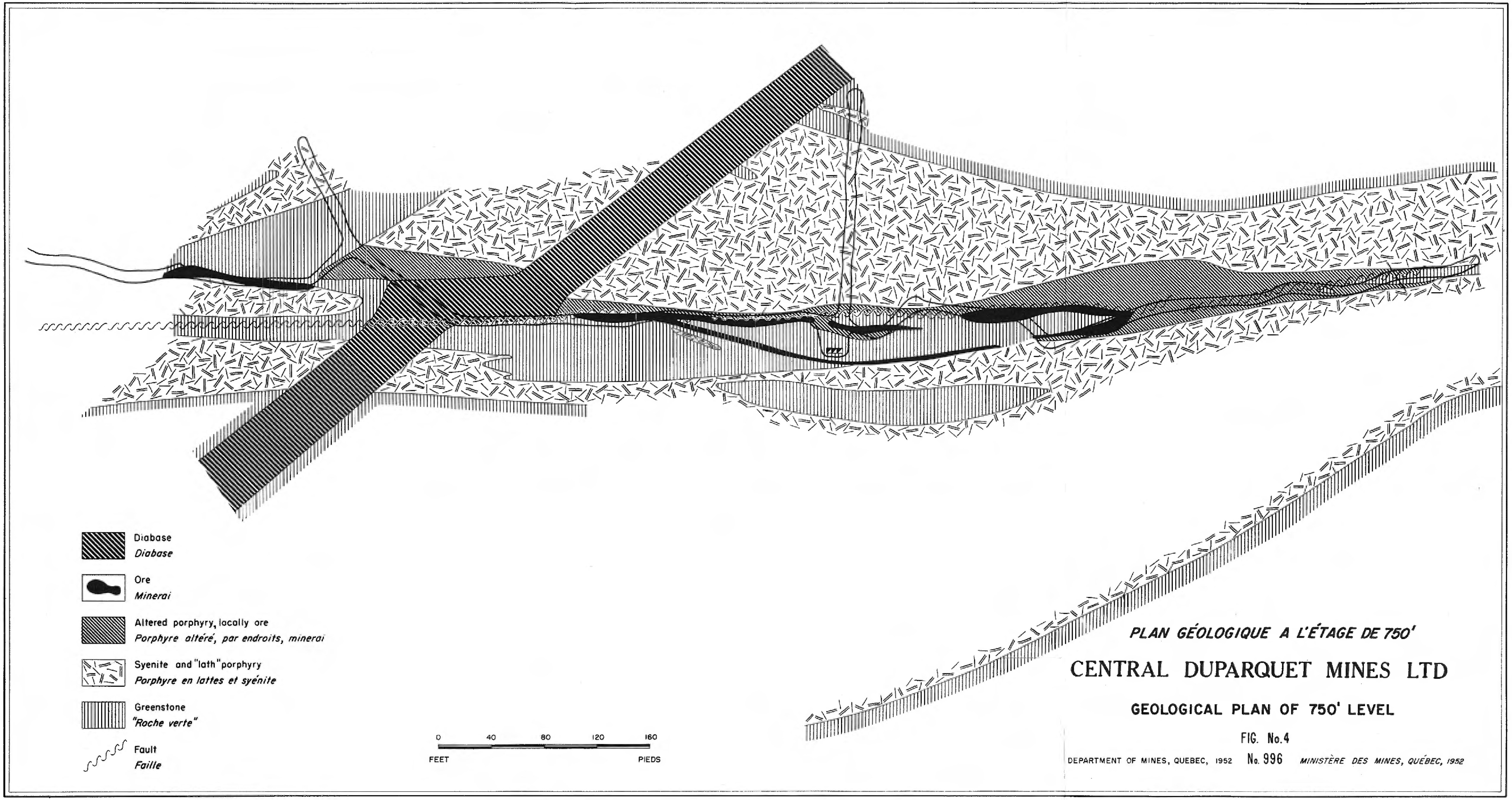
### Ava Gold Mining Company Ltd.

This property is situated 2 miles west of Duparquet. The Cléricy sediments, which occupy the central part of the property, are underlain to the south and overlain to the north by basic and intermediate volcanic rocks with associated dioritic intrusives. The Porcupine-Destor fault, which passes through the sediments, is offset to the northwest by a northwesterly-trending cross fault at the west end of the property. During the summer of 1950 the company drilled 5 diamond drill holes having a total length of 4,044 feet. No mineralization of economic importance was reported from this drilling.

### Brossard Group

The Brossard group consisted of lots 1 to 14, range VII, Hébécourt township. It has now reverted to the Crown. The property was optioned in 1945 by the Consolidated Mining and Smelting Company of Canada Ltd., Nipissing Mines Company Ltd., Leitch Gold Mines, Ltd., Miami Copper Company and Siscoe Gold Mines Ltd. under a joint agreement. In 1945 and 1946, 7 diamond drill holes were drilled, totalling 5,558 feet, along the Porcupine-Destor fault zone. A magnetometer survey of lots 7 to 14 was made in 1946.

The geology of the property is essentially the same as on the Nemrod group immediately to the east (p.54). There are very few outcrops. Several small bodies of quartz-feldspar porphyry and


Diabase
Diabase
Ore
Minerai
Altered porphyry, locally ore
Porphyre altéré, par endroits, minerai
Syenite and "lath" porphyry
Porphyre en lattes et syénite
Greenstone
"Roche verte"
Fault
Faille
0 40 80 120 160
FEET
PIEDS
PLAN GÉOLOGIQUE A L'ÉTAGE DE 750'
CENTRAL DUPARQUET MINES LTD
GEOLOGICAL PLAN OF 750' LEVEL
FIG. No. 4
DEPARTMENT OF MINES, QUEBEC, 1952
No. 996
MINISTÈRE DES MINES, QUÉBEC, 1952

feldspar porphyry were intersected in the drilling. A northwesterly trending dyke of diabase was intersected in two drill holes.

Two intersections carrying 0.06 ounce of gold per ton over 3.5 feet and 0.11 ounce over 3.5 feet were reported from the drilling on this property.

Canadian Malartic Gold Mines Ltd.

Canadian Malartic Gold Mines Ltd. holds a group of claims southeast of the town of Duparquet.

The northern part of the property is underlain by the Duparquet sediments and the southern part by the Cléricy sediments. The Porcupine-Destor fault forms the contact between the two.

Central Duparquet Mines Ltd.

This group was staked by George Kellar in 1924. The property has been held successively by the Duparquet Mining Co. Ltd., the Dumico Gold Corporation and Central Duparquet Mines Ltd.

The eastern end of the Beattie feldspar porphyry occupies the southern part of the property. The porphyry is well fractured and contains numerous minor shear zones. Many inclusions of highly altered greenstone are contained in this part of the mass. These inclusions of greenstone have previously been called various types of porphyry, but residual volcanic structures may be observed in many of them. Immediately to the south are the porphyry conglomerate breccias, succeeded by the Duparquet sediments. To the north of the porphyry are andesitic lavas and related intrusive rocks. The Beattie, Donchester and Central Duparquet faults pass through the property in a general easterly direction.

In 1928 an inclined shaft was sunk to a depth of 51 feet on claim A.866, just north of the Central Duparquet fault and about 500 feet east of the centre line of Duparquet township. The shaft was sunk on a quartz vein 1 to 4 feet wide which strikes N.40°W. and dips 72° southwest. According to O'Neill (9, p.101), a section of the shaft bottom gave three assays of $6.40, $11.60 and $16.10 over widths of 13, 22 and 24 inches respectively. The values were in gold calculated at $20.67 per ounce. During 1928 and 1929, a two-compartment shaft was sunk about 160 feet due east of the inclined shaft to a depth of 195 feet, and a crosscut 2,400 feet long was driven in a southwesterly direction on the 175-foot level. These workings are now full of water.

The main shaft, started in 1937, is 1,900 feet west of the centre line of Duparquet township. It has lateral workings on the 300-, 450-, 600-, 750- and 1,000-foot levels.

Exploratory work in this area has outlined a mineralized zone which closely follows one of the shears of the Central Duparquet fault zone. The geology on the 750-foot level is shown in Figure 6. The ore occurs as lenses in a complex mixture of greenstone and porphyry. The best mineralization is in brecciated and silicified greenstone. Ore of lower grade is found in the porphyry. The gold is associated with sparsely disseminated fine grained pyrite. Values range from 0.15 to 0.28 ounce of gold per ton.

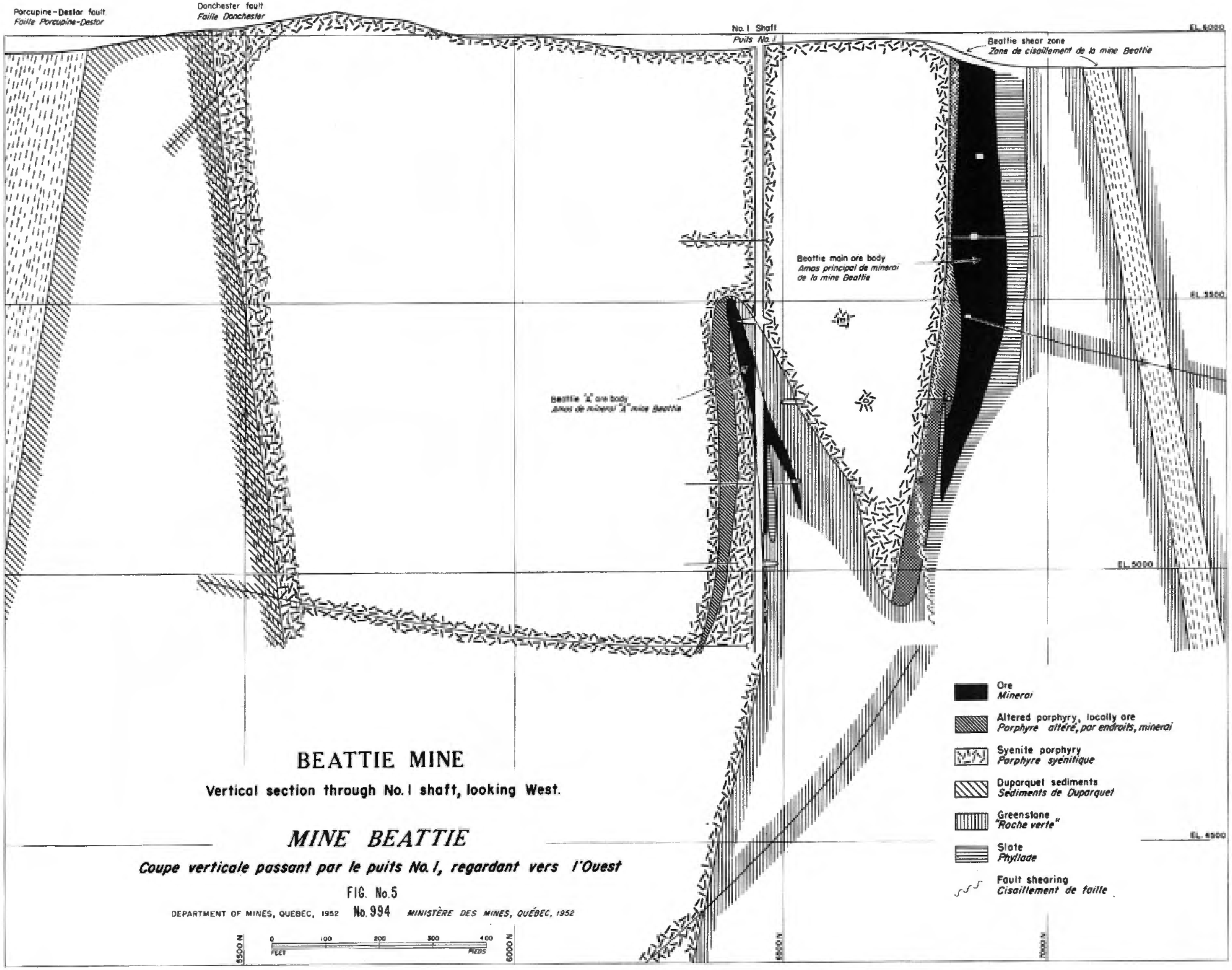
The porphyry conglomerate breccia zone which lies along the south contact of the porphyry mass on the property appears to be a physically favourable structure for gold deposition. It is mineralized by finely disseminated pyrite. However, to date no encouraging gold mineralization has been encountered. Assays of specimens collected by the writer did not exceed 0.026 ounce of gold per ton. Farther east, the zone was explored by diamond drilling and only traces of gold were reported.

Clarry Gold Mines Ltd.

This property comprises the south halves of lots 19 to 30, range VII, Duparquet township. It is underlain by trachytic, andesitic and basaltic flows. A sill-like body of gabbro outcrops in the south-central part of the property, on lots 24 to 30. About 1,400 feet north of the south boundary of the property there is an easterly-trending shear zone about 500 feet wide that consists of numerous north-dipping shears. A small exposure of quartz-feldspar porphyry occurs in the middle of lot 22. In the spring and summer of 1945, 9 diamond drill holes were drilled to explore the south half of the property. The quartz-feldspar porphyry was intersected at depth, indicating a dip to the south.

Consolidated Beattie Mines Ltd.
Beattie Group

The first claims of the Beattie group were staked by John Beattie in 1923. The property was held under option at different times by several large mining companies, and important exploratory work was done. In the fall of 1930 John Beattie made a new discovery on claim T.223. A programme of diamond drilling, started soon after the discovery, was completed in 1931. Thirty-five holes, drilled to intersect the gold-bearing zone at the 125-foot and 500-foot horizons, outlines a body of low grade gold ore having a width of 108 feet and a length of 1,158 feet. Beattie Gold Mines Ltd. was incorporated in December 1931. Shaft sinking was started in 1932. The mill started operating in May 1933. In 1939 the company was reorganized as Beattie Gold Mines (Quebec) Ltd. and in 1946 as Consolidated Beattie Mines Ltd. From 1933 to 1950 inclusive 845,014 ounces of gold was recovered from the treatment of 7,552,491 tons of ore.




# BEATTIE MINE

**Vertical section through No. 1 shaft, looking West.**

# *MINE BEATTIE*

***Coupe verticale passant par le puits No. 1, regardant vers l'Ouest***

FIG. No. 5

DEPARTMENT OF MINES, QUEBEC, 1952 No. 994 *MINISTÈRE DES MINES, QUÉBEC, 1952*

The Beattie porphyry mass occupies the centre of the Beattie property. It is bounded on the north and south by the Beattie and the Donchester faults. These faults have sheared and brecciated the porphyry but apparently have not appreciably displaced any part of it. To the south of the porphyry are andesitic volcanic rocks and some slate, succeeded by the Duparquet sediments. The Porcupine-Destor fault is 1,400 feet south of the Beattie shaft. The rocks between the main break and the Beattie mass are schistose and highly altered. Along the north and northwest side of the porphyry is a narrow band of slate underlain to the north by a series of dacitic and andesitic flows.

The Beattie orebodies have been studied in detail by Davidson and Banfield (20).

The main or north orebody occurs along the north contact of the Beattie mass, in brecciated and silicified porphyry and slate. (Figure 5). Adjacent to this body of breccia ore is a zone of mineralized and altered porphyry having considerably lower values in gold. The orebody plunges about 45° to the east. The dip is vertical or steep to the south.

The A orebody lies at the apex of a V shaped reentrant along the bottom of the porphyry. It plunges to the east. The gold mineralization is in a silicified breccia zone in the greenstone. The dip is apparently vertical.

The gold ore from these orebodies consists of finely divided and disseminated pyrite, arsenopyrite and magnetite. The pyrite varies in size from 0.07 mm. to 0.3 mm. and the arsenopyrite from 0.01 mm. to 0.04 mm. The gangue consists of silicified porphyry and slate, cut by veinlets of quartz and aplite. Most of the gold is associated with pyrite or skeleton-like crystals or arsenopyrite. Banfield (22) estimates that a little less than one third of the gold occurs in the free state.

The Donchester orebody was discovered by underground exploration work conducted from drift connecting the Beattie and Central Duparquet shafts. Sinking of the Donchester shaft was started in 1941.

In the shaft area, the Donchester orebody lies in the Donchester shear zone about 200 feet south of the Beattie mass (Figure 6). It is bounded on either side by Keewatin-type lava which is intruded by bodies of syenite porphyry and the two sets of lath porphyry dykes mentioned on p. 27.

The Donchester fault cuts obliquely through the dykes, forming lens-like ore shoots with a plunge to the east of 15° to 20°.

The best ore is found where the fault crosses the A set of lath porphyry dykes, forming shattered and brecciated zones. Other ore shoots occur in mineralized fractures and complementary shears accompanying the Donchester fault. The ore is cut into wedge-shaped blocks by two sets of younger faults which trend northeast and northwest and dip to the north. The movement was normal and left handed in both cases, but not great enough to displace the ore appreciably. Another set of post ore faults, apparently of the same age, are roughly parallel to the orebodies, cutting back and forth through the ore and adjacent wall rock. The movement along these is also minor.

Typical Donchester ore is a hard compact blue gray silicified and brecciated rock. The brecciated nature is best seen on a polished surface. Throughout this breccia is very fine grained and finely disseminated pyrite with a minor amount of arsenopyrite. Visible gold is rare. The other metallic minerals are visible to the naked eye only after close inspection. The average grade is 0.27 ounce of gold per ton. On the eighth level the orebody has a length of 2,400 feet and an average width of 6.1 feet.

Hébécourt Group

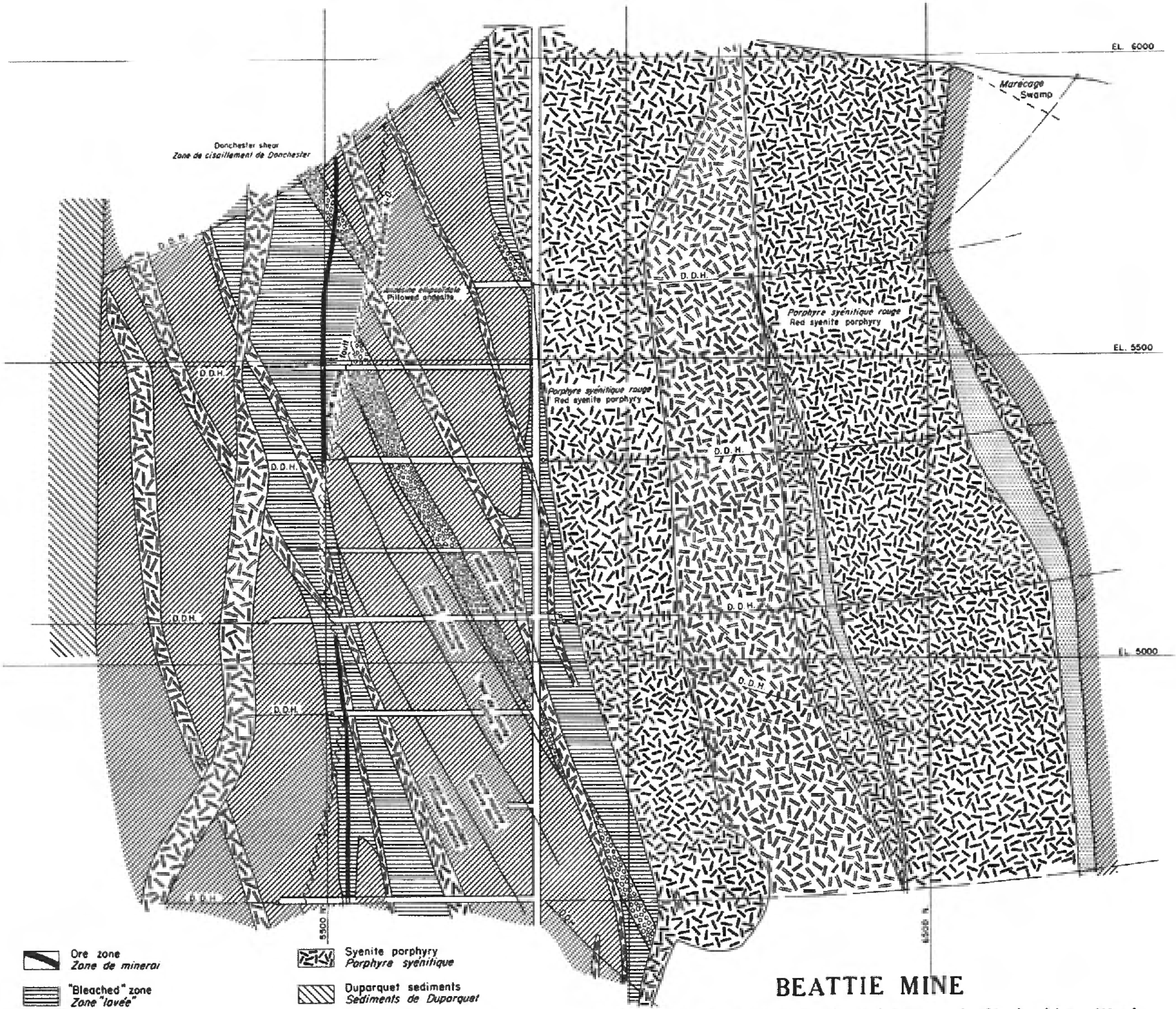
Consolidated Beattie Mines Ltd. controls lots 30 to 35, range VII, Hébécourt township. The property is extensively drift covered. The Porcupine-Destor fault passes centrally through the property. In the fall of 1946, the company did some diamond drilling in the southern part of lots 35 and 36. One small porphyry dyke was intersected in the drilling. The other rocks intersected consisted of trachyte and andesite.

Consolidated Duquesne Mining Company Limited

In 1935 Duquesne Mines Ltd. acquired several claims on either side of the Duparquet-Destor township line, including the groups formerly held by Galatea Gold Mines Ltd. and Del Rio Mining Company Ltd. The company has since been reorganized as Duquesne Mining Company Ltd. and Consolidated Duquesne Mining Company Ltd.

According to Buffam (6, p.102),some work was done in 1923 on a group known as the Brookbank claims and in 1924 on the Berner-Bachmann claims. These claims are now part of the Consolidated Duquesne property. Sinking of the Duquesne shaft was started in 1941. Production started in 1949. The ore was hauled by motor trucks to the Beattie mill for treatment. Total production during 1949 and 1950 was 41,766 tons, from which 10,985 ounces of gold were recovered.

The geology of the shaft area is complex, and is best seen by examining Figure 7. Most of the underground work has been done




| | |
|---|---|
| Ore zone / *Zone de minerai* | Syenite porphyry / *Porphyre syénitique* |
| "Bleached" zone / *Zone "lavée"* | Duparquet sediments / *Sédiments de Duparquet* |
| Sheared and silicified zone / *Zone laminée et silicifiée* | Andesite / *Andésite* |
| Lath porphyry / *Porphyre en lattes* | Agglomerate / *Agglomérat* |

0 100 200 300 400
FEET PIEDS

# BEATTIE MINE

**Vertical section through Donchester shaft, looking West**

FIG. No. 6

## *MINE BEATTIE*

***Coupe verticale passant par le puits Donchester, regardant vers l'Ouest***

DEPARTMENT OF MINES, QUEBEC, 1952 No. 995 *MINISTÈRE DES MINES, QUÉBEC, 1952*

to explore a lens of quartz-feldspar porphyry which lies north of the shaft. This lens has a general easterly strike and a steep dip to the south. It plunges steeply to the west (Figure 8). On the south side of the porphyry there is a strong fault marked by a band of intensely sheared greenstone containing many porphyry dykes. Branching away from the north side of this fault and trending into the porphyry are many subsidiary shears. Most of the movement took place along them before the intrusion of the porphyry but later minor movement has fractured, shattered and brecciated the porphyry in an irregular manner along the pre-existing shear zones. These zones were then carbonatized and silicified to varying degrees.

The Duquesne orebodies all lie at the west nose of the quartz-feldspar porphyry lens or in porphyry dykes which lie off the west end of the nose. Numerous horses of sheared greenstone are contained within the ore zone. A second porphyry lens, 200 feet to the north, represents a zone believed to be favourable for ore deposition.

Under the microscope the porphyry is seen to be much altered. Most of the phenocrysts of quartz are recrystallized to nests of smaller anhedra. The groundmass consists of a mixture of fine grained quartz, sericite and tremolite. Chlorite, quartz and carbonate vein the section. Pyrite occurs as fine disseminations containing many inclusions of chlorite. Magnetite and pyrite are present, as octahedra and cubes 1 mm. across, and as dust-like particles distributed with the larger grains along the chlorite seams. No feldspar phenocrysts were observed. In one section there were several small angular grains of gold. The mineralization is so sparsely disseminated that the sequence of deposition could not be definitely determined.

Danis Quebec Gold Mines Ltd.

This property is in the east central part of Duparquet township. The area is underlain by the Duparquet sediments. Two lenses of quartz-feldspar porphyry lie along easterly trending shear zones in the sediments in the central part of the property. Some trenching has been done along the more southerly of the two porphyry lenses, but the results of the work are not known.

Donmaque Gold Mines Ltd.

The Donmaque property comprises lots 24 to 29, range VII, Hébécourt township. It was formerly known as the Hyland-McNalley group. The work done on the property consists of a magnetometer survey and 7 diamond drill holes having a total length of 5,500 feet. There is a trench in lot 27, just west of the middle of Dancès lake and some stripping on lot 29 along a foliated zone on the northeast end of the hill in the middle of range VII. The Porcupine-Destor fault passes across the northern part of the property. It has been intersected by five of the diamond drill holes referred to above. To the north of the fault the property is largely covered by drift. To the south, the formations consist of basalt, spherulitic flows, some andesite and medium-grained gabbro related to the flows. Several northeasterly trending shears cross the property to the south of the Porcupine-Destor fault. One of these joins it at the east end of the property and another one lot farther east.

East Bay Gold Ltd.

This property straddles the Hébécourt-Duparquet township line near the north end of Duparquet lake, and includes Beattie island, where John Beattie made the original gold discovery in the district about 1910.

The north tip of Beattie island is light grey trachyte; the remainder is gabbro. Several fine grained gabbro dykes cut the gabbro in the southern part of the island. An east-west shear, dipping 60° to the south, cuts the northern tip of the island; another shear trends slightly south of east across the island and dips vertical to 55° south. These two shears should intersect about 500 feet to the west. The shears are offset by two northerly trending younger faults.

An easterly-trending quartz vein lies along the more southerly of the two shear zones, near the northwest corner of the island. Beattie explored this vein by means of an adit 15 feet long and an inclined shaft which followed the vein down the dip for 30 feet. The vein is about 2 feet wide and dips 15° to 30° north with numerous rolls and irregularities. About 10 inches below the main vein there is another vein 1 foot wide. The quartz veins are milky and well fractured. The fractures are filled with brown-weathering ferruginous carbonate. Coarse grains of pyrite and chalcopyrite up to 1/4 inch across occur as flakes in the fractures. On the whole, sulphide mineralization is sparse. The wall rock is bleached, carbonated, schistose intermediate lava. It is mineralized by finely crystalline aggregates of pyrite, averaging 1 inch by 3/8 inch, arranged parallel to the foliation in the rock. Both the main vein and the wall rock are reported to be gold-bearing.

During the winter and spring of 1948, 9 diamond drill holes, aggregating 3,020 feet, were drilled. The holes intersected several quartz veins and shear zones cutting gabbro, trachyte and andesite. The drilling was done from the footwall side of the vein zone and directed towards it. The holes dip 40° to 62° north. Several zones with gold mineralization were intersected, the most interesting

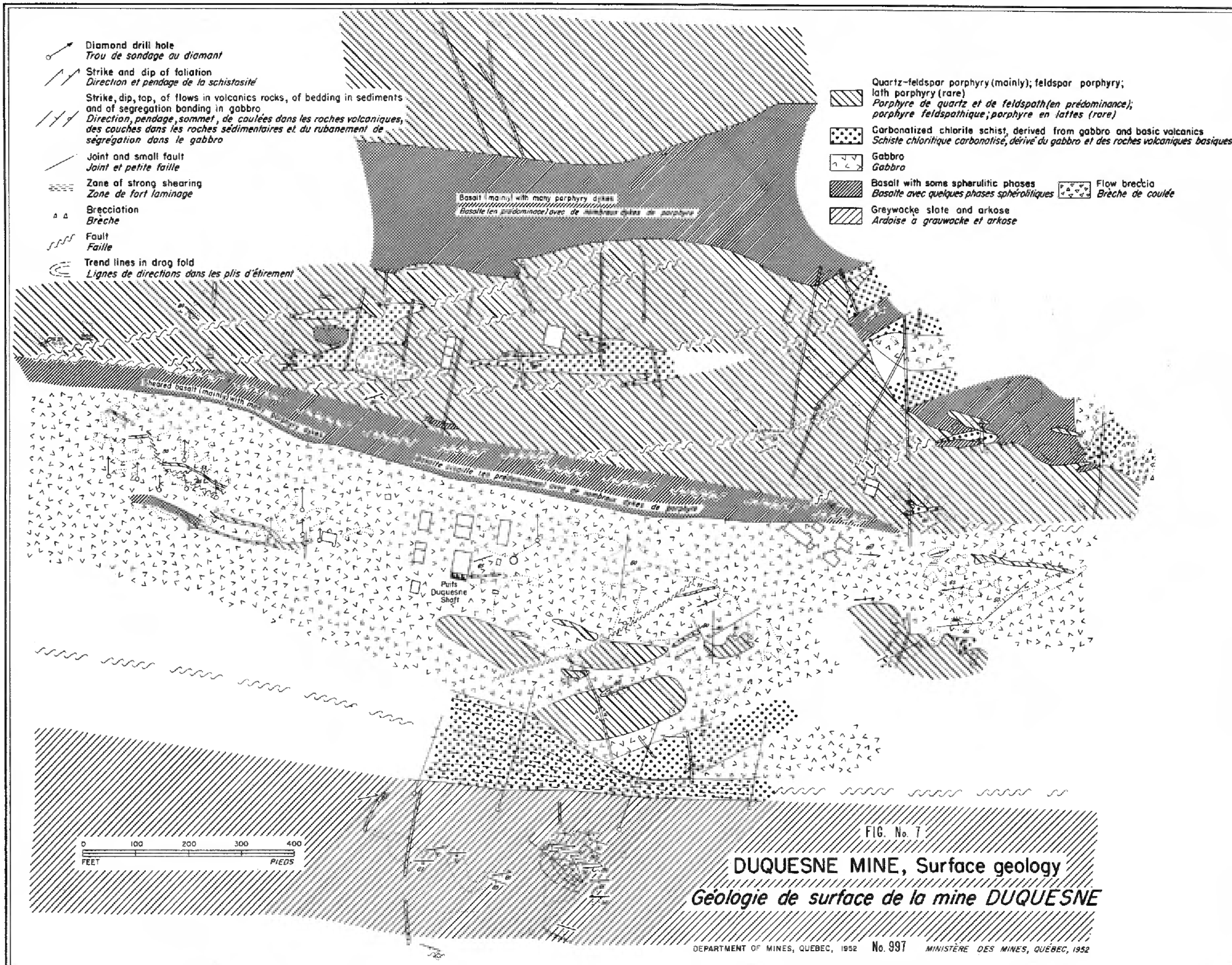



FIG. No. 7

**DUQUESNE MINE, Surface geology**

*Géologie de surface de la mine DUQUESNE*

DEPARTMENT OF MINES, QUEBEC, 1952 No. 997 MINISTÈRE DES MINES, QUÉBEC, 1952 being 2.5 feet wide and containing 0.75 ounce of gold per ton.

Eastchester Mines Ltd.

This group of claims lies in the eastern part of range VI, Duparquet township. Underlying the claims are volcanic rocks of the lower member of the Older Volcanics. Here they consist of andesite, trachyte, basalt and a few narrow bands of siliceous tuff. They are intruded by related dykes and sills of diabase and quartz diabase.

A magnetometer survey was carried out in 1945. This was followed by diamond drilling to check some of the anomalies outlined by the magnetometer survey, and to test the easterly extension of the Beattie structure.

Glenallan Gold Mines Ltd.

This group is in the central part of Duparquet township just south of the Duparquet road. The property is underlain by conglomerate and arkose of the Duparquet group. There is a boss of quartz-feldspar porphyry 1,600 feet south of the east-west centre line and 1 mile east of the north-south centre line of the township. The porphyry is elongated in a general east-west direction, having an exposed length of 700 feet and a width of 300 feet. A magnetometer survey and geological examination indicate that this body of porphyry has a length of at least 1,750 feet.

Five north-south trenches,cut across this body along a length of 600 feet, have exposed abundant disseminated fine pyrite. A sample taken from the brecciated and silicified porphyry at the north contact assayed 0.02 ounce of gold per ton. In October of 1946, 3 diamond drill holes were put down to further explore the porphyry. A total of 500 feet of drilling was done along the north contact. The porphyry intersected in the drilling was silicified, brecciated and well mineralized with pyrite.

Golconda Mines Ltd.

This property straddles the Duparquet road in Duparquet and Destor townships. Trenching 800 feet south of the road has exposed a zone of shearing, brecciation, silicification and carbonatization 2 1/2 to 5 feet wide, from which good assay values in gold have been reported. It strikes northeast and dips 70° to 80° northwest and forms the contact between pillow lavas to the southeast and porphyry to the northwest. Diamond drilling has proved this zone to be 1,100 feet long and has intersected several other parallel silicified shear zones. These shear zones are probably connecting links between the Ottman and Lépine Lake faults, indicating a possible length of 2,300 feet for the favourable zone.

Hébécourt Gold Mines Ltd.

The Hébécourt property consists of lots 36, and 42 to 51, range VII, Hébécourt township. The property is traversed by the easterly trending Porcupine-Destor fault and by a band of basalt which lies to the south of the fault. To the north and south of the band of basalt the rocks are dominantly andesite. To the north of the Porcupine-Destor fault the andesite is bleached and silicified. The western part of the property is almost devoid of outcrops. A magnetometer survey of the property was made in 1946. Several magnetic anomalies were found, the most pronounced being in the band of basalt referred to above.

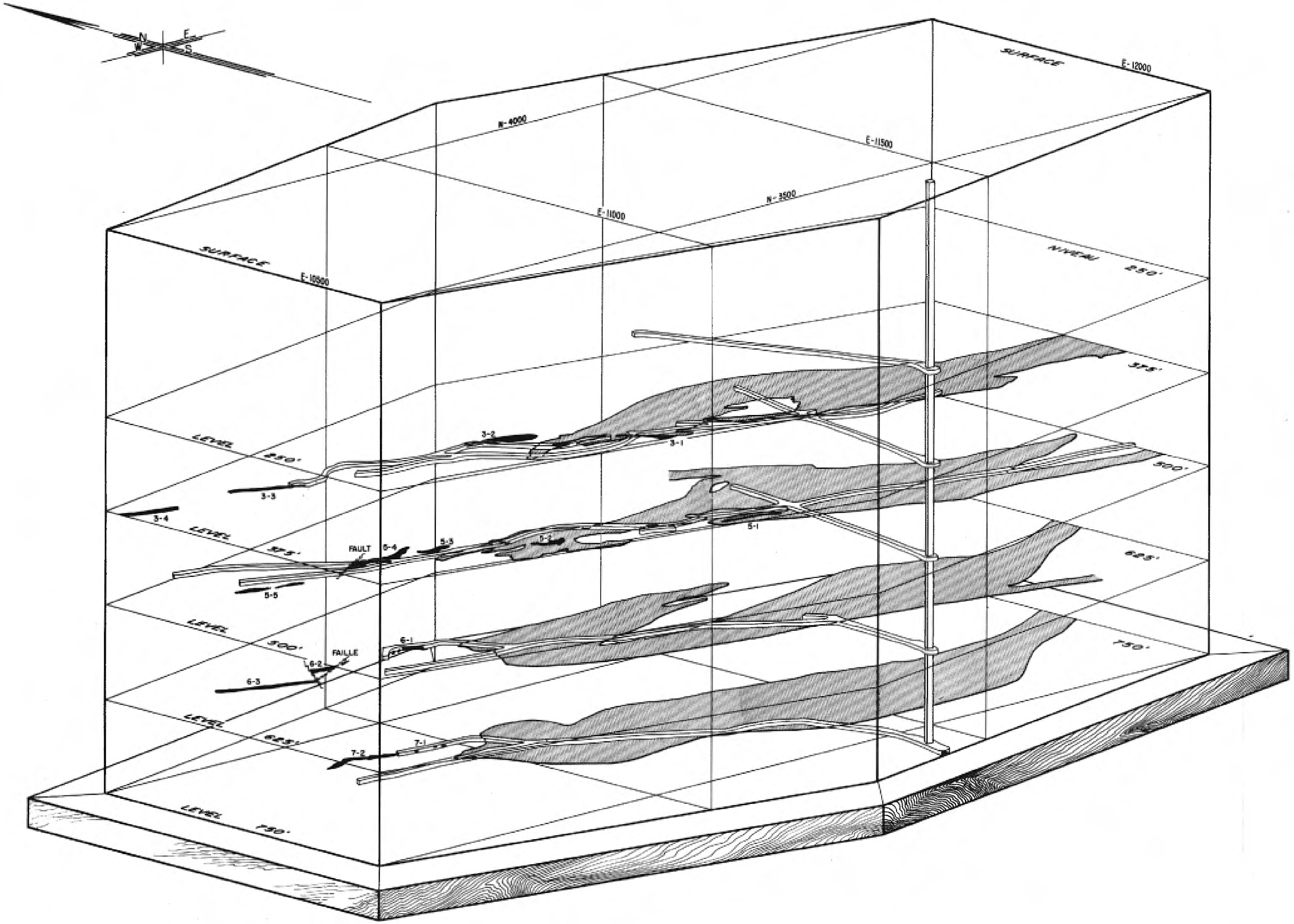
In the fall of 1947, a magnetometer survey was completed in lot 37, which is no longer held by the company. Several magnetic anomalies were located. One of these is near the north end of the lot, on the strike of the syenitic feldspar porphyry body which outcrops in the northern part of lot 39. The long axis of the anomaly has the same direction as the strike of the shear zone which passes through the porphyry mass. The close association of this anomaly to the porphyry merits careful consideration.

Nemrod Mining Company Ltd.

The ground held by this company covers lots 15 to 23, range VII, Hébécourt township.

The Porcupine-Destor fault passes centrally across the property. Several northeasterly-trending shears branch away from the north side of the fault and cross the northern part of the property. A lens of carbonatized quartz-feldspar porphyry intrudes the lava in lots 17 and 18, 1,100 to 1,300 feet south of the range line. From north to south the formations consist of trachyte, basalt, spherulitic flows, basalt, andesite and basalt. In places diorite sills are present.

The earliest recorded work on this property was done by Ventures Ltd. and Noranda Mines Ltd. in 1939, under a joint option. Considerable trenching was done on the high ground between lots 17 and 20 along the zones of shearing which lie 1,200 feet south of the range line. This was followed by the drilling of 13 diamond drill holes having a combined length of 5,149 feet. The ground was staked again in 1943 by Leo Brossard and optioned jointly by the Consolidated Mining and Smelting Company of Canada, Ltd., Nipissing Mines Company Ltd., Leitch Gold Mines Ltd., Miami Copper Company, and Siscoe Gold Mines Ltd. A magnetometer survey and 7 diamond drill holes totalling 3,263




# DUQUESNE MINING COMPANY LTD

CANTON DE DESTOR TOWNSHIP

ABITIBI - OUEST

PROJECTOGRAM OF
NORTH PORPHYRY MASS AND ORE SHOOTS

PROJECTOGRAMME DU MASSIF NORD DE
PORPHYRE ET DES LENTILLES DE MINERAI

LEGEND - LÉGENDE

PORPHYRY *PORPHYRE*

3-2 ORE *MINERAI*

FAULT *FAILLE*

0 100 200 400
FEET PIEDS

FIG. - 8

D.M.Q. 1953, 998 M.M.Q. 1953, 998

LINE OF SIGHT: ORIENTATION N 45°E, INCLINATION -15°

LIGNE DE VISÉE: ORIENTATION N 45°E, INCLINAISON -15°

feet were completed between June 1945 and March 1946. The drilling was confined to the Porcupine-Destor fault and a zone extending 1,000 feet north of the fault. The rocks intersected consisted of sheared, carbonatized and in places bleached and silicified lavas containing a few small dykes and lenses of feldspar porphyry and quartz-feldspar porphyry. The following year, the property was taken over by the Nemrod Mining Company Ltd., but to date no further work has been done.

Scattered values up to 0.30 ounce of gold per ton have been reported from the trenches and up to 0.15 ounce for 2-foot widths from the drilling.

Ottman Gold Mines Ltd.

The Ottman group straddles the Duparquet road in the eastern part of Duparquet township. Underlying the property are altered volcanic rocks of the upper member of the Older Volcanics. Fractured feldspar porphyry is exposed in two small outcrops and also in a trench on the south side of the road in the central part of the property. There is another exposure 800 feet south of the road. Here the feldspar porphyry occurs as a small dyke in greenstone. The greenstone is strongly foliated in a northeast direction. The foliation dips 55° to 65° north. This is characteristic of the northeast links in the Central Duparquet fault zone farther east. There is an apparent offset of the sediment-greenstone contact along a northeasterly-trending fault near the east end of the property. The northwest side has been displaced 2,500 feet southwest.

During 1945-46 the Teck Exploration Company Ltd. carried out a diamond drilling programme on the property. In all, 15,250 feet of drilling was done to explore the porphyries and the north-easterly-trending fault mentioned above. The fault was found to be a sheared and brecciated zone 50 to 200 feet wide. Local intrusions of syenitic feldspar porphyry were encountered along this zone, but no gold mineralization of commercial grade was discovered.

Pitt Gold Mining Company Ltd.

The Pitt Gold Mining Company Ltd. has a group of claims in the southeast quarter of Duparquet township. Most of the recent exploration work has been done 1 1/2 miles west of the township line and 4,000 feet south of the Duparquet road. This area is covered by muskeg to a depth of 40 to 80 feet. The formations intersected by diamond drilling consist of altered lavas and sediments, intruded by numerous easterly trending lens-like bodies of porphyry up to 200 feet wide. Passing through this zone is a shear approximately 100 feet wide striking N.80°W. and dipping 73 to 76° southwest. It is believed to represent the main zone of the Porcupine-Destor fault.

A pipe-like zone containing gold ore was found in one of the bodies of porphyry at a point where the main shear is intersected by another shear trending N.65°E. The porphyry is brecciated and altered. Quartz phenocrysts were found in only two of the nine specimens examined. The alteration is typical of that in the vicinity of shear zones throughout the area. The porphyry is highly sericitized, some sections consisting of 30 to 40 per cent sericite. Carbonate occurs replacing the groundmass of the porphyry and as veinlets. It may make up as much as 50 per cent of a section. Carbonate is followed in order of abundance by chlorite veinlets and to a lesser extent quartz veinlets. Pyrite occurs as cubes, pyritohedrons and subhedral and dust-like forms with magnetite, it is disseminated throughout the mass. The main concentration of these minerals is, however, along the chlorite veinlets which seam the rock. Fibrous aggregates of chlorite commonly rim the pyrite or occur as inclusions. One small particle of gold was observed in a veinlet of microbreccia, consisting of quartz cemented by carbonate.

Quain Group

This property straddles the III-IV range line and the north-south centre line of Duparquet township. Only the north part is included in the map-area. The property was originally known as the Silver-Prickett claims. Pyrite has been found in the southern part of range IV, 1,400 feet west of the centre line of the township. The formations consist of alternating beds of pillowed and massive trachyte with intercalated beds of tuff. Trenching over a width of 200 feet has exposed 4 veins of massive pyrite 6 to 8 feet wide. The veins strike N.65°W. and have been traced northwest into Duparquet lake. The pyrite favours tuff beds and the contacts between massive and pillowed flows. The rock in the zone containing the pyrite veins is highly jointed, fractured and silicified. Locally the rock has been brecciated and the fragments cemented by siliceous material. The rock between the massive pyrite veins contains disseminated pyrite. Pyrite mineralization has also been observed in scattered outcrops to the southeast of the trenches. A vertical diamond drill hole in the central part of the mineralized zone traversed trachytic breccia with heavy pyrite mineralization to a depth of 415 feet. Below this point the pyrite was disseminated, comprising less than 10 per cent of the core.

St. Francis Mining Company Ltd.

The St. Francis property consists of lots 52, 53 and 54 in range VII, Hébécourt township. The trace of the Porcupine-Destor fault across the property is marked by a valley about 700 feet wide. On either flank of the valley overburden is shallow, and a few scattered outcrops are visible. On the north side of the valley in lots 52 and 53, trenching has exposed a zone of carbonatized and bleached schist for a length of 1,600 feet. Cutting the schist are numerous fractured milky quartz veins, locally carbonatized and mineralized with disseminated pyrite. The quartz veins have an easterly strike and a nearly vertical dip and range in width up to 3 feet. Several samples from one of these veins are reported to have contained gold, the highest being 0.38 ounce per ton. A small amount of diamond drilling was done on these veins in the fall of 1946. On the south flank of the valley, several trenches have exposed a zone of easterly trending schist for a length of 200 feet. Cutting the schist are several quartz veins similar to those across the valley. They strike approximately east and dip nearly vertically. Widths range up to 3 feet.

Wettring Gold Mines Ltd.

The property of Wettring Gold Mines Ltd. is at the outlet of Duparquet lake, in Hébécourt and Duparquet townships. The property is traversed by the Porcupine-Destor fault and several subsidiary faults to the north and south. The Cléricy sediments, which underlie the central part of the property, are intruded by a composite body of feldspar and quartz-feldspar porphyry, immediately east and west of the Duparquet river. The porphyry is extensively fractured and locally is sheared and carbonatized. To the north is an extensive area of bleached lavas. South of the porphyry mass and the Cléricy sediments, the property is underlain by spherulitic, basaltic and andesitic flows.

A total of 10,663 feet of diamond drilling has been completed on the property. Except for a small amount of trenching and stripping, the porphyry body referred to above has scarcely been touched. It warrants a careful examination.

## Other Areas of Interest

Two zones, mineralized with chalcopyrite, pyrrhotite and pyrite, occur in agglomerate and tuff in the aureole of alteration which surrounds the diorite bodies southwest of Hébécourt lake. The larger of the two zones is on a hill 1,800 feet north of the south boundary of the map-area and 2 3/4 miles east of the Ontario boundary. It strikes N.78°E. and the containing formations dip 75° to 80° south. It is exposed for a strike length of 700 feet and disappears under drift at either end. The width is 250 feet. The mineralization is sparse, occurring in the matrix between the fragments and in the fragments themselves. A grab sample submitted by the writer contained 0.01 per cent copper, 0.018 ounce of gold per ton, and traces of nickel. The smaller mineralized zone is similar to the larger zone and lies 900 feet south of it. It is exposed over a width of 50 feet and a strike length of 150 feet. The south contact and both ends are covered by drift.

Lots 38 to 41, range VII, Hébécourt township, were held at one time by Consolidated Beattie Mines Ltd. but the claims have been allowed to lapse. The Porcupine-Destor fault passes centrally through the property. A band of basalt outcrops at the north end of the lots. A zone of shearing occupies the central part of the band of basalt and along it is intruded a lens-like body of syenitic feldspar porphyry about 2,000 feet long and 300 feet wide. The porphyry is locally sheared and mineralized with pyrite, and the basalt to north of the porphyry is bleached, silicified and locally mineralized with finely disseminated pyrite. These conditions are favourable for the deposition of gold.

Just north of the Pitt property and west of the Danis group in Duparquet township a porphyry body outcrops on the south side of a valley through which the Lépine Lake fault passes. The porphyry is bounded on the south by conglomerate. A hill which forms the north side of the valley is also conglomerate. The porphyry zone has been drilled but the results were not available.

During the winter of 1945-46, 8 diamond drill holes were drilled by Nipissing Mines Company Ltd. 5,000 feet south of the Duparquet road and 1,800 feet east of the centre line of Duparquet township. The area explored extends 1,200 feet along and 1,800 feet across the strike of the Cléricy and Duparquet sediments. The drilling intersected the main zone of the Porcupine-Destor fault. Narrow discontinuous lenses of quartz-feldspar porphyry were found to lie along the north side of the fault.

A westerly trending body of micrographic feldspar porphyry outcrops at the west end of range III, Destor township. Near the south edge of the porphyry is a pronounced shear zone with several northeasterly trending branches. There are several other faults to the north and south of this zone. Cross faulting has complicated the general structure. During the summer of 1945 some surface exploration work was done by Independent Mining Corporation Ltd. near several branching shears in the porphyry just east of the Duparquet-Destor township line. Some areas were found to contain finely disseminated pyrite with traces of gold.

In Destor township some trenching and diamond drilling has been done by Nipissing Mines Company Ltd. on lots 41 to 45, range west of Macamic road. The work was confined to claims R.18254 and R.18257 where there is a contact between gabbro to the north and basalt to the south. The rocks are much shattered and altered. Porphyry lenses were intersected in the drilling but none were noted when the property was mapped. Values in gold up to 0.64 ounce per ton were reported from the drilling.

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ALPHABETICAL INDEX