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FORTUNE LAKE AND WASA LAKE AREAS, DASSERAT AND BEAUCHASTEL TOWNSHIPS

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GEOLOGICAL REPORT No. 5

FORTUNE LAKE AND WASA LAKE  
MAP-AREAS

DASSERAT AND BEAUCHASTEL TOWNSHIPS

by

G. S. MacKenzie



QUEBEC

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1940



# FORTUNE LAKE AND WASA LAKE MAP-AREAS

## DASSERAT AND BEAUCHASTEL TOWNSHIPS

*by G. S. MacKenzie*

### TABLE OF CONTENTS

|                                                           | PAGE |
|-----------------------------------------------------------|------|
| INTRODUCTION.....                                         | 5    |
| General statement.....                                    | 5    |
| Location and access.....                                  | 5    |
| Previous work.....                                        | 6    |
| Acknowledgments.....                                      | 6    |
| GENERAL GEOLOGY.....                                      | 7    |
| General statement.....                                    | 7    |
| Table of formations.....                                  | 7    |
| Keewatin.....                                             | 8    |
| Basic lavas.....                                          | 8    |
| Acid lavas.....                                           | 8    |
| Volcanic fragmentals.....                                 | 9    |
| Temiscamian (?) sediments.....                            | 10   |
| Pre-Huronian intrusives (Algoman).....                    | 10   |
| Diorite.....                                              | 10   |
| Quartz porphyry.....                                      | 11   |
| Syenite porphyry.....                                     | 11   |
| Aplite.....                                               | 12   |
| Lamprophyre.....                                          | 12   |
| Huronian, Cobalt sediments.....                           | 12   |
| Keweenawan (?) diabase.....                               | 12   |
| Pleistocene and Recent.....                               | 13   |
| STRUCTURAL GEOLOGY.....                                   | 13   |
| Folding in the Keewatin series.....                       | 13   |
| Shearing and foliation in Keewatin and younger rocks..... | 15   |
| Faulting.....                                             | 16   |
| ECONOMIC GEOLOGY.....                                     | 17   |
| Properties in Wasa Lake map-area.....                     | 18   |
| La Mine d'Or Champlain, Limitée.....                      | 18   |
| Properties in Fortune Lake map-area.....                  | 19   |
| Arncœur Gold Mines, Limited.....                          | 19   |
| Eclipse Mining Company, Limited.....                      | 21   |
| McLaren claims.....                                       | 21   |
| Properties in the Arntfield-Aldermac map-area.....        | 22   |
| Arntfield Gold Mines, Limited.....                        | 22   |
| Francoeur Gold Mines, Limited.....                        | 24   |

TABLE OF CONTENTS—*Continued*

MAPS AND ILLUSTRATIONS

|                                                                                                          |             |
|----------------------------------------------------------------------------------------------------------|-------------|
| Map No. 463.—Geology of Fortune Lake map-area . . . . .                                                  | (In pocket) |
| Map No. 464.—Geology of Wasa Lake map-area . . . . .                                                     | (In pocket) |
| Map No. 462-A.—Generalized map of Fortune Lake, Arntfield-Aldermac, and<br>Wasa Lake map-areas . . . . . | (In pocket) |

PLATES

(After page 14)

|                                                                                                                                                                                                |  |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|
| Plate I—A.—Patch of white-weathering alteration in acid volcanics, Dasserat township.<br>B.—Conglomerate, Claim R-28072, Dasserat township.                                                    |  |
| Plate II—A.—Patch of dioritized conglomerate; 800 feet east of conglomerate shown in<br>Plate I-B.<br>B.—Pegmatitic area in coarse-grained diorite, lot 31, range VI, Beauchastel<br>township. |  |
| Plate III—A.—Headframe of No. 3 shaft and mill, Arntfield mine.<br>B.—Headframe, Francoeur mine.                                                                                               |  |

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## FORTUNE LAKE AND WASA LAKE AREAS DASSERAT AND BEAUCHASTEL TOWNSHIPS

*by G. S. MacKenzie*

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### INTRODUCTION

#### GENERAL STATEMENT

The geology of an area surrounding the Arntfield and Aldermac mines, in Beauchastel township, was mapped by Dr. E. L. Bruce for the Quebec Bureau of Mines in 1932 (1). During the summer of 1937, the writer carried the geological mapping eastward and westward from the above area. New developments at the Arntfield and Francoeur mines within the area mapped by Bruce were also examined, though no detailed study was made of the geology at these mines.

The two separate areas were mapped because of the interest occasioned by new discoveries in or near each of them. The interest in the eastern area was due to the finding of gold-bearing mineralized zones on the property of La Mine d'Or Champlain, Limitée, early in 1937. Tracing of the Francoeur mineralized zone westward to the Dasserat-Beauchastel township-line during 1936 and 1937 gave hope of finding extensions of this zone in the western area.

The geological formations encountered in each area are essentially the same as those occurring in the Arntfield-Aldermac area.

#### LOCATION AND ACCESS

The areas examined adjoin the Arntfield-Aldermac map-area on the east and west, and are, respectively, in Beauchastel township and Dasserat township, both in Témiscamingue county. The eastern area extends one and a half miles eastward from the Arntfield-Aldermac area examined by Bruce and is bounded on the east by the north-south centre-line of Beauchastel township. The western area extends two miles westward from the Dasserat-Beauchastel boundary. The north and south boundaries of both areas are respectively three-quarters of a mile north and two miles south of the east-west centre-line of these townships.

The Swastika-Noranda branch of the Nipissing Central railway crosses the north-central part of the eastern area and the southeastern corner of the western area. The Noranda-Kirkland Lake highway parallels the railway. Most of the mining properties can be reached over motor or wagon roads which connect with the main highway. A road, usable by motor in dry weather, runs north from a point on the highway south of Fortune lake to the Arncœur property, at the west end of King of the

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(1) Que. Bur. Mines, Ann. Rept., Part C., 1932, pp. 29-87.

North lake, and, branching westward from it, a waggon road extends as far as Desvaux lake. A trail leads north from the Arncoeur camp to the Eclipse property northwest of Demin lake. The property of La Mine d'Or Champlain, which is adjacent to Wasa lake and about half a mile east of Aldermac railway-station, has connection by motor road with the main highway, and from the camp a waggon road extends eastward. Also, at a point eight hundred feet southwest of the Aldermac filter-plant, a waggon road leads south from the highway, turns southeast along the north side of Wasa lake, and continues easterly to the east boundary of the area. The western area is accessible by canoe through lakes Fortune and King of the North, and from the Kanasuta flag-station on the railway through Berthemet (Ogima) and Desvaux lakes.

Most of the district has been burned over one or more times, some sections in quite recent years. Hence the country is mostly open, though the re-growth is heavy southwest of Wasa lake and west of Demin lake. Some good-sized green spruce and cedar have been preserved in the muskeg between Demin lake and the Dasserat-Beauchastel township-line.

#### PREVIOUS WORK

Reference to work by Bruce in the Arntfield-Aldermac area has already been made. Earlier work in the region by officers of the Geological Survey of Canada and others is summarized in the report by Bruce. The principal reports concerned are the following:

- WILSON, M. E., *Geol. Surv. Can., Summ. Repts.*, 1908, 1909, 1910 and 1911; *Mems.*, 17, 39 and 103.
- HARVIE, ROBERT, *Ann. Rept., Mines Branch, Dept. Colonization, Mines and Fisheries, Quebec*, 1910.
- COOKE, H. C., *Some Gold Deposits of Western Quebec*; *Geol. Surv. Can., Summ. Rept.*, 1923, Part CI, p. 76.
- COOKE, H. C., *Gold and Copper Deposits of Western Quebec*; *Geol. Surv. Can., Summ. Rept.*, 1925, Part C.
- GUNNING, H. C., *Syenite Porphyry of Boischatel Township, Quebec*; *Geol. Surv. Can., Bull.* 46, 1927, pp. 31-41.
- COOKE, H. C., JAMES, W. F., and MAWDSLEY, J. B., *Geology and Ore Deposits of Rouyn-Harricana Region*; *Geol. Surv. Can., Mem.* 166, 1932.

#### ACKNOWLEDGMENTS

A geological survey of many of the properties included in the areas mapped by the writer was made during the summer of 1937 under the direction of Dr. J. E. Gill, of McGill University. The writer is indebted to Dr. Gill and his associates for their co-operation and for much useful information. Information and courtesies received from the following are gratefully acknowledged: Mr. V. A. James, manager, and Mr. R. Finlay, assistant manager, of Arntfield Gold Mines, Limited; Mr. John Knox, Jr., manager of Francoeur Gold Mines, Limited; Mr. C. Hare, of Arncoeur Gold Mines, Limited; and many others.

W. Nowers Asbury, graduate of McGill University, and Gabriel Lefebvre, graduate of Laval University, proved very capable field assistants.

## GENERAL GEOLOGY

### GENERAL STATEMENT

Petrographic descriptions of almost all the rock types represented in the map-areas have been given in the reports by Bruce and earlier workers. Save for special features, no detailed discussion of the petrography will be given in this report.

The oldest, and most abundantly-occurring, rocks in the areas mapped are steeply dipping, evidently closely-folded, lava flows and pyroclastics of Keewatin age. Dykes, and sill-like and irregular masses, of diorite, largely post-Temiscamian in age, invade the Keewatin volcanics. The only suggestion of the former presence of Temiscamian sediments is a lenticular inclusion of conglomerate in the diorite. Pre-Cobalt intrusives, younger than the diorite, are represented by a large, elongated mass of quartz porphyry, numerous dykes of syenite porphyry, and one of lamprophyre. Diabase dykes, younger than the above rocks and presumably younger than the Cobalt sediments, are also present. Cobalt sediments overlie the peneplaned surface of the older rocks across the southern margin of the map-areas. Unconsolidated deposits of Pleistocene and Recent age cover the greater part of the areas examined.

In addition to the folding experienced by the Keewatin rocks prior to the invasion of the diorite, they have been further deformed in later periods. These later deformations affected also the pre-Cobalt intrusives. Mineralization, in places gold-bearing, has occurred along sheared and fractured zones resulting from these stresses.

TABLE OF FORMATIONS

|                                         |                                                                                                        |
|-----------------------------------------|--------------------------------------------------------------------------------------------------------|
| PLEISTOCENE<br>AND RECENT               | Boulder clay, sand and gravel, stratified clay                                                         |
| <i>Great unconformity</i>               |                                                                                                        |
| KEWEENAWAN(?)                           | Quartz diabase                                                                                         |
| <i>Intrusive contact (?)</i>            |                                                                                                        |
| HURONIAN                                | Cobalt series, conglomerate                                                                            |
| <i>Unconformity</i>                     |                                                                                                        |
| PRE-HURONIAN<br>INTRUSIVES<br>(ALGOMAN) | Aplite, syenite porphyry, quartz porphyry, lamprophyre, granodiorite, diorite porphyry, quartz diorite |
| <i>Intrusive contact</i>                |                                                                                                        |
| TEMISCAMIAN (?)                         | Conglomerate                                                                                           |
| <i>Unconformity</i>                     |                                                                                                        |
| KEEWATIN                                | Volcanic rocks:<br>Basic and acid flows<br>Tuffs and agglomerates                                      |



### KEEWATIN

Rocks of Kewatin age underlie the greater part of the areas examined. The series consists of acid and basic lava flows in about equal proportions, with occasional lenses of pyroclastics. The acid and basic volcanics tend to outcrop in distinct bands, though some intermingling occurs. The trend of the bands in each of the areas is 10 degrees or more north of east. This is also the usual strike of the flows and fragmental bands, though some strike east-west. The latter appears to be the more common direction in the intervening Arntfield-Aldermac area (1). In Map No. 462-A, an attempt has been made to outline the areas underlain by the acid and basic volcanics, and the prominent younger formations, across the three map-areas concerned.

It was not found possible to trace individual flows for any great distance, or, in fact, to distinguish one flow from another, except in a few places. However, a markedly porphyritic andesite outcrops at intervals along the north shore of Fortune lake and borders the diorite on the south, across the southern part of claim R.28072, west of Samia lake. Some fragmental beds were traced for a few hundred feet.

#### BASIC LAVAS:

Quite commonly, the basic volcanics display well-developed and well-preserved pillow structure, notably so northwest of Fortune lake and west of Samia lake. Many of the flows are porphyritic, even those with pillow structure. The phenocrysts of feldspar are seldom over an eighth of an inch in length.

Very few specimens of the basic lavas were studied microscopically. A thin section of the porphyritic variety showed it to have the composition of andesite. In large part at least, other facies are probably also of this composition.

The basic lavas are in general not markedly foliated, except along zones of shearing, as the one following the south shore of Fortune lake. The volcanics here are also highly carbonatized and with difficulty distinguishable from intrusive, similarly altered, diorite in the vicinity.

#### ACID LAVAS:

The acid volcanics are light-grey to buff on weathered surfaces. Occasionally they exhibit small pillow and ellipsoidal structures. In many specimens, phenocrysts of feldspar are visible, but quartz phenocrysts were observed in very few. As determined by earlier workers in the region, the rocks are mainly trachytes, though some are rhyolites (2).

Many of the outcrops in the main band of acid volcanics north of King of the North lake display fragments which are barely distinguishable from the enclosing material. The latter frequently shows flow structure, and the rocks accordingly are mapped as flows. The fragments probably developed by brecciation during the original movement of the partially cooled lava. Vesicles, usually wholly or partially filled with quartz, were

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(1) BRUCE, E. L., *op. cit.*, pp. 41-42.

(2) BRUCE, E. L., *op. cit.*, pp. 43-47.

observed in the rock in many places. Some of the amygdules are up to two or more inches in length and resemble inclusions.

Dykes and irregular patches of massive, white to reddish weathering, aphanitic material (Plate I-A) may be seen in the acid volcanics in many parts of the area, but more particularly in the main band referred to above. Usually, they have a light reddish-brown colour on the freshly broken surface. They are rarely traceable for more than 50 feet. Some are in sharp contact with the surrounding lavas, but others have one contact well-defined and the other gradational. Certain of the smaller patches were observed to occupy the central part of pillows. In some occurrences, the rock contains phenocrysts of quartz. Thin-sections show a fine, but by no means rhyolitic, texture. Quartz is the most abundant constituent, with some unaltered acid plagioclase, and carbonate. Similar material occurs along the sheared zone that follows the contact of the acid volcanics with the basic volcanics to the south of them. In places, it is mineralized with pyrite. At least some of these occurrences seem to have developed as a result of hydrothermal alteration of the lavas, but others may be dykes of quartz porphyry. Material of this type was not observed within the nearby basic volcanics and diorites.

The main band of acid volcanics, with some interbedded basic volcanics, persists across the northern part of the Arntfield-Aldermac area into the Wasa Lake area, where rocks of this composition outcrop in the northern part of range V and the southern part of range VI. East of the Aldermac mine, however, farther north in range VI, basic volcanics occur. Some difficulty was experienced in differentiating these basic volcanics and what appear to be chloritized facies of the acid volcanics immediately to the west.

Also occurring in the above vicinity are irregular areas of rock consisting of rhyolitic inclusions in a highly chloritic groundmass. Some occurrences suggest that the rock is a volcanic fragmental, others that the rhyolitic material is a later injection in a basic flow.

The rocks farther south and east in range VI, mapped as acid volcanics, are generally lacking in volcanic structures and may be acid intrusives rather than flows.

Most of the acid volcanics are quite massive, though bands of schistose rock occur. Southwest of Wasa lake, however, these rocks are foliated, and occasionally quite fissile, over a wide zone (see Map No. 462-A). Within this zone, also, they are slightly chloritized. They are greyish-green in colour on the freshly broken surface, but weather to a greenish-white. Some of the rocks included in the zone may have been of intermediate, rather than acidic, composition.

#### VOLCANIC FRAGMENTALS:

The occurrence of indistinct fragments in the acid flows of the main band in the western map-area has already been noted. Few definitely identifiable coarse pyroclastics were observed in this area, though some have been intersected in diamond drilling at the south margin of the band. In the eastern map-area, however, north of the railway, coarse fragmentals in fairly well-defined bands are interbedded with the acid volcanics. Fragments vary from less than an inch up to one foot in diameter. Most

of them are lighter grey in colour than the matrix, but similar in texture; some are light to dark-green and coarser than the matrix.

Fragmental beds are not common in the basic lavas. On a few outcrops southwest of Fortune lake, irregular lighter-weathering fragments are enclosed in a dark-green lava. Basic rocks with more definite fragments are exposed in the middle part of lot 31, range V, Beauchastel township.

Few fine-grained tuffs were definitely identified as such in either of the areas examined.

#### TEMISCAMIAN (?) SEDIMENTS

Remnants of a conglomerate occur as inclusions in diorite on claim R.28072, between Samia and Desvaux lakes, in Dasserat township. About 150 feet north of the middle of the south boundary of the claim, a small outcrop shows rounded fragments of granodiorite up to one foot in diameter, and other smaller ones of acid and basic volcanic material, in a dark-green and chloritic matrix (Plate I-B). Except for the boulders of granodiorite, the rock resembles an agglomerate. In outcrops 400 to 800 feet east of the above, rounded fragments are still apparent in the rock, but these and the matrix have the composition of the surrounding diorite. The fragments occur in irregular patches which are separated by massive diorite (Plate II-A). The rock would appear to represent a band of conglomerate, presumably of Temiscamian age, engulfed and partially assimilated by the diorite.

#### PRE-HURONIAN INTRUSIVES (ALGOMAN)

##### DIORITE:

Under the term 'diorite' are included rocks of several varieties, and possibly of different ages, that are commonly referred to in the region as 'quartz diorite', or 'older gabbro'.

The large mass of diorite, mapped by Bruce, which lies between Fortune and King of the North lakes was found to continue westward to the southern part of Desvaux lake. Bruce (1) notes that the south contact of the diorite with the basic volcanics at the Lake Fortune mine has a rather flat dip northward. The same feature was observed by the writer at three exposures of the south contact, between Samia and Desvaux lakes, and also at one point where the north contact is exposed. In each case, the dip is 45 degrees or less to the north. These observations suggest that the diorite forms a tabular mass, possibly with sill-like relations to the invaded basic volcanics. A southward offshoot from this mass of diorite forms the barrier between Fortune and Samia lakes.

The large area of diorite northwest of Demin lake is part of the northeasterly trending mass which, as shown on the Opasatika sheet of the Geological Survey of Canada, crosses the central part of Dasserat township.

In addition to the above and other large diorite masses (Map. No. 462-A), numerous smaller ones, and many dykes, cut the Keewatin volcanics. In these latter forms, the rock tends to be fine-grained and chloritized.

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(1) *Op. cit.*, p. 53.

The diorite generally is a medium to fine grained rock, green in colour. In places, and most markedly in the most northerly of the outcrops northwest of Demin lake, the diorite grades into granodiorite. This rock contains abundant quartz in the locality indicated. Much of the diorite in the large mass north of the Aldermac railway-station is coarse-grained, with a nodular weathered surface (1). Irregular patches with pegmatitic texture occur within this mass (Plate II-B) and less commonly in the diorite at other places.

Many dykes of related composition were observed to intrude the diorite. These trend in various directions. They are usually short and narrow, though some are traceable for a hundred feet or more. They are generally darker green in colour and finer in grain than the enclosing diorite. An east-west dyke of diorite porphyry, 30 feet or more in width, is traceable on scattered outcrops for 1,800 feet across lots 30 and 31, just north of the centre-line of Beauchastel township.

On the southeast shore of Wasa lake, a contact can be seen between what are, apparently, two types of diorite. One is fairly light coloured, the other dark-green and partially carbonatized. Some of the outcrops to the east are similar to this latter facies. Mutual age relations could not be determined. Possibly the lighter-coloured rock is a coarse-grained volcanic, though it lacks the characteristic structures of such rock.

Most of the diorite is massive, but southwest of Wasa lake it is markedly gneissic. Where grains of quartz are visible, they have a bluish opalescent appearance.

#### QUARTZ PORPHYRY:

One large, and several smaller, outcrops of quartz porphyry occur just north of the railway and west of the Aldermac filter-plant. These outcrops are an eastward continuation of the mass to the west, mapped by Bruce, and the rock is as described by him (2). Small outcrops of similar rock in lot 29, just north of the centre-line of Beauchastel township, may indicate a farther eastward extension of the same mass. The more northerly of the last mentioned outcrops, and one immediately west of the Aldermac filter-plant, consist of brecciated fragments of quartz porphyry cemented and veined by glassy, white quartz. A small dyke of quartz porphyry was observed to cut the volcanic fragmentals and a dyke of diorite on the high hill east of the Aldermac mine.

#### SYENITE PORPHYRY:

The basic border of the syenite porphyry complex north of the Aldermac mine (3) lies just within the northwest corner of the eastern map-area. Numerous dykes radiate from this mass southward and eastward as far as the railway track. One dyke with a width of less than five feet was traced for a distance of 1,200 feet. These dykes are mainly the

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(1) BRUCE, E. L., *op. cit.*, p. 54.

(2) *Op. cit.*, p. 55.

(3) GUNNING, H. C., *Syenite Porphyry of Boischatel Township, Quebec*; Geol. Surv. Can., Bull. 46, 1927, pp. 31-41.

red trachytoid type, but some, though red in colour, are fine-grained and even-textured.

Dykes of grey, and in some places reddish, syenite porphyry, with equidimensional feldspar phenocrysts, occur in the same vicinity and also within the western map-area. One such dyke in claim R.25565, southeast of Demin lake, is 30 feet wide and lies along the strike of a similar dyke mapped by Bruce in the area to the east.

#### APLITE:

Dykes of reddish aplite, usually only a few inches in width, were frequently observed to cut the lavas and the diorite in the western map-area. Though narrow, they are persistent, one being traced for a distance of 400 feet. Many of them have an east-west direction.

#### LAMPROPHYRE:

A dyke of lamprophyre, cutting basic volcanics, can be traced in a succession of outcrops over a distance of 2,000 feet across lots 24, 25, and 26, range V, Beauchastel township. It varies in width from three to fifteen feet, and has an average direction N.80°E. The rock is dark in colour and brown-weathering, with a medium grain size. It is faintly gneissic. Numerous flakes of biotite are visible in the hand specimen. A thin-section shows a much altered rock, containing, in addition to the biotite, remnants of augite, and secondary carbonate. No feldspar is recognizable. Relations of this dyke to the other intrusives were not observed, but its foliation, alteration, and the fact that it is offset along a north-south fault, leave little doubt as to its pre-Cobalt age.

#### HURONIAN

##### COBALT SEDIMENTS:

Cobalt sediments, chiefly conglomerate with some fine-grained sandy facies carrying only a few pebbles, outcrop on the Kekeko hills that cross the southern portion of the map-areas.

Excellent exposures of the contact with underlying volcanics and diorite are to be seen south and southwest of Wasa lake. Despite irregularities in the peneplaned surface of the older rocks, these exposures suggest a southward dip for this surface and the overlying sediments.

#### KEWEENAWAN (?)

##### DIABASE:

On the map of the Arntfield-Aldermac area, Bruce shows two parallel dykes of diabase trending southeast from the Aldermac mine. Continuations of these dykes were found in the area to the east, mapped by the writer. Within a short distance, the more easterly dyke fingers out in the trachyte, though it is joined to the westerly one by a narrow cross-dyke. The same diabase outcrops at intervals southeastward to below Wasa lake. It was not observed to cut or underlie the Cobalt sediments, as a marked, drift-filled gully lies along the strike, at the northern margin of the

Kekeko hills. A thin section of the rock from an outcrop northwest of Wasa lake showed it to be a quartz diabase. South of the railway, the outcrops of these dykes are fairly well aligned, but to the north, as will be seen from the map, successive outcrops appear to be offset either to the east or to the west, not more than 200 feet. This is suggestive of faults in the intervening drift-covered sections. However, the manner in which the more easterly of the dykes may be seen to pinch out makes irregularity in the fractures they follow an equally likely explanation of the lack of alignment. A smaller dyke branches westward from this main line of outcrops. Other diabase dykes to the east and west seem to be isolated occurrences.

Only two dykes of this 'younger gabbro' were observed in the western map-area. Both cut the diorite northwest of Demin lake. Others may be present here, as the gabbro, on the weathered surface, is not readily distinguished from the surrounding diorite, save by its more massive appearance. These younger gabbro dykes lack the ophitic texture characteristic of diabase.

#### PLEISTOCENE AND RECENT

For a description of the glacial geology and physiography of the areas, reference may be made to earlier reports, cited on page 6.

For some distance around Demin lake, the overburden, mostly clay and boulder clay, is particularly heavy, and hence outcrops are scarce. The same is true to a lesser extent in the country north and northeast of Wasa lake.

#### STRUCTURAL GEOLOGY

##### FOLDING IN THE KEEWATIN SERIES

Earlier work in the region has demonstrated that, before the invasion of the diorite, the Keewatin volcanics had already been subjected to folding processes both prior to and following the deposition of the Temiscamian sediments. Some of the foliation, fracturing, shearing, and drag-folding now apparent in the volcanics undoubtedly originated during these earlier periods. However, similar structures, affecting the pre-Cobalt intrusives as well as the Keewatin rocks, were also developed in later periods. In some places, these later structures follow the same lines of weakness as the earlier ones, but in other places they are independent of them.

Cooke, James, and Mawdsley, in their memoir on the Rouyn-Harri-cana region, have made some suggestions as to the structure of the Keewatin formations in and near the areas discussed in the present report (1). On the map accompanying the memoir, a synclinal axis is shown passing across the south end of Demin (Uwass) lake and north of King of the North lake. The direction of the axis is N.80°W. The evidence for this structure, named the Dasserat syncline, is discussed in the memoir. Bruce points out that, south of Dasserat lake, the axial plane of this fold must be overturned toward the north, and not toward the south as stated in the above memoir (2).

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(1) *Op. cit.*, p. 89; p. 94.

(2) BRUCE, E. L., *op. cit.*, p. 49.

In regard to the structure of the Arntfield-Aldermac area, Bruce notes the limitations of the available data but suggests that the structure is synclinal with the axial plane overturned to the south. The axis of this syncline would presumably lie somewhere in the basic volcanics south of the Arntfield and Francoeur mines, as he concludes that these rocks are younger than the acid volcanics to the north (1).

The writer was unable to make sufficient determinations of attitude to permit any definite statement in regard to the folding of the Keewatin rocks in the areas he examined. However, some suggestions in furtherance, and others in modification, of the views outlined above seem justified.

The trends of the main bands of acid and basic volcanics (see Map No. 462-A), and the observed strikes of the flows and fragmental beds, suggest a direction ranging from east-west to  $10^{\circ}$  or more north of east for the axes of the folds. The few dips recorded are consistently northward. This supports the conclusion reached by Bruce, and earlier by Cooke, James and Mawdsley, that, in the areas concerned, the axial planes of the folds dip northward.

Several observations—no one of them conclusive—on pillowed andesites northwest of Fortune lake and west of King of the North lake, all indicate that the flows concerned have their tops to the north. This agrees with the determination of attitude made by Cooke in this vicinity (2). The pillow lavas south of Demin lake also appear to face north. The writer, however, was unable to confirm the presence of south-facing beds to the northeast of Demin lake, as recorded by Cooke (3), though no evidence to the contrary was observed.

In the eastern area, but two determinations of attitude were made, one of which is deemed reliable. This particular observation was made in lot 24, range VI, about 3,000 feet north of the centre-line of Beauchastel township. Here, pillow lavas, in sharp contact with coarse fragmental rocks to the north of them, grade on the south to ropy and brecciated lava, indicating that the top of the flow is to the north. The dip is not determinable here, but, farther southwest, tuffaceous beds dip  $75^{\circ}$  to the north. The other observation of attitude was made in lot 30, range IV, southeast of Wasa lake, where well-preserved pillows in andesite are exposed on a north-south vertical cliff. The average flattening of the pillows indicates a northward dip, possibly as flat as  $45^{\circ}$  degrees. The top of the flow is not clearly indicated but seems to be to the north.

The writer concludes from the above observations that the acid volcanics in the main band, extending from the south part of Desvaux lake northeast and east to and beyond the Aldermac mine, are younger than the wide band of basic volcanics to the south (see Map No. 462-A). This implies that the acid volcanics lie in a syncline. If Cooke's determinations of south-facing beds northeast of Demin lake and on Arnoux lake to the north (4) are taken into consideration, the axis of this syncline would be placed as extending eastward from the vicinity of Demin lake. This conception of the general structure differs from the earlier ones chiefly in

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(1) *Op. cit.*, p. 49.

(2) *Op. cit.*, p. 94.

(3) *Op. cit.*, p. 94.

(4) *Op. cit.*, p. 94.



A.—Patch of white-weathering alteration in acid volcanics, Dasserat township.



B.—Conglomerate, Claim R-28072, Dasserat township.





A.—Patch of dioritized conglomerate, 800 feet east of conglomerate shown in Plate I-B.



B.—Pegmatitic area in coarse-grained diorite, lot 31, range VI, Beauchastel township.



A.—Headframe of No. 3 shaft and mill, Arntfield mine.



B.—Headframe, Francoeur mine.



that the axis of the Dasserat syncline east of Demin lake is considered to have a north of east, rather than a south of east, direction. A bend in the axis is suggested by the trends of the formations near Desvaux lake. The presence, east of the Aldermac mine, of basic volcanics succeeding acid ones to the west, and the apparent northeast trend of the formations, indicates some complication of the general structure in this vicinity. If the general structure is synclinal, a westward pitch of the axis would account for the observed relationships.

The band of acid volcanics crossing the south part of Wasa lake may mark the axis of another syncline, or these flows may be interbedded with the basic volcanics to the north and south. The relationship of the basic volcanics around Demin lake to the acid flows to the north, south, and east is also, as yet, a matter of conjecture.

#### SHEARING AND FOLIATION IN KEEWATIN AND YOUNGER ROCKS

Two prominent zones of shearing, present in the Arntfield-Aldermac area, persist westward into the area mapped by the writer in Dasserat township (Map No. 462-A). At least some of the pre-Cobalt intrusives are intersected by these shear-zones.

The first of these zones is that on which the Arntfield and Francoeur mines are located. Within the Arntfield-Aldermac map-area, this zone has been traced, by diamond drilling on the Francoeur property, westward to the Dasserat-Beauchastel township-line. There is no outcrop to the west, along the strike of the zone north of King of the North lake, and this country has not yet been explored by diamond drilling. Thus it cannot definitely be stated that shearing is present along this section. West of the lake, however, a sheared zone has been traced for nearly a mile south-westward and westward across the Arncoeur property. This latter zone follows the contact between acid volcanics to the north and basic volcanics to the south, and the zone extending westward from the Francoeur mine seems to do likewise. The presence of fragmental and tuffaceous bands near this contact also appears to be a factor in the localization of the zone. Sheared zones intersected in drill holes farther north, on the Arncoeur property, may indicate extensions or branches of the Arntfield-Francoeur zone, more westerly in direction than the one on which most of the exploration has been concentrated.

This general zone of shearing has also been traced southeastward from the Arntfield No. 3 shaft as far as the highway. Whether or not it persists through to the eastern area mapped by the writer is not definitely known. However, southwest of Wasa lake, the acid volcanics and intrusive diorite are markedly foliated, and locally sheared, over a wide area, roughly on the strike of the Arntfield zone. The strike of the foliation is  $N.65^{\circ}W.$ , quite evidently cutting across the older structural directions. The dip is 65 to 70 degrees northward.

There would thus seem to be a general arcuate zone, or zones, of shearing crossing the areas mapped by the writer, and the intervening Arntfield-Aldermac area, from near the south part of Desvaux lake, on the west, to south of Wasa lake on the east. Shearing was most intense and localized in the central and western part of the zone, where the shear planes paralleled earlier lines of weakness in the Keewatin rocks. The dip

of the zone is everywhere northward but seems to be flattest in its central part. Thus, at the Arntfield mine, the dip is as low as 45 degrees, but toward the western part of the Arncoeur property it is as steep as 80 degrees.

The second general zone of shearing extending into the western map-area is that on which the Lake Fortune mine is located. The exact course of the zone east of the south bay of the lake is not known. It probably lies beneath the lake, though some sheared rock occurs along the shore. Between Fortune and Samia lakes, however, the zone is well-exposed in old trenches. The dip averages 70 degrees northward in this section but is less steep at the Lake Fortune mine. The continuation of the zone west of Samia lake would appear to lie south of the map-area, as shearing is exposed in old trenches to the southwest. This general zone, like that first described, has an apparent arcuate trend. It is to be noted that this zone of shearing occurs not far to the south of a large mass of northward-dipping diorite, and at least the western part of the other main zone lies just to the north of this same mass. Doubtless this mass was one of the factors causing localization of the shearing.

Several other, smaller sheared zones were observed in the western map-area, both in the volcanics and in the diorite. Most of these strike east and west, and this is also the direction of the most prominent schistosity in the volcanics. Another common direction of foliation, and less so of shearing, is around N.80°E., more nearly parallel to the general trend of the flows. The dip of the structures having either of these main directions is almost everywhere northward, though some are vertical. At least two narrow, but marked, shear-zones, and several quartz-filled fractures, were observed to dip to the south, some quite flatly.

It has already been noted that, west and southwest of Wasa lake in the eastern map-area, the prominent direction of shearing and foliation is around N.65°W., with northward dip. Farther north, the trend becomes more nearly east-west, and the dips are generally steeper northward, with some vertical and even southward. On the property of La Mine d'Or Champlain, zones of fracturing strike N.45°-70°E. North of the railway track, no zones of heavy shearing were observed, though some shearing and quartz-filled fractures occur along the contact of diorite and volcanics half a mile northwest of the Aldermac railway-station. These strike N.E. and N.65°E.

#### FAULTING

Bruce has noted the presence of low-angle faults cutting the earlier shearing in the underground workings at the Francoeur No. 1 shaft, and at the Arntfield No. 1 and No. 2 shafts (1). A pronounced fault runs the length of the present workings at the Francoeur No. 2 shaft. It dips about 45 degrees to the north, whereas the shearing dips 60 degrees in the same direction. Similar, but less-marked, faults occur in the workings at the Arntfield No. 3 shaft. Cleavage and small drag-folds show that the latest movements on these fault-planes were normal, with some horizontal component of movement. The magnitude of these movements, and whether

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(1) *Op. cit.*, p. 58.

or not they were preceded by thrusting along the same planes, was not determined by the writer. The presence of similar faults along the sheared zone crossing the Arncoeur property is indicated in the diamond-drill holes. No faults were observed at the surface in the western map-area.

In the eastern map-area, two small faults were noted just south of the railway track, in lot 24, range V. They strike N.15°E. and N.45°E., and dip steeply. A quartz vein is displaced twenty feet along one of them, and a lamprophyre dyke five feet on the other. In each case, the east side of the fault moved northward. Several small faults with similar directions were observed west of Wasa lake, and indications of a fault were obtained in a drill hole near the railway track, just west of the Aldermac filter-plant.

The possibility that faulting caused the lack of alignment in the large diabase dyke which crosses the Wasa Lake area southeastward from the Aldermac mine has already been suggested. Other evidence supports this view. At the railway track in lot 25, range V, an apparent offset occurs. A diamond-drill hole put down beneath the railway track east of this point and just west of the Aldermac filter-plant, intersected a fault-zone. There is another apparent offset east of MacKay lake, in range VI, where a drift-filled valley to the east and west suggests an underlying zone of weakness. In addition, some shearing and quartz veins aligned with the valley occur farther to the east.

The direction of the probable fault-zone in each case would be 10 degrees or more north of east.

## ECONOMIC GEOLOGY

There are, as noted by Bruce (1), two main types of ore deposits in the Arntfield-Aldermac area, one the gold-bearing mineralized shear-zones of the Arntfield and Francoeur mines, and the other the copper-gold sulphide bodies of the Aldermac mine. No new deposits of this latter type had been discovered in the areas discussed in this report up to the close of 1937.

New discoveries have been made on the Arntfield and Francoeur properties in recent years. Gold-bearing mineralization has also been discovered in an apparent westward extension of the Arntfield-Francoeur zone on the Arncoeur property, in Dasserat township. The showing of La Mine d'Or Champlain in the eastern map-area differs in its occurrence from the above discoveries in that it apparently is not located along a major zone of shearing. The mineralization follows the contact of a body of diorite intruding andesitic volcanics. Some factors which appear to cause localization and intensification of the shearing along the general arcuate zones of shearing that cross the area have been indicated in discussing the structural geology. Factors which, in addition to the intensity of the shearing, appear to cause localization of ore deposition within these zones, are the presence of easily-replaceable fragmental and tuffaceous horizons; warps in the shear-planes; and the presence of the later, low-angle faults with their concomitant fracturing of the wall-rocks.

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(1) *Op. cit.*, p. 58.

## PROPERTIES IN WASA LAKE MAP-AREA

### *La Mine d'Or Champlain, Limitée*

This Company holds a group of claims lying about Wasa lake, in Beauchastel township. The chief discovery on the property is in lot 30, range V, about half a mile due east of the Aldermac railway-station. Gold-bearing mineralization was discovered at this point by diamond drilling during the winter of 1936-37.

The only rock outcropping in the vicinity is a low dome of massive andesite. The drilling has shown the presence of an irregular, dyke-like body of diorite to the south of the volcanics. It has been traced for nearly 1,000 feet in a northeast-southwest direction. At the southwest, it has a width of 250 feet, but it narrows to 25 feet at the northeast.

A series of 17 diamond-drill holes, distributed over a length of 1,300 feet, have been drilled along or near this body of diorite, mostly intersecting the north contact. Some mineralization, usually carrying appreciable gold values, was intersected in all but three of the holes, one of which cuts only the south contact. In several of the holes, mineralization was found in more than one zone.

Gold values occur both in the volcanics and in the diorite, but chiefly in the former. The intersections are difficult to correlate from hole to hole, but there would appear to be a continuous ore-zone, averaging ten feet or more in width, bordering the north contact of the diorite for a length of 250 feet. The Company reports that a gold value of 2.04 ounces per ton over a width of ten feet was obtained in one intersection, and that values in the others range from 0.10 ounces over a width of two feet to 0.55 ounces over a width of ten feet. The gold values are associated with pyrite in quartz and country rock.

A shaft was sunk on the property during the summer of 1937 to explore the above and other mineralized zones encountered in the drill holes. Drifting was about to begin on the first level at the time the writer left the area early in September, 1937.

Much exploratory trenching was done elsewhere on the property during the summer of 1937, but no other mineralized zones of commercial importance had been discovered up to the date mentioned.

Several minor mineralized zones, trending N.65°W., accompanied by irregular quartz veins containing yellowish carbonate, have been discovered in the diorite and in remnants of the invaded acid volcanics southwest of Wasa lake. The mineralization in the quartz and wall-rocks is mainly coarse pyrite. An old shaft on the Wasamac property is in this vicinity. It is located near an outcrop of diorite. The trenches are now filled-in, but, to judge by the material on the dump, the work was done on a mineralized quartz-carbonate vein similar to those described above.

Other small, mineralized zones, explored by trenching, occur in the acid volcanics east of Wasa lake and in the basic volcanics west, north, and southeast of the lake.

### *General Note*

A number of other companies hold claims in the vicinity of Wasa lake, but La Mine d'Or Champlain is the only property on which important discoveries have been made to date. Some of the veins on that property

have been traced westward into block Q of the Arntfield property south of Wasa creek. A diamond-drill hole put down on one of these by the latter Company failed to reveal mineralized material carrying gold values. Other exploratory holes in diorite to the south, and in basic volcanics to the north, failed to intersect significant mineralization.

Some slight pyrite mineralization is present in the brecciated quartz-porphyry and quartz complex on the Aldermac property just north of the railway track and west of the filter plant. As previously noted, similar material occurs farther west, on lot 30, on the property of La Mine d'Or Champlain.

A large quartz-vein, barren so far as known, is exposed farther north on the Aldermac property, about 3,000 feet northwest of Aldermac railway-station. It strikes N.65°E., following the contact of diorite (to the south) with chloritized acid volcanics (to the north), and it is cut by northeast-striking veinlets of later quartz. A few feet north of the main vein, an irregular mass of quartz, which seems to lie along a northeast-trending fractured zone, is exposed for a few feet. This quartz is quite heavily mineralized with pyrite and some chalcopyrite, sphalerite, and galena, over a width of a foot.

#### PROPERTIES IN FORTUNE LAKE MAP-AREA

##### *Arncoeur Gold Mines, Limited*

Arncoeur Gold Mines, Limited, hold a group of 45 claims in Dasserat township. The group extends south from the centre-line of the township almost to the southern limit of the map-area. The east boundary runs northward from the west end of King of the North lake, and the west boundary lies along the eastern shore of Desvaux lake.

During the winter of 1936-37, a series of 14 diamond-drill holes, spaced southward across claims R.27288, 27447, 27449, 27450, and 27451, were put down in the hope of finding a westward extension of the Arntfield-Francoeur mineralized zone. Some narrow mineralized zones intersected in these holes may mark westward branches of that zone, but none of them carried important gold values.

The main line of shearing on the property was found to lie south-westward from the west end of King of the North lake, following the contact of acid volcanics to the north with basic volcanics to the south. This contact is not exposed at the surface except on claim 24859, east of Desvaux lake. The contact was explored during the summer of 1937 in a series of 19 drill holes spaced over a length of nearly a mile. Six other holes were drilled at points farther north on the property. In addition, much surface exploration was carried out by means of trenching.

Where the contact referred to is exposed on claim 24859, the shearing is not heavy, but the rocks are highly altered over widths of 30 feet and more. In addition to the acid and basic volcanics, there are, at the margins of this zone, alternations of schistose chloritic rocks with some suggestion of included fragments, and cutting across the zone are masses, some of them dyke-like, of buff-weathering, massive, aphanitic material, referred to on page 9. These rocks, and particularly the chloritic material, are impregnated with carbonate and pyrite. Some 100 feet north of the con-



tact, in claim 24858 near the west boundary of the property, pyrite is disseminated in a small area of schistose trachyte. Free gold was found in a small quartz stringer traversing the rocks in this vicinity. Intersections in the diamond-drill holes eastward to King of the North lake show mineralization in sheared andesite, and in buff and red alterations of this and the acid rocks, similar to that occurring at the Arntfield and Francoeur mines to the east. Some diorite was also encountered in the drilling. In at least one hole, the gold values were found to be associated with medium-grained pyrite in quartz stringers. Information furnished by the Company shows some gold values in all but a few of the holes, but the values generally are low. One intersection with 0.17 ounces gold per ton over 2.7 feet is reported, and others ranging from 0.10 to 0.13 ounces over widths up to 17 feet. Commercial ore-zones did not appear to be indicated by the drilling completed up to the time the writer left the area in September, 1937.

In claim 24856, about 800 feet north of the above zone, a vertically-dipping, narrow shear strikes N.80°W. across the N.80°E. foliation in the surrounding trachyte. The zone is mostly less than 3 feet in width and is traceable for some 200 feet. A little quartz, present as stringers along the zone, contains some tourmaline and pyrite. The latter mineral is also disseminated in the schistose trachyte. Gold values were obtained along 30 feet of this zone, ranging up to 0.5 ounces per ton over a width of three feet. Other similar zones occurring elsewhere in the acid volcanics explored at the surface and by diamond drilling were not found to carry appreciable gold values.

Other mineralized zones on the property, which, however, at the present stage of exploration have not been found to be of commercial importance, are as follows:

In the northeast corner of claim 24860 near Desvaux lake, the acid volcanics, just south of their contact with andesite to the north, are heavily impregnated with and replaced by fine-grained pyrite.

On the west side of claim 25937, trenching has exposed an east-west sheared zone in altered basic volcanics near their contact with diorite to the west. The sheared zone is about 15 feet wide at the centre pit but is narrower in those to the east and west. The rock is replaced by cherty quartz and massive, fine-grained pyrite. A bright green micaceous mineral, possibly fuchsite, occurs in the schist along the zone.

Just south of the centre-line of the township, near Demin lake, on claim 29604, a complex of irregular quartz veins occurs within an area 50 feet square in the diorite. Some of the veins follow north and northeast striking fractures which dip flatly, some to the southeast and others to the northwest. Most of the quartz is barren, but in places it contains large grains of yellowish carbonate, coarse cubes of pyrite, and large grains and veinlets of chalcopyrite.

In claim 27451, just north of Fortune lake, an east-west shear or fault-zone in diorite is partially exposed for a length of 200 feet. Some trenching has been done along the zone in earlier years. The zone dips 70 degrees northward. The footwall is well-defined and slickensided, and above the footwall the diorite is schistose for three feet or more, and consists largely of dark-coloured, acicular amphibole. A few irregular quartz lenses and veinlets occur along the zone. These contain calcite and

some fine to coarse pyrite. In this vicinity, very occasional large grains of chalcopyrite were observed in some narrow quartz veins cutting the massive diorite.

*Eclipse Mining Company, Limited*

The Eclipse Mining Company did exploratory work during the early part of the summer of 1937 on a group of claims lying north of the centre-line of Dasserat township and northwest of Demin lake.

No one was at the property at the time it was examined by the writer, so some of the work done may have been overlooked. Two inclined diamond-drill holes have been put down in valleys between high ridges of diorite, one in claim R.27882 and the other in claim R.27885. The holes are just north of the south boundary of the claims. Some pyrite was observed in silicified, much jointed, granodiorite, 400 feet northwest of the drill-hole in claim 27885. A little pyrite occurs in the diorite near a dyke of syenite porphyry at the drill hole in claim 27882, and also near another dyke 400 feet to the south. A narrow shear in massive diorite is traceable for 200 feet in a northwest direction at a point 400 feet west of the drill-hole in claim 27882. A very minor amount of pyrite was observed in the chloritized diorite. An old pit along this zone was filled with water. About 500 feet north of the southwest corner of claim 27892, a quartz-vein less than one foot wide is traceable for over 200 feet in an east-west direction. It dips 65 degrees southward. In a pit at the eastern end of this vein, some pyrite occurs in the diorite wall-rock, but none was seen in the quartz.

*McLaren Claims*

D. McLaren holds a group of 5 claims, Nos. R.28051 to 28055, lying around Samia lake. The continuation of the Lake Fortune sheared zone crosses the property between Fortune lake and Samia lake. Some trenching and diamond drilling has been done along this section in earlier years. The zone crosses andesitic volcanics.

In the trenches on the zone just east of Samia lake, the rock is schistose and carbonatized over widths up to 80 feet, and is intensely sheared in one or more sections up to 30 feet wide. Irregular veins and lenses of quartz, with associated carbonate, occur along the zone. Pyrite, generally fine, occurs in the quartz and schist, abundantly in some places but scantily in others. Several irregular veins and lenses of quartz occur in the massive diorite about 200 feet north of the shear-zone, both to the east and west of the Arncoeur road. These are up to 5 feet in width but not over 50 feet in length. Large grains of yellowish carbonate, and in some veins some purplish calcite, accompany the quartz. Some pyrite is scattered in the veins and wall-rocks in places. Mr. McLaren reports that low values in gold were obtained from assays of the mineralized sections in these veins.

*General Note*

Quartz-carbonate veins, with some pyrite, are exposed at intervals in a zone of slight shearing that follows the south shore of King of the North lake. Some quite large, but little mineralized, quartz-veins occur in claims R.34719, 34720, and 34777, west of Samia lake. Many small quartz veins and stringers, with associated specular hematite, were observed in the acid volcanics crossing the central part of the map-area.

PROPERTIES IN THE ARNTFIELD-ALDERMAC MAP-AREA

*Arntfield Gold Mines, Limited*

Two new, inclined shafts, No. 2 and No. 3, have been put down, and a mill erected, on the Arntfield property (Plate III-A) since it was described by Bruce in 1932 (1). In addition, much exploratory diamond drilling and trenching has been done on the property.

No. 2 shaft is 700 feet east of No. 1 (see Map No. 462-A), and the workings of the two shafts are connected on the 150- and 250-foot levels. Drifts have been opened on three deeper levels at the No. 2 shaft: for 100 feet east on the 375-foot level; 250 feet east and 350 feet west on the 500-foot level; and 100 feet east and 250 feet west on the 625-foot level. A raise connects the western drifts of the 625- and 500-foot levels. No. 3 shaft is 2,000 feet east of No. 2. Development work in recent years has been chiefly concentrated at this shaft. Levels have been opened at inclined depths of 250, 525, 675, 825, and 975 feet. A raise from the 500-foot level, and a winze from the 250-foot level, give access to a drift on the 375-foot level east of the shaft. Drifting has extended 1,200 feet east of the shaft on the 525-foot level and almost as far on the other levels, and also for 300 feet west of the shaft on the 250- and 500-foot levels. Many sections of the mineralized zones, not yet reached by the workings, have been explored by underground and surface diamond-drill holes. When the writer visited the property in September, 1937, the ground below the lowest levels at both the No. 2 and No. 3 shafts was being explored by diamond drilling.

The writer examined the new workings but did not map the surface or underground geology in detail. A thesis study of the property is being made by Mr. S. Malouf, graduate student at McGill University, under the direction of Dr. J. E. Gill.

The general features of the geology and occurrence of the ore at the lower levels of the No. 2 shaft are essentially the same as described by Bruce for the upper levels. These are, briefly, the occurrence of a wide zone of shearing cut by low-angle faults, roughly paralleling the contact of acid volcanics to the north with basic volcanics to the south. The gold-bearing zones are in highly altered portions of the acid rocks. The altered rock is mostly red, less commonly buff, in colour, and consists largely of quartz, some sodic plagioclase, and carbonate, liberally impregnated with fine pyrite. The alteration is streaky in places, with chloritic remnants of the replaced rock. During 1937, ore was being mined from a shoot on the 625-foot level, some 300 feet west of the shaft. This shoot is the downward continuation of one on the 500-foot level, mined-out in previous years. No ore-zones have been outlined in the drifts eastward on the 375- and 500-foot levels, but good gold values were obtained in a hole drilled eastward from the end of a drift on the 375-foot level. Three diamond-drill holes put down from the surface between the No. 1 Arntfield shaft and the No. 1 Francoeur shaft, 1,200 feet to the west, failed to intersect mineralization carrying commercial gold values.

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(1) *Op. cit.*, pp. 64-72.

Geological conditions at the No. 3 shaft are somewhat different from those at the other two shafts. As at those workings, the mineralization occurs along a sheared zone dipping on an average about 45 degrees northward, though the dip varies from one level to another. The shearing is not very pronounced west of the shaft and almost fades out in that direction in andesitic lavas exposed at the surface and in the workings below. To the east of the shaft, the sheared zone trends, with some irregularities, nearly southeast, and it widens in that direction, having an indicated width up to 150 feet in some of the surface drill-holes 1,000 feet to 1,500 feet southeast of the shaft.

The andesite continues eastward from the shaft, along and to the north of the drifts in that direction. South of it, on the 675-foot level, is a coarse fragmental rock with acidic fragments in a dark, chloritic matrix; both fragments and matrix are speckled with small phenocrysts of quartz. What appear to be more altered and sheared representatives of the same rock are present on the upper levels, and are perhaps the downward extension of fragmentals that outcrop at the surface southeast of the shaft. Two bodies of an aphanitic, massive, reddish coloured rock, in which occasional grains of quartz are visible, form the foot- and hanging-walls of the ore-zones some 500 to 1,000 feet east of the shaft on the upper levels and are traceable downward to the 825-foot level, becoming shorter with depth. These bodies would appear to be intrusive, though they may be a replacement facies of the fragmental rock. Mapping by Mr. Malouf shows that these masses occur at a marked flexure in the trend of the formations. This flexure, or warp, and the presence of these masses, were evidently factors in localizing ore deposition in this section.

In addition to the above rocks, dykes of red syenite, and one nearly north-south dyke of lamprophyre, have been encountered underground. Faults cut the sheared zone and closely parallel it in strike and dip, but are not so evident as those in the western workings. The gold values occur in siliceous, grey and red, altered portions of the sheared rocks, which are mineralized with fine pyrite. The ore may be quite massive in appearance, or finely to coarsely banded. That occurring in the larger shoots 500 to 1,000 feet east of the shaft is of the grey-coloured type.

Most of the ore mined from the No. 3 shaft at present, and in recent years, has come from shoots east of the shaft. However, two ore-zones, each with a length of about 150 feet, have been mined in workings west of the shaft, one lying between the 250-foot level and the surface and the other above the 500-foot level. The largest ore-shoot so far discovered, now largely mined out, lies between 500 feet and 1,000 feet east of the shaft. It has been exposed at the surface by removal of the heavy overburden, allowing outlet to a raise, and it persists downward to the 375-foot level. Actually, it continues to greater depth but is not of mineable grade between the 375- and 525-foot levels, except for a short distance below the former level and a shoot 100 feet in length, now mined-out, above the 525-foot level. The downward continuation of this latter shoot is being mined on the 675-foot level, where it has a length of 160 feet and is up to 30 feet wide; below this horizon it tapers, but it persists to the 825-foot level. Another ore-shoot, now more than half mined out, lies between that just described and the shaft. This shoot persists from above the 525-foot level to below the 675-foot level, with a rake to the east. It has a length of

nearly 300 feet on the 525-foot level and of 190 feet on the 675-foot level. On the 525-foot level, material which is almost of ore-grade occurs to the west between this shoot and the shaft and also eastward from the shoot for some 250 feet. At the time of the writer's visit to the property, diamond drilling in progress from the 825-foot level, at a point 500 feet east of the shaft, had indicated mineralization of good grade at a vertical depth of 140 feet below that level. No deeper exploration had been done east or west of this location, except for 100 feet of drifting eastward from the shaft on the 975-foot level.

Diamond drilling in five holes, put down at points between No. 2 and No. 3 shaft to intersect the ore-zone at a vertical depth of around 200 feet, showed some mineralization, but no very heavy shearing or promising gold values. In one hole, 350 feet west of No. 3 shaft, and cutting the zone at a vertical depth of 400 feet, mineralized sections of 4 and 5 feet assayed 0.18 and 0.40 ounces in gold per ton respectively.

The sheared zone has been explored in eight diamond-drill holes spaced over a length of 500 feet southeast from the limit of the present workings, or to a point nearly half a mile southeast of No. 3 shaft. Gold values are lacking in four of the holes and are less than 0.20 ounces per ton in the others. However, some of the holes are as much as 500 feet apart.

Exploratory diamond-drilling has been done at points between the Arntfield No. 3 shaft and the village of Arntfield, and southeast of the village on the flanks of the Kekeko hills. The latter drilling was undertaken in hopes of locating an eastward extension of the Lake Fortune sheared zone. In one hole near the Arntfield-Ville Marie highway, quartz-carbonate veinlets in altered greenstone were intersected. This material carried gold values of 0.27 ounces per ton over one section of 2.5 feet, and lower values over other sections. However, no gold values were obtained in three holes farther east.

Diamond drilling on the Arntfield property in the Wasa Lake map-area has been mentioned on page 19.

#### *Francoeur Gold Mines, Limited*

The property of Francoeur Gold Mines, Limited, consisting of 13 claims in Beauchastel township, adjoins the Arntfield property on the west. The Caplan group of 10 claims in Dasserat township, farther west, were optioned by the Company in 1937.

Development work on the property up to 1932 has been described by Bruce (1). This work and that of subsequent years up to 1935 was largely centred on the ore-zone on which the No. 1 shaft is located. This shaft is near the east side of claim T.134, along the strike of the mineralized zone at the Arntfield No. 1 shaft. As these workings were flooded when seen during the summer of 1937, the writer was unable to examine them. Results of development carried out from this shaft are given in the annual reports of the Bureau for the years 1933-35 (2).

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(1) *Op. cit.*, pp. 72-73.

(2) Que. Bur. Mines, Ann. Rept., Part A, 1933, p. 93; 1934, p. 70; 1935, p. 44.

During the summer of 1936, a new ore-zone was discovered on the property, some 2,000 feet west of No. 1 shaft. No surface outcrops of the zone occur. It was discovered by means of diamond drilling based on geological work by Dr. J. E. Gill.

By the summer of 1937, this mineralized zone had been explored westward across claim M.L.2055F to, and 300 feet beyond, the Dasserat-Beauchastel boundary-line (see Map No. 462-A). The total explored length is nearly 6,000 feet. An inclined shaft, known as No. 2 shaft (Plate III-B), has been put down in the footwall of the ore-zone at the site of the initial discovery. Early in September, drifting on the first level, at a vertical depth of 125 feet, had progressed 750 feet to the west, and 200 feet to the east, along the strike of the mineralized zone, and a raise had been put through to the surface from a cross-cut north on this level. A cross-cut had also been driven through to the ore-zone on the 200-foot level.

The writer did not map the geology of the property, but the following general features were observed. The mineralized shear-zone appears to follow, in a general way, the contact between acid volcanics to the north and basic volcanics to the south. Lack of outcrop across the western part of the property prevents a definite statement in this regard. The rocks occurring immediately along the zone, as exposed in underground workings and intersected in diamond-drill holes, are andesitic lavas, and coarse and fine pyroclastics with both acid and basic fragments. The breccias (save for some fragments), and other, possibly tuffaceous, rocks seem to be composed largely of basic volcanic material, though some may have been originally acidic and subsequently chloritized. The sheared and altered rocks are cut by a remarkably persistent fault, almost parallel in direction to the shear-zone but dipping 45 degrees north in contrast to a dip of 60 degrees north for the shearing.

The gold-values occur in red and buff, altered and replaced portions of the sheared rock, as at the Arntfield mine. This material contains abundant fine pyrite. Locally, there are veinlets of quartz with some yellowish carbonate, accompanied by larger grains of pyrite and specular hematite.

Results of sampling on the 125-foot level up to September, 1937, as reported by the Company, indicate the presence of four ore-shoots. One of these, the A shoot, with a length of 212 feet, extends both east and west of the shaft, mostly in the north wall of the drift. It has a grade of 0.281 ounces gold per ton over an area of 7,736 square feet. The other three ore-shoots lie west of the shaft and have dimensions and grade as follows:

| ORE-SHOOT      | LENGTH   | AVERAGE WIDTH | GRADE             |
|----------------|----------|---------------|-------------------|
| <i>B</i> ..... | 183 feet | 7 ft. 0 in.   | 0.348 oz. per ton |
| <i>C</i> ..... | 91 "     | 2 ft. 4½ in.  | 0.196 " " "       |
| <i>D</i> ..... | 127 "    | 6 ft. 6 in.   | 0.208 " " "       |

Sampling in the drift for 300 feet farther west indicated that the *D* ore-shoot continues westward over much, if not the whole, of this distance. Shorter sections within these ore-shoots are of considerably higher grade than shown in the table. The earlier diamond-drilling indicates that these shoots continue both upward and downward from the 125-foot level.

Between 2,000 feet and 3,000 feet west of the No. 2 shaft, other possible ore-shoots along the same zone are indicated by diamond drilling. Holes intersecting the zone at vertical depths of 100 to 150 feet show, in general, lower gold values than holes intersecting it at greater depths down to 400 feet. Drill holes cutting the zone farther west, up to the Dasserat-Beauchastel boundary line, mostly at shallow depths, did not reveal important gold values. A length of about 1,000 feet of the zone, between the workings at the No. 1 and No. 2 shafts, has not yet been explored.

In a report dated April 8th, 1938, included in their annual report, the Company give the ore reserves, outlined up to that time, as 151,400 tons, averaging \$9.08 in gold per ton. Of this total, 122,400 tons are in the area reached by the workings at No. 2 shaft, and the remainder in those at No. 1 shaft. The directors have authorized erection of a 150-ton concentrator.

#### *Lake Fortune and Aldermac Mines*

The Lake Fortune and Aldermac mines were not examined by the writer. Results of developments at these properties, since they were described by Bruce in 1932, will be found in the Annual Reports (Part A) of the Bureau of Mines.

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## ALPHABETICAL INDEX

|                                | PAGE   |                                | PAGE |
|--------------------------------|--------|--------------------------------|------|
| Algoman intrusives.....        | 10     | Keewatin volcanics .....       | 8    |
| Andesite, Keewatin .....       | 8      | Structure in .....             | 13   |
| Structure in .....             | 13     | Keweenawan (?) intrusives..... | 12   |
| Aplite, Algoman .....          | 12     | Lamprophyre, Algoman.....      | 12   |
| Arncoeur Gold Mines, Ltd.—     |        | Lefebvre, Gabriel.....         | 6    |
| Description of property.....   | 19     | MacKenzie, G. S.—              |      |
| Arntfield Gold Mines, Ltd.—    |        | Rept., Fortune lake and        |      |
| Description of property.....   | 22     | Wasa lake areas.....           | 1-26 |
| Asbury, W. Nowers.....         | 6      | McLaren claims, Samia lake...  | 21   |
| Caplan claims, Dasserat tp.... | 24     | Mine d'Or Champlain, La—       |      |
| Champlain, La Mine d'Or—       |        | Description of property.....   | 18   |
| Description of property.....   | 18     | Pre-Huronian intrusives.....   | 10   |
| Conglomerate—                  |        | Quartz porphyry.....           | 11   |
| Cobalt.....                    | 12     | Rhyolite, Keewatin.....        | 8    |
| Temiscamian (?) .....          | 10     | Structure in .....             | 13   |
| Diabase, Keweenawan (?).....   | 12     | Samia lake, claims on .....    | 21   |
| Diorite, Algoman.....          | 10, 18 | Shearing.....                  | 15   |
| Eclipse Mining Co.—            |        | Syenite porphyry.....          | 11   |
| Description of property.....   | 21     | Temiscamian (?) sediments....  | 10   |
| Faulting .....                 | 16     | Trachyte, Keewatin.....        | 8    |
| Fortune lake area—             |        | Structure in .....             | 13   |
| Rept., G. S. MacKenzie.....    | 1-26   | Volcanics, Keewatin.....       | 8    |
| Mining properties in .....     | 19     | Structure in .....             | 13   |
| Francoeur Gold Mines—          |        | Wasa lake area—                |      |
| Description of property.....   | 24     | Rept., G. S. MacKenzie.....    | 1-26 |
| Gold deposits.....             | 17-26  | Mining properties in.....      | 18   |
| Granodiorite.....              | 11     | Wasamac property.....          | 18   |
| Huronian (Cobalt) seds.....    | 12     |                                |      |



